Enterprise Modelling: The Key to Successful Business Systems Integration

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Declaration

"I, John Francis Brudenell, declare that the PhD thesis entitled 'Enterprise Modelling: The Key to Successful Business Systems Integration' is no more than 100,000 words in length, exclusive of tables, figures, appendices, references and footnotes. This thesis contains no material that has been submitted previously, in whole or in part, for the award of any other academic degree or diploma. Except where otherwise indicated, this thesis is my own work".

Signature

Date

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Abstract

The Enterprise Modelling (EM) approach to systems design is followed to promote business information systems integration and a high degree of data integrity. This research reports on a comprehensive case study of one of Australia's leading telecommunications carriers and service providers. The case study relates to the advent of Mobile Number Portability (MNP) into the Australian telecommunications market on 25 September 2001, a world's first, real-time 'Churn' business process. Specifically, it reports on Service Level Agreement (SLA) and reporting performance of two similar systems evaluated in terms of accepted Information Systems Architectural Criteria. The researcher derived a number of architectural evaluation criteria from the literature, which provided insight into the ways of evaluating information systems. One purpose-built operational system, named the Mobile Number Portability System (MNPS) was designed and built using the latest object-oriented techniques and tools. The other system, named the Data Repository System (DRS) was designed using the EM approach.

The MNPS failed to meet SLA functionality and reporting functionality. It performed poorly when evaluated in terms of accepted Information Systems Architectural Criteria. For example, the MNPS' support of fundamental business rules was extremely poor. It should be noted that the SLA functionality was the most complex aspect of the system to design and implement, as it constantly changes according to the requirements of the Regulator (ACA). Hence, it was decided to build this functionality into a separate system, the DRS using a different approach based on EM. The new system was designed using this top-down approach. The DRS successfully met all SLA functionality and reporting functionality. It performed extremely well when evaluated against the Information Systems Architectural Criteria. The DRS significantly outperformed the MNPS confirming the claims made for the EM approach.

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Thesis Control Sheet

Date	Thesis Submission Description	Examiner Name
30th August 2006	Original Submitted Thesis	Not Applicable
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- Page 88, Chapter 4, Research Design - Statement acknowledging the multiple roles performed by the candidate
- Page 14, Chapter 2, Literature Review - Last Paragraph, 2nd sentence reworded
- Page 15, Chapter 2, Literature Review - Apostrophe added
- Page 93, Chapter 4, Research Design - Modified “measures” to “measured”
- Page 97, Chapter 4, Research Design - Format change
- Page 116, Chapter 4, Research Design - Removed “and”
- Page 116, Chapter 4, Research Design - Simplified wording in Section 2
- Page 134, Chapter 5, Data Collection and Data Analysis - Comma inserted
- Page 137, Chapter 5, Data Collection and Data Analysis - Replaced “to” with “at”

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Explanation of Major Concepts

Enterprise Model

The Enterprise Model depicts the way information is created, used and shared in an organisation. It is the outcome of using the Enterprise Modelling Approach in order to define the organisation's Information Flows among the Business Functions and Processes. Hence, it is also known as the Information Flow Schema or Model of the Enterprise. The Enterprise Model is independent of the organisation's Organisation Structure, its existing Applications, Technology and existing Business Processes.

The Enterprise Model consists of three perspectives of the organisation; the Business Functional Outline, the Business Themes and the Business Information Flows. The Enterprise Model provides a basis for understanding the business from an information perspective in a big picture, that is, a holistic information-oriented view, without which, it is unlikely that a business system will be planned and scoped correctly. Without the benefit of top-down guidance provided from an Enterprise Model, it is claimed that it is difficult to achieve any degree of data sharing and hence integration of information systems.

Enterprise Modelling Approach

Enterprise Modelling is the name the researcher has given to an approach that models the way information is created, used and shared in an organisation. It is believed to be an innovative approach developed by the researcher and has been used successfully in industry, both within Australia and overseas. The Enterprise Modelling Approach is based on a comprehensive understanding of the literature supplemented by extensive practitioner experience in successfully using the approach for a range of information systems in a number of organisations of all sizes around the world.

Enterprise Modelling is the construction of a limited system (a Model of the Enterprise) that represents the larger system in question; where the larger system is the enterprise. The enterprise is a system of business objects working together to accomplish mutually beneficial goals. Enterprise Modelling is performed to gain an understanding of the organisation's Business and Information Requirements from an Enterprise perspective, not an Applications perspective.

Enterprise Modelling Used in Other Approaches

Enterprise Modelling as a holistic concept was first used by the U.S. aircraft industry in the late 1980s. The term may have been used earlier, but then only to denote any kind of model, ranging from mathematical models to Information Technology Architecture models, to corporate data models, geometric models, and even physical replica models.

The most common kind of enterprise models are process models, showing the transformation from input to output, and the tools, controls, and resources required to do this. On the other hand enterprise process modelling in particular is not performed for one specific goal only, which partly explains the great diversity of approaches found in literature and practice.

The latest research states that Enterprise Modelling needs to provide a capability for externalising, making, and sharing enterprise knowledge. However, it has been recognised that other Enterprise Modelling approaches typically only provides one perspective, such as a Corporate Data Model or Business Process Model. It is accepted that the enterprise model must be more than the sum of known individual views.

Mobile Number Portability (MNP) Initiative

This research relates to a particular controlled Telecommunications environment, which involves the movement of a customer's mobile service number and mobile service from one Network Provider to another or one

Service Provider to another. These network providers and service providers are competitors in the Australian Telecommunications industry. This movement is known as a 'Churn' event and is governed by a mandatory business process named the Mobile Number Portability (MNP) initiative. It is implemented as part of the Australian Telecommunications regulatory environment by the Australian Communications Authority (ACA).

The MNP business initiative is defined in the Australian Communications Industry Forum (ACIF) MNP Information Technology (IT) Specification, which identifies the functional and technical baseline business requirements for the support of the ACIF MNP Operations Code. The ACIF MNP IT Specification defines the minimum mandatory business processes to be followed for each of the MNP 'Churn' events. It includes a detailed definition of the mandatory business processes, the business concepts, business rules and business scenarios that each Network Provider and Service Provider must follow.

Mobile Number Portability System (MNPS)

The MNPS is the Telecommunications organisation's implementation of the MNP business initiative as defined in the ACIF MNP IT Specification. The Telecommunications Service Provider plays both roles as a Network Provider and a Service Provider and hence, the implementation of the MNP business initiative was more complex than the implementations for most of the other industry players. In addition to the business processes specified for each MNP 'Churn' event in the operations code, the MNPS was designed to implement the reporting and Service Level Agreement (SLA) components of the MNP business initiative.

The MNPS was replaced by the Data Repository System (DRS) several months after it was implemented, which supported the same Network Provider and Service Provider requirements.

Chapter 1 Introduction

1.1 Thesis Outline

This thesis reports on a comprehensive case study of a leading Australian Telecommunications carrier that confirms the claims made for the Enterprise Modelling Approach to systems development. Specifically, it reports on Service Level Agreement (SLA) functionality and reporting performance of two similar systems. One system named the Mobile Number Portability System (MNPS) was designed using the latest object-oriented tools and techniques with no top-down guidance provided from an Enterprise Model. The other system, named Data Repository System (DRS) was designed using the Enterprise Modelling Approach. These two systems are real systems operating in a real environment; they are not simulated. The MNPS was implemented into production in 2001 and the DRS was implemented into production nearly twelve months later, in 2002. The DRS has since been expanded to incorporate an additional six regulatory products and their associated systems, with minimal cost and minor changes in its data structure. It has taken over all SLA and reporting functionality from these six systems and a further nine operational systems have been fully integrated into the DRS. On the other hand, the MNPS has remained stagnant as its design could not support any changes in scope or additional functionality.

The Australian Communications Association (ACA) established the Australian Communications Industry Forum (ACIF) to define the Mobile Number Portability (MNP) business requirements and business processes, jointly developed and agreed by all industry carriers and service providers. The ACIF Code covering MNP business requirements and business processes that must be followed by all carriers and service providers is described in the Information Technology (IT) Specification. The development of the MNPS and the DRS was based on the same specification of requirements, namely the IT Specification. The evaluation of these two systems was performed against commonly accepted Information Systems Architectural Criteria. The DRS significantly outperformed the MNPS confirming the claims made for the Enterprise Modelling Approach. These claims are that the use of an Enterprise Modelling Approach results in significantly improved performance of an organisation's information systems. This improved performance is evidenced by a high degree of information systems integration and high data integrity of its information systems.

The performance of each of the two systems was evaluated by the IT architects and MNP Programme Manager in terms of commonly agreed Information Systems Architectural Criteria. These criteria were also agreed with each of the stakeholders of the Mobile Number Portability business initiative. The Programme Manager, architects and stakeholders were the same group for both the MNPS and the DRS. The Information Systems Architectural Criteria used to evaluate and compare the performance of the MNPS and the DRS are:

1. Architectural Principles
2. Fundamental Business Rules
3. Functional Scope and Interfaces
4. Data Sharing, Data Redundancy & Data Consistency.

Architectural Principles refer to the good practices in the overall design of information systems. These principles include capturing data from its true source and as a by-product of a business process, and structuring the data based on the inherent nature of the business. Fundamental Business Rules are the rules under which the mainstay of the business operates and upon which, the data structure of the information system is based. If the data structure does not reflect these business rules then the information system will not satisfy the business requirements. Functional Scope and Interfaces refers to the totality of the business functions implemented by the information system including the interfaces among these functions. Data Sharing, Data Redundancy and Data Consistency pertains to sharing data across the business functions as the basis for integrating different aspects of an information system or integrating different systems.

The MNPS failed to meet SLA functionality and Reporting functionality. It performed poorly when evaluated in terms of the Information Systems Architectural Criteria. The SLA functionality is the most complex aspect of the system to design and implement as the SLAs constantly change according to the requirements of the Regulator, an external party. The MNPS lacks the flexibility to support the business rules associated with the SLA functionality.

The DRS was designed using the top-down Enterprise Modelling Approach and successfully met all SLA functionality and reporting functionality. It performed extremely well when evaluated against each of the Information Systems Architectural Criteria. It has also stood the test of time, with more than 350 reports developed by the users in its first twelve months in production, without any IT involvement.

The results of the comparison support the claims made for the Enterprise Modelling Approach. The Telecommunications carrier was able to transform its non-integrated information systems into one integrated enterprise view of mobile number portability, managing SLAs and real-time reporting to the Office of the Regulator General. The results show that the use of enterprise modelling is a key driver in achieving integrated information systems and major improvements in data quality, significantly improving the quality of service delivery and significantly improving the carrier's regulatory capability. The success of this information system required a paradigm shift by the carrier to focus on the customer and guarantees of service quality. The case study demonstrates that substantial benefits can be achieved with a minimal investment by understanding the way in which information flows throughout an organisation. The study's findings confirm the claims made for the Enterprise Model. In summary, the case study's findings confirm the major claims of:

- The Enterprise Modelling Approach leads to the development of information systems that operate in concert with one another based on shared data, such that no redundant data will be created. The Enterprise Modelling Approach results in information systems and sub-systems that are fully integrated, in terms of cross-functional integration.

- Data integrity will be assured by performing data modelling, as a part of Enterprise Modelling based on the Enterprise Business Functional Analysis, to capture all the relevant business policies and business rules which form the basis for designing an Enterprise's databases.

- Application Program modules or system components will be developed that can be reused across different information systems and sub-systems by performing process modelling as a part of Enterprise Modelling based on the interaction of the business functions on the data, as described by the information flows depicted in the Enterprise model.

The Enterprise Modelling Approach should prove useful for all organisations that experience the continuing problems of a lack of information systems integration, inadequate support of business policies and business rules and poor data integrity. The Enterprise Modelling Approach to information systems planning, design, development and implementation promotes cross-functional systems integration and data integrity. This results in greater business efficiency and improved customer service.

In summary, the aims of this research were to develop an Enterprise Modelling Approach to systems development and to evaluate the usefulness of this approach using commonly accepted Information Systems Architectural Criteria and a well-defined system specification of requirements. The usefulness of the Enterprise Modelling Approach was measured by comparing the performance of two information systems performing the same functionality and the same specification of requirements. One used the Enterprise Modelling Approach and the other did not. The comparative evaluation of the two business systems clearly rates the DRS ahead of the MNPS in each of the four architectural evaluation criteria. The high scores achieved by the DRS for data sharing and meeting all fundamental business rules showed that it is five times more compliant than the MNPS.

The problems of a lack of information systems integration with organisations' systems, poor support of fundamental business rules and poor integrity of data remain continuing problems that were identified decades ago. As the literature reveals, many approaches have been adopted to resolve these problems, but have been unable to do so. This thesis reports on the development of a new and innovative approach to resolving these problems, namely Enterprise Modelling. It also reports on testing its usefulness with the development of real production systems, not simulated information systems; systems that the researcher has been actively involved with.

As a result of this case study, the Telecommunications industry should have access to an Enterprise-wide Information Flow Schema, known as an Enterprise Model, which enables its businesses to achieve the level of information systems integration necessary to remain competitive in an increasingly global market. By using an Information Systems Architecture based on its corresponding Enterprise Model, decisions with respect to the identification, development and integration of information systems will be informed, planned and strategic. The Enterprise Model is useful to all industries, not just Telecommunications, as the Enterprise Modelling approach is generic and provided the organisation under review performs some common business functions based on their business objectives then those aspects of the Enterprise Model are directly applicable.

This research has:

- Developed a new approach for preparing an Enterprise Model to achieve cross-functional integration of information systems.
- Tested the Enterprise Modelling Approach in a real-live environment.
- Refined the Enterprise Model based on its actual application in a major Telecommunications carrier and service provider.

Such research is claimed to be a significant and original contribution to the solution of an increasingly important problem, not only in the Telecommunications industry but to all organisational types that suffer from disparate systems.

1.2 Thesis Structure

The introductory chapter of this thesis, Chapter 1 Introduction provides an outline or summary of the thesis.

Chapter 2 Literature Review describes the two most important deficiencies of information systems architectures long identified in the literature. These deficiencies are the lack of integrated information systems architectures together with poor data integrity. The chapter also identifies the proposed information systems architecture solutions from the literature and discusses why the proposed solutions have largely failed. It then documents from the literature the consequences of the continued failure of information systems architectures to solve these problems and demonstrates why these continuing problems are serious for organisations. The theoretical foundations of Enterprise Modelling from the literature is then identified and discussed.

Chapter 3 An Enterprise Modelling Approach shows how it incorporates the best features of other approaches. It also describes the Enterprise Modelling process and its key output the Enterprise Model. The chapter then demonstrates the importance of Enterprise Modelling with reference to a leading Telecommunications carrier.

Chapter 4 Research Design incorporates four main stages to ensure that the aims of the research can be achieved. These stages are:

1. Develop an Enterprise Model for the Telecommunications Service Provider.
2. Document the current MNP Information Systems Architecture, based on the existing implemented MNPS.
3. Apply the Enterprise Model to the MNP initiative in developing a new system, known as the Data Repository System (DRS), which is based on the Enterprise Model.
4. Test the usefulness of the Enterprise Model to the Telecommunications Service Provider.

These four stages of the research are described in detail in Chapter 4, as are each of the information systems architectural evaluation criteria together with a discussion on the relative importance of each criterion.

Chapter 5 Data Collection and Data Analysis, describes the method of collecting the data to perform the measurements against each architectural evaluation criteria, what is to be measured, how it is to be measured and the data analysis technique employed to perform the comparative analysis of the two business systems. The technique used to provide a quantitative perspective of system performance is known as Figure-of-Merit Analysis. The steps in the Figure-of-Merit Analysis are outlined in this chapter. Figure-of-Merit Analysis has been used successfully in Australia for many years by a number of large organisations and also by a number of major corporations around the world.

Chapter 6 Comparative Evaluation describes how the data is analysed and discusses the findings based on that analysis from the development and implementation of the two information systems, the Mobile Number Portability System (MNPS) and the Data Repository System (DRS) respectively. It addresses the important consideration in the findings of the comparative analysis between the two information systems to determine whether these findings support the major hypothesis of this thesis. The comparative study based on the Information Systems Architectural Evaluation Criteria, assesses and compares the relative strengths of the two information systems with respect to each of these criteria.

Chapter 7 Conclusion and Future Research discusses the future research opportunities that exist and should be conducted into how an Enterprise Model can be used to support a business:

- As the basis for Data-centric Business Process Re-engineering (BPR).
- As a basis for evaluating Package-based Application Systems and Interfacing requirements with other systems.
- In performing Architectural Gap Analysis as the basis for developing Strategic Information Systems Plans (SISP) and Migration Plans.
- As the basis to identify Executive Information Systems (EIS) and Decision Support Systems (DSS) to facilitate senior management in their planning and decision-making.

The next chapter, Chapter 2 Literature Review, describes the two most important deficiencies of information systems architectures long identified in the literature and the failure of approaches to resolve these problems. These deficiencies are the lack of integrated information systems architectures and poor data integrity.

Chapter 2 Literature Review

2.1 Introduction

This chapter identifies two of the most important ongoing problems of information systems since the 1950s and 1960s. These problems are the lack of business systems integration and poor data integrity. The literature has identified that these two problems are the most important as the resolution of other problems depends on these two problems being resolved. Other problems include the inability to reuse business system components; the lack of cost-effectiveness in systems building; an inability to adequately perform project selection; the lack of project co-ordination; and the inability to perform systems dovetailing and systems migration planning. This thesis addresses the two most fundamental and important problems with information systems.

Most of the literature concentration has been on the two core problems of lack of systems integration and poor data integrity. As a result of the literature concentration on these two key problems of information systems architectures, a number of architectural evaluation criteria have been able to be derived to be used to measure the effectiveness of information systems design and development. These architectural evaluation criteria are adopted for the purpose of this thesis and are discussed in Chapter 4 Research Design.

This chapter also identifies the proposed information systems architecture solutions from the literature and discusses why the proposed solutions have failed to solve the problems of a lack of integration and data integrity. Despite this, many of these solutions are continuing to be used today as there is some merit in them. Despite the best of intentions and the excellent work performed by researchers and practitioners, information systems architectures today manifest the two core problems that have plagued the design of integrated information systems since the advent of commercial computing.

This chapter also discusses the consequences of the continued failure of information systems architectures to solve these problems and why these problems are serious for organisations. The literature identifies three major consequences to organisations. First, is the lack of IT alignment with the business. The "best" technology solutions are not always the best solutions for the business if they do not meet the business requirements. Second, is the high cost and risk of not designing for integration among the information systems. It is too late after an information system is designed, let alone after it is implemented into production to look at its integration needs. Finally, are the resultant poor quality management decisions that are made through the lack of current, accurate and relevant information to business decision-makers when they need it.

2.2 The Continuing Problem of Lack of Systems Integration

It is imperative that organisations achieve a high level of information systems integration to ensure that their systems and system functional components are operating in concert with one another based on some shared data. Organisations have been attempting to integrate their information systems since the advent of commercial computing in the 1950s and 1960s. The more recent push to enterprise resource planning (ERP), supply chain management (SCM), customer relationship management (CRM), sales force automation and Web-enabled commerce has brought the issue of integration to a head. Where systems still exist as 'islands of information' the benefits of these new technologies are unlikely to be achieved and this is largely the case with today's information systems (Hunter and Tan, 2005; Putnik and Cunha, 2005; McKeen and Smith, 2003; Chan et al., 2002; Sauer and Willcocks, 2002; Luftman, 2000; Bellini, 1999; Rosen, 1999; Sauer and Yetton, 1997; Taylor, 1995).

Most organisations, large and small alike, facing increased global competition and in attempting to provide improved customer service, are pushing their information technology to get its various applications -

operations, sales, transport and distribution, marketing, finance, logistics, e-commerce - to work in unison; to have a seamless flow of information and cut out the manual bottlenecks. Integration refers to information systems operating in concert with one another based on some shared data such that no redundant data will be created and that the benefit of an update to the data will be shared across all information systems using the data. The major problem is that over the years most organisations have implemented piecemeal (legacy) applications, which work well standalone but cannot talk to each other (Hunter and Tan, 2005; Putnik and Cunha, 2005; Inmon et al., 1998; Gale and Eldred, 1996; Boar, 1995; Kim, 1995; Mattison and Sipolt, 1994; Boar, 1993; Spewak, 1993; Sowa and Zachman, 1992b; Taylor, 1992; Kim, 1990; Connor, 1985; Gillensons and Goldberg, 1984; Long, 1982; Burnstine and Soknacki, 1979). This inability of application systems to talk to each other is caused from a lack of top-down guidance and results in a lack of integration from a business and information perspective; it is not a technology issue (Hunter and Tan, 2005; Krogstie et al., 2005; Putnik and Cunha, 2005; Department of Defence, 2004; Reich and Nelson, 2003; Watson et al., 1997; Brancheau et al., 1996; Katz, 1990; Gotlieb, 1985; Pizzarello, 1984; Kerner, 1982). Information systems integration has largely not been achieved.

Existing research (Hunter and Tan, 2005; Krogstie et al., 2005; Putnik and Cunha, 2005; Department of Defence, 2004; McKeen and Smith, 2003; Reich and Nelson, 2003; Chan et al., 2002; Sauer and Willcocks, 2002; Luftman, 2000; Bellini, 1999; Sauer and Yetton, 1997; Vernadat, 1996; Boar, 1995; Mowbray and Zahavi, 1995; Watterson, 1995; Smith and Guengerich, 1994; Hammer and Champy, 1993; Spewak, 1993; Sommerville, 1992) recommends a variety of cross-communication and collaboration between business and Information Technology (IT) managers to achieve the cross-functional integration of information systems based on sharing data among these systems and to ensure the strategic alignment of IT with the business. It is extremely difficult if not impossible to integrate the 'islands of information' after the information systems have been designed due to their inability to share data and the high degree of uncontrolled data redundancy within each of the information systems. These information systems tend to have an application view of the data or a single business function perspective of the data, rather than a holistic business cross-functional perspective based on sharing the data. Attempts at systems integration after implementation have been found to be extremely difficult to achieve.

A recent Chief Information Officer (CIO) global survey, (Varon and Ware, 2005) where CIOs were asked to rank their technology and management priorities, responded with the top priorities as:

- Integration of information systems ranked number one for technology priorities in six out of seven countries surveyed, including Australia and the United States.

- Aligning IT and business goals ranked number one for management priorities in three countries and number two in the other four countries.

In summary, there is substantial literature that describes the continuing problem of a lack of systems integration in information systems architectures. This means that an organisation's data will not be shared among its information systems resulting in an inability to reuse system components, a lack of cost-effectiveness in systems building and an inability to perform systems dovetailing and systems migration planning. This will ultimately result in the information systems architecture's inability to provide a 'whole of customer' and a 'whole of business' perspective, adversely impacting the performance of business functions such as sales and marketing.

2.3 The Continuing Problem of Poor Data Integrity

Data integrity refers to the correctness, completeness and consistency of data (Inmon et al., 1998; Strong et al., 1997; Orman et al., 1996; Wand

and Wang, 1996; Kim, 1995; Edmond, 1992; Redman, 1992; Simon, 1992; Agmon and Ahituv, 1987; Long, 1982). Correctness of data refers to the extent to which the data matches another set of data, which acts as a specification, or a reference set and the extent to which the data conforms to the business rules as specified. This set of data may be some aspect of the 'real world', such as the address of a client, to be obtained from visiting the client on a particular date, or the data set may be in a file or another computer system. Related to data correctness is completeness of data (and consistency of data). Incompleteness problems in a given data set point to possible correctness problems.

For the purpose of this case study, correctness, completeness and consistency have been treated separately as they have often been cited individually as important data quality dimensions (Strong et al., 1997; Orman et al., 1996; Wand and Wang, 1996; Redman, 1992; Agmon and Ahituv, 1987). Completeness refers to the extent that the data is available to satisfy the user requirements that the information system is intended to satisfy. Consistency refers to a single representation of the same data or, if more than one representation of the same data occurs, copies are controlled and have the same format and content. This means that the format and content of the same data each conform to the business rules as defined by the business and its users.

Data integrity is a fundamental problem in most organisations. Where data integrity is lacking in organisations, it results in poor data quality. There is a major data quality issue primarily caused by a lack of enforcement of the fundamental business rules not being performed by information systems in most organisations and hence, an inability to plan and control data redundancy (Hunter and Tan, 2005; Krogstie et al., 2005; Putnik and Cunha, 2005; Department of Defence, 2004). Control of data redundancy is a necessary condition for the guarantee of data consistency and data integrity of data stored in corporate databases.

A recent Chief Information Officer (CIO) global survey, (Varon and Ware, 2005) where CIOs were asked to rank their technology and management priorities, responded with data integrity ranked number two for technology priorities in six out of seven countries surveyed, including Australia and the United States.

Since the late 1980s, the availability and usability of relational database programs has significantly increased, especially for mini and personal computers. This increase has led to a proliferation of databases being created and maintained by business end-users. These databases are often queried to provide information for important business decisions. The quality of these decisions depends on the quality of the data, that is, the value and usefulness of information systems depend on the accuracy of their data (Kaomea and Page, 1997; Redman, 1995; Janson, 1988). Empirical studies of corporate databases have shown that most organisations' databases contain data anomalies (Medawar, 1995; Icerman and Hillison, 1991; Laudon, 1986; Morey, 1982). Information Technology (IT) professionals designed these corporate databases and their controls. Databases designed by business end-users, who have limited or no training in relational data modelling and design, are likely to contain an even larger percentage of data anomalies and data quality problems. Hence, the second major problem of Information Systems Architectures is commonly known as a lack of Data Integrity.

Again, in summary there is a substantial literature that describes the continuing problem of a lack of data integrity of information systems. This means that poor data integrity leads to unplanned and uncontrolled data redundancy in organisations' information systems, which in turn leads to a lack of information and ultimately poor management decision-making.

2.4 Deficiencies in Commonly Used Approaches to Deriving Integrated Information Systems Architectures

2.4.1 Introduction

The literature is rich in proposed solutions for solving the problems of a lack of information systems integration and poor data integrity. Each proposed solution can be generally assigned to one of three stages in systems development over time. The three stages identified in the literature are:

- Late 1960s to Mid-1980s – Strategic Planning to Database Design – The Continuous Flow Approach
- 1987 to 1996 – Frameworks for Information Systems Architecture
- 1995 to Present – An Object-Oriented Enterprise Model

These stages in the development of proposed solutions are now discussed and their major deficiencies indicated.

2.4.2 Strategic Planning to Database Design – The Continuous Flow Approach

Commencing in the late 1960s through to the mid-1980s, the thinking was directed to the combination of three areas: strategic planning, systems analysis and database design. Specific, practiced methods included Structured Analysis and Design Technique (SADT); Business Systems Planning (BSP); Business Information Analysis and Integration Technique (BIAIT); and Business Information Control Study (BICS) (Gillensons and Goldberg, 1984; IBM, 1984; Kerner, 1982; Zachman, 1982; Burnstine and Soknacki, 1979).

According to Beznosov (2000) and Khoury and Simoff (2005), these solutions were found to be unsatisfactory to organisations as they lacked rigor in both the way the business functions and processes were identified and defined, and the ways in which the data were analysed and defined. This resulted in inconsistent outcomes, which relied too heavily on the skills of the architects and analysts. The use of these solutions was abandoned in the late 1980s when their key proponents, such as Zachman introduced frameworks for Information Systems Architecture.

2.4.3 Frameworks for Information Systems Architecture (1987 – 1996)

Architecture is, by definition, borne of a metaphor based on classical architecture: the planning and construction of buildings. When Zachman established the notion of information systems architecture the analogy was very much a deliberate one, as Zachman consciously projected the levels of representation produced by classical architects onto the system development lifecycle. These representations give rise to a set of views representing the various perspectives taken by different participants in the system development process. Each of these representations is completely different, "...different in content, in meaning, in motivation, in use..." (Zachman, 1987: 278). The Zachman Framework for Information Systems Architecture has been widely adopted by systems analysts and database designers. It provides a taxonomy for relating the concepts that describe the real world to the concepts that describe an information system and its implementation (Sowa and Zachman, 1992a; Zachman, 1987). However, the frameworks approach, and the ensuing developments in the conceptual modelling of enterprise architectures, created a range of issues (Khoury and Simoff, 2005).

The Zachman framework is probably the most recognised and popular approach to enterprise modelling. Zachman created seminal works in the area of enterprise architecture (Khoury and Simoff, 2005; Sowa and Zachman, 1992a; Zachman, 1987). In essence, the Zachman framework provides a matrix that segments the enterprise into a variety of different views based on the different roles an actor can take, such as owner, designer, builder. As each view is modelled using disparate techniques and methods, developed independently of the Zachman framework, each segment interface presents a discontinuity. This creates a barrier to the understanding of how structures flow from one part of the enterprise to another. Thus, by dividing the organisation into distinct views the Zachman framework defeats its goal, which is to provide a unified model of the organisation (Khoury and Simoff, 2005). Sowa and Zachman were the key proponents of frameworks for Information Systems Architecture over a period of nearly ten years (Moriarty, 1996; Sowa and Zachman, 1992a; Zachman, 1987; Sowa, 1984). According to Khoury and Simoff (2005), despite the hype surrounding enterprise architectures, the frameworks approach has delivered little on their promise.

A Framework for Information Systems Architecture has been found to be a good starting point where the planner and architect have little working knowledge of the industry in which the organisation is operating. However, it is more useful at the industry level and a major drawback is that it does not identify a migration path for the organisation to move in a systematic way toward its vision. Widespread use of these frameworks has shown them to be deficient in integrating business systems successfully (Kaomea and Page, 1997; Redman, 1995; Janson, 1988). Although the development of frameworks has been very useful as a starting point, they have failed to solve the integration problem in most organisations (Hunter and Tan, 2005; Medawar, 1995; Icerman and Hillison, 1991).

Many new developments in the area of enterprise architecture can be viewed as attempts to complete the Zachman framework by developing techniques for specifying each of the thirty views precisely. There has been less focus on showing how the views inter-relate. Since this work is not yet complete, a complete enterprise model based on the Zachman framework is still beyond reach. In other words, after more than a decade of development, the predominant approach to enterprise architecture still does not provide a pragmatic solution to the problem of developing an enterprise-wide model (Khoury and Simoff, 2005).

Like many enterprise architecture approaches, the Zachman framework lacks "...scientific foundation" (Beznosov, 2000: 8). While the framework provides "...an observation of some natural rules for segmenting an enterprise into understandable parts" (Sowa and Zachman, 1992a: 596), there is little analysis of the laws and principles that govern these natural rules "...in order not only to observe them but also to discover new rules and to be in a position to explain them" (Beznosov, 2000: 8). As a result, the Zachman framework remains primarily a taxonomy which is ineffective for guiding the development of enterprise information systems.

According to Beznosov (2000), what we need from enterprise architectures is a method that is effective in:

- Developing a single and coherent model of an enterprise, and
- Allowing us to guide the future development of an enterprise without the creation of arbitrary internal boundaries.

The Zachman framework does not deliver either.

2.4.4 An Object-Oriented Enterprise Model (1995 - Present)

With a recent resurgence in enterprise modelling, most research has revolved around the object-oriented paradigm. The Object-Oriented Enterprise Model enables systems developers to gain a general systems view of an enterprise. It recognises not only information, but also other corporate resources such as technology, assets and human resources, enabling analysts to model and re-engineer an enterprise effectively. The Object-Oriented Enterprise Model marries two important paradigms: General Systems Theory and Object Orientation. One paradigm provides a way of defining the general characteristics and properties of all systems, the other provides a way to organise and present our understanding of these systems. Together, they provide a powerful means of modelling enterprise systems (Doroshenko, 1999; Gale and Eldred, 1996; Singer, 1996; Sullo, 1994; Martin and Odell, 1992; Tozer, 1992).

Gale and Eldred (1996) originally proposed Object-Oriented Enterprise Modelling in 1996. Through their years of experience they have observed a strong need for an enterprise-planning and leadership process that reflects the realities of dramatically changing environments within which enterprises must operate. Current business planning processes are almost always focused on the internal processes and operations of the business itself. Typically, the business vision, competitive strategy and the current business plan do not exist. Where it does exist, it does not focus on the global environment and how the enterprise should relate to, contribute to, and benefit from that environment (Gale and Eldred, 1996).

Khoury and Simoff (2005) argue that enterprise architectures built using component-based approaches are fundamentally flawed, in that they model the enterprise as a set of independent structures with discrete boundaries. Disparate concrete metaphors are used to describe each of these structures, with the result that enterprise architectures can only achieve partial success, at best, in providing a unified view of the enterprise.

According to Khoury and Simoff (2005), one of the most prominent drawbacks of component-based approaches such as Object-Oriented Enterprise Modelling is its complexity. For an Enterprise Model to be successfully implemented it must not only embody the vision of the enterprise but it must be easily understood by the business and technologists alike. The business must champion any new information systems architecture initiative or it is doomed to failure. With a complex solution business buy-in will be very difficult if not impossible to obtain. The proponents of Object-Oriented Enterprise Modelling (Gale and Eldred, 1996; Singer, 1996; Sullo, 1994; Tozer, 1992) have failed to realise that, at the enterprise level, planners and architects are dealing with business issues, not technology issues. Developing properly architected systems using object-oriented techniques is a separate issue. A well-developed Information Systems Architecture must analyse and define business functions, business information and the business information flows independently of how they are going to be implemented within the organisation. Some architected systems may be developed using object-orientation; others such as data warehousing systems will not use object-orientation.

Considerable research is continuing in the field of Object-Oriented Enterprise Modelling, where most of the effort is geared towards introducing and defining notions for representing system behaviours and system architectures, such as business components, software packages and enterprise beans. The development of software applications using object-oriented technologies is largely requirements-centred. Little attention is shown in providing semantic frameworks to justify that the database systems and transactional systems are integral components of the enterprise operational environment and are providing functionalities that will satisfy enterprise operational requirements in an effective and efficient manner. Since the resultant object-oriented applications are tightly bound to particular requirements, they are not engineered with the capability of evolving with the ever-changing enterprise environment.

Khoury and Simoff (2005) state that in developing enterprise architectures, it is the ability to portray the relationships between the different parts of the enterprise that is most essential. For the strategic planner, it is important to know what impact a change to one part of the organisation will have on another. A component based approach does not provide this information. It is essentially a deconstruction of an enterprise along arbitrary lines, but usually from an information systems perspective. Relationships between the various enterprise objects can of course be built into a framework, but this is an afterthought that tends not to fit in naturally with the framework description, and in practice usually turns out to be extremely onerous to develop and near impossible to maintain.

2.4.5 Conclusion

Solutions to deriving integrated Information Systems Architectures for an organisation have not proved entirely successful as evidenced by the literature. There has been renewed interest by researchers in Enterprise Modelling (Dietz, 2006) as they are still looking at new approaches, searching for the answer to the problems of a lack of information systems integration and poor data integrity. This is because the consequences for organisations are important.

2.5 Consequences of Continued Lack of Information Systems Integration

2.5.1 Introduction

The consequences to organisations of a continued lack of information systems integration and poor data integrity are important. This section discusses these in the following sections.

According to the literature, there are three major consequences to organisations of a continued lack of information systems integration and poor data integrity. They are:

- Lack of Information Technology (IT) alignment with the business.
- High cost and risk associated with attempting to integrate systems after their design.
- Poor quality management decisions.

2.5.2 Lack of IT Alignment with the Business

There was a time when Information Technology managers thought of strategic planning, systems analysis and database design as independent and only marginally related. Even by 1984, business strategic planners seemed to ignore Information Technology, and the gaps between Information Technology strategic planning, systems analysis and database design seemed to be wide. Beginning each step appeared to be an exercise in starting from scratch (Gillensons and Goldberg, 1984).

Ensuring that Information Technology (IT) is in harmony with and provides support for business strategy is commonly known as IT Strategic Alignment (McKeen and Smith, 2003; Tregoe et al., 1989; Tregoe and Zimmerman, 1980). Research has shown that alignment of Information Technology with business strategy can have significant positive impacts on business performance (Chan et al., 2002; Croteau, 2001). Also, Chief Information Officers (CIOs) and other Information Technology executives have consistently considered the alignment of Information Technology with business strategies as a top priority in their roles (Putnik and Cunha, 2005; McKeen and Smith, 2003; Reich and Nelson, 2003; Chan et al., 2002; Croteau, 2001; Watson et al., 1997; Brancheau et al., 1996). The common theme to date by researchers is the critical importance of mutual understanding of business strategy between business and Information Technology managers, incorporation of this understanding into Information Technology planning and systems development activities, and the demands for cross-functional integration of these application systems. Existing research recommends a variety of cross-communication and collaboration between business and Information Technology managers to achieve the cross-functional integration of information systems based on sharing of data among the systems. The lack of integrated Information Systems Architectures is the major reason for the lack of IT alignment with the business.

IT Strategic Alignment is the alignment of information technology with the business and in particular business strategies. The development, acquisition and implementation of information systems must be aligned with the strategic business directions including business objectives, business strategies and strategic attributes of the organisation.

2.5.3 High Cost and Risks

The attempt at integrating multiple information systems and sub-systems, few or none of which are designed to integrate with each other, each of which carries its own embedded risks, is an extremely difficult, costly and high risk exercise, which rarely achieves its integration objective. Again, the lack of integrated Information Systems Architectures is the major reason for organisations expending large dollars on attempting to integrate their information systems after implementation.

Estimates show that from 30% to as much as 70% of IT spending goes towards attempting application integration after implementation and in the Australian Department of Defence, systems integration after implementation is estimated to account for anywhere between 45% and 60% of Defence major capital projects (Department of Defence, 2004; Bellini, 1999). This view is supported by Taylor (1995: 17) who states "…many different kinds of application software that are so resistant to integration they are referred to in the industry as 'islands of automation'. " Where systems still exist as 'islands of information' the benefits of new technologies will not be achieved (Krogstie et al., 2005; McKeen and Smith, 2003; Chan et al., 2002; Sauer and Willcocks, 2002; Luftman, 2000; Bellini, 1999; Rosen, 1999; Sauer and Yetton, 1997; Taylor, 1995). The inability of application systems to talk to each other is caused from a lack of top-down guidance and results in a lack of integration from a business and information perspective; it is not a technology issue (Krogstie et al., 2005; Reich and Nelson, 2003; Kaomea and Page, 1997;

Watson et al., 1997; Brancheau et al., 1996; Redman, 1995; Janson, 1988).

This view is supported by the Australian Department of Defence (Department of Defence, 2004) as electronic systems pose particular challenges to Defence in implementing the Government's decision of October 2004 to adopt a more strategic approach to systems acquisition. Electronic systems account for a significant portion of the Defence forward procurement program. The value of attempting systems integration alone is estimated to account for between $15 billion and $19 billion of projected capital acquisition expenditure over the next ten years. Electronic systems carry significant risk for Defence. They are central to the sensors, weapons, and data links, data processing and mission systems of every platform and system operated by Defence. The integration of these systems with each other, with platform systems, and with theatre-wide systems, lies at the very core of functional effectiveness for the Australian Defence Force. Electronic systems, and most especially their integration, are an inherently risky business. They involve creative processes integrating multiple sub-systems, few or none of which are designed *ab initio* to integrate and each of which carries its own embedded risks. This makes the business of systems integration high risk throughout the world. Around half of the systems-intensive projects encounter cost or schedule difficulties that can be attributed in part or whole to the systems integration component of the projects. In some well-publicised cases, this has led to schedule and cost over-runs of major proportions and a clear lack of achievement of the systems integration objective.

The Australian Defence Force requires integration of disparate weapons, sensors, platforms, communications and data processing systems, and the risk of failure is very much a function of the risk attaching to incompatibilities amongst the constituent sub-systems. In a recent Department of Defence publication, systems integration is estimated to account for anywhere between 45% and 60% of Defence major capital projects (Department of Defence, 2004). In this publication, the Department of Defence identifies systems integration projects as being particularly vulnerable to higher risk potential: "Projects of any type that require substantial systems integration are potential sources of significant cost and schedule overruns and capability requirement shortfalls. The track record of such projects is extremely poor" (Department of Defence, 2004: 47).

The Head of Electronic Systems Division (HESD) advised a Senate committee that in a survey of company software capabilities conducted by Defence (Foreign Affairs Defence and Trade References Committee, 2002) it was found that:

- 68% of companies did not perform adequate requirements management
- 80% of companies did not adequately plan for risk management, including systems integration requirements
- 90% of companies did not perform adequate systems planning
- 90% of companies did not have satisfactory decision making processes, and
- 100% of companies failed to use measurement to satisfy information needs.

Information systems that cannot talk to each other is caused from a lack of top-down guidance and results in a lack of integration from a business and information perspective; any attempt at integrating these information systems after they are designed is an extremely difficult, costly and high risk exercise. These high cost, high risk projects are a direct consequence of not designing the information systems with an objective of integration in the first place.

2.5.4 Poor Quality Management Decisions

Current research (McKeen and Smith, 2003; Reich and Nelson, 2003; Bellini, 1999) shows that most managers rely on instinct and do not have the information they need, let alone an integrated set of information. Other survey findings are that:

- 60% of managers have no knowledge strategy
- 40% of managers have no planning system
- 75% of managers do not exploit knowledge assets
- 0.2% of managers get the information they need, and
- 50% of managers say IT people do not understand their business needs.

The quality of management decisions depends on the quality of the data, that is, the value and usefulness of information systems depend on the accuracy of their data (Putnik and Cunha, 2005; Kaomea and Page, 1997; Redman, 1995; Janson, 1988). Empirical studies of corporate databases have shown that most organisations' databases contain data anomalies (Hunter and Tan, 2005; Medawar, 1995; Icerman and Hillison, 1991; Laudon, 1986; Morey, 1982). Control of data redundancy is a necessary condition for the guarantee of data consistency and data integrity of data stored in corporate databases.

A lack of knowledge exists in some organisations due to a lack of integrated information and there is data chaos in most organisations with islands of information still in existence (Hunter and Tan, 2005; Putnik and Cunha, 2005; McKeen and Smith, 2003; Chan et al., 2002; Sauer and Willcocks, 2002; Luftman, 2000; Bellini, 1999; Rosen, 1999; Sauer and Yetton, 1997; Taylor, 1995; McFarlan and McKenney, 1983; McFarlan et al., 1983). Information is not seen as a strategic asset. Most organisations have incompatible legacy systems with no strategy for ‘knowledge audit’ and a distrust of the Information Technology function. There exists a need for ‘knowledge mapping’, knowledge stewards and knowledge directors (Bellini, 1999; Taylor, 1995).

Poor quality management decisions are a direct consequence of a continued lack of information systems integration and poor quality data. This is due to an inability of information systems to provide the information managers need and the data anomalies found in organisations’ databases that are designed with a high level of data redundancy. Unplanned and uncontrolled data redundancy results in poor data integrity.

2.6 Theoretical Foundations of Enterprise Modelling

2.6.1 Introduction

Planners, modellers, analysts and developers must be able to grasp a general systems view of an enterprise, to examine the most fundamental business concepts, understand the overall business environment, as well as the ways in which the enterprise should interact with this environment. To accomplish this, an Enterprise Modelling Approach must provide a powerful means of modelling enterprise systems. Hence, Enterprise Modelling must borrow from, refine and enhance, integrate and synthesise existing theoretical work in a number of diverse areas.

This section shows that the literature supports the development of new approaches, including Enterprise Modelling. The Enterprise Modelling Approach described in Chapter 3 is a synthesis of the best features and has solid theoretical foundations that are described in this section from the literature. The blending of disparate disciplines and experience covers existing theoretical work in a number of diverse areas. These are referred to as:

- Business Foundations to Enterprise Modelling.

- Theoretical Foundations to Enterprise Modelling.
- Modelling and Methodology Foundations to Enterprise Modelling.

These disparate disciplines provide the bases for the Enterprise Modelling approach. Although each of the diverse areas are proven in their own right, it is the bringing of them together with an enterprise perspective that distinguishes the Enterprise Modelling Approach from each of the individual methods identified within these diverse areas.

The recommended approach to Enterprise Modelling to be developed and evaluated as a major part of this study allows abstraction of an entire enterprise as a whole, in part(s), and at its most fundamental level. It borrows from, integrates and synthesises existing theoretical work in the areas identified above. Each is now discussed in detail. How each are used in the Enterprise Modelling Approach is discussed in Chapter 3 An Enterprise Modelling Approach.

2.6.2 Business Foundations to Enterprise Modelling

Business foundations cover strategic business planning and include competitive business fundamentals such as strategic business requirements and business imperatives, industry analysis and trend analysis. Business foundations look at industries and markets, strategy and vision, and general management concepts (Capezio and Morehouse, 1993; Drucker, 1993; Hammer and Champy, 1993; Keen, 1993; Morton, 1991; Porter, 1990; Tregoe et al., 1989; Porter, 1985; Porter, 1980; Tregoe and Zimmerman, 1980).

These business foundations have influenced the researcher’s views on the purpose and content of enterprise modelling, in particular, the alignment of information technology with business strategy. Of significance is Porter’s value chain approach, where Porter (1985) proposes that the basis for every enterprise is the process of taking some source materials and manipulating them such that value is added to those materials. The overall process consists of a series, or chain, of smaller value adding steps, the value chain. Porter (1985) states that the competitiveness of any business is determined by that business' position in the overall value chain of an industry.

Further to the value chain approach, Porter's discussions of competitive opportunity and advantage are within the context of the external environment within which businesses operate (Porter, 1980). The most important relationships an enterprise model must reflect and represent are those between the enterprise and external entities such as customers, suppliers, regulators and competitors.

The concept of driving force (Tregoe and Zimmerman, 1980) in business planning and management are also fundamental business foundations to enterprise modelling. According to Tregoe and Zimmerman (1980), strategy is vision directed to what the enterprise should be, and not how the enterprise will get there. Strategy is the framework which guides the choices that determine the nature and direction of an enterprise. Tregoe and Zimmerman (1980) propose that there are nine fundamental strategic areas with which enterprise management is concerned and that, of these, one that is of paramount importance to any business. The strategic area of 'products offered' relates to the products and ongoing support or maintenance services an enterprise offers. These are defined in terms of common characteristics such as needs met, functions performed, and scale and durability. An enterprise that holds this as its driving force believes these products are the key to its long-term success. All other strategic areas of the business will be directed towards supporting the effective development, production, sale, delivery, and servicing of these specific products.

According to Tregoe and Zimmerman (1980), a finite number of unique but identifiable and manageable strategic forces drive an enterprise. The ability to identify meaningful strategic areas that affect industries and to establish a useful driving force for individual enterprises is an extremely powerful part of the business modelling environment.

2.6.3 Theoretical Foundations to Enterprise Modelling

Four theories are of particular relevance for developing an Enterprise Model. They are:

1. Theory of General Systems

   One of the main premises of this study is that the enterprise is an example of a general system and modelling can be performed using the tools, techniques and concepts from general systems theory (Kramer and de Smit, 1977; Sutherland, 1975).

2. Theory of Communications

   An enterprise is a premier example of an information-processing network. The information-processing network is a unique example of a general system because it contains a significant property: information. The structure of the information-processing network is a communications infrastructure that transmits information between its subsystems (Gale and Eldred, 1996).

3. Theory of Conceptual Modelling

   Conceptual modelling is a primary tool used to understand complex systems. The primary technique of modelling is abstraction. Where the collection of objects defined by conceptual modelling pursues the same overall objective, then it can be described as a system (Krogstie et al., 2005; Halpin, 2001; Halpin, 1995; Sowa, 1992; Tepfenhart, 1992; Sowa, 1991; Nijssen and Halpin, 1989; Van Griethuysen, 1987; Sowa, 1984).

4. Theory of Hierarchical Systems

An important organisational structure of a complex general system such as the enterprise is the hierarchical-multilayer system. An enterprise is a premier example of a hierarchical-multilayer system. The hierarchical-multilayer organisation means that the system has both a hierarchical aspect and a multilayer aspect. The hierarchical aspect means that the various sub-systems will be arranged in hierarchies in which a co-ordination and control function is part of the larger system. The multilayer aspect means the division of the system into functional abstraction layers (Kim, 1990; Mesarovic and Takahara, 1989; Mesarovic et al., 1970).

2.6.4 Modelling and Methodology Foundations to Enterprise Modelling

The modelling foundations rely on computer science, the relational model and its extension to a semantic relational model, which contains all of the properties of the object-oriented paradigm (Krogstie et al., 2005; Halpin, 2001; Gale and Eldred, 1996; Halpin, 1995; Jacobson et al., 1995; Kim, 1995; Nijssen and Halpin, 1989; Van Griethuysen, 1987; Chen, 1976).

The development of an Enterprise Model is made possible by using the best features of existing proven methods from leading experts and enhancing these methods to achieve the objective of delivering an Enterprise Model. It is important to note that none of the following methods have been developed in order to deliver an Enterprise Model. These methods documented in the literature do not contain a step-wise approach with the one overall objective in mind; they are piecemeal in that they deliver one small aspect of the overall design of an information system and they were never intended to address the need to design one Enterprise System. The works of John Sowa in Conceptual Modelling and Information Systems Architecture Framework has been very important here. However, the two areas of research have been largely unrelated as they did not share a common research objective. In fact, the works of each of these researchers and authors has been very important here as a foundation to build upon for Enterprise Modelling. These methods, however, represent a sound methodology foundation that is well documented in the literature:

- Driving Force / Strategic Framework (Tregoe et al., 1989; Tregoe and Zimmerman, 1980).

- Strategy and Vision, and Value Chain Analysis (Porter, 1990; Porter, 1985; Porter, 1980).

- Information Technology (IT) Strategic Alignment (Dietz, 2006; McKeen and Smith, 2003; Reich and Nelson, 2003; Chan et al., 2002; Croteau, 2001; Watson et al., 1997; Brancheau et al., 1996).

- Function and Process Modelling (Dietz, 2006; Martin and Odell, 1992; Martin, 1990; Martin, 1989).

- Information Modelling and Data Modelling (Krogstie et al., 2005; Halpin, 2001; Halpin, 1995; Edmond, 1992; Nijssen and Halpin, 1989; Van Griethuysen, 1987; Vetter, 1987; Chen, 1976).

- Business Re-engineering (Hammer and Champy, 1993; Morton, 1991).

- Object-Orientation (Dietz, 2006; Henderson-Sellers and Simons, 2000; Booch et al., 1999; Jacobson et al., 1999; Rumbaugh et al., 1999; Gale and Eldred, 1996; Jacobson et al., 1995; Kim, 1995; Soley and Stone, 1995; Taylor, 1992).

- Information Systems Architecture Framework (Moriarty, 1996; Sowa and Zachman, 1992a; Sowa, 1992; Zachman, 1987; Sowa, 1984).

2.7 Aims and Hypotheses of the Research

A comprehensive review of the relevant literature reveals the continuing problems of a lack of information systems integration and poor data integrity. It also reveals the undesirable consequences of these problems. There is a need for a new approach but one that incorporates the best of the commonly used approaches and techniques. This thesis reports on such a new approach, which is referred to as an Enterprise Modelling Approach.

The general aims of this research are to develop and to evaluate the usefulness of the Enterprise Modelling Approach for the development of Information Systems Architectures. Using a leading Telecommunications Service Provider company as the comprehensive case study, this approach will be compared against a commonly used alternative approach to investigate whether the claimed benefits of Enterprise Modelling are realised.

Specifically, the research aims are as follows, together with a cross reference to the most relevant section of the thesis that addresses each aim:

1. Identify the major performance problems that result from a lack of information systems integration. This research aim is addressed in Chapter 2, Section 2.5, Chapter 3 and Chapter 5, Section 5.7.

2. Identify the major deficiencies in the commonly used approaches and the need for a better approach to ensure integrated information systems architectures. This research aim is addressed in Chapter 2, Section 2.4 and Chapter 3, Section 3.4.

3. Develop and apply the Enterprise Modelling Approach in a real-live environment to a Telecommunications Service Provider. This research aim is addressed in Chapters 3 to 7.

4. Identify the commonly accepted criteria for the evaluation of Information Systems Architectures and their relative importance. This research aim is addressed in Chapter 2, Chapter 4, Section 4.9, and Chapters 5 to 7.

5. Document the current implemented Information Systems Architecture of the MNPS for the Telecommunications Service Provider. This research aim is addressed in Chapter 4, Section 4.5.3, Chapter 5, Section 5.3 and Chapters 6 and 7.

6. Demonstrate the usefulness of the Enterprise Modelling Approach by a comparative evaluation of MNPS and DRS using the commonly accepted criteria. This research aim is addressed in Chapter 4, Section 4.8, Chapter 5, Section 5.5 and Chapters 6 and 7. The research environment is real and not simulated.

The main hypothesis of this research is that an information system designed and implemented in accordance with the Enterprise Model is superior to an information system that does not use an Enterprise Model as its basis of development. The information system designed on the basis of an Enterprise Model will be naturally integrated with the other information systems and its data will have a high degree of data integrity. The following subsidiary hypotheses support the main hypothesis:

- An information system designed and implemented in accordance with the Enterprise Model is more likely to support widely accepted architectural principles than one that is not.

- An information system designed and implemented in accordance with the Enterprise Model is more likely to support the fundamental business rules than one that is not.

- An information system designed and implemented in accordance with the Enterprise Model is more likely to have a well-defined functional scope and interface specification than one that is not.

- An information system designed and implemented in accordance with the Enterprise Model is more likely to support data sharing, planned and controlled data redundancy and a high degree of data consistency than one that is not.

2.8 Summary

This chapter has discussed the continuing problems of the lack of information systems integration and poor data integrity, and the undesirable consequences that follow from these problems. Current approaches to information systems architectures have not solved these problems. This suggests the need for a new approach, but one that incorporates many of the best features and techniques of some current approaches.

Such an approach is referred to as Enterprise Modelling and it is described in Chapter 3 An Enterprise Modelling Approach. It is claimed that such an approach will successfully integrate information systems and ensure a high level of data quality. Any organisation which builds and implements its information systems architecture based on an Enterprise Model is likely to realise the following benefits:

- Well-structured information systems architectures, with strategic alignment of IT with the business and consistently defined information systems.

- High degree of data sharing.

- Planned and controlled data redundancy.

- Controlled process redundancy.

- Data consistency and high quality data, as the basis of management decision-making.

- Lower cost and lower risk of information systems integration.

Chapter 3 An Enterprise Modelling Approach

3.1 Introduction

Enterprise Modelling is the name the researcher has given to an approach that models the way information is created, used and shared in an organisation. It is believed to be an innovative approach developed by the researcher and has been used comprehensively in industry, both within Australia and overseas. This includes a range of industry sectors and organisations of varied size. Refer to Appendix A - List of Organisations Using the Enterprise Model, for a list of organisations where the author believes the Enterprise Modelling Approach has been used successfully.

The research reported in this thesis relates to a particular controlled Telecommunications environment involving the management of ‘Churn’ events named the Mobile Number Portability (MNP) initiative, implemented as part of the Australian regulatory environment by the Australian Communications Authority. The MNP initiative is a mandatory business process for all industry players to manage the movement of a customer’s service number and service (known as ‘Churn’) from one Carrier (also known as Network Provider) to another or one Service Provider to another.

This chapter first explains the Enterprise Modelling process. There are three stages to the process of Enterprise Modelling. Like any process, it receives inputs and transforms these inputs into outputs. The resultant outcome of the process is an Information Flow Model that is named the Enterprise Model. Stage 1 involves conducting executive interviews and workshops with each of the organisational units to better understand the business, its strategic objectives, business strategies, organisational constraints and business functions. The output of Stage 1 is then input into Stages 2 and 3. Stage 2 involves the strategic alignment of information technology to the business and its strategic directions. Stage 3 takes input from Stages 1 and 2 to perform business functional analysis, information analysis and information flow analysis. The major output of Stage 3 is the Information Flow Model or Enterprise Model. The Enterprise Model is important in ensuring an organisation implements an 'optimum' information systems architecture that promotes integration of information systems based on the sharing of common data.

Next this chapter describes the Enterprise Model in generic form and illustrates with reference to a Telecommunications Service Provider case study.

Finally, the chapter concludes with a discussion on the importance of the Enterprise Model as the key to successful information systems integration. The case for Enterprise Modelling is presented again with examples from the Telecommunications Service Provider case study.

3.2 An Enterprise Modelling Approach

3.2.1 Introduction

This section describes the Enterprise Modelling process in generic form and is illustrated as Figure 1 - An Enterprise Modelling Approach.

The Enterprise Modelling Approach consists of three sequential stages. They are:

- Stage 1 – Data Gathering
- Stage 2 – IT Strategic Alignment
- Stage 3 – Information Flow Modelling

The process is triggered by an organisation experiencing problems with information systems integration or poor data quality or simply requiring a strategic perspective of its information. Each stage consists of a number of steps and produces outputs which are used by the subsequent stage. The final major output of Stage 3 is the Enterprise Model.

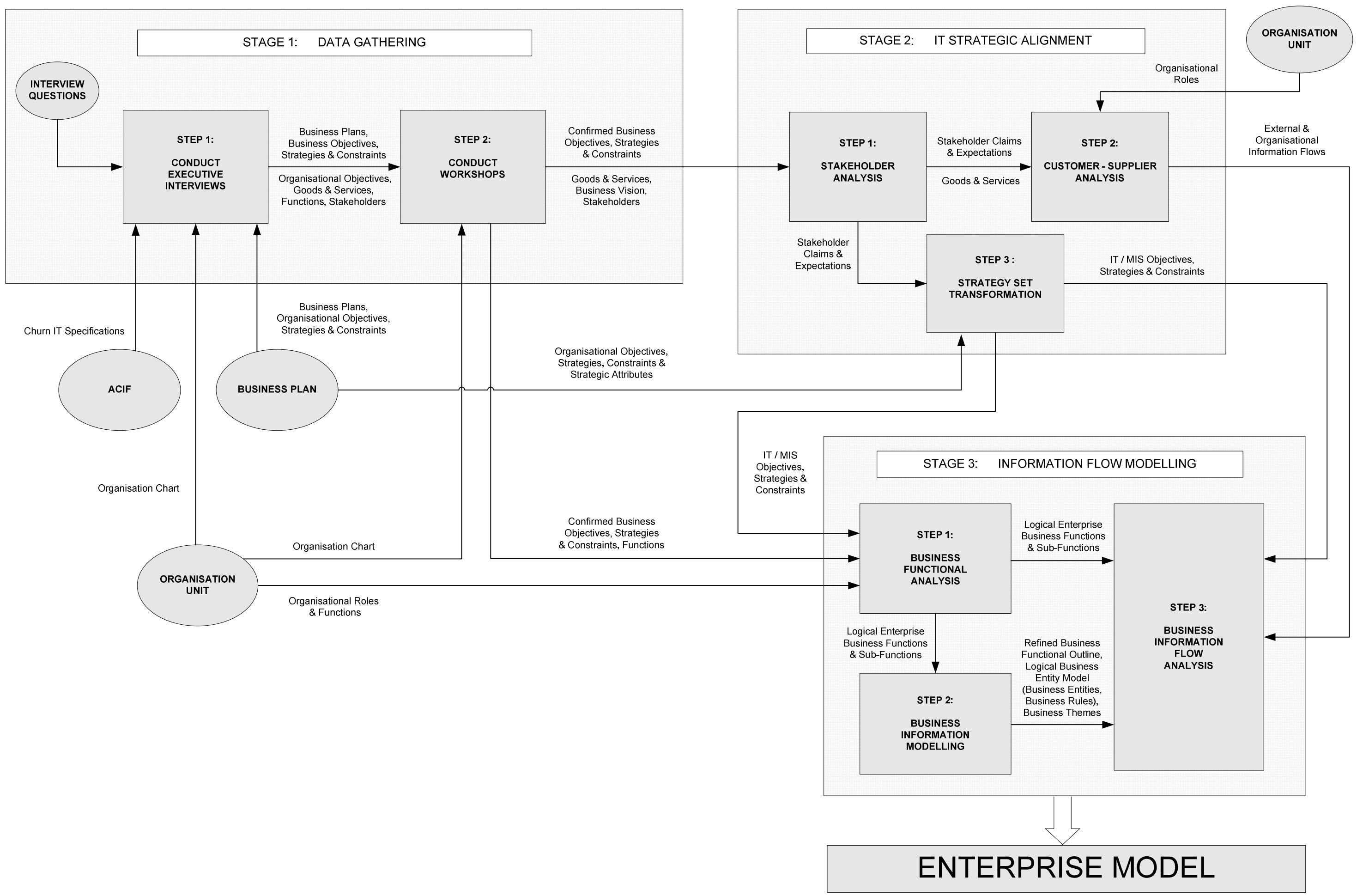

Figure 1 - An Enterprise Modelling Approach

The Enterprise Modelling Approach is based on a comprehensive understanding of the literature supplemented by extensive practitioner experience in successfully using the approach for a range of information systems in a number of organisations of all sizes around the world. The Enterprise Modelling Approach to Information Systems Architectural design is a synthesis of the best features from other approaches and has solid theoretical foundations described previously in Section 2.6. This blending of disparate disciplines and experience covers existing theoretical work in a number of diverse areas which are Business Foundations; Abstract Theoretical Foundations; Modelling Foundations and Methodology Foundations. These disparate disciplines provide the bases for the Enterprise Modelling Approach. Although each of these diverse areas is proven in its own right, it is the bringing of them together with an enterprise perspective that distinguishes the Enterprise Modelling Approach from each of the individual methods identified within these diverse areas. The researcher believes that other approaches to Information Systems Architectural design lack the solid theoretical foundations of the Enterprise Modelling Approach.

3.2.2 Stage 1 – Data Gathering

The first stage in the Enterprise Modelling Approach is Data Gathering. The Data Gathering Stage consists of two sequential steps. They are:

- Step 1 – Conduct Executive Interviews
- Step 2 – Conduct Workshops

The Data Gathering Stage is conducted in the same way whether an organisation is experiencing problems with information systems integration or suffers from poor data quality or requires a strategic perspective of its information or information technology. The Data Gathering Stage is now described and is shown as Figure 2 – Stage 1 Data Gathering of an Enterprise Modelling Approach.

The first step in this stage, Step 1 - Conduct Executive Interviews, consists of taking a number of inputs and applying the standard set of interview questions to all executives in the organisation. These inputs consist of a comprehensive organisation chart that shows all organisational units, business planning and other strategic company documentation that shows organisational objectives, strategies and constraints and the ACIF IT Specifications for each of the regulatory products.

The Organisation Chart identifies the organisational functions performed at this time and is the basis of identifying executives to be interviewed. The business planning documentation provides an initial understanding of the business and its strategic direction and is used to supplement the standard set of interview questions.

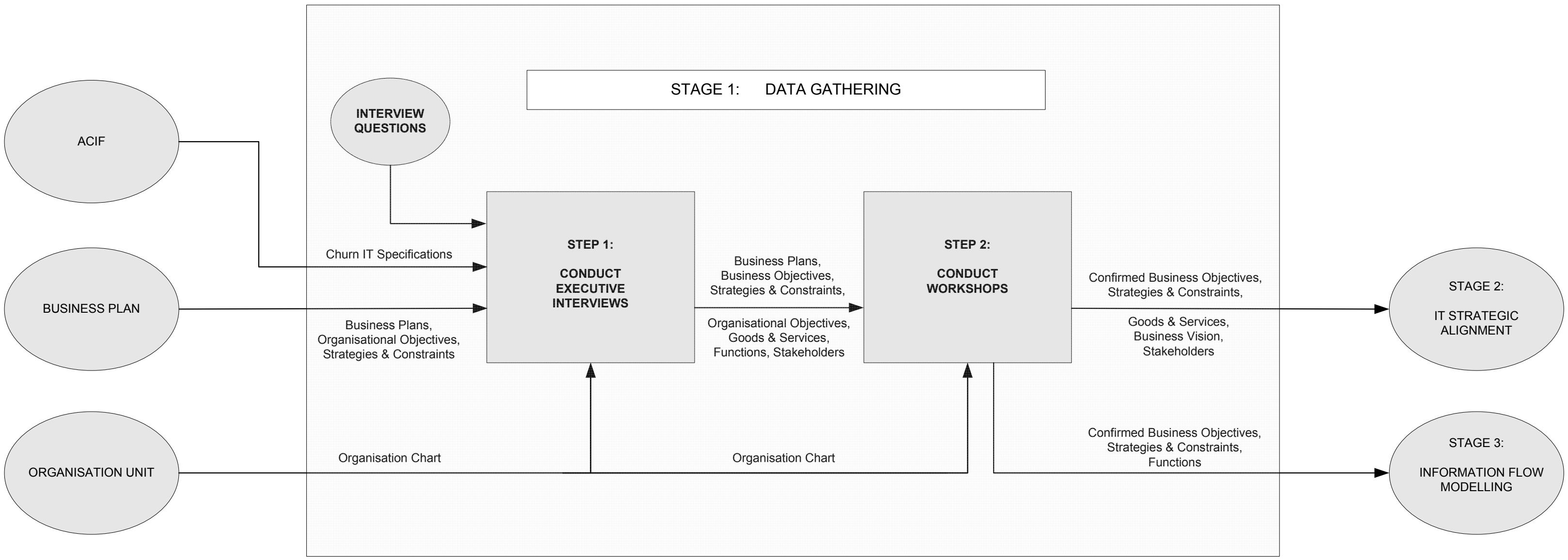

Figure 2 – Stage 1 Data Gathering of an Enterprise Modelling Approach

Step 2 - Conduct Workshops consists of taking the outputs from Step 1 and analysing them further with cross-functional groups throughout the organisation to gain clarification and confirmation right down to the operational units within the organisation. The outputs of Step 1 used as inputs to Step 2 are:

- Business Plans
- Business and organisational objectives, strategies and constraints
- Goods and services provided
- Organisational functions
- Stakeholders as perceived by the executives of the organisation.

The Organisation Chart identifies the organisational functions performed at this time and is the basis of identifying human resources to be included in the workshops. The final major output of Stage 1 is the confirmed business objectives, goods and services, business strategies, business vision, constraints, organisational functions and stakeholders used as input into Stages 2 and 3.

The primary focus of the interviews and workshops performed in this stage is as follows:

- Gaining an understanding of the organisation's Business and Information Requirements from an Enterprise perspective, not an Applications perspective, with particular emphasis on using this information as a basis for developing the Enterprise Model.
- Gaining an understanding of the organisation's Business Plan and Strategic Plan, including strategic business objectives, strategies, outcomes and strategic attributes, with particular emphasis on using this information as a basis for developing the Enterprise Model.

- Elicit the organisation's current Business Information Management requirements, including the existing Information Management Policies and Principles.

- Gaining an understanding of the scope and inter-relationships of the current Information Systems projects.

- Elicit any specialist Information Management needs with particular emphasis on using this information as a basis for developing the Enterprise Model.

- Gaining an understanding of the existing Information Systems Strategy.

- Gaining an understanding of the basis of the current selection of technologies and tools.

The focus of the Data Gathering stage is to gain an understanding of the business foundations of the enterprise under study with the emphasis on business strategy and vision. The Data Gathered in this stage is used as input for all subsequent stages.

3.2.3 Stage 2 – Information Technology (IT) Strategic Alignment

The second stage in the Enterprise Modelling Approach is IT Strategic Alignment and is shown as Figure 3 – Stage 2 IT Strategic Alignment of an Enterprise Modelling Approach. The IT Strategic Alignment Stage consists of three steps. They are:

- Step 1 – Stakeholder Analysis

- Step 2 – Customer-Supplier Analysis

- Step 3 – Strategy Set Transformation

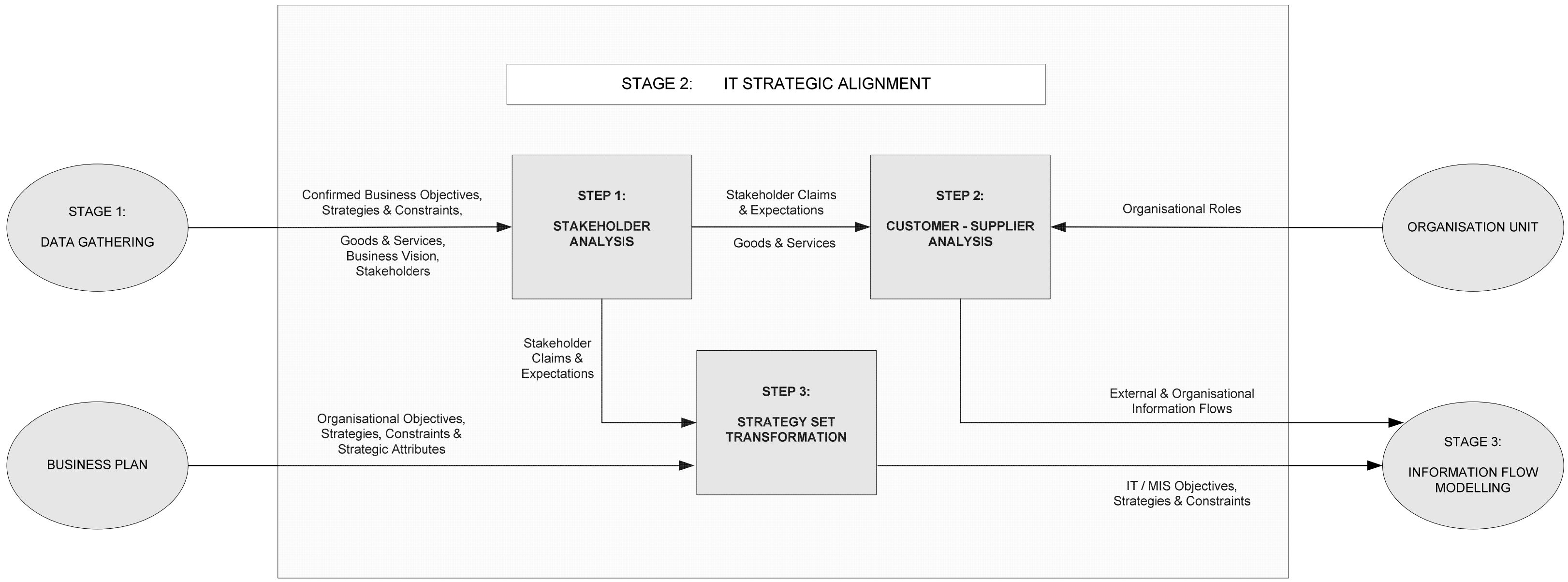

Figure 3 – Stage 2 IT Strategic Alignment of an Enterprise Modelling Approach

Ensuring that Information Technology (IT) is in harmony with and provides support for business strategy is commonly known as IT Strategic Alignment (McKeen and Smith, 2003). Research has shown that alignment of Information Technology with business strategy can have significant positive impact on business performance (Chan et al., 2002; Croteau, 2001). Also, Chief Information Officers (CIOs) and other Information Technology executives have consistently considered alignment of Information Technology with business strategy as a top priority in their roles (Reich and Nelson, 2003; Watson et al., 1997; Brancheau et al., 1996). The three steps described below are performed on the data gathered during the interviews and workshops. Once completed, the outcome of this stage ensures the IT Strategic Alignment with business strategy.

The outcome of these three steps is of particular relevance as input into the development of an Enterprise Model. The three steps in IT Strategic Alignment are:

1. Step 1 - Stakeholder Analysis

Stakeholder Analysis (McKeen and Smith, 2003; Reich and Nelson, 2003; Chan et al., 2002; Croteau, 2001; Watson et al., 1997; Brancheau et al., 1996; Hammer and Champy, 1993; Morton, 1991; Porter, 1990; Tregoe et al., 1989; Porter, 1985; Porter, 1980; Tregoe and Zimmerman, 1980) is a method for depicting succinctly the nature of an organisation in relation to its environment (that is, the rest of the world), in terms of the purpose it serves, the role it plays and the social responsibilities it is charged with. A stakeholder may be a shareholder, a customer, a creditor, an employee, an interest group, a regulatory body or the public. Step 1 Stakeholder Analysis consists of taking a number of inputs from Stage 1, in particular, confirmed business objectives, business strategies and constraints, business vision, goods and services provided, and stakeholders identified by the executives and analysing these inputs. In Stakeholder Analysis, the legitimate claims and expectations of each of the stakeholders are documented and analysed. The results are then fed as input into a subsequent step Strategy Set Transformation.

2. Step 2 - Customer Supplier Analysis

Customer-Supplier Analysis (Gale and Eldred, 1996; Hammer and Champy, 1993; Morton, 1991; Porter, 1990; Tregoe et al., 1989; Porter, 1985; Porter, 1980; Tregoe and Zimmerman, 1980) is a method for analysing the role played by an organisation's constituent organisational units. Any organisation or its constituent organisational unit can be considered as an on-going business concern with its own (generic) customers and (generic) suppliers. Step 2 Customer-Supplier Analysis consists of taking a number of inputs from Step 1, in particular, stakeholder claims and expectations and goods and services provided, together with the organisational roles identified for each organisational unit and analysing these inputs. Based on the goods and services identified in Customer-Supplier Analysis, the respective organisational information flows and external flows can be identified. The outcome is then fed as input to a subsequent step, Business Information Flow Analysis.

The outcome of Business Information Flow Analysis is the Enterprise Model, which is independent of organisational structure and technology. Customer-Supplier Analysis performed as part of IT Strategic Alignment is based on the way information flows into and out of the constituent organisational units of an enterprise. This step provides an organisational perspective of the information flows.

3. Step 3 - Strategy Set Transformation

Strategy Set Transformation (Gale and Eldred, 1996; Boar, 1995; Porter, 1990; Porter, 1985; Porter, 1980) is an analysis method for deriving the Information Technology (IT) and Management Information System (MIS) objectives, strategies and constraints from the respective organisational objectives, strategies and strategic attributes. Step 3 Strategy Set Transformation consists of taking a number of inputs from Step 1, in particular, stakeholder claims and expectations, together with the organisational objectives, strategies, constraints and strategic attributes obtained from the Business Plan and confirmed with the business executives in Stage 1 and analysing these inputs. The outcome of Step 3, the IT / MIS objectives, strategies and constraints is then fed as input to subsequent steps in Stage 3, Business Functional Analysis and Business Information Flow Analysis as shown in Figure 3 - Stage 2 IT Strategic Alignment of an Enterprise Modelling Approach.

The outcome of Stage 2 IT Strategic Alignment is the alignment of information technology with the business and in particular business strategies. This ensures that the Enterprise Model developed in Stage 3 is aligned with the strategic business directions including business objectives, business strategies and strategic attributes of the organisation.

3.2.4 Stage 3 – Information Flow Modelling

The third stage in the Enterprise Modelling Approach is Information Flow Modelling and is shown as Figure 4 - Stage 3 Information Flow Modelling of an Enterprise Modelling Approach. The Information Flow Modelling Stage consists of three sequential steps. They are:

- Step 1 – Business Functional Analysis
- Step 2 – Business Information Modelling
- Step 3 – Business Information Flow Analysis

The outcome of the steps performed in Stage 3 is the Enterprise Model.

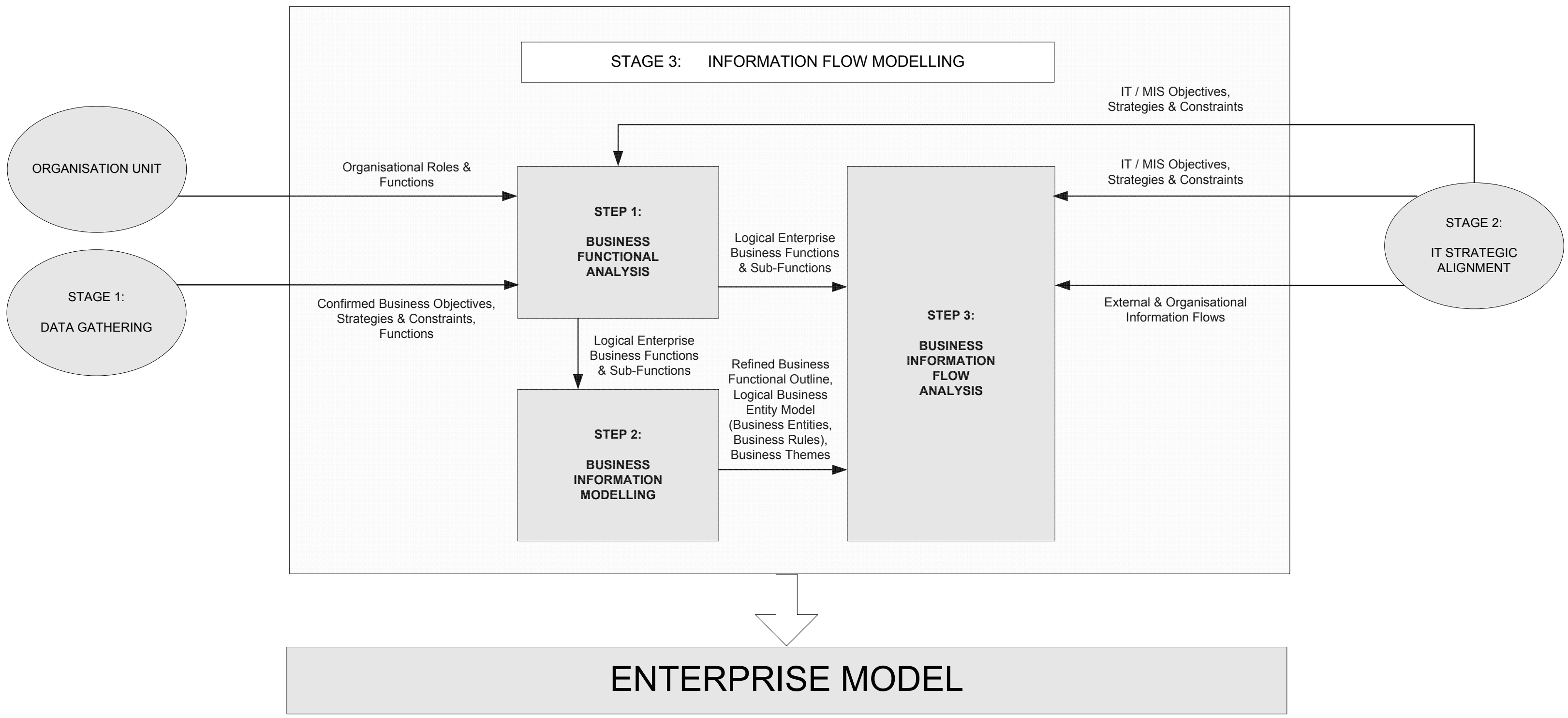

Figure 4 – Stage 3 Information Flow Modelling of an Enterprise Modelling Approach

The Information Flow Modelling performed as part of an Enterprise Modelling initiative consists of the following major steps:

1. Step 1 – Business Functional Analysis

The objective of Functional Analysis (Dietz, 2006; Martin, 1990; Martin, 1989) is to describe the business functions performed by each of the organisation's lines of business. Step 1 Functional Analysis consists of taking a number of inputs from Stages 1 and 2, in particular, the confirmed business objectives, business strategies and constraints, and the organisational functions obtained from Stage 1 and the IT / MIS objectives, strategies and constraints obtained from Stage 2 and analysing these inputs. Another key input into Step 1 is the organisation's Organisational Structure taking into consideration the organisational roles and functions. All of these inputs are then analysed using business life-cycle analysis and means-end analysis to produce a set of logical enterprise business functions and sub-functions that are then input into Steps 2 and 3.

Functional Analysis is a method for analysing the business functions and processes performed by a complex organisation in order to decompose the organisation into a hierarchy of constituent sub-functions in such a way that:

- The information flows among the constituent sub-functions are minimised.
- The totality of the lowest-level sub-functions constitutes the entirety of the original functional area.

The outcome of Functional Analysis is a Functional Outline depicting a hierarchy of logical enterprise business functions and sub-functions performed by the organisation's lines of business and supporting business units that are independent of the way the organisation is structured.

The functional areas of the Functional Outline are used to define the scope of the Business Entity Models developed, as the data to be modelled is created and used by the business functions of the organisation.

2. Step 2 - Business Information Modelling

Business Information Modelling (Krogstie et al., 2005; Halpin, 2001; Halpin, 1995; Edmond, 1992; Nijssen and Halpin, 1989; Van Griethuysen, 1987; Vetter, 1987; Chen, 1976) is a method for identifying and depicting the kinds of things of interest to the business (that is, business entity types), how they are inter-related to one another (that is, relationship types) and the fundamental business rules applied to them in the on-going conduct of the business (that is, business constraints).

Business Information Modelling takes as input the logical enterprise business functions and sub-functions comprised in the Functional Outline and perform the following three sub-steps:

- Business Entity Identification - The objective of Business Entity Identification is to identify all business entity types within the scope and context of the organisation's functional area of study. The Functional Outline is used to identify the potential business entity types and any inconsistencies that arise from the Functional Outline are clarified and confirmed with the relevant business representatives. The outcomes of this sub-step are a refined business Functional Outline and a list of potential business entity types relevant to the functional area of study. With respect to the case study, the functional area of study is the enterprise.

- Business Entity Modelling - The objective of Business Entity Modelling is to identify and describe the relationships between each pair of business entities that is, how they are inter-connected with one another. The business entities are analysed in context of their inter-relationships and conceptualisation is used to delve into the meaning of the entity types and data elements. The purpose of conceptualisation is to facilitate the correct interpretation of business data, avoid naming conflicts and establish a basis for modelling business 'reality'. Any inconsistencies that arise from the identified potential business entity types are clarified and confirmed with the relevant business representatives. The outcome of this sub-step is a Business Entity Model for each of the organisation's business functional areas. This Business Entity Model forms the basis of the shared data structures to be implemented in the information systems' data bases.

- Business Entity Clustering - The objective of Business Entity Clustering (also known as Affinity Analysis) is to cluster closely related business entity types into Business Themes that enable the organisation's business to understand its information from a holistic perspective. Business Entity Clustering involves the business representatives working closely with the analyst in analysing the strength of the association type between each pair of business entity types. The outcome of this sub-step is a logical Business Entity Model clustered into Business Themes.

3. Step 3 - Business Information Flow Analysis

Business Information Flow Analysis (Dietz, 2006; Gale and Eldred, 1996; Sowa and Zachman, 1992a; Tozer, 1992; Zachman, 1987; Gillensons and Goldberg, 1984; Sowa, 1984) is a method for depicting and analysing an enterprise (or a part thereof) in terms of where information is derived, processed and passed on from one business function to another.

The objective of Business Information Flow Analysis is to identify how the organisation's information is created, used and shared among the Business Functions, providing the 'big picture' of the organisation's business information flows.

This step takes as input the logical enterprise business functions and sub-functions described as the outcome of Step 1 Business Functional Analysis, and the refined business functional outline, the business themes, business entities and business rules described as the outcome of Step 2 Business Information Modelling. Matrix analysis is then performed by analysing the way information flows among the Business Functions by identifying the information (in terms of Business Themes) created and used by the Business Functions, taking into account the information systems objectives, strategies and strategic attributes derived from Strategy Set Transformation and the external and organisational information flows identified as a result of performing Customer-Supplier Analysis.

The outcome of this step is the organisation's Information Flow Schema (Model), which is simply named the Enterprise Model. The Enterprise Model is independent of the organisation's Organisation Structure, its existing Information Systems and Technology and its People.

The steps performed in Stages 2 and 3, IT Strategic Alignment and Information Flow Modelling respectively, are used in this case study in a different way to which similar methods are generally used, as it is the bringing of them together with an enterprise perspective that distinguishes the Enterprise Modelling approach from each of the individual methods. In this study as described, the output from one method such as Stakeholder Analysis is used as input to another method such as Strategy Set Transformation.

Development of the Enterprise Model draws upon the insights and contributions from the literature of those researchers identified above and also to the researchers and authors whose work and ideas have significantly influenced the development of the Enterprise Modelling Approach to Information Systems Architecture.

The Enterprise Model consists of three perspectives of the organisation; the Functional Outline, the Business Themes and the Information Flows. These three perspectives are further described and illustrated by real-live examples from the case study in the next section.

3.3 The Enterprise Model

3.3.1 Introduction

This section describes a model of a generic Enterprise Model and is shown as Figure 5 – Meta-model of the Enterprise Model. This model is known as a Meta-model of the Enterprise Model as it describes the components (that is, objects of the Enterprise Model) and the relationship between these components.

A generic Enterprise Model consists of five related components. They are:

- Business Function
- Business Entity Type
- Business Theme
- Function Entity Type
- Function Business Theme

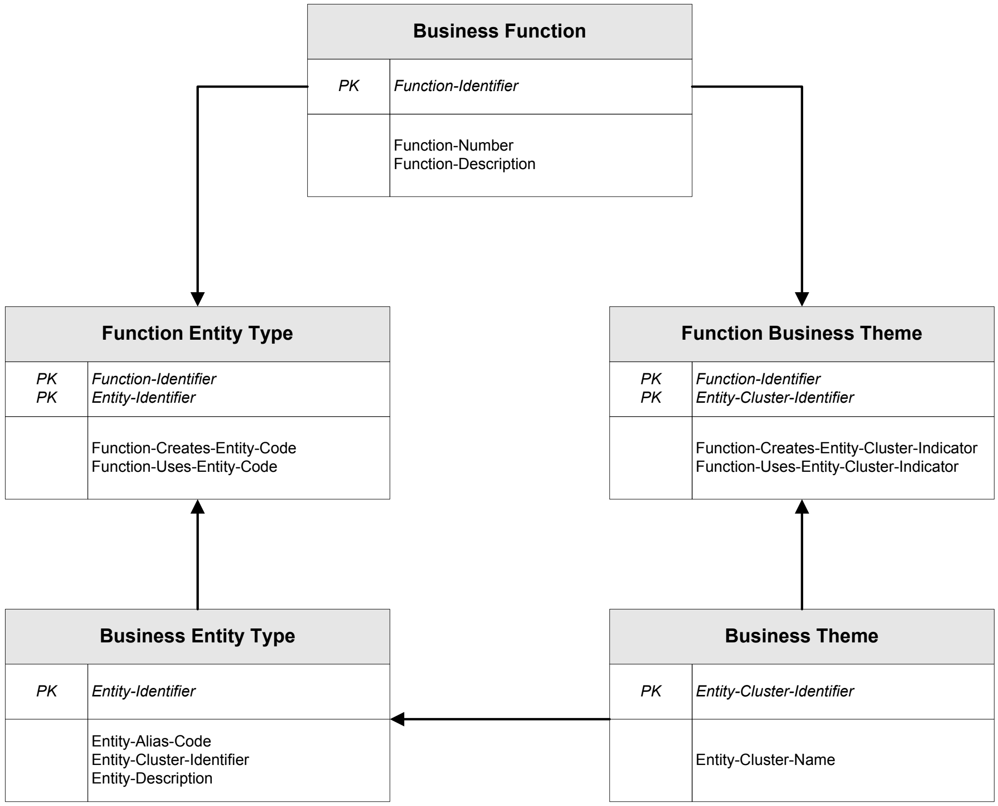

Figure 5 – Meta-model of the Enterprise Model

This Meta-model of the Enterprise Model supports the three steps of information flow modelling described previously in Section 3.2.4. The object “Business Function” supports Business Functional Analysis and the resultant Functional Outline. The objects “Business Entity Type” and “Business Theme” support Business Information Modelling and its output of a logical Business Entity Model clustered into Business Themes. The objects “Function Entity Type” and “Function Business Theme” support Business Information Flow Analysis and its major outcome, the information flows of the Enterprise Model.

The three perspectives of the Enterprise Model, that is, the Functional Outline, the Business Themes and the Information Flows, are described in terms of a generic Enterprise Model in the following sections.

3.3.2 The Functional Outline of the Enterprise Model

The Business Function object type supports Business Functional Analysis and the resultant Functional Outline. A Business Function is a collection of inter-related business activities that operate coherently to achieve some common business objectives. Each occurrence of the Business Function object type represents a business function or business sub-function. A function is a sub-function relative to its superior function and the same function is a function relative to its subordinate function. Thus, whether a business unit is a function or a sub-function only makes sense relative to another function. The Meta-model does not distinguish between a function and a sub-function; they are all occurrences of the Business Function object type.

A function may consist of more than one other function but a function may belong to only one function. The relationships among the functions must form a strict hierarchy; no recursion or cycle is allowed in any structure of functions. To illustrate the subset of the Functional Outline of the Enterprise Model relevant to the Mobile Number Portability (MNP) business initiative is shown below:

F4.0 MANAGE INDUSTRY & REGULATORY ENVIRONMENT

F4.1 Manage Regulatory Strategy

F4.2 Manage Regulatory Communication

F4.3 Manage Regulatory-Product Movement Rules

F4.4 Manage Regulatory-Product Movement

F4.4.1 Capture Regulatory-Product Movement Request

F4.4.1.1 Record Regulatory-Product Movement Request

F4.4.1.2 Check Regulatory-Product Movement Request

F4.4.1.3 Acknowledge Regulatory-Product Movement Request

F4.4.1.4 Reject Regulatory-Product Movement Request

F4.4.2 Validate Regulatory Product Movement

F4.4.2.1 Validate Regulatory-Product Movement End-User Customer Authorisation

F4.4.2.2 Validate Regulatory-Product Movement Involved Parties

F4.4.2.3 Check Incomplete Regulatory-Product Movements

F4.4.2.4 Validate Regulatory-Product Movement Service-Number

F4.4.2.5 Validate Regulatory-Product Movement Service

F4.4.2.6 Validate Regulatory-Product Movement Involved Industry Party Ownership

F4.4.2.7 Validate Regulatory-Product Movement Customer-Required-Date

F4.4.2.8 Validate Regulatory-Product Movement Retargeted Customer-Required-Date

F4.4.3 Process Regulatory-Product Movement

F4.4.3.1 Process Initiated Regulatory-Product Movement

F4.4.3.1.1 Process Initiated Regulatory-Product Movement Notification

F4.4.3.1.2 Process Initiated Regulatory-Product Movement Confirmation

F4.4.3.1.3 Process Initiated Regulatory-Product Movement Rejection

F4.4.3.1.4 Process Initiated Regulatory-Product Movement Disputed Rejection

F4.4.3.1.5 Process Initiated Regulatory-Product Movement Retargeted Customer-Required-Date

F4.4.3.1.6 Process Initiated Regulatory-Product Movement Withdrawal

F4.4.3.1.7 Process Initiated Regulatory-Product Movement Expiry

F4.4.3.2 Process Regulatory-Product Movement Cutover

F4.4.3.2.1 Process Regulatory-Product Movement Cutover Notification

F4.4.3.2.2 Process Regulatory-Product Movement Cutover Confirmation

F4.4.3.2.3 Process Regulatory-Product Movement Cutover Rejection

F4.4.3.3 Process Regulatory-Product Movement Broadcast

F4.4.3.3.1 Process Regulatory-Product Movement Broadcast Notification

F4.4.3.3.2 Process Regulatory-Product Movement Broadcast Confirmation

F4.4.3.4 Process Regulatory-Product Movement Receipt

F4.4.4 Monitor Regulatory-Product Movement Progress

F4.4.4.1 Assess Regulatory-Product Movement Progress

F4.4.4.2 Disseminate Regulatory-Product Movement Progress Details

F4.5 Monitor Regulatory-Product Movement Impact

F4.6 Take Regulatory-Product Movement Impact Minimisation Measures

F4.7 Manage Regulatory-Product Movement Compliance

This Functional Outline is a subset of the entire Enterprise Functional Outline represented on the vertical axis of the Enterprise Model (refer to Appendix B - The Enterprise Model). It comprises the functional perspective of the Data Repository System (DRS) based on the Enterprise Model.

3.3.3 The Business Themes of the Enterprise Model

The objects “Business Entity Type” and “Business Theme” support Business Information Modelling and its output of a logical Business Entity Model clustered into Business Themes. Each occurrence of the Business Entity Type object represents an entity type which is itself an abstraction of a type of thing of interest (e.g., Customer) in the ‘real world’ (or the universe of discourse). The information that are created and used by the Business Functions is clustered into Business Themes based on Affinity Analysis, which is used to group closely related business entity types together. A Business Theme is a major category of information that the business creates or uses in its day-to-day functioning. A Business Theme typically corresponds to a logical database of an information system at the implementation level. The affinity between each pair of business entity types is determined by how closely related they are as perceived by the business users of the information. To determine the affinity requires a good understanding of the business that deals with such business entities.

A Business Theme may be composed of one or more business entity types but a business entity type may belong to only one business theme.

The subset of the Business Themes of the Enterprise Model that pertains to the Mobile Number Portability (MNP) business initiative is shown below:

- T25 Industry Regulator
- T26 Service Provider

- T27 Network Provider
- T28 Movement Industry Dialogue Type
- T29 Movement Rule
- T30 Service Number Movement Performance Measurement Rule
- T31 Service Movement Performance Measurement Rule
- T32 Service Number Movement
- T33 Service Movement
- T34 Carrier Re-route Broadcast MSN Movement
- T35 Involved Party Service Number Movement Progress
- T36 Involved Party Service Movement Progress
- T37 Service Number Movement Progress Performance Measure
- T38 Service Movement Progress Performance Measure

Without the guidance provided by an Enterprise Model, it is claimed that it is difficult to define the full scope and boundary of the Data Repository System or any other new information system, due to the information used but not specifically managed, that is created, by that new system. The Business Themes used and shared by Business Function F4 Manage Industry and Regulatory Environment but not managed by this function include the following:

- T1 Business Direction
- T2 Business Policy
- T3 Business Procedure

- T4 Organisation Unit
- T6 Network Performance Measure
- T7 Network Plant
- T8 Network Technology Type
- T10 Geographic Network Area
- T11 Product
- T12 Product Offer
- T39 Competitor
- T40 Competitor Network Asset
- T41 Competitor Geographic Network Area
- T42 Competitor Contract
- T43 Competitor Product
- T45 Competitor Customer
- T46 Retail Customer
- T51 Market Event
- T67 Service
- T72 Service Number
- T88 Customer Service Guarantee Rebate Rule
- T89 Customer Service Guarantee Rebate

- T110A External Communication
- T110B Internal Communication

These Business Themes are a subset of the entire Enterprise Business Themes represented on the horizontal axis of the Enterprise Model (see Appendix B - The Enterprise Model). These Business Themes represent the shared data that must form the scope of the Data Repository System. It is highly unlikely that these shared data would be identified and scoped into the boundary of a new information system without the benefit of top-down guidance provided by an Enterprise Model. These Business Themes form a key part of the information perspective of the Data Repository System based on the Enterprise Model.

3.3.4 The Information Flows of the Enterprise Model

The objects “Function Entity Type” and “Function Business Theme” support Business Information Flow Analysis and its major outcome, the information flows of the Enterprise Model. The Function Entity Type object represents the following relationships between the two object types, Business Function and Business Entity Type respectively:

- A Business Function ‘Has as Input’ many Business Entity Type instances and a Business Entity Type ‘Is Input to’ many Business Function instances (a many-to-many relationship type).
- A Business Function ‘Has an Output’ many Business Entity Type instances and a Business Entity Type ‘Is Output from’ many Business Function instances (a many-to-many relationship type).
- A Business Function ‘Updates’ many Business Entity Type instances and a Business Entity Type ‘Is Updated by’ many Business Function instances (a many-to-many relationship type).

- A Business Function ‘Creates’ many Business Entity Type instances and a Business Entity Type ‘Is Created by’ one Business Function instance (a one-to-many relationship type).

The Function Business Theme object represents the following relationships between the two object types, Business Function and Business Theme respectively:

- A Business Function ‘Has as Input’ many Business Theme instances and a Business Theme ‘Is input to’ many Business Function instances (a many-to-many relationship type).

- A Business Function ‘Has an Output’ many Business Theme instances and a Business Theme ‘Is Output from’ many Business Function instances (a many-to-many relationship type).

- A Business Function ‘Updates’ many Business Theme instances and a Business Theme ‘Is Updated by’ many Business Function instances (a many-to-many relationship type).

- A Business Function ‘Creates’ many Business Theme instances and a Business Theme ‘Is Created by’ one Business Function instance (a one-to-many relationship type).

The business information flows are identified and analysed with two purposes in mind, which are to:

- Better understand the information systems, particularly in terms of scope and boundaries.

- Provide a basis for determining the natural sequence of systems development and implementation, which is a valuable input into the systems prioritisation process.

To illustrate, a subset of the Enterprise Model relevant to the Mobile Number Portability (MNP) business initiative, known as the Churn Enterprise Sub-model, is shown as Figure 6 – The Churn Enterprise Sub-model.

Business Function \ Business Theme	T1 Business Direction	T2 Business Policy	T3 Business Procedure	T4 Organisation Unit	T6 Network Performance Measure	T7 Network Plant	T8 Network Technology Type	T10 Geographic Network Area	T11 Product	T12 Product Offer	T25 Industry Regulator	T26 Service Provider	T27 Network Provider	T28 Movement Industry Dialogue Type	T29 Movement Rule	T30 Service Number Movement Performance Measurement Rule	T31 Service Movement Performance Measurement Rule	T32 Service Number Movement	T33 Service Movement	T34 Carrier Re-route Broadcast MSN Movement	T35 Involved Party Service Number Movement Progress	T36 Involved Party Service Movement Progress	T37 Service Number Movement Progress Performance Measure	T38 Service Movement Progress Performance Measure	T39 Competitor	T40 Competitor Network Asset	T41 Competitor Geographic Network Area	T42 Competitor Contract	T43 Competitor Product	T45 Competitor Customer	T46 Retail Customer	T51 Market Event	T67 Service	T72 Service Number	T88 Customer Service Guarantee Rebate Rule	T89 Customer Service Guarantee Rebate	T110 Communication - External	T110 Communication - Internal
F4 Manage Industry & Regulatory Environment																																						
F4.1 Manage Regulatory Strategy	U	U			U	U		U	U	U	U	C	C	U	U	U	U									U	U	U	U	U		U						
F4.2 Manage Regulatory Communication	U	U	U	U							U	U	U	U	U	U	U						U	U	U							U					U	
F4.3 Manage Regulatory-Product Movement Rules											U	U	U	C	C	C	C	U	U	U	U	U	U	U														
F4.4 Manage Regulatory-Product Movement																																						
F4.4.1 Capture Regulatory-Product Movement Request																																						
F4.4.1.1 Record Regulatory-Product Movement Request							U		U	U		U	U	U				C	C	C	C	C																
F4.4.1.2 Check Regulatory-Product Movement Request							U		U	U		U	U	U				U	U	U	U	U																
F4.4.1.3 Acknowledge Regulatory-Product Movement Request							U		U	U		U	U	U				U	U	U	U	U																
F4.4.1.4 Reject Regulatory-Product Movement Request							U		U	U		U	U	U				U	U	U	U	U																
F4.4.2 Validate Regulatory-Product Movement							U		U	U																												
F4.4.2.1 Validate Regulatory-Product Movement End-User Customer Authorisation							U		U	U		U	U					U	U		U	U									U							
F4.4.2.2 Validate Regulatory-Product Movement Involved Parties							U		U	U		U	U	U	U			U	U	U	U	U																
F4.4.2.3 Check Incomplete Regulatory-Product Movements							U		U	U		U	U	U	U			U	U		U	U																
F4.4.2.4 Validate Regulatory-Product Movement Service-Number							U		U	U		U	U					U	U	U														U				
F4.4.2.5 Validate Regulatory-Product Movement Service							U		U	U		U	U					U	U														U					
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F4.4.2.7 Validate Regulatory-Product Movement Customer-Required-Date							U		U	U		U	U	U	U			U	U		U	U		U														
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F4.4.3.1.2 Process Initiated Regulatory-Product Movement Confirmation							U		U	U		U	U	U				U	U	U	U	U																
F4.4.3.1.3 Process Initiated Regulatory-Product Movement Rejection							U		U	U		U	U	U				U	U	U	U	U																
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F4.4.3.1.5 Process Initiated Regulatory-Product Movement Retargetted Customer-Required-Date							U		U	U		U	U	U				U	U	U	U	U																
F4.4.3.1.6 Process Initiated Regulatory-Product Movement Withdrawal							U		U	U		U	U	U				U	U	U	U	U																
F4.4.3.1.7 Process Initiated Regulatory-Product Movement Expiry							U		U	U		U	U	U				U	U	U	U	U																
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F4.4.3.3.1 Process Regulatory-Product Movement Broadcast Notification							U		U	U		U	U	U				U	U	U	U	U																
F4.4.3.3.2 Process Regulatory-Product Movement Broadcast Confirmation							U		U	U		U	U	U				U	U	U	U	U																
F4.4.3.4 Process Regulatory-Product Movement Receipt							U		U	U		U	U	U				U	U	U	U	U																
F4.4.4 Monitor Regulatory-Product Movement Progress																																						
F4.4.4.1 Assess Regulatory-Product Movement Progress							U		U	U		U	U	U	U	U	U	U	U	U	U	U	C	C														
F4.4.4.2 Disseminate Regulatory-Product Movement Progress Details							U		U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U														
F4.5 Monitor Regulatory-Product Movement Impact							U		U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U														
F4.6 Take Regulatory-Product Movement Impact Minimisation Measures	U	U					U		U	U	U	U	U		U	U	U	U	U	U	U	U	U	U	U										U	U		U
F4.7 Manage Regulatory-Product Movement Compliance	U	U					U		U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U										U	U		U

Figure 6 – The Churn Enterprise Sub-model

The Churn Enterprise Sub-model defines the scope and boundary of the Data Repository System (DRS). The scope of the DRS is defined by all of the Business Themes that are Created and Used, hence the ‘C’ and the ‘U’ in the matrix above, by each of the business functions within Business Function F4 Manage Industry & Regulatory Environment. Of critical importance in defining the scope is the identification of a number of Business Themes that are not managed by Business Function F4 Manage Industry & Regulatory Environment, but the information are used by and shared with this Business Function F4, as represented in the Churn Enterprise Sub-model shown above. For a better understanding of where Business Function F4 fits within the overall business, refer to Appendix B - The Enterprise Model.

An Enterprise Model provides a basis for understanding the business from an information perspective in a big picture, that is, a holistic information-oriented view, without which, it is unlikely that a business system will be planned and scoped correctly. In the case of the DRS, there are twenty-four (24) external information inflows, as above, that need to be incorporated into the scope of the system. Thus, the scope of the DRS is well understood from both a functional perspective and an information perspective, well prior to the commencement of detailed requirements analysis and design. The Enterprise Model then continues to provide the top-down guidance necessary to model the business system down to the implementation level.

There are a total of 415 information flows identified in the Churn Enterprise Sub-model. These information flows are made up of 125 cross-functional information flows and 290 intra-functional information flows. The cross-functional information flows have been defined as those information flows between the high level information systems depicted in the Churn Enterprise Sub-model. The intra-functional information flows have been defined as those flows within the high level information system, in this case the DRS.

3.4 The Importance of an Enterprise Model

3.4.1 Introduction

This section describes the importance of an Enterprise Model for any type of organisation as it is claimed that it is the key to successful information systems integration. In particular, it illustrates with specific reference to the Telecommunications Service Provider case study. Specifically, it uses the Churn Enterprise Sub-model introduced in Section 3.3.4 The Information Flows of the Enterprise Model. The case is then made for an Enterprise Model-based Information Systems Architecture and the use of an Enterprise Model as a tool for planning and managing information systems. The use of the Enterprise Model as a planning and management tool is further supplemented by describing, with examples from the case study, the importance of information flow analysis and hence information dependency as the basis of prioritising information systems development and implementation.

Finally, the benefits of data sharing and the minimisation of data redundancy are also discussed.

3.4.2 The Importance of an Enterprise Model as a Planning and Management Tool

An Enterprise Model provides a basis for understanding the business from an information perspective, simply known as an Information Architecture or an Information Systems Architecture, where each of the information systems described in the Enterprise Model have been defined in terms of their functionality and the information *Created (C)* and *Used (U)* by those information systems. Hence, the Enterprise Model defines the information systems operating in concert with one another based on shared data such that no redundant data will be created and that the benefit of an update to the data will be shared across all information systems using the data. This is known as Functional Integration. Without the benefit of top-down guidance from an Enterprise Model, it is difficult to achieve any degree of information systems integration.

A clear unambiguous definition of the scope and boundary of each information system is a key consideration in the planning, designing, building and implementation of a system, including how that system needs to interact with all other systems within the overall information systems architecture. This is of particular importance in ensuring information systems integration, as commonly used approaches result in information systems that lack the flexibility and adaptability in responding to changes in business needs. This in turn leads to a high level of uncontrolled data redundancy and poor quality information. In the case of the Data Repository System (DRS), the identification of a number of Business Themes that are not managed by Business Function F4 Manage Industry & Regulatory Environment, but the information are used by and shared with Business Function F4, as represented in the Churn Enterprise sub-model, is of prime importance. There are fourteen (14) Business Themes managed by Business Function F4 Manage Industry & Regulatory Environment. Whereas there are twenty-four (24) information inflows into Business Function F4 that represent information created by other business functions that are required to be used by and shared with Business Function F4. Of these thirty-eight (38) Business Themes forming a key part of the scope and boundary of the DRS, only 36% are created and managed by this system. The importance of scoping and defining these information inflows as key components of the DRS cannot be emphasised enough and this is only made possible by using an Enterprise Model as a planning and management tool.

As an Enterprise Model is a foundation for further understanding the business and its directions, it should be extended and refined as a whole or in part, to derive the Information Systems Architecture. An Enterprise Model-based Information Systems Architecture is a blueprint for building information systems that facilitates the business to achieve its goals while remaining focused by using the 'big picture' as the foundation. By using an Enterprise Model-based Information Systems Architecture, decisions with respect to the identification, development and integration of information systems will be informed, planned and strategic.

Figure 7 – The Enterprise Model as a Tool for Planning and Managing depicts the Enterprise Model as a tool for planning and managing an Enterprise Model-based Information Systems Architecture.

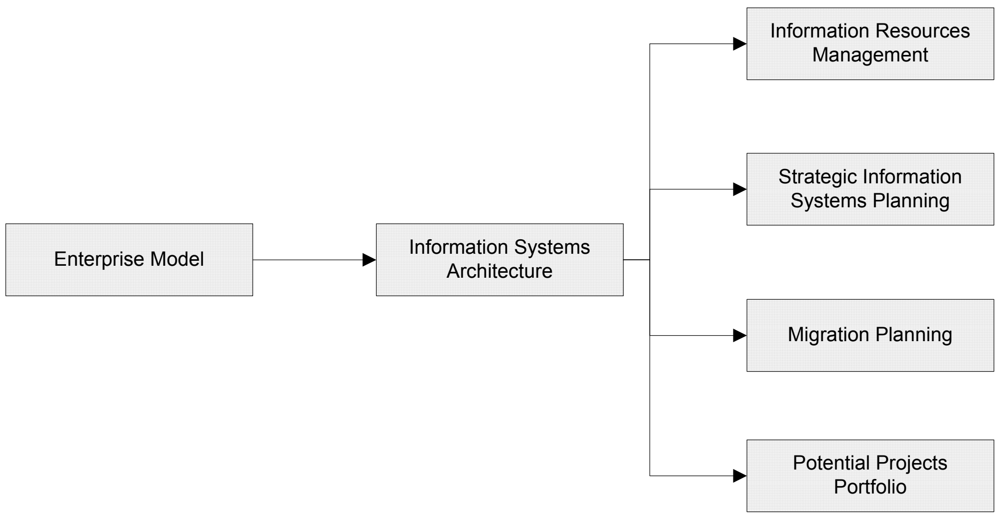

Figure 7 - The Enterprise Model as a Tool for Planning and Managing

The Enterprise Model is a high-level planning and management tool that is used to provide top-down guidance and a holistic view to subsequent information systems planning and information systems development.

The Information Systems Architecture evolves from its corresponding Enterprise Model as each information system can be identified, scoped and defined fully from the Enterprise Model. The information systems are defined in terms of their supported business functions, the information created and used by those functions defined as Business Themes, and the information flows among those business functions.

The information systems analysed and defined for the Telecommunications Service Provider, based on the Enterprise Model are named below:

- Business Management
- Network Technology Capability Management
- Product Offer Management
- Industry and Regulatory Environment Management (Implemented in the Data Repository System (DRS))
- Marketing Management
- Customer Relationship Management
- Customer Profile Management
- Customer Contract Management
- Customer Contact Management
- Service Request Management
- Service Pre-Provisioning Management
- Service Order Management
- Service Provisioning Management
- Service Fault Management
- Network Usage Rating
- Service Number Management
- Customer Account Management

- Customer Charge Management
- Customer Discount Management
- Customer Rebate Management
- Customer Settlement Management
- Customer Invoice Management
- Customer Payment Management
- Customer Debt Management
- Customer Billing Dispute Management
- Customer Service Guarantee Management
- Customer Service Performance Management
- Supply Management
- Human Resource Management
- Financial Planning
- Financial Operations Management
- Management Accounting
- Financial Risk Management
- Financial Performance Management
- Communications Management
- Information Management

Each of these information systems are identified directly from the Enterprise Model shown as Appendix B - The Enterprise Model and are fully described in terms of the business functions supported, the business entity types that are created and used by the system and the information flows among the business functions. The DRS is one of the thirty-six (36) information systems described in the Enterprise Model. These systems are named above.

When a business function requires information created in another function, then that function is said to have information dependency on the other function. With respect to Business Function F4 Manage Industry and Regulatory Environment, information flowing into these functions from some other functions are said to be exogenous.

Information flows within a function, that is, to and from sub-functions within that function, for example Business Function F4 Manage Industry and Regulatory Environment are said to be endogenous. Hence, in considering information dependency for the major business functions one has to consider exogenous information inflows into those functions as well as the endogenous information flows among the sub-functions within each of those functions. These information flow dependencies provide useful information for the planning and scoping of future projects.

The Information Dependency perspective considers the information sharing ability and commonality of the information across the business functions. It is identified by analysing the Enterprise Model; in particular, by mapping information *Created (C)* by one business function and determining how that information is *Used (U)* and hence shared across all other business functions, including the analytical business functions. The information dependencies based on the information flows are used to determine the priorities for development and implementation of these information systems.

Each Business Functional Area and Analytical Business Function and Sub-function can be considered as a Candidate Information System. However, before Candidate Information Systems can be determined, the

Information perspective must be considered. The Information Dependency shown in Table 1 – Core Business Function Information Dependency Prioritisation and Table 2 – Analytical Business Function Information Dependency Prioritisation only considers a subset of the Information Systems, that is, those systems that support core business functions and analytical business functions respectively. The Information Dependency highest priority is ranked as number 1 and all subsequent lower prioritisation is ranked in ascending number sequence.

BUSINESS INFORMATION SYSTEM NAME	**INFORMATION DEPENDENCY**
Product Offer Management (F3.0)	1
Customer Relationship Management (F6.2)	2
Industry & Regulatory Environment Management (F4.0)	3
Customer Contract Management (F6.4)	4
Service Request Management (F6.6.1)	5
Service Pre-Provisioning (F6.6.2)	6
Service Order Management (F6.6.3)	7
Service Provisioning Management (F6.6.4)	8
Network Usage Rating (F6.6.6)	9
Customer Account Management (F6.7.1)	10
Customer Charging (F6.7.3)	11
Customer Discount Management (F6.7.4)	12
Customer Rebate Management (F6.7.5)	13
Customer Service Guarantee Management (F6.9)	14
Customer Invoice Management (F6.7.7)	15
Customer Payment Management (F6.7.8)	16
Customer Debt Management (F6.7.9)	17
Customer Billing Dispute Management (F6.8)	18
Financial Risk Management (F9.4)	19

Table 1 – Core Business Function Information Dependency Prioritisation

This ranking based on information dependency sets out the priority for systems development and implementation according to information flow analysis that is, maximising the sharing of data and eliminating data redundancy. For example, the Customer Contract Management System that supports business function F6.4 requires information inflows such as Product Offer and Customer data as inputs from the Product Offer Management System (F3.0) and the Customer Relationship Management System (F6.2) respectively.

Additional Analytical Business Functions, outside of the core business functional areas, identified in the Enterprise Model have been included where they use and share the same information as that created by the Core Business Functions. The analytical business function information dependency prioritisation is shown in Table 2 – Analytical Business Function Information Dependency Prioritisation.

BUSINESS INFORMATION SYSTEM NAME	INFORMATION DEPENDENCY
Contract Discount Analysis (F12.2.2.8) & Contract Rebate Analysis (F12.2.2.9)	1
Customer Account Reconciliation (F12.2.5.2.1) & Customer Service Reconciliation (F12.2.5.2.3)	2
Customer Usage Analysis (F12.2.1.9)	3
Bill Reconciliation (F12.2.5.1)	4
Customer Billed Revenue Analysis (F12.2.7.1)	5
Customer Billing Dispute Analysis (F12.2.1.10)	6
Contract Pricing Analysis (F12.2.2.5)	7
Product Offer Revenue Analysis (F12.2.7.5) & Product Revenue Analysis (F12.2.7.4)	8

Table 2 – Analytical Business Function Information Dependency Prioritisation

3.4.3 Data Sharing as the Basis of Common Data and Common Systems

The key issues pertaining to data sharing are common data and common systems. Without the benefit of top-down guidance provided from an Enterprise Model, it is difficult to achieve any degree of data sharing and hence integration of information systems.

The term 'Common Data' refers to two distinct and yet related aspects of data sharing – shared data structure and shared data. Shared data structure is the case in which a common data structure is used to implement data for more than one information system either within the same business group or across business groups. Such a common data structure may be a sub-structure within a larger data structure. An Enterprise Model is the basis of identifying shared data structures as it is these data structures that form the basis of the Business Themes defined in the Enterprise Model and were discussed in Section 3.2.4. Sharing common data structures speeds up systems development and at the same time significantly reduces the overall costs of information systems projects.

Shared data is the case in which the actual data per se (not just the data structure) is used by more than one information system; either within the same business group or across business groups. The common data being shared may or may not be stored physically in the same database, that is, it may be replicated.

The advantages of sharing common data include minimisation and control of data redundancy and reduction of costs in maintaining and using the data. Control of data redundancy is a necessary condition for the guarantee of data consistency and integrity. Minimising data redundancy improves storage efficiency and information systems performance. It is claimed that an Enterprise Model-based approach is a prerequisite for an organisation to minimise and control data redundancy and hence, to ensure a high level of data consistency and integrity.

While sharing data presupposes an underlying common data structure, it is important to note that the converse is not true, that is, sharing a common data structure may or may not entail sharing common data. For example, different business groups may have the same staffing structure and hence they may share the same data structure for implementing at least a part of their personnel databases. However, since the business groups are staffed by different employees, the actual data in their personnel databases are not the same. This is the case in which common data structure is shared without sharing common data. The advantages are obvious: data design for the personnel databases need only be done once and then shared, perhaps with minor adaptation, across business groups. This also allows common programmes and logical routines that manipulate the same data structure to be shared: thus significantly reducing the overall costs of those projects.

It is important to realise that it is not so much a matter of whether an organisation should have 'common data', but rather a matter of when, where and how to share data structures and data.

A prerequisite for sharing data structures and data is to have an Enterprise Model that is used to co-ordinate with the various business groups and the systems development teams in order to derive a common data structure that accommodates the views of all the business groups concerned.

The term 'Common Systems' is often used to refer to information systems shared by more than one department (for example, Invoicing and Ordering departments), different businesses or different business groups. It is important to note that common systems may exist within a business.

Furthermore, a 'common system' may be a shared subsystem within an overall information system, part of which is not common to the sharing parties. This amounts to sharing some common programmes. However, sharing common programmes presupposes common data structures upon which the common programmes operate against. This may or may not involve sharing the actual data. Thus, a prerequisite for having common systems is sharing a common data structure and a prerequisite for sharing data structures and data is to have an Enterprise Model. The common systems of an organisation can be defined and scoped upfront as part of the information flow analysis performed in Enterprise Modelling.

The advantages of having common systems are:

- Elimination of duplicated effort in systems development and hence reduces the overall cost of information systems projects.

- Ensuring consistency in programme logic and data via sharing common programmes and common data structures. This in turn leads to minimisation and control of data redundancy and ensures a level of data consistency and high data integrity.

3.4.4 The Importance of an Enterprise Model in Controlling Data Redundancy

Data Redundancy is the converse of Data Sharing. An information system with a high degree of data redundancy will have limited or no data sharing capability. Data redundancy may occur at the type level, that is at the data element and entity type level. It can also occur at the value level within the same entity type.

Redundancy at the type level is said to occur when the same data element or the same entity type appears more than once globally in the corporation's data. Such replication of data may be deliberate, that is planned and hence controlled by some data synchronisation measures. However, the same data element or entity type may appear more than once under the guise of different names. In such a case, the data redundancy is said to be unplanned and hence uncontrolled. Such data redundancy is undesirable because it will lead to internal inconsistency of data and rapid deterioration of the quality of data. Uncontrolled data redundancy at the type level can be eliminated by adopting a top-down, business driven approach as described by an Enterprise Model using conceptualisation and a systematic naming convention that establishes a one-to-one correspondence between the name of the entity type or data element and its meaning. This is done by conceptualising on the meaning of the data and constructing a descriptive name that comprehensively reflects its meaning from a business perspective and is hence unique.

Redundancy at the value level is said to occur when the value of the same data element representing the same fact is recorded more than once within the same entity type. It is undesirable, in general, because it gives rise to update anomalies and is liable to result in internal inconsistency of data within the set of entity instances belonging to the same entity type. Furthermore, it adversely affects data storage and therefore system performance.

To avoid data redundancy at the value level, the data must be structured in such a way that a fact about an instance of an entity type must be recorded once only. Hence, the adage in data design is to put one fact in one place. An Enterprise Model is the basis of identifying shared data structures as it is these data structures that form the basis of the Business Themes defined in the Enterprise Model. Data redundancy and data sharing are closely related as one is the converse of the other. An information system characterised by a high degree of data sharing, such as any one of the thirty-six (36) information systems defined by the Telecommunications Service Provider Enterprise Model, will plan and control data redundancy; the converse being an information system with uncontrolled data redundancy will have limited or no data sharing capability.

3.4.5 Summary of the Importance of an Enterprise Model

This chapter has discussed the importance of an Enterprise Model as the key to successful information systems integration. Organisations that have built their information systems architectures without the benefits of top-down guidance from an Enterprise Model are likely to create an environment that is typified by:

- Limited or no data sharing.
- Uncontrolled data redundancy.
- Uncontrolled process redundancy.
- Poorly structured information systems architectures with a lack of systems integration.

However, organisations that build their information systems architecture based on an Enterprise Model are more likely to create an environment that is typified by:

- A high degree of data sharing.
- Planned and controlled data redundancy.
- Controlled process redundancy.
- Well-structured information systems architecture, with strategic alignment of IT with the business and consistently defined information systems.
- Data consistency and high quality data, as the basis of management decision-making.

Such a position is supported by the literature and confirmed by this case study research.

3.5 Summary

This chapter has described an Enterprise Modelling Approach to Information Systems Architectural design that incorporates the best features from other approaches. The Meta-model of an Enterprise Model described what an Enterprise Model is in generic form, illustrated by reference to the case study. This included the definition of the scope and boundary of the DRS based on the Enterprise Model; the Information Systems Architecture, including the identification, definition and prioritisation of all information systems for the Telecommunications Service Provider.

An understanding of Enterprise Modelling was provided and the use of an Enterprise Model as a planning and management tool was illustrated by reference to the case study. The importance of Enterprise Modelling was further demonstrated by data sharing as the basis for deriving common data and common systems. Without the benefit of top-down guidance provided from an Enterprise Model, it is claimed that it is difficult to achieve any degree of data sharing and hence integration of information systems. The importance of an Enterprise Model in controlling data redundancy was discussed and argued that it can be eliminated by adopting a top-down, business-driven approach as described by an Enterprise Model.

The chapter concluded with the importance of Enterprise Modelling as the key to successful information systems integration. This chapter has addressed the following research aims:

- Identify the major performance problems that result from a lack of information systems integration, due to the inability of commonly used information systems architecture approaches in identifying, scoping and fully defining the boundaries of its information systems. This in turn, leads to a high level of data redundancy and poor quality information.

- Identify the major deficiencies in the commonly used approaches and the need for a better approach to ensure integrated information systems architectures.

- Develop and apply the Enterprise Modelling Approach in a real-live environment to a Telecommunications Service Provider.

This research is claimed to be a significant and original contribution to the solution of this problem, not only in the telecommunications industry but to all organisational types with disparate systems.

The next chapter, Chapter 4 Research Design, describes how the usefulness of the Enterprise Modelling Approach is tested in a controlled Telecommunications environment. In this case, usefulness is applied in terms of integrated information systems and the degree of data integrity.

Chapter 4 Research Design

4.1 Introduction

This chapter describes the research design appropriate to the research aims of the development, evaluation and refinement of the Enterprise Modelling Approach. The chapter first describes the selected research approach, methods and techniques used for this study and why they are chosen. It discusses the qualitative approach adopted with the research being Interpretivist, the case study method and the use of structured interviews, focus groups and technical documentation analysis. In particular, it discusses data collection methods, the sources of evidence and the specific sources of evidence to be used in each stage of the research design, and data analysis methods.

Next the chapter discusses the validity of the research. It discusses a number of validity concepts and how they are used to ensure the validity of this thesis. In particular, the use of construct validity, content validity, face validity, criterion validity, internal and external validity is explained, together with triangulation, the use of multiple data collection methods and multiple data sources. It also emphasises the control of the case study with the use of a common IT specification and a group of stakeholders that understands and accepts the architectural evaluation criteria together with their respective weightings. The research validation is strengthened by the use of a strong chain of evidence among research questions, methodology, raw data, and findings.

The research relates to a particular controlled Telecommunications environment, which involves the movement of a customer’s mobile service number and mobile service from one Network Provider to another or one Service Provider to another. This movement is known as a ‘Churn’ event and is governed by a mandatory business process named Mobile Number Portability. It is implemented as part of the Australian regulatory environment by the Australian Communications Authority. The chapter explains why the telecommunications industry was selected and the circumstances surrounding the selection of Churn, the MNPS and the DRS.

The chapter then explains the research design that involves four stages. The first stage involves the development of an Enterprise Model, which is the basis of a new system to be developed. This section describes how the Enterprise Model is prepared. The second stage involves documenting the existing MNPS and describes how it has been developed using a widely accepted development approach; how it is controlled and proves that the approach is correctly used. The third stage relates to the development of a new system, known as the Data Repository System (DRS), which is based on the Enterprise Model developed in Stage 1 and applied to the MNP business initiative. This section describes how the DRS is developed; how it is controlled and proves that the Enterprise Modelling approach is correctly used. The fourth stage consists of a comparative evaluation of the two information systems using widely accepted architectural evaluation criteria identified from the literature. This stage tests the usefulness of the Enterprise Model to the Telecommunications Service Provider by comparing and evaluating the two alternative information systems using widely accepted architectural evaluation criteria identified from the literature.

Finally, the chapter concludes with a discussion on the evaluation of the Enterprise Modelling approach to its alternative using widely accepted criteria. This section describes the architectural evaluation criteria, which are based on a comprehensive view of the literature supplemented by extensive practitioner experience in successfully using the criteria in a range of information systems projects in a number of organisations around the world. This section describes the techniques that were employed in evaluating the Enterprise Modelling approach to its alternative and the measures used for each architectural evaluation criterion such as the examination of technical documents.

4.2 Research Approach, Methods and Techniques

The research approach adopted for this thesis is one of qualitative research, which is a broad term that encompasses a variety of approaches to interpretive research. Interpretive researchers start out with the assumption that access to reality (given or socially constructed) is only through social constructions such as language, consciousness and shared meanings. The philosophical base of interpretive research is hermeneutics and phenomenology (Boland, 1985). Interpretive studies generally attempt to understand phenomena through the meanings that people assign to them and interpretive methods of research in information systems are "...aimed at producing an understanding of the context of the information system, and the process whereby the information system influences and is influenced by the context" (Walsham, 1993:4). Interpretive research does not predefine dependent and independent variables, but focuses on the full complexity of human sense making as the situation emerges (Kaplan and Maxwell, 1994). This research is Interpretivist as it aims at understanding the context of the information system by examining a single case in-depth in order to understand the phenomenon, and in this case that context is one which requires enforcement of the fundamental business rules and a high degree of data sharing and hence integration with other information systems.

According to Creswell (1994), there are four main qualitative research designs, namely case study, ethnography, phenomenology, and grounded theory. Case studies emphasise detailed contextual analysis of a limited number of events or conditions and their relationships. Yin (1984) defines the case study research method as an empirical inquiry that investigates a contemporary phenomenon within its real-life context; when the boundaries between phenomenon and context are not clearly evident; and in which multiple sources of evidence are used. The case study method is selected as the researcher explores a single phenomenon (the case) bounded by time and an activity, the building of a new system to satisfy the requirements of the Mobile Number Portability (MNP) business initiative. Also, the researcher collects detailed information by using a variety of data collection procedures during a sustained period of time. According to Creswell (1994), almost any phenomenon can be examined by means of the case study method. This case enabled the researcher to focus on the MNPS design and building due to its unique and exceptional qualities as it is a world's-first development with the researcher playing a key participatory role in the new information system. Not only has the researcher assumed an interactive role with the development team (participants), but he has become personally involved with the team and the phenomenon being studied. To this extent, the researcher has won an award from the client for his personal involvement beyond that of his role. Also, in order to meet all Service Level Agreements (SLA) and regulatory requirements, the new system has to share data that it does not create or manage, so data sharing and data redundancy are key factors to be considered in the design of this system. This research is well suited to the case study method as the nature of the research process is summarised by the two key factors. First, it is a case where the scope and boundary of the study is well-defined. Secondly, the case focuses on its natural context as it is driven by well-understood business benefits.

Yin (1993) has identified some specific types of case studies: *Exploratory*, *Explanatory*, and *Descriptive*. Exploratory cases are sometimes considered as a prelude to social research. In exploratory case studies, field work, and data collection may be undertaken prior to definition of the research questions and hypotheses. This type of study has been considered as a prelude to some social research. However, the framework of the study must be created ahead of time. The work in this study is definitely not of an exploratory nature.

Explanatory case studies may be used for doing causal investigations. In very complex and multivariate cases, the analysis can make use of pattern-matching techniques. Moore and Yin (1987) conducted a study to examine the reason why some research findings get into practical use. They used a funded research project as the unit of analysis, where the topic was constant but the project varied. The utilisation outcomes were explained by three rival theories: a knowledge-driven theory, a problem-solving theory, and a social-interaction theory. Descriptive cases require that the investigator begin with a descriptive theory to be developed before starting the project, or face the possibility that problems will occur during the project. Pyecha (1988) used this methodology to study special education, using a pattern-matching procedure. Several states were studied and the data about each state's activities were compared to another, with idealised theoretical patterns. Thus what is implied in this type of study is the formation of hypotheses of cause-effect relationships. Hence the descriptive theory must cover the depth and scope of the case under study. This work is definitely explanatory and descriptive in nature. It commences with a descriptive theory that covers both the depth and scope of the MNP case and it forms hypotheses of cause-effect relationships. The main hypothesis of this research is that an information system designed and implemented on the basis of an Enterprise Model will be naturally integrated with the other information systems and its data will have a high degree of data integrity. In other words, the cause of poor data integrity and the lack of information systems integration is designing systems in isolation to each other by not using an Enterprise Model.

Stake (1995) included three additional types of case studies: *Intrinsic* - when the researcher has an interest in the case; *Instrumental* - when the case is used to understand more than what is obvious to the observer; *Collective* - when a group of cases is studied. In all of the above types of case studies, there can be single-case or multiple-case applications. The research also falls under the definition of an Intrinsic case study if we take Stake's categories as the researcher has more than just a direct interest in the case. The researcher has spent several years working on Churn systems and their integration with information systems architectures, something which has not been achieved anywhere else in the world. Also, the researcher is a participant-observer in this study as he worked as the Project Manager. The researcher acknowledges that he performed further roles of developer of the Enterprise Model, a participant member of the evaluation team and researcher in the conduct of this study. The researcher has spent the past five years implementing the Enterprise Model in the Telecommunications Service Provider integrating sixteen (16) disparate applications into a single integrated database for information accessibility to the business at all levels.

Yin (1994) also identified six steps in completing case study research. The steps are:

- Determine and define the research questions.
- Select the case(s) and determine data gathering and analysis techniques.
- Prepare to collect the data.
- Collect data in the field.
- Analyse and evaluate the data.
- Prepare the report.

This research has followed Yin's steps with Chapter 2 defining the research problems and consequences, aims of the research and hypotheses; Chapter 3 defining the Enterprise Modelling Approach as a proven solution to solving these problems, and the importance of an Enterprise Model; Chapter 4 describing the research design, including selection and description of the case study and discussion of the evaluation criteria; Chapter 5 describing the data gathering and analysis techniques, preparing to collect and actually collecting the data, and analysing the data collected; while Chapter 6 performs the evaluation of the two information systems in order to determine whether the hypotheses are supported or not.

With case study research, data collection and analysis tend to occur simultaneously. The methods of data collection in this study are formal and informal interviews in developing the Enterprise Model, interactive fieldwork in developing a new system and some use of quantitative measures to evaluate and compare the two information systems.

Again, Yin (1994) also identifies five components of research design that are important for case studies. These components are:

- A study's question(s).
- Its propositions, if any.
- Its unit(s) of analysis.
- The logic linking the data to the propositions.
- The criteria for interpreting the findings.

The research design of this study has incorporated Yin’s components as described previously in defining adherence to Yin’s steps. The research question is well-defined in the literature and is a long-standing problem in the information technology discipline. The study’s propositions are described by the hypotheses and the plan put forward to solve the problems identified in the research question. The study’s units of analysis is the MNP case as it relates to the evaluation criteria, while the logic linking the data to the propositions refers to the data collected to measure each evaluation criterion to determine whether the hypotheses are supported or not. Finally, the criteria for interpreting the findings relates to the comparative evaluation of the two information systems in this study.

Importantly, both Yin (1994) and Stake (1995) identified six sources of evidence in case studies. The following list of the sources of evidence, although not ordered, reflects their research:

- Documents
- Archival records
- Interviews
- Direct observation
- Participant-observation
- Physical artifacts

The researcher uses all sources of evidence available, which include business planning documents, interviews, direct observation and participant-observation in this case study. Archival records and physical artifacts do not exist as the MNP business initiative is a world's first and nothing existed prior.

In analysing case study evidence, Yin (1994) encourages researchers to make every effort to produce an analysis of the highest quality. In order to accomplish this, he presents four principles that should attract the researcher's attention. These principles are:

- Show that the analysis relied on all of the relevant evidence.
- Include all major rival interpretations in the analysis.
- Address the most significant aspect of the case study.
- Use the researcher's prior, expert knowledge to further the analysis.

The researcher has used these principles as guidelines to produce an analysis of the highest quality in this study. The analysis in this study did rely on all of the relevant evidence from each of the four sources. The evaluation criteria were designed so that there could not be any rival interpretations in the analysis of the data. For example, if one of the systems was designed on the basis of highly shared data, then the degree of data redundancy must be low, and vice versa. Similarly, the adherence to the fundamental business rules could only be met on the basis of high sharability of the data. These were the most significant aspects of the case study as the integration of systems is based on sharing the data across functional boundaries of the systems. Also, the researcher has specialised in Information Management since 1984, and in particular Information Systems Architecture. His experience and expert knowledge in the field ensures that the key aspects of analysis are addressed using all the relevant evidence available from each of the four sources of evidence. All analyses are documented using natural documentation techniques so that no information is forgotten or lost. Specific sources of evidence are used in each stage of the research design. They are:

- Stage 1 - Documents and interviews are used as the relevant evidence in the development of the Enterprise Model.

- Stage 2 - Documents and direct observation are used as the relevant evidence to document the existing MNPS.

- Stage 3 - Direct observation and participant-observation are used as the relevant evidence in the development of the DRS based on the Enterprise Model.

- Stage 4 - Participant-observation in targeted focus groups (known as the evaluation team) and natural documentation are used as the relevant evidence in the comparative evaluation of the two information systems.

Gall et al. (1996) describe three approaches to analysing case study data as interpretational, structural, and reflective analyses. Interpretational analysis refers to examining the data for constructs, themes, and patterns that can be used to describe and explain the phenomenon studied. The method of data analysis this study requires is interpretational, that is, searching for constructs and themes in the data, and in this case analysing the data to determine (interpret) the information systems' enforcement of the fundamental business rules and their degree of data sharing, data redundancy and data consistency.

4.3 Research Validation

According to Trochim (2002) validity is the ability to produce accurate results and to measure what is supposed to be measured. Validity is an attribute of the qualitative research being conducted in this study and quantitative research. In research terms, validity refers to the accuracy and truth of the data and findings that are produced (Rymarchyk, 2000). It refers to the concepts that are being investigated; the people or objects that are being studied; the methods by which data are collected; and the findings that are produced. There are several different types of validity which are discussed in this section.

Construct validity, according to Hunter and Schmidt (1990), refers to the construct as the phenomena being studied or measured and of concern is whether the construct as described is a valid conceptualisation of the phenomena. Tellis (1997) concludes that Construct validity is especially problematic in case study research. It has been a source of criticism because of potential researcher subjectivity. Yin (1994) proposed three remedies to counteract this: using multiple sources of evidence, establishing a chain of evidence, and having a draft case study report reviewed by key informants. According to Rymarchyk (2000) the Construct validity check is the most rigorous validity test that can be performed. In this study, the researcher measures whether the information system under study is integrated with other systems and sub-systems or is not integrated. To do this, the researcher defines an integrated information system in terms of measuring adherence to a number of architectural evaluation criteria identified from the literature, as follows:

- Whether the system is designed on the basis of well accepted good design practices known as architectural principles.
- Whether the system enforces the fundamental business rules based on the ability of its data structure to support the defined business rules as described in the Enterprise Model.
- The definition of the functional scope of the system and the interfaces among these functions needs to implement the totality of the business functions performed by the system and their adherence to the hierarchical decomposition of business functions as described in the Enterprise Model.
- The ability of different functions in the information system to use and share the same data across sub-systems and with other systems, as described in the Enterprise Model.

The issue to consider is whether each of these measures constitutes a valid measure of an integrated information system. Each of the architectural evaluation criteria and how each is measured is widely accepted in the literature. Focus groups with key case study stakeholders were conducted to confirm the relative importance of the architectural evaluation criteria and to identify the sources of data required for the investigation. These architectural evaluation criteria focus on the outcomes to be achieved in order to deliver an optimal information systems architecture. Measurement for each architectural evaluation criteria are also understood and accepted by the business representatives and stakeholders of the MNP business initiative.

Content validity, according to Burns (1996), is the extent to which the content of the test or procedure adequately represents all that is required for validity. Rymarchyk (2000), states that the researcher must ask experts in the field. Hence, the researcher allows other competent professionals; in fact the full evaluation team to examine the content of the procedures, including all data collected and analysed to ensure that all relevant measures are included and that each of the evaluation criteria are weighted appropriately for the respective procedure. Also, the researcher defines an integrated information system in terms of measuring adherence to a number of architectural evaluation criteria identified from the literature, and the evaluation team has access to the data collected, the analysis of that data and its results, and participates in the evaluation of the two information systems in terms of those evaluation criteria.

Face validity, according to Burns (1996), is concerned with the extent to which the contents of a test or procedure look like they are measuring what they are supposed to measure. Rymarchyk (2000), states that Face validity requires that your measure appears relevant to your construct to an innocent bystander. In order to have a valid measure of a social construct, you should never stop at achieving only Face validity, as this is not sufficient. However, you should never skip establishing Face validity, because if you do not achieve it, you cannot achieve the other components of validity. In this study, the researcher defines an integrated information system in terms of commonly accepted architectural evaluation criteria and measures identified from the literature, and the evaluation team is convinced that they are a valid measure of integration.

According to Hunter and Schmidt (1990), Criterion validity is a measure of validity which is established by use of a criterion measure. Rymarchyk (2000), states that many studies proceed following Content validity achievement, however this does not necessarily mean the measures used are entirely valid. Criterion validity is a more rigorous test than Face or Content validity. In this study, we have two information systems, one which is designed and implemented using modern systems design techniques but without any top-down guidance provided from an Enterprise Model, and the second which is designed and implemented based on an Enterprise Model. If the researcher's tests are used to discriminate between the two information systems, then it would be said to have criterion validity, that is, its validity is demonstrated against known criteria.

Internal validity, according to Tellis (1997), refers to the extent to which changes in the dependent variable (the observed effects) can be attributed to the independent variable rather than to extraneous variables. It is a concern only in causal (explanatory) cases. The Mobile Number Portability business requirements and business processes that are to be followed by all carriers and service providers is described in the Information Technology (IT) Specification. The development of the MNPS and the DRS was based on the same specification of requirements, namely the IT Specification. In this study, the researcher had control over all extraneous variables such that the outcome of the two implemented information systems are attributed to the approach used for their design and development. The two information systems developed are based on a common IT specification; they have the same stakeholders (who form the evaluation team), all of who accept the architectural evaluation criteria and as a group set the weightings for each of those criteria.

External validity, according to Tellis (1997), refers to the degree to which the results of a study are able to be generalised beyond the immediate study sample and setting to other samples and settings. It deals with knowing whether the results are generalisable beyond the immediate case. The results of this study are able to be generalised to other information systems as each measure of the architectural evaluation criteria constitutes a valid measure of an integrated information system. Not only has the Telecommunications Service Provider adopted the Enterprise Modelling Approach as the company's standard in software package evaluation, the Enterprise Model is generalisable to other organisations in telecommunications, utilities, transport and logistics, and government agencies. More than 80% of the Telecommunications Service Provider’s Enterprise Model is found to be generalisable to these other organisations.

Gall et al (1996), discuss additional validity checks commonly employed to achieve “trustworthiness” in a qualitative study. Triangulation, which is recommended to be used in all types of qualitative traditions, refers to the process of using multiple data collection methods, multiple data sources, or theories to check the validity of a study’s findings. As discussed in the previous section, the researcher uses multiple data collection methods and multiple sources of evidence in this study. Also, similar themes are noted in data collected from a variety of sources in this study, enhancing the interpretation. For example, a high degree of data sharing in an information system’s design, the basis of systems integration, is normally associated with a low level of data redundancy and planned and controlled data redundancy where it does exist. Furthermore, a system that is designed to maximise data sharing and minimise data redundancy typically takes advantage of well accepted good systems design practices known as architectural principles. Hence, there is a strong correlation among the architectural evaluation criteria where the findings are self-checking. This represents a strong chain of evidence among research questions, methodology, raw data, and findings to strengthen the validity of this study.

4.4 The Case Study

The advent of the MNP business initiative into the Australian telecommunications market on 25 September 2001 is a world’s first. A new Virtual Private Network (VPN) provides use by each of the seven major mobile network providers. Each of these network providers is represented in the Australian Communications Industry Forum (ACIF) where the MNP business processes have been jointly developed by these network providers and agreed over a period of eighteen (18) months. Each network provider then designed and built its own Mobile Number Portability System to address the business requirements and processes defined in the ACIF IT Specification. The Telecommunications Service Provider selected by the researcher is one of Australia's leading companies and is the case study reported here. Its purpose built operational system, the MNPS, has been designed and built using a commonly used approach by the world's largest systems developer and was implemented prior to the cutover of the MNP business initiative on 25 September 2001.

The case study enterprise is typical of telecommunications companies worldwide and typical of this sector, as it is a mature company with a heavy reliance on Information Technology (IT). Also, there is a world-wide focus on the MNP business initiative in the telecommunications industry, as it is a world's first near real-time Churn process introduced in Australia through regulation. The Telecommunications Service Provider relies heavily on quality information and the strategic application of IT for successful business performance. The MNP business initiative is an ideal case study, as all Australian network providers and service providers are required to conform to the regulatory requirements defined by the Australian Communications Industry Forum (ACIF) and the world-wide focus on MNP. These requirements are clearly defined in the ACIF MNP IT Specification and are available at http://www.acif.org.au/data/page/3269/ G573-1_2004_Dec.pdf. For a detailed understanding of the MNP IT Specification, refer to Appendix D - The ACIF MNP IT Specification.

The existing MNPS, itself newly developed for the MNP business initiative, was experiencing major data integrity problems and an opportunity presented itself for the Reporting and Service Level Agreement functionality to be redeveloped using a different approach, based on an Enterprise Model. The researcher, playing a significant architectural role in the development of previous Churn initiatives, convinces the Telecommunications Service Provider management that a new system based on an Enterprise Model is required to ensure the high level of data integrity and systems integration necessary in meeting the needs of industry regulation. The design and development of this new system was agreed by management and the industry regulator. It is named the Data Repository System (DRS). The MNP business initiative makes an ideal case study as the MNP IT Specification is agreed by all industry players and is a stable set of business requirements relevant to the existing MNPS and the newly announced DRS. The same set of business requirements are baselined, allowing for the two information systems to be compared and evaluated in the case study.

It is expected that the findings of this case study will be directly applicable to other companies in the Telecommunications industry as the Mobile Number Portability near real-time Churn process is mandatory for all network providers and service providers. The use of an Enterprise Model in the Telecommunications industry will bring major benefits resulting from an integration of information systems with the management of Churn processes a major focus of all industry players.

4.5 Stage of Research Design

4.5.1 Introduction

There are four stages in the conduct of the research, which are described in detail in this section. The stages are:

1. Stage 1 Design – Develop the Enterprise Model

   This stage describes the development of an Enterprise Model for the Telecommunications Service Provider.

2. Stage 2 Design – Document the MNPS

This stage defines the existing implemented MNPS as the basis of the Mobile Number Portability (MNP) Information System Architecture.

3. Stage 3 Design – Develop the DRS on the basis of the Enterprise Model.

This stage applies the Enterprise Model to the MNP business initiative in developing a new system, known as the Data Repository System (DRS), which is based on the Enterprise Model.

4. Stage 4 Design – Evaluation of Alternatives

This stage tests the usefulness of the Enterprise Model to the Telecommunications Service Provider by comparing and evaluating the two alternative information systems.

The relationships between the four stages are depicted in Figure 8 - Stages of the Research. Refinements to the Enterprise Model are iterative, occurring throughout the application of the Enterprise Model in building the new DRS and also on comparison of the DRS to the existing MNPS.

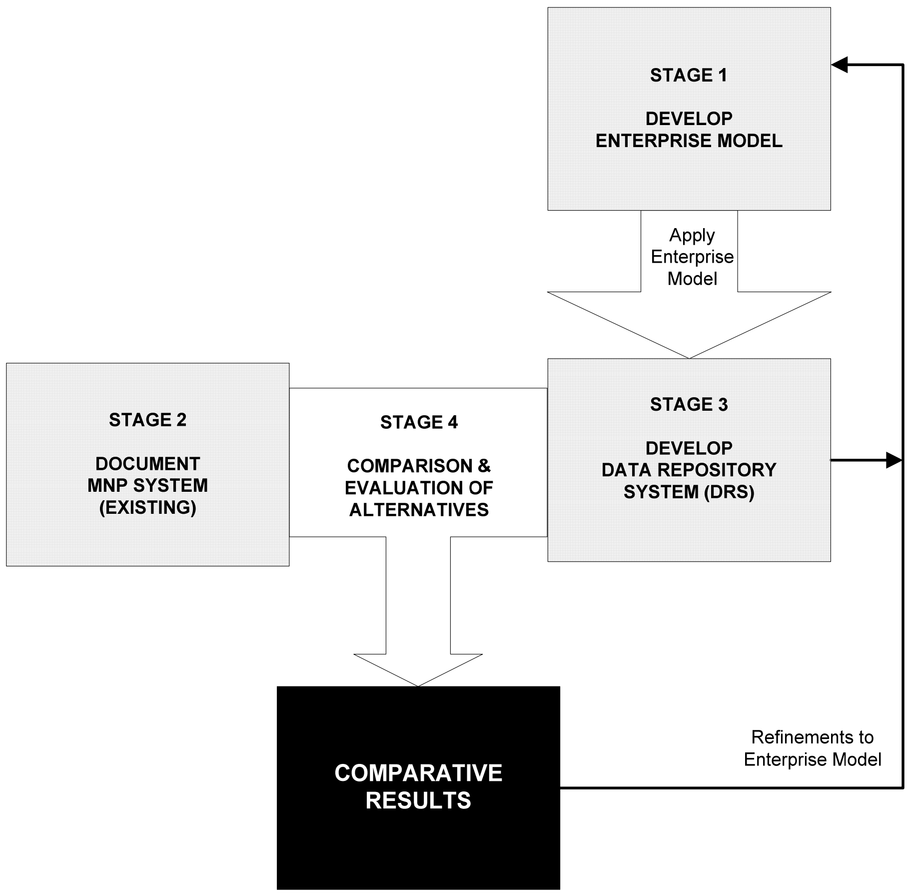

Figure 8 – Stages of the Research

These four stages address the major research aims defined in Section 2.7 Aims and Hypotheses of the Research.

4.5.2 Stage 1 Design – Develop the Enterprise Model

The first stage in the conduct of the research is the development of an Enterprise Model for the Telecommunications Service Provider, which is to be used as the basis of a new system to be developed. This stage addresses the research aim to develop and apply the Enterprise Modelling Approach in a real-live environment to a Telecommunications Service Provider, and is defined in Chapter 2, Section 2.7 Aims and Hypotheses of the Research.

The researcher had access to all senior executives of the Telecommunications Service Provider, permission to interview relevant staff and conduct workshops within the company. Interviews were conducted with the Managing Director, Direct Reports, General Managers and Executive and Line Managers in all states and the national office. The researcher also had access to all relevant documentation associated with the MNP business initiative and the existing MNPS, and all strategic company documentation regarding organisational objectives and strategies, business plans and organisation charts.

Data was collected through structured interviews with all levels of management and clarification and confirmation was attained by running workshops with a cross-section of users from different functional areas of the business. The researcher had access to all senior executives of the Telecommunications Service Provider and permission to interview staff had been obtained. Using the organisation chart to identify the relevant staff involved in key business activities, interviews were arranged top-down, initially with the Managing Director, the Managing Director's direct reports being Chief-of-Operations (COO), Chief Financial Officer (CFO), Chief Information Officer (CIO), National Sales and Marketing Group Manager, Head-of-Business Development and General Manager Human Resources. Interviews with senior executives were scheduled to last from one to two hours each. Interviews were then arranged with all executives and Line Managers in all states and the head office. These interviews were scheduled to last from two to three hours each. In total, one hundred and thirty five (135) service provider staff were scheduled to participate in interviews and workshops, over an intensive eight (8) week period of data gathering.

The researcher identified three categories of interviewees. The three categories of interviewees are:

1. Interviews of the Managing Director and the Managing Director's direct reports. Questions asked included the following. The full set of interview questions is found in Appendix C – Interview Questions Pertaining to Enterprise Modelling.

    - What is the company's mission? Is there a formal mission statement? What is the role played by your company? What useful purpose does it serve?

    - What are the major stakeholders of the company? In what sense is each of these a stakeholder?

    - What are the major external entities that your company interacts with and what are the interactions?

    - Can you describe your strategic vision for the company? What are your specific goals for the company in the short, medium and long terms?

2. Interviews of Executives and Line Managers including State Managers and State Accountants, Customer Operations Managers, Group Manager Wholesale Customer Transfers (covering Churn and regulatory products), Group Manager Wholesale Pricing, Customer Service Managers, Call Centre Managers and State Sales and Marketing Managers. Questions asked included the following:

    - What is your Department's mission? Is there a formal mission statement, a charter or terms of reference? What is the role played by your Department? What useful purpose does your Department serve? What is your Department's raison d'etre?

- Who are your Department's generic customers or beneficiaries, both within the company, your Department and outside? What services does your Department provide to each of these generic customers or beneficiaries?

- Who are your Department's generic suppliers? What services do they provide to your Department?

- Can you summarise the business functions performed by your Department?

3. Interviews of Information Technology Executives including the Chief Information Officer and Group Manager, Churn Systems and Processes. Questions asked included the following (in addition to those asked of Executives and Line managers):

   - What are the policies and guidelines governing centralisation and decentralisation of your Department's functions and resources?

   - How many information resource people are decentralised and how many remain within the IT Department?

Owing to the difference in nature of the three categories of interviewees the questions posed to interviewees and the issues discussed are different. An interview guideline, comprising a set of standard questions was used for each of the categories of interviewees. These questions constituted the core of the interviews. An interview guideline was used to ensure that the focus areas of the research were discussed during the interviews and all relevant questions were asked. The interview guideline provides eleven (11) areas of questions, with most areas containing multiple questions and the questions are both closed and open-ended.

Once the interviews were completed, half-day workshops were conducted which consisted of taking the outputs from the interviews and analysing them further with cross-functional groups throughout the organisation to gain clarification and confirmation, right down to the operational units within each of the departments around Australia.

The interview questions are described with reference to a 'real' Enterprise Modelling initiative at the Telecommunications Service Provider. The results of the interviews were analysed and cross-checked for consistency with feedback to each interviewee to provide clarification and confirmation.

The interviews and workshops formed part of the Data Gathering Stage described in Section 3.2.2. Other key inputs included business planning documentation and the ACIF MNP IT Specification, which defines the full set of business requirements for the MNP business initiative.

4.5.3 Stage 2 Design – Document the MNPS

The second stage in the conduct of the research was capturing documentation on the existing MNPS Architecture, based on an existing implemented system, known as the MNPS. This stage addresses the research aim to document the current implemented Information Systems Architecture of the MNPS for the Telecommunications Service Provider, and is defined in Section 2.7 Aims and Hypotheses of the Research.

The MNPS was developed during 2000 and 2001 based on the agreed IT Specification developed by all industry players as a member of ACIF. The scope of the MNPS was well-defined from a business process perspective and an application system perspective. This resulted in the MNPS Architecture being defined prior to the development of the Enterprise Model, which meant that an understanding of the MNPS Architecture was simply a matter of examining the technical documentation resulting from the development of the MNPS. For a detailed examination of the MNPS technical documentation, refer to Appendix D - The ACIF MNP IT Specification and Appendix E - The Existing MNPS Architecture.

The MNPS technical documentation consisted of its conceptual schema (logical data model) and the MNPS Business Reference Data outlining the contents of the existing MNPS Database Tables. The existing MNPS Architecture details the values of each of these database tables. This technical documentation was acquired six (6) months after the MNPS implementation to allow the project team time to implement system modifications, enabling improvements to the MNPS.

The MNPS was developed using a commonly used approach by the world's largest systems developer and the approach was followed faithfully. The Telecommunications Service Provider's project management and systems architects reviewed and signed off all deliverables within the proven framework of the Telecommunications Service Provider's delivery methodology. The Telecommunications Service Provider's MNP Programme Manager and Chief Architect were highly qualified, experienced in their respective roles, knowledgeable in the business processes, in particular other Churn processes and had worked alongside ACIF with other industry players in developing the ACIF MNP IT Specification throughout 2000 and 2001.

4.5.4 Stage 3 Design – Develop the DRS on the Basis of the Enterprise Model

The third stage in the conduct of the research is the development of a new system, known as the Data Repository System (DRS), which was to be designed and implemented on the basis of the Enterprise Model developed in Stage 1 and applied to the MNP business initiative.

The DRS was developed in 2002 based on the Telecommunications Service Provider's Enterprise Model and the agreed ACIF IT Specification developed by all industry players. The scope and boundary of the DRS was well-defined from a business process perspective and was identical to the scope and boundary defined for the existing MNPS.

The business process architecture was defined as part of the Telecommunications Service Provider's Enterprise Model, with detailed process modelling on the ACIF MNP IT Specification forming a basis for developing program modules for the DRS, modules identified that are common across different information systems and sub-systems, including the DRS. This eliminated the need for rework in the development of program modules that can otherwise be reused from some already developed modules.

Data integrity was assured by first coming up with a data architecture, as part of the Telecommunications Service Provider's Enterprise Model, by performing detailed data modelling to capture all the relevant business policies and business rules identified in the ACIF MNP IT Specification, which then formed a basis for designing the databases. Unless an Enterprise Model is used as a basis for subsequent detailed data modelling, this will ultimately corrupt the data and thus undermine the validity of the information systems that use the data, in this case the DRS and other information systems that share the data.

With the use of the Telecommunications Service Provider's Enterprise Model as a blueprint for building the DRS, an information systems strategic perspective also resulted in co-ordination among other projects in terms of resource scheduling and inter-project activities.

The DRS was developed using the Telecommunications Enterprise Model, together with the ACIF MNP IT Specification and the approach was followed faithfully, as the Telecommunications Service Provider's project management and systems architects reviewed and signed off all deliverables within the proven framework of the Telecommunications Service Provider's delivery methodology. The Programme Manager and Chief Architect were the same highly qualified, experienced and knowledgeable resources that played identical roles in the development of the existing MNPS and the successful deployment of many other Churn systems within the Telecommunications Service Provider's IT environment.

The researcher was engaged as both project manager and researcher in the DRS development and implementation. The role included that of change agent in the development of the Enterprise Model and its subsequent implementation to re-engineer the Telecommunications Service Provider's business processes.

The Enterprise Model, once developed, was used and will continue to be used as the basis of planning, developing and implementing a number of fully integrated Churn business systems, with the DRS being the first of such systems. It was envisaged that minor refinements to the Enterprise Model would be made during the DRS planning and development process and would be fully documented. It was expected that further minor refinements would be made to the Enterprise Model during the development and implementation of subsequent business systems based on the Enterprise Model.

4.5.5 Stage 4 Design – Evaluation of Alternatives

The fourth stage in the conduct of the research, involved testing the usefulness of the Enterprise Model to the Telecommunications Service Provider. It consisted of a comparative evaluation of the two information systems using widely accepted architectural evaluation criteria identified from the literature. These architectural evaluation criteria are fully described in Section 4.6. This stage addresses the research aim to test the usefulness of the Enterprise Modelling Approach by evaluating business systems designed specifically to meet the needs of the MNP business initiative in a major Telecommunications Service Provider. The Enterprise Modelling Approach will be compared against a commonly used alternative approach.

It is important to note that the two approaches used the same specification of requirements. This common specification of requirements was one of the key inputs into the development of the two information systems.

The objective of this stage of the research was to perform a comparative evaluation of the two information systems designed specifically to meet the needs of the MNP business initiative, using different approaches, against the following architectural evaluation criteria and to identify the impact of implementing these information systems with respect to these criteria. They are:

1. Architectural Principles
2. Fundamental Business Rules
3. Functional Scope and Interfaces
4. Data Sharing, Data Redundancy and Data Consistency

People would not regard each of these criteria as being of equal weight. What the researcher did was to organise for the stakeholders to identify the relative weightings. Using these four architectural evaluation criteria, a number of workshops were performed with key business representatives and stakeholders, including the MNP Project Owner and a number of Churn business experts, the Group Manager Wholesale Customer Transfers, the MNP Project Sponsor, the MNP Programme Manager, Chief Architect and the Project Director, Data Repository System (DRS). The workshop attendees allocated a ‘2’ to the Weighting Factor of the most important dimension, that is, Fundamental Business Rules.

Adherence to the Fundamental Business Rules was regarded by the stakeholders as the most important architectural evaluation criteria and should be specified as Structured English Sentences based on the Logical Data Model (Conceptual Schema) developed as a part of the Enterprise Model. The detailed business rules, developed as a part of the Enterprise

Model, are provided as Appendix H - The DRS' Compliance with the Fundamental Business Rules and Appendix I - The DRS Conceptual Schema.

The stakeholders considered Functional Scope and Interfaces as the least important architectural evaluation criteria and allocated a '1.25' to the Weighting Factor of this dimension. The researcher believes this was due to the two approaches using the same IT specification of requirements.

Data Sharing, Data Redundancy and Data Consistency was regarded by the stakeholders as the second most important dimension and allocated a '1.75' to its Weighting Factor relative to Fundamental Business Rules and Functional Scope and Interfaces.

The stakeholders considered Architectural Principles as more important than Functional Scope and Interfaces as it pertains to the good design practices employed in developing an information system. However, they allocated a '1.50' to the Weighting Factor of Architectural Principles as they considered it to be 75% relative to the Weighting Factor of Fundamental Business Rules.

The DRS' technical documentation was used to compare the DRS to the architectural evaluation criteria and consists of its conceptual schema (logical data model) and the DRS' compliance with the fundamental business rules. This technical documentation was used as the basis to score the DRS against the respective architectural evaluation criterion using the Figure-of-Merit data analysis technique described in Section 5.6 Data Analysis Technique. In particular, the DRS' compliance with fundamental business rules based on its conceptual schema was used to determine the DRS' adherence to the fundamental business rules developed as a part of the Enterprise Model. Comparing the DRS to the architectural evaluation criteria was performed by analysing its technical documentation against each of the measures defined for each architectural evaluation criterion. On the basis of the data analysis of the

DRS' technical documentation, the DRS was assigned a raw score on a relative scale of 1 to 10 with respect to each of the Architectural Evaluation Criterion as one of the key five steps in Figure-of-Merit analysis. The resultant scoring against the architectural evaluation criteria was assigned by the evaluation team comprising the researcher, together with the Group Manager Wholesale Customer Transfers, MNP Programme Manager, Chief Architect and Project Director.

As previously discussed in Section 4.5.3, the MNPS' technical documentation consists of its conceptual schema (logical data model) and the MNPS Business Reference Data. This technical documentation was used as the basis to score the MNPS against each respective architectural evaluation criterion using the Figure-of-Merit data analysis technique. Comparing the MNPS to the architectural evaluation criteria was performed by analysing its technical documentation against each of the measures defined for each architectural evaluation criterion. The analysis of the MNPS' technical documentation and the resultant scoring against the architectural evaluation criteria was assigned by the same evaluation team that assessed the DRS. The raw score assigned by the evaluation team to the architectural evaluation criteria was then input into the Figure-of-Merit analysis for the MNPS.

The evaluation of the two systems was performed by the evaluation team in bi-weekly half-day workshops conducted over a period of four weeks with facilitation provided by the researcher. The scores assigned to each criterion for the DRS by the evaluation team were compared and contrasted to those scores assigned by the same evaluation team to each criterion for the existing MNPS. The results were analysed using Figure-of-Merit analysis to ascertain the level of data integrity and the degree of integration achieved by utilising the top-down guidance provided by the Enterprise Model.

4.6 The Architectural Evaluation Criteria

4.6.1 Introduction

As discussed in Chapter 2 Literature Review, the literature provides insight into the ways of evaluating information systems based on a number of architectural evaluation criteria. These architectural evaluation criteria focus on the outcomes to be achieved in order to deliver an optimal information systems architecture. The researcher has derived these architectural evaluation criteria from the literature, which does not talk specifically about evaluation criteria. This section identifies the measures pertaining to each architectural evaluation criteria as recognised by the business representatives and stakeholders of the MNP business initiative. This section also lists the weighting attributed to each evaluation criterion by the same business representatives and stakeholders. The section then defines the architectural evaluation criteria under their respective heading.

4.6.2 Architectural Evaluation Criteria, Relative Weighting & Measures

Table 3 - Measures Pertaining to Each Architectural Evaluation Criterion, identifies the important dimensions and sub-dimensions, also known as Architectural Evaluation Criteria, recognised by the business representatives and stakeholders of the MNP business initiative. It defines the precise measures to be performed on each Architectural Evaluation Criterion and it also lists the relative weighting to be applied in analysing the data collected on each Architectural Evaluation Criterion.

ARCHITECTURAL EVALUATION CRITERIA	RELATIVE WEIGHTING	MEASURE
1. Architectural Principles a. Data Captured at Source	1.5	1. Source of Data Capture. 2. Number of Business Functions that Capture Data.
b. Data Consistency & Data Maintainability (100% Principle)		3. Basis of Data Structure 4. Adherence to 100% Principle
c. Data Redundancy		5. Same Data Captured & Stored more than once 6. Poor structuring of Data
d. Separation of Concern		7. Clustering of Business Entities into Business Themes, as defined in the Enterprise Model 8. Hierarchical Decomposition of Business Functions, as defined in the Enterprise Model 9. Well-defined Program Modules or System Components
2. Fundamental Business Rules	2	Ability of the Data Structure (Conceptual Schema) to support the defined Business Rules based on the Enterprise Model
3. Functional Scope & Interfaces	1.25	The Totality of the Business Functions performed by the System, as defined in the Enterprise Model
4. Data Sharing, Data Redundancy & Data Consistency	1.75	Ability of different functions in the System to use and share the same Data, as defined in the Enterprise Model

Table 3 - Measures Pertaining to Each Architectural Evaluation Criterion

The objective is to evaluate the two business systems designed to meet the needs of the business, using different approaches, against the architectural evaluation criteria and the impact of implementing these business systems with respect to these criteria. It is important to note that these criteria are relevant in evaluating any information system.

4.6.3 Definition of Architectural Evaluation Criteria

The architectural evaluation criteria are described in detail below.

1. Architectural Principles

Architectural Principles refer to the good practices in the overall design of business systems. In the architectural evaluation of the two systems designed to meet the needs of the business, the following architectural principles are used:

a. Data Captured at Source

Capturing data where it occurs, that is, at its source, is deemed to be a good system design practice. If the same kind of data is captured by different business functions and not centrally co-ordinated, duplicated capturing of the same data may result. This in turn leads to data inconsistency and data redundancy (refer to Sections Data Consistency and Data Maintainability (100% Principle) and Data Redundancy).

The measure used for this criterion is to examine the technical documentation of the system to identify the business function that initially creates the definition of the data, that is, the source of data capture. In addition, the number of business functions that create the data provides useful information as to whether this criterion is observed in the system design. For example, the same MSN Movement data may be captured in individual customer request systems, in activation and provisioning functions by the Provisioning systems, as well as in Network Provider Interfacing. Hence, the same MSN Movement data is captured two or three times and stored as data for different customers.

b. Data Consistency and Data Maintainability (100% Principle)

The way the data is structured must be based on the inherent nature of the business. If the data is not structured properly it is impossible to maintain its accuracy. Hence, the data will become inconsistent and not maintainable.

A well accepted good design practice called the 100% Principle, a fundamental architectural principle advocated by the International Standards Organisation (ISO) which stipulates that any business rule (which may be applicable to different business functions) must be asserted once and in one place only. This eliminates the possibility of the same business rule being asserted inconsistently in different business functions. When implemented in an information system, these business rules will be implemented as data integrity rules residing with the data to which they apply.

The measures used for this criterion relate to the basis of the data structure, adherence to the 100% Principle, whether the same data are captured and stored more than once, and poor structuring of the data. The basis of the data structure should be based on the inherent nature of the business in terms of the business requirements and the business rules, with the outcome of a normalised data structure. The business rules may be specified as Structured English Sentences based on the data structure.

The 100% Principle advocates that all (i.e. 100%) of the rules concerning the updates of data be handled centrally by the database management system rather than by each and every one of the application programs that invoke the rules. Apart from eliminating duplicated efforts it guarantees that the data is updated consistently across the board and renders the data more maintainable. The alternative to adherence to the 100% Principle is the hard coding of the business rules in each and every one of the application programs. Poor structuring of the data often brings about hard coding, but hard coding itself leads to poor data structuring over the maintenance life of the information system.

c. Data Redundancy

Data Redundancy results from the same data being captured and stored more than once or poor structuring of the data. Apart from wasting data storage it renders the data accuracy and quality not maintainable.

The measures used for this criterion are the basis of the data structure, adherence to the 100% Principle, whether the same data are captured and stored more than once, and poor structuring of the data.

d. Separation of Concern

Another fundamental architectural principle is the principle of separation of concern. It stipulates that business concepts and business processes that are closely related should be grouped together and business functions should only be concerned with those business concepts and business processes that are relevant to it. This principle ensures that each business function, based on which a component is built, is highly cohesive.

If a system is highly modularised, that is, broken down into program modules in a well-defined manner, then changing the logic of a program module may not affect other program modules. This can significantly reduce maintenance costs of the system.

The measures used for this criterion are the clustering of business entities into business themes and the hierarchical decomposition of business functions as the basis of well-defined program modules and system components. For an understanding of business functional decomposition and the clustering of business entities into business themes, refer to Section 3.3 The Enterprise Model.

2. Fundamental Business Rules

Fundamental Business Rules are the rules under which the mainstay of the business operates upon which the data structure is based. If the data structure does not reflect these business rules it is impossible for the system to satisfy the business requirements. These business rules and their corresponding data structure (conceptual schema), based on the Enterprise Model, are found in Appendix G - The MNPS' Compliance with the Fundamental

Business Rules and Appendix H - The DRS' Compliance with the Fundamental Business Rules.

The measure used for this criterion is the ability of the data structure, as defined in the Conceptual Schema (Logical Data Model), to support the defined business rules as described in the Enterprise Model.

3. Functional Scope and Interfaces

Functional Scope refers to the totality of the functions performed by the system. The interfaces refer to the interfaces among these functions. This evaluation criteria looks at the coverage of the system in terms of the functions and their interrelationships.

The measure used for this criterion is the totality of the business functions performed by the system and their adherence to the hierarchical decomposition of business functions as described in the Enterprise Model.

4. Data Sharing, Data Redundancy and Data Consistency

Different functions in a system may use the same data. Sharing data across the functions is the basis for integrating different aspects of a system or different systems. If the data is shared properly then the benefit of an update to a piece of shared data is automatically shared across these systems. This eliminates the need for duplicating data and reduces the overall costs of the systems.

The measure used for this criterion is the ability of different business functions in the system to use and share the same data as defined by the Enterprise Model, where the data modelling and data definition is based on conceptualisation. The level of integration based on an Enterprise Model, ensures that no redundant data will be created and that the benefits of an update to the data will be shared across all information systems using the data.

4.7 Summary

This chapter has described the research design necessary to achieve the research aims of developing, testing and refining the Enterprise Modelling Approach. It described the research approach, methods and techniques used and why they have been chosen. It also discussed the different aspects of validity for the research and how these have been measured.

The chapter also identified why the specific Telecommunications case study was chosen and described that case study in terms of the four stages and the relevant research methods employed in each stage. Next the chapter discussed in detail the four stages of the research design. Stage 1 of the research design addressed the research aim to develop the Enterprise Modelling Approach in a real-live environment for a Telecommunications Service Provider. Stage 2 of the research design addressed the research aim to document the current Information Systems Architecture of the MNPS. Stage 3 of the research design addressed the research aim to apply the Enterprise Modelling Approach in a real-live environment in developing the DRS. Stage 4 of the research design addressed the research aim to test the usefulness of the Enterprise Modelling Approach by evaluating two information systems designed specifically to meet the needs of the MNP business initiative. The Enterprise Modelling Approach was compared against a commonly used alternative approach. In this evaluation, use is made of widely accepted architectural evaluation criteria.

The next chapter, Chapter 5 Data Collection and Data Analysis describes the techniques of collecting the data based on the research design, including interviews and examination of technical documents, and the data analysis technique employed to perform the comparative evaluation of the two business systems.

Chapter 5 Data Collection and Data Analysis

5.1 Introduction

This chapter describes the techniques of collecting the data based on the four stages of research design. This includes interviews, examination of technical documents and the data analysis technique employed to perform the comparative evaluation of the two business systems. As with other case study research, data collection and analysis tend to occur simultaneously.

The methods of data collection in Stage 1 - Develop the Enterprise Model, were primarily formal interviews. Some informal interviews were undertaken to obtain the business knowledge in the development of the Telecommunications Enterprise Model. The interviews commenced with the Managing Director, and included all managerial levels within the business, moving from the top level through to operational managers. All interviews ran smoothly and according to plan, with no problems encountered. The managerial group was extremely helpful with no interviews cut short and an abundance of business planning documentation provided, both tactical and strategic.

Workshops were facilitated by the researcher with cross-functional groups of operational users across the business, to validate the management views of the business obtained in the interviews, and to provide further levels of detail. The interviews and workshops provided access to all company documentation and all of the required data was obtained for the development of the Enterprise Model.

The data collection and data analysis of Stage 2 - Document the MNPS, involved identification and capture of the MNPS' design documents and technical documentation as a basis of performing an architectural evaluation. This documentation was successfully captured by formal requests in writing to the Vendor Project Manager, System Architect and business analysts, followed up with formal meetings to discuss the data provided. There was initially some reluctance on the part of the Vendor Project Manager to provide the requested MNPS design documentation. However, as Client Project Manager, the researcher was in a position to formally request such documentation with the client's assistance. On receipt and subsequent analysis of the technical design documentation, some aspects were not comprehensive, up-to-date and were incomplete. This resulted in a number of working sessions to define and capture the necessary data so that documentation of the MNPS could be completed.

The data collection and data analysis of Stage 3 - Develop DRS on Basis of the Enterprise Model, is relevant to the DRS' design documents and technical documentation as a basis of performing an architectural evaluation. As the DRS was successfully developed top-down on the basis of the Enterprise Model, its documentation was readily available without any problems or issues being raised. Also, the researcher was a participant-observer in the full development life-cycle, playing an active role in the DRS' development.

Stage 4 - Evaluation of Alternatives, of the research design required a comparative evaluation of the two business systems using the architectural criteria. This required acceptance of the criteria by the evaluation team and the setting of their relative weightings. The evaluation criteria were accepted by the evaluation team and stakeholders. The major area of discussion was the setting of their relative weightings, which occurred over a period of many weeks with a number of formal workshops facilitated by the researcher.

This chapter also describes the data analysis technique used to perform and score the comparative analysis of the two business systems. This is referred to as the Figure-of-Merit Analysis. The chapter concludes with a discussion of the problems identified in the interviews, which include evidence of the problems discussed in the literature that were experienced by the Telecommunications Service Provider.

5.2 Stage 1 – Develop the Enterprise Model

This section describes the techniques of collecting the data based on the research design, including formal and informal interviews. The methods of data collection in Stage 1 are primarily formal interviews, with only some informal interviews occurring, to obtain the business knowledge in the development of the Telecommunications Enterprise Model.

Formal interviews were conducted at all managerial levels within the business, commencing with the Managing Director and the Direct Reports of the Managing Director. There were nine interviews conducted at the senior management level, consisting of the Managing Director, Head of Business Planning, Head of Sales, Head of Commercial Operations, the Chief-of-Operations (COO), the Chief Information Officer (CIO), the Chief Financial Officer (CFO), the General Manager, Products and the General Manager, Human Resources. The next levels of managers were interviewed in turn, which consisted of Executives and Line Managers, grouped together as Middle Managers, who reported through to one of the senior management team. The final groups of managers, the operational managers were interviewed last. All interviews ran smoothly and according to plan, with no problems encountered.

The only issue that arose was that the Organisation Chart was not up to-date and the researcher had to clarify the reporting structure and positions in each of the senior management interviews. All managerial groups were extremely helpful with no interviews cut short and an abundance of business planning documentation provided, both tactical and strategic. There were two strategic planning documents available to the researcher to review in order to understand the strategic business direction. The first covered the period 2002 to 2006 and a controlled copy was provided. It focused on regulation and the increasing emphasis on wholesale data security. The second strategic plan, known as the 2010 Strategic Plan, was not made available to the researcher but it was discussed in the interview with the Head of Business Planning. The 2010 Strategic Plan focused on the industry and its key players with particular emphasis placed on operational separation.

The interviews were documented by the researcher and returned to the interviewees for clarification and confirmation. Although some senior executives were slow in reviewing the interview notes and required follow-up, all interviewees assisted the researcher by responding. The data required to develop the Enterprise Model was successfully obtained from the interviews and there were no surprises. This stage was the most important for the success of the research as the alignment of IT to the business is dependent on a full understanding of the business, including strategic business objectives, business strategies in place to achieve those objectives, goods and services provided to customers, business functions performed and stakeholders in the business. A list of interviews conducted of the senior and middle management groups is found in Appendix L - Interviews Conducted.

Following the interviews, workshops were facilitated by the researcher with cross-functional groups of operational users across the business, to validate the management views of the business obtained in the interviews, and to provide further levels of detail, particularly in business functions and business information requirements. In excess of one hundred and thirty people participated in interviews and workshops over a two month period.

The interviews and workshops provided access to all company documentation and all of the required data was obtained to develop the Enterprise Model. Clarification and confirmation working sessions were facilitated by the researcher throughout the process of developing the Enterprise Model to illicit further input from the business and to instill a level of ownership in the Enterprise Model outcome.

5.3 Stage 2 – Document MNPS

The data collection and data analysis of Stage 2 relates to the MNPS' design documents and technical documentation as a basis of performing an architectural evaluation. The MNPS technical documentation consists of its conceptual schema (logical data model); the MNPS Business Reference Data outlining the contents of the existing MNPS' Database Tables and the fundamental business rules implemented by the MNPS.

The development of the MNPS was outsourced to the world's largest IT provider using the systems development framework of the Telecommunications Service Provider, which has been used in thousands of systems development projects over a number of years. This development was managed by the client against its defined deliverables and milestones, with the Vendor Project Manager reporting to the MNP Programme Manager. The MNPS documentation was captured by formal requests in writing to the Vendor Project Manager, Systems Architect and business analysts, followed up with formal meetings to discuss the data provided. There was initially some reluctance on the part of the Vendor Project Manager to provide the requested MNPS design documentation. However, as Client Project Manager, the researcher was in a position to formally request such documentation with the client's assistance. The MNPS design documentation is provided as Appendix E - The Existing MNPS Architecture. The MNPS design documentation is captured in the same format, structure and content that was provided by the vendor.

Further technical design documentation was captured of the MNPS consisting of the fundamental business rules enforced by the system. On receipt and subsequent analysis of the technical design documentation, some aspects were not comprehensive, up-to-date and were incomplete. In this case, the data collection involved data analysis at the time of data capture. The researcher had to use the MNPS' design documentation, together with formal meetings with the MNPS' Architect and business analysts to identify which fundamental business rules were supported by the MNPS and if they were supported, how they were supported. This resulted in a number of working sessions to define some of the design concepts and business rules. The outcome of this data collection and analysis is shown as Appendix G - The MNPS' Compliance with the Fundamental Business Rules.

In documenting a logical data model, the meaning of data has to be clearly defined based on the business concepts being represented by the data. The usage of data and its representation have to be clearly defined in order to have good design of systems and their associated databases. Proper data definition must also be supported by good naming conventions that reflect the meaning of the data being named. The researcher, as an observer in the development of the MNPS, believed that this had not been performed. This view was confirmed with the data capture of the MNPS' technical documentation. The kernel business concepts defined as part of the MNPS' logical data model, including the MNPS Business Reference Data, were not defined from a business perspective but from a technical perspective. This was a problem as it meant that the data required further data analysis, in some cases right down to the values of the data, which then required further data to be captured. This is true for the MNPS Business Reference Data, which outlines the contents of the existing MNPS' Database Tables which is also found in Appendix E - The Existing MNPS Architecture.

The researcher captured all the required data of the MNPS necessary to perform the architectural evaluation. It was time consuming and tedious, but none the less successful.

5.4 Stage 3 – Develop DRS on Basis of the Enterprise Model

The data collection and data analysis of Stage 3 relates to the DRS' design documents and technical documentation as a basis of performing an architectural evaluation. As the DRS was developed top-down on the basis of the Enterprise Model, its documentation was readily available without any problems or issues being raised. Unlike the MNPS, the development of the DRS was not outsourced, but developed in-house. Also, the researcher was a participant-observer in the full development life-cycle, playing an active role in the DRS' development as the Client Project Manager.

The DRS' technical documentation consists of its conceptual schema (logical data model), the physical database schema and the fundamental business rules implemented by the DRS. This documentation was captured by the researcher actively participating in the development of the DRS with the MNP Programme Manager and Systems Architect. The DRS design documentation is provided as Appendix I - The DRS Conceptual Schema and Appendix J - The DRS Physical Database Schema.

Further DRS technical design documentation concerning the enforcement of fundamental business rules was also captured. On capture and subsequent analysis of the DRS' technical design documentation, all aspects were comprehensive, up-to-date and complete. With respect to the fundamental business rules, the data collection involved data analysis at the time of data capture. The fundamental business rules were defined as part of the Enterprise Model development which was used as the basis of designing the DRS. The researcher worked together with the MNP Programme Manager and Systems Architect to identify which fundamental business rules were supported by the DRS and how they were supported. The outcome of this data collection and analysis is provided as Appendix H - The DRS' Compliance with the Fundamental Business Rules.

With the DRS' conceptual schema (logical data model), the meanings, origin and usage of the data was clearly defined based on the business concepts represented from an enterprise perspective. The usage of data and its representation must be clearly defined in order to have a good design of the DRS system and its associated databases. Proper data definition was supported by good naming conventions that reflect the meanings of the data. The researcher, as an active participant in the development of the DRS, was able to influence the MNP Programme Manager and Systems Architect based on the work performed in developing the Enterprise Model. This view was confirmed with the data capture of the DRS' technical documentation. The kernel business concepts defined as part of the DRS' logical data model were clearly defined from a business perspective and backed up by using proper naming standards and conventions. This avoided the problem of having to perform further data analysis in order to capture the data required to perform the architectural evaluation. It avoided the need to analyse the values of the data to understand their meanings.

The researcher successfully captured all the required data of the DRS necessary to perform the architectural evaluation. It was less tedious than capturing the documentation of the MNPS, but as with the MNPS, it required data collection and data analysis to be performed simultaneously.

5.5 Stage 4 – Evaluation of Alternatives

This section describes the techniques of collecting the data necessary to perform a comparative evaluation of the two business systems which is discussed in Chapter 6. This stage focused on the data that had to be collected before the evaluation of the two business systems could occur, the correct identification by the evaluation team, including stakeholders of the MNP business initiative, of widely accepted architectural evaluation criteria and the setting of their relative weightings. This stage was made easier by the mandatory adherence and agreement across the industry on the common IT specifications.

The technical design documents of the DRS and the MNPS respectively, provided the bases of collecting the data to be analysed in order to evaluate the two business systems against the architectural evaluation criteria. Table 4 Data Collection Sources for each Architectural Evaluation Criterion summarises the method of collecting the data against each criterion in order to assess the respective business systems. The data collection method consists of collecting data based on the data structures of the two business systems, at both the conceptual and physical levels. In analysing the data structures of the two information systems, both current and future functionality of each system is inferred from their respective data structures.

ARCHITECTURAL EVALUATION CRITERIA	DATA COLLECTION METHOD
1. Architectural Principles a. Data Captured at Source b. Data Consistency & Data Maintainability (100% Principle) c. Data Redundancy d. Separation of Concern	Mapping of MNPS & DRS Design Documents & Technical Documents (Conceptual Schema & Physical Database Schema) to the Enterprise Model to identify duplicates & gaps & adherence to the defined Architectural Principles
2. Fundamental Business Rules	Mapping of MNPS & DRS Design Documents & Technical Documents (Conceptual Schema & Physical Database Schema) to the Enterprise Model to identify the Business Rules that are supported
3. Functional Scope & Interfaces	Mapping of MNPS & DRS Design Documents & Technical Documents (Conceptual Schema & Physical Database Schema) to the Enterprise Model to identify the Business Functions performed by each System & those Business Functions that can be supported by each System in the future
4. Data Sharing, Data Redundancy & Data Consistency	Mapping of MNPS & DRS Design Documents & Technical Documents (Conceptual Schema & Physical Database Schema) to the Enterprise Model to identify the Functions that must use the same Data; Performing Key Analysis on the MNPS & DRS Conceptual Schema & Physical Database Schema to identify the level of Data Redundancy (inversely, denotes the level of Data Sharing)

Table 4 - Data Collection Sources for Each Architectural Evaluation Criterion

The data collection method consisted of mapping the DRS and the MNPS' technical design documents, that is, the Conceptual Schema (also known as the Logical Data Model) and the Physical Database Schema to the Telecommunications Enterprise Model to identify the following:

- Adherence to the defined Architectural Principles.
- Architectural Gaps in Business Functions and data.
- Duplicate Business Functions and redundant data.
- Level of support of the Fundamental Business Rules.
- Business Functions performed by each system and those Business Functions that can be supported by each respective system in the future.
- Business Functions that must use and share the same data.
- The level of data redundancy of each respective system.

The architectural evaluation criteria were accepted by the evaluation team and stakeholders. The MNP Programme Manager and Systems Architect, both of whom had extensive Churn systems experience, provided a great deal of support in their understanding and acceptance of the architectural evaluation criteria. The stakeholders and business representatives forming the majority of the evaluation team were clearly focused on two evaluation criteria, the fundamental business rules and data sharing. This focus had resulted from their previous experiences in systems development. They had not recognised the importance of adherence to architectural principles as it was considered more abstract than the two key criteria. However, as soon as architectural principles were explained in terms of well accepted systems design approaches and guidelines, these evaluation team members accepted the criteria as important in evaluating the two business systems.

Similarly, the same group of stakeholders and business representatives in the evaluation team had not understood the importance of functional scope and interfaces. They believed that the scope had been well defined by ACIF and agreed to by all industry players in the MNP IT Specification, which was common across the two business systems. However, they had not considered the interfaces into and out of the MNP processes and the use of data created by other systems outside of Churn. Again, when the functional scope and interfaces criterion was explained to the evaluation team, with the support of the MNP Programme Manager and Systems Architect, the team fully understood and accepted this as a valid criterion.

The major area of discussion with the evaluation team was the setting of the relative weightings of each of the architectural evaluation criterion, which occurred over a period of four weeks with bi-weekly half-day workshops facilitated by the researcher. This activity necessitated revisiting the definition of the evaluation criteria with a number of iterations so that their relative importance could be agreed and weightings formed. The following relative weightings were allocated to the architectural evaluation criteria by the evaluation team:

1. Architectural Principles	1.50
2. Fundamental Business Rules	2.00
3. Functional Scope and Interfaces	1.25
4. Data Sharing, Data Redundancy and Data Consistency	1.75

The evaluation team clearly understood and agreed with the evaluation criteria and set their relative weightings well before the comparative evaluation of the two business systems was performed. This opened the way to a successful comparative evaluation as the whole evaluation team was clear on the aims of the research, the hypotheses to be supported or not, the research design and its validity, and the data collection and analysis that provided the results.

5.6 Data Analysis Technique

The data analysis technique employed to perform the comparative analysis of the two business systems implemented is Figure-of-Merit (FoM) Analysis. The Figure-of-Merit data analysis technique has been taken from a Strategic Planning paper presented to the Australian Computer Society in 1988 (Ng, 1988) and the technique is used extensively in the Australian Department of Defence and has been used in more than twenty-six (26) corporations worldwide since 1988. It was first introduced into the RAAF in 1988 and has since been extended to the three services and Civilian Administration in Defence. For further details regarding its use, refer to Appendix K - Project Evaluation and Selection in Information Systems Strategic Planning.

The steps performed in the Figure-of-Merit Analysis are:

i. Based on the Architectural Evaluation Criteria and their relative significance, assign a Weighting Factor (WF) to each of the Architectural Evaluation Criterion to reflect its relative significance. Weighting factors were assigned by the Evaluation Team, including stakeholders of the MNP business initiative.

ii. Calculate the Unitising Factor (UF) as follows:

$$\text{UF} = \frac{\text{Sum of WFs}}{\text{Number of WFs}}$$

iii. For each of the Business Systems assign a raw score on a relative scale of 1 to 10 with respect to each of the Architectural Evaluation Criterion.

iv. Unitise the raw score as follows:

$$\text{Unitized Score (US)} = \frac{\text{Raw Score x WF}}{\text{UF}}$$

v. Calculate the Average Unitised Score (AUS) for each Business System:

$$\text{AUS} = \frac{\text{Sum of unitized scores (US)}}{\text{Number of Architectural Evaluation Criteria}}$$

The AUS is the ultimate indication of how well a Business System is rated against the Architectural Evaluation Criteria. The rounded off AUS is thus the Figure-of-Merit (FoM).

It should be noted that the Evaluation Team assigned the raw score to each of the Architectural Evaluation Criterion for the two information systems and participated in all steps to calculate the Figure-of-Merit for the two information systems under assessment. In fact, the objectivity of Figure-of-Merit analysis was so well received by the Telecommunications Service Provider that it has become the standard for information systems and software package evaluation, recently overturning the decision to acquire a major new Billing software package for the corporation.

5.7 Evidence of Problems Identified in Interviews

5.7.1 Introduction

This section discusses the problems identified in the interviews conducted in the development of the Enterprise Model, which include evidence of the problems discussed in the literature that were experienced by the Telecommunications Service Provider. These problems are the continuing lack of business systems integration and poor data integrity. Evidence documented as a result of analysing the interview data collected are grouped under the respective management position levels of interviewee, being top management, management and end-user.

5.7.2 Evidence of Problems Identified in Top Management Interviews

The interview results documented from the interviews conducted with the Managing Director and Direct Reports were the basis of data collection for subsequent data analysis in the development of the Telecommunications Enterprise Model. These interview results of the Managing Director and Direct Reports provided a strategic view of the business from a business perspective and in the alignment of Information Technology (IT) to the business and its strategic direction. The key strategic focus of the business is geared towards managing its customers, customer contracts and its products, with particular emphasis on pricing functions. Information regarding markets and the impacts of customer deals including migrations and relocations, acquisitions and Churn on pricing functions are key imperatives in growing the business. These interview results also provided a business function perspective and an information perspective for subsequent use in information flow modelling. Specifically, the interview results of the senior executives revealed the following key facts about the business.

The Chief-of-Operations (COO) stated that the biggest single problem facing the corporation is the lack of data integrity in its information systems, with the resulting poor data quality having a significant impact on management decision making. The COO cited Churn data as a significant problem with the disparate implementation of each Churn specific information system. There was no integrated view of Churn information across the six disparate Churn systems and many different business processes resulted in widely conflicting Churn information as the business rules were not implemented consistently.

According to the Chief Information Officer (CIO) the business is data rich but information poor as there is a lack of information about the business with an inability to perform ‘What / If’ analysis. There is an inability to link data across information systems, that is, a lack of cross-functional integration. This inability to properly integrate its systems results in revenue leakage due to poor data quality. The CIO also stated that the key business function to understand is Product Management, which became a key focus in subsequent interviews and workshops.

The Managing Director, together with the Head of Business Development reiterated the inability of information systems to talk to each other resulting in the lack of a 'Whole-of-Customer' view and the lack of a 'Whole-of-Product' view. This in turn is limiting the ability of the business to form partnerships with both customers and competitors to provide flexibility in product offerings. It was stated that Product Management, in particular Product Pricing as a subset of Contract Pricing, was important to the business in creating new revenue streams and markets for business growth. Individually negotiated customer contracts were important in generating deals around the infrastructure services. A list of interviews conducted of the senior and middle management groups is found in Appendix L - Interviews Conducted.

5.7.3 Evidence of Problems Identified in Management Interviews

The interview results documented from the interviews conducted with the Executives and Line Managers form an additional part of the basis of data collection for subsequent data analysis in the development of the Telecommunications Enterprise Model. These interview results of the Executives and Line Managers provided further levels of detail to build upon the strategic view of the business from a business perspective and in the alignment of IT to the business and its strategic direction. These interview results also provided a more detailed business function perspective and an information perspective for subsequent use in information flow modelling and were used to clarify and confirm the more strategic view elicited from the Managing Director and Direct Reports interview results.

A continuation of the general theme of a lack of key strategic information on how the business is performing continued with the Executives and Line Managers interviews. In particular, the General Manager Customer Operations, Group Manager Pricing, Group Manager Business Development, Group Manager Wholesale Pricing and the Manager Billing Integrity and Billing Disputes focused on real-time access to information that was integrated and flexible. The alignment of service operations and finance areas was seen to be crucial with the need for quick and efficient information flows and integrated data to support pricing at every level, including volume based pricing, distance based pricing and product bundling requirements to be supported. Product bundling and packaging is not handled in information systems but handled manually.

The major goals over the next two years were based on more innovative use of the network capability through integration with other networks and sharing data by adding value to product offerings. The core business functions were seen to be Call Management, Order Provisioning, Rating and Billing, Service Delivery in particular to Corporate Customers, large service provider wholesale customers including Optus, AAPT and Vodafone, Product Management including Product Pricing, Economic Modelling, Sales and Business Development and Credit Management. The Order Provisioning function is not well integrated with the Rating and Billing functions and contractual arrangements with customers are not reflected in information systems due to a lack of integration. This has led to a large manual effort in attempting to maintain billing data integrity and determining root cause analysis on billing disputes. In fact, in April 2002 64% of the corporation's bills were handled manually with a high level of data redundancy and inaccurate data.

The Group Manager Wholesale Customer Transfers and Group Manager Churn Systems and Processes discussed and explained the two types of products marketed and sold by the business. Declared products, also known as Regulatory products, are non-contestable and highly regulated in that the business cannot maneuver on price. Pricing is performed by regulatory negotiation with the ACCC on behalf of other network providers and service providers. The second type of product is the Contestable product, where the business is free to compete openly in the retail market. Churn, also known as Customer Transfers internally within the corporation, affects the Contestable products in the marketplace. The key issues with Churn systems are the lack of integration and poor data integrity due to six disparate Churn systems acting independently across the customer base.

Reporting of the key performance metrics to the ACCC is the responsibility of the Manager, Wholesale Customer Services - Performance and Analysis. This role is also responsible for customer reporting to the Sales group such as the reporting of provisioned orders on time and reporting on volumes and performance of products. The two key issues experienced to date are poor data integrity in terms of a lack of a consistent view of the data and a lack of integration of data. What is required is a 'Whole-of-Business' view where 100% data integrity can be assured. A list of interviews conducted of the senior and middle management groups is found in Appendix L - Interviews Conducted.

One of the key results of these interviews was providing the ability for the business to use information strategically. It was well understood in the business at every level, that the use of information strategically was being hindered by the lack of cross-functional integration of its information systems.

5.7.4 Evidence of Problems Identified in End-User Interviews and Workshops

The End-User interview and Workshop results documented from the interviews and workshops conducted form an additional part of the basis of data collection for subsequent data analysis in the development of the Telecommunications Enterprise Model. These user interview and workshop results provided an operational perspective and further levels of detail to build upon the management views of the business, from a business perspective and in the alignment of IT to the business consistent with its strategic direction. These user interview and workshop results also provided a more detailed business function perspective and an operational data perspective for subsequent use in information flow modelling and were used to clarify and confirm the views elicited based on the management interview results.

The key results of the user interviews were the need for information accessibility to operational information and the streamlining of business processes. In the functional area of Customer Transfers, each of the Churn systems required access to information that was captured and stored redundantly in each system. Redundant data included customer and service data, network provider and service provider data and the inability to determine whether the activation or deactivation of a service was the result of a Churn or not, due to the lack of integration of the Churn systems with the provisioning and billing systems.

The focus of the workshops was targeted at those aspects of the business that relied upon a strategic use of information such as Billing Integrity and revenue assurance, Product Pricing and revenue generation. The business needed to use information strategically by performing strategic marketing to generate revenue. To do this, it must understand its customers' end-user usage patterns and target the development of new products to market to those end-users. The results of the workshops were an understanding of the business functions and data required to provide the business with a 'Whole-of-Customer' view and the ability to use information strategically. This view required information relating to all products including some additional product information regarding competitors and products currently handled manually.

5.8 Summary

This chapter describes the techniques used for data collection. They include interviews, the researcher playing the role of a participant-observer, and the collection and examination of technical documents. As with other case study research, it explains where data collection and analysis are required to occur simultaneously.

The method of data collection in Stage 1 Develop the Enterprise Model is primarily formal interviews to obtain the business knowledge to develop the Enterprise Model. The interviews were conducted top-down commencing with the senior management team, followed by executives and line managers, through to operational managers. All interviews ran smoothly and according to plan, with no problems encountered. There was a number of business planning documents made available to the researcher spanning the period 2002 to 2010. Workshops were facilitated by the researcher with cross-functional groups of operational users to validate the data collected in the interviews and to obtain further levels of detail. All of the data required to develop the Enterprise Model was successfully obtained from the interviews and there were no surprises.

The data collection and data analysis of Stage 2 revolved around the MNPS' design documents and technical documentation as a basis of performing an architectural evaluation of the MNPS. The development of the MNPS was outsourced and the vendor used the systems development framework of the Telecommunications Service Provider. The MNPS documentation was captured by formal requests in writing to the vendor and followed up with formal meetings to discuss the data provided. Further technical design documentation was captured of the MNPS regarding the fundamental business rules implemented. The researcher used the MNPS design documentation, together with formal meetings with the MNPS Architect and business analysts to identify which fundamental business rules were supported. The researcher captured all the required data of the MNPS necessary to perform the architectural evaluation.

The data collection and data analysis of Stage 3 revolved around the DRS' design documents and technical documentation as a basis of performing an architectural evaluation of the MNPS. The DRS' documentation was readily available as it was developed top-down on the basis of the Enterprise Model. The researcher was a participant-observer in the development of the DRS, playing an active role as Client Project Manager. Further technical design documentation was captured of the DRS regarding the fundamental business rules implemented. The researcher worked together with the MNP Programme Manager and Systems Architect to identify which fundamental business rules were supported. The researcher successfully captured all the required data of the DRS necessary to perform the architectural evaluation.

In Stage 4 Evaluation of Alternatives, capturing the technical design documents of the DRS and the MNPS provided the bases of the data to be analysed so that the evaluation of the two business systems could be performed against the architectural evaluation criteria. This section describes the method of collecting the data against each evaluation criterion to enable the business systems to be assessed. The two approaches followed in developing the DRS and the MNPS used the same specification of requirements. Also discussed was the understanding and acceptance of the architectural evaluation criteria by the evaluation team and their setting of the relative weightings of each of the evaluation criterion.

The chapter then described Figure-of-Merit (FOM) Analysis, its origin and use, and the steps involved in performing the data analysis of the two business systems. It also pointed out the acceptance of FOM by the Telecommunications Service Provider, including its use as the company's standard in performing information systems and software package evaluation.

Finally, the chapter discussed the problems identified in the interviews conducted in the development of the Enterprise Model. These problems of a continuing lack of business systems integration and poor data integrity were identified as a result of analysing the interview data collected.

The next chapter describes the evaluation of the DRS and the MNPS according to the four accepted Architectural Evaluation Criteria. The findings and their significance are discussed in order, for each of the architectural evaluation criterion.

Chapter 6 Comparative Evaluation

6.1 Introduction

This chapter evaluates the two information systems, the Data Repository System (DRS) and the MNP System (MNPS), according to the four accepted Architectural Evaluation Criteria. First, the support of the architectural principles of data captured at source, data consistency and data maintainability (the 100% Principle), planned and controlled data redundancy and separation of concern. Second, the two systems' support of the fundamental business rules as defined by the Enterprise Model. Third, the two systems' support of the functional scope and interfaces as defined by the Enterprise Model. Fourth, the two systems' support of data sharing, minimal data redundancy and data consistency as defined by the Enterprise Model. The findings and their significance are discussed in order, for each of the architectural evaluation criterion. The next section summarises these findings and the following sections discuss the results in detail.

6.2 Summary of Comparative Study Results

The comparative study based on Architectural Evaluation Criteria, assesses and compares the relative strengths of the two business systems with respect to each of the Architectural Evaluation Criteria described in Chapter 4 Research Design.

The findings support the main hypothesis of this research, namely, that an information system designed and implemented in accordance with the Enterprise Model is superior to an information system that does not. The information system designed on the basis of an Enterprise Model will be naturally integrated with the other information systems and its data will have a high degree of data integrity. Specifically, the findings support each of the following subsidiary hypotheses:

- An information system designed and implemented in accordance with the Enterprise Model is more likely to support widely accepted architectural principles than one that is not.

- An information system designed and implemented in accordance with the Enterprise Model is more likely to support the fundamental business rules than one that is not.

- An information system designed and implemented in accordance with the Enterprise Model is more likely to have a well-defined functional scope and interface specification than one that is not.

- An information system designed and implemented in accordance with the Enterprise Model is more likely to support data sharing, planned and controlled data redundancy and a high degree of data consistency than one that is not.

The DRS designed and developed on the basis of the Enterprise Model, is superior to the alternative MNPS with respect to all of the architectural evaluation criteria. A summary of the case study comparative results of the two business systems is shown in Table 5 - Business Systems Comparative Results Summary Using Figure-of-Merit Analysis.

Based on the Figure-of-Merit analysis, using weighting factors and scoring out of ten, the relative strengths of the two business systems are reflected by their respective unitised scores as follows:

- DRS scored 9.39 out of ten, that is, 93.90% compliance with the Architectural Evaluation Criteria.

- MNPS scored 2.85 out of ten, that is, 28.50% compliance with the Architectural Evaluation Criteria.

ARCHITECTURAL EVALUATION CRITERION	WEIGHTING FACTOR	RAW SCORE		WEIGHTED SCORE		UNITISED SCORE	
		MNP	DRS	MNP	DRS	MNP	DRS
1. Architectural Principles	1.50	4.00	9.00	6.00	13.50	0.92	2.08
2. Fundamental Business Rules	2.00	2.00	10.00	4.00	20.00	0.62	3.08
3. Functional Scope & Interfaces	1.25	4.00	8.00	5.00	10.00	0.77	1.54
4. Data Sharing, Data Redundancy & Data Consistency	1.75	2.00	10.00	3.50	17.50	0.54	2.69
TOTAL SCORE		**3.00**	**9.25**	**4.875**	**15.03**	**2.85**	**9.39**

Table 5 - Business Systems Comparative Results Summary Using Figure-of-Merit Analysis

The DRS which scored at 93.90% compliance with the Architectural Evaluation Criteria meets all required business needs as expressed in its high score for Fundamental Business Rules and is architecturally sound with its flexibility to meet changing business needs in the future due to its compliance with the Architectural Principles. This result indicates that the DRS, due to its flexibility, will be less costly to maintain during its life than other systems, such as the MNPS, which are not architecturally sound. On the other hand, it is clear that the MNPS which scored at 28.50% compliance with the Architectural Evaluation Criteria is not architecturally sound as it now stands, as it does not abide by the Architectural Principles and it does not meet the business requirements as expressed in terms of the Business Rules. Hence, the MNPS does not possess the flexibility to meet changing business needs in the future. These two key aspects of this architectural evaluation are paramount in determining the size and type of customisation necessary to rectify the MNPS deficiencies and therefore, align it to the MNP business requirements.

The observation of the Regulator and key Churn managers has been that no other network provider in the Australian market has been able to implement the ACIF Code and in particular, the performance measurements with SLAs. Hence, the Telecommunications Service

Provider has been given responsibility for managing the industry from a regulatory reporting perspective.

The result of the findings for the DRS, which scored at 93.90% compliance with the Architectural Evaluation Criteria, is that it meets all required business requirements and it is architecturally sound with its ability to adapt in meeting changing business needs over time. On the other hand, the MNPS, which scored at 28.50% compliance with the Architectural Evaluation Criteria, result is that it does not meet the currently defined set of business requirements and it is not architecturally sound. That is, the MNPS foundation ensures that it will not be capable of adaptation in meeting perceived future business needs. This architectural failure with the MNPS means that information systems integration is not possible now or in the future and its poor data integrity will continue to become more prevalent as the system is modified over time.

The findings support the belief that enterprise modelling is a key to integrated business systems, significantly improving the quality of service delivery and significantly improving regulatory capability. The success of this information system required a paradigm shift by the Telecommunications Service Provider to focus on the customer and guarantees of service quality. The case study demonstrates that substantial benefits can be achieved with a minimal investment by understanding the way in which information flows throughout the enterprise.

6.3 Architectural Principles Comparative Evaluation

6.3.1 Introduction

This section comprehensively discusses the findings of the comparative evaluation of the DRS and the MNPS according to the following important architectural principles:

- Data Captured at Source
- Data Consistency and Data Maintainability
- Data Redundancy
- Separation of Concern.

6.3.2 Data Capture, Consistency and Maintainability

The DRS and the MNPS capture their source data from the messages sent and received by each Network Provider and Service Provider established as part of the Business-to-Business (B2B) Virtual Private Network (VPN). Each business system fully complies with this architectural principle of capturing the data from its true source.

The DRS also abides by the 100% Principle as it does not hard code any of the business rules in its application programs and it implements all Service Level Agreements (SLAs) as rules-based, where the authorised business representatives can add, delete or modify any rules without the need to change application programs or hard code those rules. Hence, flexibility and data integrity in the DRS can be fully guaranteed.

In contrast to the MNPS, the integrity of data in the DRS and hence the correctness, consistency and completeness of information can be fully guaranteed. The MNPS does not abide by the 100% Principle as it hard codes the business rules in its application programs and therefore data integrity cannot be guaranteed.

The integrity of data and hence the correctness, consistency and completeness of information cannot be guaranteed by the MNPS due to the poor structuring of the MNPS' data compared with those data in the DRS. This is captured in examining the database tables required to support Report Number 1 Performance (SLA) Report as shown in Appendix F - Data Differences between the MNPS and the DRS. The MNPS uses five database tables, none of which contain the "MSN Movement Performance Measurement Rule" data, or the "MSN Movement Progress Performance Measure" data, whereas the DRS uses just three tables with no hard coding required. A detailed analysis of the structuring of the two business systems' data used to generate all fifteen (15) mandatory operational reports has been performed with similar findings to that of Report Number 1.

6.3.3 Data Redundancy

The data stored against each of the MNPS' entity types (tables) provided as Appendix E - The ACIF MNP IT Specification, will be entered, processed, stored and maintained redundantly. It is therefore impossible to maintain consistency and hence correctness of the data if this issue is not addressed. For example, the raw XML message is received and dumped to table T302_Request_Tx. The data is then redundantly stored into table T301_Request based on a secondary index, "Request_Id". The "Request_Type_Code" is then determined according to the rules established in table T002_Request_Type. The only Request types defined in this table are "Port", "Giveback" and "Technology Transfer". The Request Type largely overlaps with another table, T014_Number_Movement_Type, which has values of "Port", "Giveback", "Technology Transfer" and "Churn". This denotes a high level of data redundancy. The values in these two tables are roughly equivalent to the type of MSN Movement in the Enterprise Model, which includes the following business entity types:

- Port-In MSN Movement
- Port-Out MSN Movement
- Technology Transfer Churn MSN Movement
- Churn MSN Movement
- Customer MSN Movement Reversal
- Giveback-In MSN Movement
- Giveback-Out MSN Movement

The DRS' data is structured in line with these eight business entity types as defined in the Enterprise Model and is based on the inherent nature of the Mobile Number Portability business. An examination of Appendix I – The DRS Conceptual Schema shows the business entity types as defined in the Enterprise Model have been implemented and can be mapped directly to the DRS Physical Database Schema shown as Appendix J – The DRS Physical Database Schema. Hence, the DRS does not suffer from data redundancy.

6.3.4 Separation of Concern

The fundamental architectural principle of Separation of Concern ensures that each business function, based on which a component is built, is highly cohesive. In building the DRS components, this principle has been abided by.

In the DRS, the business concepts and business processes that are closely related are grouped together and the following business functions are only concerned with those business concepts and business processes that are relevant to them. This is because they are based on the Enterprise Model, as follows:

F4.0 MANAGE INDUSTRY & REGULATORY ENVIRONMENT

- **F4.1 Manage Regulatory Strategy**
- **F4.2 Manage Regulatory Communication**
- **F4.3 Manage Regulatory-Product Movement Rules**
- **F4.4 Manage Regulatory-Product Movement**
  - *F4.4.1 Capture Regulatory-Product Movement Request*
  - *F4.4.2 Validate Regulatory Product Movement*
  - *F4.4.3 Process Regulatory-Product Movement*
  - *F4.4.4 Monitor Regulatory-Product Movement Progress*
- **F4.5 Monitor Regulatory-Product Movement Impact**
- **F4.6 Take Regulatory-Product Movement Impact Minimisation Measures**
- **F4.7 Manage Regulatory-Product Movement Compliance**

In the MNPS, there has been a tendency to group the Message Capture function into the Mobile-Service-Number (MSN) Movement component as distinct from the Service Request function. This is a direct violation of the principle of Separation of Concern and has resulted in disparate functions being implemented into the same system component. This in turn results in a high degree of unnecessary information flows across the components, rendering the interface complicated and unmanageable. These business system components must be defined based on the information flows and information dependencies described in the Enterprise Model and implemented as in the DRS.

Another major issue with the MNPS is that application logic and application level business rules have been implemented in the Business-to-Business communications layer. This is a direct violation of the principle of Separation of Concern and has resulted in like business functions being implemented into different system components. In contrast, the DRS defines its business system components based on the information flows and information dependencies that are described in the Enterprise Model and hence suffers none of the problems experienced by the MNPS with respect to Architectural Principles.

On the basis of the architectural assessments above, the DRS has been assigned by the evaluation team, a raw score of “9” on a relative scale of 1 to 10 with respect to the Architectural Principles criterion. This raw score of “9” is input into the Figure-of-Merit analysis. Similarly, on the basis of the architectural assessments above, the MNPS has been assigned by the evaluation team, a raw score of “4” on a relative scale of 1 to 10 with respect to the Architectural Principles Criterion. This raw score of “4” is input into the Figure-of-Merit analysis.

In conclusion, the architectural assessments support the hypothesis that an information system designed and implemented in accordance with the Enterprise Model is more likely to support widely accepted architectural principles than one that is not.

6.4 Fundamental Business Rules Comparative Evaluation

6.4.1 Introduction

This section discusses the results of the comparative evaluation of the DRS and the MNPS in regards to their support for the MNP initiative’s fundamental business rules. The results confirm the value of the Enterprise Model as the DRS supports all of the fundamental business rules. The MNPS developed without the top-down guidance and holistic view of the business provided by an Enterprise Model, supports few of the fundamental business rules.

6.4.2 Fundamental Business Rules Comparative Evaluation - General

The DRS supports all of the fundamental business rules for the MNP initiative and is shown as Appendix H - The DRS’ Compliance with the Fundamental Business Rules, which describes all fundamental business rules and the DRS’ compliance with them. All of the 156 business rules are fully supported by the DRS.

On reviewing the DRS' design documents and physical database schema developed from the Enterprise Model, it has been found that in the DRS different fundamental business rules apply to different kinds of MSN movements (modelled as a subtype of MSN Movement in the Enterprise Model). The DRS does support all of the MSN Movement subtypes and subsets, where numerous fundamental business rules related to MSN movements are asserted and hence important MNP business functions and business information are supported. For example, a Technology Transfer Churn MSN Movement will have an associated BPCN message, whereas a Churn MSN Movement will not have an associated BPCN message. The DRS enforces these business rules and abides by the 100% Principle in doing so.

Similarly, on reviewing the DRS' design documents and physical database schema developed from the Enterprise Model, it has been found that in the DRS, different business rules are applied to different types of MSN movements, viz. Customer MSN Movement, Network MSN Movement and End-User Unallocated MSN Movement. These types of MSN Movement are clearly differentiated in the DRS. This is conducive to implementing a correct MNP component to effectively support related business functions.

The impact of full compliance of the DRS with the Enterprise Model means that the MNP solution is flexible enough to support these different types of MSN movements and reporting changes, such as the development of 350 new reports by business users in the last twelve months, without any change to the DRS and its data structures.

The MNPS' support for the fundamental business rules identified by the Enterprise Model is extremely low, with only 25 business rules supported by the MNPS out of a total of 156 business rules. That is, the MNPS supports only 16% of the fundamental business rules described in the MNP business requirements. For further details refer to Appendix G – The MNPS' Compliance with the Fundamental Business Rules.

On mapping the MNPS' design documents and physical database schema to the Enterprise Model, it has been found that in the MNPS different fundamental business rules apply to different kinds of MSN movements (modelled as a subtype of MSN Movement in the Enterprise Model). Not differentiating one MSN Movement subtype from another will result in fundamental business rules not being able to be supported. This is because the MNPS is not based on an Enterprise Model.

The MNPS does not support any of the MSN Movement subtypes and subsets. If the MSN Movement subtypes and subsets are not supported, numerous fundamental business rules related to MSN movements cannot be asserted and hence important MNP functions and information will not be supported by MNP Reporting when it is implemented. For example, a Technology Transfer Churn MSN Movement will have an associated BPCN message, whereas a Churn MSN Movement will not have an associated BPCN message (c.f. Enterprise Model). These are two important business rules that must be supported, as network rerouting must be performed on a Technology Transfer Churn MSN Movement but no network rerouting is performed on a Churn MSN Movement.

Additionally, on mapping the MNPS' design documents and physical database schema to the Enterprise Model, it has been found that in the MNPS, different business rules are applied to different types of MSN movements, viz. Customer MSN Movement, Network MSN Movement and End-User Unallocated MSN Movement. Currently, these types of MSN Movement are not clearly differentiated. This is not conducive to implementing a correct MNP component to effectively support related business functions.

As the MNPS does not support the above-mentioned fundamental business rules, the future MNP solution will not be flexible enough to support these different types of MSN movements. This means that the business will be locked in to manually performing many business functions, for example, identifying an end-user's propensity to Churn, for years to come.

6.4.3 Fundamental Business Rules Comparative Evaluation - Specific

On reviewing the DRS' design documents and physical database schema developed from the Enterprise Model, it has been found that the following business concepts and business rules that are not supported in the MNPS are fully supported in the DRS:

> Unacknowledged Customer MSN Movement, Acknowledged Customer MSN Movement, Rejected Customer MSN Movement, Approved Customer MSN Movement, Unacknowledged Cutover Customer MSN Movement, Acknowledged Cutover Customer MSN Movement, Rejected Cutover Customer MSN Movement, Approved Cutover Customer MSN Movement, Unacknowledged Withdrawn Customer MSN Movement, Acknowledged Withdrawn Customer MSN Movement, Rejected Withdrawn Customer MSN Movement, Approved Withdrawn Customer MSN Movement, Unacknowledged Expired Customer MSN Movement, Acknowledged Expired Customer MSN Movement, Resubmitted Cutover Customer MSN Movement & Resubmitted Withdrawn Customer MSN Movement.

As the DRS supports all of the business rules defined in the Enterprise Model, this has positive consequences for the business. These consequences are now described:

1. The above business concepts constitute a substantial portion of MNP tracking which are implemented in the DRS and reported against. This reflects a high degree of flexibility, as the business users have produced 350 reports without any change required to the DRS, whether to computer programs or to the database schema.

2. Future enhancements of MNP Reporting in the DRS, to support a wider array of tracking MSN movements can be easily implemented. This reflects a high degree of flexibility as the business users modify and create reports without any change to the DRS.

3. The correct reporting of MSN movements relating to the above business concepts include:

   - The state of a Resubmitted Cutover Customer MSN Movement must be changed from Rejected Cutover to Unacknowledged Cutover. The current DRS reporting fully support Resubmissions and report them correctly.

   - The state of a Resubmitted Withdrawn Customer MSN Movement must be changed from Rejected Withdrawn to Unacknowledged Withdrawn. The current DRS reporting fully support Resubmissions, Rejections and Withdrawals and report them correctly.

   - The Rejected Cutover state is fully supported in the DRS and where it is resubmitted, its state is automatically changed to Unacknowledged Cutover.

   - The Rejected Withdrawn state is fully supported in the DRS.

On mapping the MNPS' design documents and physical database schema to the Enterprise Model, it has been found that the MNPS does not support the following business entity types and business rules:

> Unacknowledged Customer MSN Movement, Acknowledged Customer MSN Movement, Rejected Customer MSN Movement, Approved Customer MSN Movement, Unacknowledged Cutover Customer MSN Movement, Acknowledged Cutover Customer MSN Movement, Rejected Cutover Customer MSN Movement, Approved Cutover Customer MSN Movement, Unacknowledged Withdrawn Customer MSN Movement, Acknowledged Withdrawn Customer MSN Movement, Rejected Withdrawn Customer MSN Movement, Approved Withdrawn Customer MSN Movement, Unacknowledged Expired Customer MSN Movement, Acknowledged Expired Customer MSN Movement, Resubmitted Cutover Customer MSN Movement & Resubmitted Withdrawn Customer MSN Movement.

The MNPS does not support the above-stated fundamental business rules and this leads to undesirable consequences for the business. These consequences are now described:

1. The above business concepts constitute a substantial portion of MNP tracking which cannot be implemented in the MNPS and reported against. This reflects a major loss in flexibility, as the different states of a Port or Churn business transaction cannot be tracked. For example, reporting the number of Resubmissions or Rejected Resubmissions of a specific Port or Churn transaction cannot be performed.

2. Future enhancements of MNP Reporting in the MNPS, to support a wider array of tracking MSN movements cannot be easily implemented. This reflects a loss in flexibility due to the above-mentioned business entity types not being supported.

3. The reporting of MSN movements relating to the above business entity types will be incorrect within an MSN movement's lifecycle. Examples of this invalid reporting include the following:

    - The state of a Resubmitted Cutover Customer MSN Movement must be changed from Rejected Cutover to Unacknowledged Cutover. The current MNPS reporting does not support Resubmissions and reports them erroneously.

    - The state of a Resubmitted Withdrawn Customer MSN Movement must be changed from Rejected Withdrawn to Unacknowledged Withdrawn.

    - The current MNPS reporting does not support Resubmissions and reports them erroneously as it only stores the latest Resubmission in its database. There are a large number of occurrences of Resubmissions that exceed 100 in number.

    - Rejected Cutover is retained as Notification Confirmed in the MNPS, which is incorrect.

    - Rejected Withdrawn cannot be reported in the MNPS as it specifies a Rejected state or a Withdrawn state but not a Rejected Withdrawn state.

Due to its lack of compliance with Fundamental Business Rules and conceptual ambiguities of the MNPS, full and complete data reconciliation is not possible.

On the basis of the architectural assessments above, the MNPS has been assigned by the evaluation team, a raw score of “2” on a relative scale of 1 to 10 with respect to the Fundamental Business Rules Criterion, as the MNPS only supports 16% of the fundamental business rules. This raw score of “2” is input into the Figure-of-Merit analysis. On the same basis, the DRS has been assigned by the evaluation team, a perfect raw score of “10” on a relative scale of 1 to 10 with respect to the Fundamental Business Rules criterion, as the DRS supports 100% of the fundamental business rules. This raw score of “10” is input into the Figure-of-Merit analysis.

In conclusion, the architectural assessments support the hypothesis that an information system designed and implemented in accordance with the Enterprise Model is more likely to support the fundamental business rules than one that is not.

6.5 Functional Scope and Interfaces Comparative Evaluation

6.5.1 Introduction

This section discusses the DRS and the MNPS in regards to their support of the MNP functional scope and interfaces. The evidence resulting from this case study supports the value of the Enterprise Model, as the DRS implementation is flexible enough to support other Port and Churn business functions into its scope. The DRS also accommodates future expansion to support changes in Service Level Agreements (SLA) into the scope of MNP Reporting. On the other hand, the MNPS does not support other Port and Churn business functions and it does not support SLA reporting.

6.5.2 Functional Scope and Interfaces Comparative Evaluation

The emphasis of the DRS is on structuring the data around the fundamental business rules based on the Enterprise Model. The implemented solution is flexible enough to cater for future expansion to incorporate support for the SLA Management component into the scope of

MNP Reporting. It is also flexible enough to cater for future expansion to incorporate support for other Port and Churn functions such as Local Number Portability (LNP), Multi-Carrier Preselection (MCP), Commercial Churn and DSL Transfers. Business Function “F4.7 Manage Regulatory-Product Movement Compliance” incorporates the SLA Management component of the architecture. For a detailed examination of the Business Functions described in the Enterprise Model, refer to Appendix B - The Enterprise Model.

Senior Management, Group Manager Wholesale Customer Transfers and Group General Manager IT Systems and Processes, have stated that it will be simple and cost-effective to expand the scope of the DRS in the future to support full SLA reporting, with no change at all to the DRS and its database and incorporate support for Local Number Portability (LNP) Reporting and the other Port and Churn systems, due to the top-down design of its data structure and the fact that the DRS is structured architecturally correctly, based on the Enterprise Model. More recently, the DSL Transfers Churn requirements have been implemented in the DRS and fully integrated with MNP reporting and SLA reporting. The integrated DRS database has been successfully shared between the two business systems.

The current emphasis of the MNPS is on structuring its data around the XML Messages received (T302_Request_Tx). It will be very difficult and costly to expand the scope of the MNPS in the future to support SLA reporting due to the lack of top-down design of its data structure and the fact that it is not structured architecturally correctly. Also, due to these design issues, the MNPS cannot be expanded in the future to incorporate support for other Port and Churn functions such as Local Number Portability (LNP), Multi-Carrier Preselection (MCP), Commercial Churn and DSL Transfers. In fact, six disparate business systems have previously been developed for these other Port and Churn systems, in violation of the Enterprise Model and at a huge cost to the business.

On the basis of the architectural assessments above, the DRS has been assigned by the evaluation team, a raw score of "8" on a relative scale of 1 to 10 with respect to the Functional Scope and Interfaces criterion. This raw score of "8" is input into the Figure-of-Merit analysis. On the same basis, the MNPS has been assigned by the evaluation team, a raw score of "4" on a relative scale of 1 to 10 with respect to the Functional Scope and Interfaces Criterion. This raw score of "4" is input into the Figure-of-Merit analysis.

In conclusion, the architectural assessments support the hypothesis that an information system designed and implemented in accordance with the Enterprise Model is more likely to have a well-defined functional scope and interface specification than one that is not.

6.6 Data Sharing, Data Redundancy and Data Consistency Comparative Evaluation

6.6.1 Introduction

This section discusses the results of the comparative evaluation of the DRS and MNPS in regards to their support of data sharing within the scope of the MNP business initiative and the wider Churn business requirements. The evidence resulting from this case study supports the value of the Enterprise Model, as the DRS implements the shared business entity types consistently and once only. In particular, the MSN Movement-related entity types are shared across the different MNP business functions. In contrast, the MNPS developed without the top-down guidance and holistic view of the business provided by an Enterprise Model, has been implemented with a high level of data redundancy and a lack of data sharing.

6.6.2 Comparative Evaluation of the DRS and MNPS

On reviewing the DRS' design documents and physical database schema developed from the Enterprise Model, it has been found that in the DRS, the following list of MSN Movement-related entity types are shared across different MNP functional components. It is imperative that the shared entity types have been implemented consistently and once only. Table 6 – Mapping of Enterprise Model Business Entity Types to DRS Database Tables, maps the business entity types defined in the Enterprise Model to their corresponding DRS database tables as implemented in the DRS. It clearly shows that each business entity type defined as part of the Enterprise Model is implemented in one, and only one DRS Database Table, maximising the sharing of the DRS data.

ENTERPRISE MODEL BUSINESS ENTITY TYPE NAME	DATA REPOSITORY SYSTEM (DRS) DATABASE TABLE NAME
Mobile Service Number (MSN)	MSN
Mobile Service Number (MSN) Movement	MM
Customer Mobile Service Number (MSN) Movement	CMM
Network Mobile Service Number (MSN) Movement	NTWK_MM
End-User Unallocated Mobile Service Number (MSN) Movement	EU_UNALC_MM
Reroute Broadcast Mobile Service Number (MSN) Movement	RBMM
Carrier Reroute Broadcast Mobile Service Number (MSN) Movement	CRR_RBMM
End-User Allocated Mobile Service Number (MSN) Movement	EU_ALCTD_MM
Customer Mobile Service Number (MSN) Movement Reversal	CSTR_MM_RVSL
Rejected Customer Mobile Service Number (MSN) Movement	RJTD_CMM
Cutover Customer Mobile Service Number (MSN) Movement	CTVR_CMM
Rejected Cutover Customer Mobile Service Number (MSN) Movement	RJTD_CTVR_CMM
Resubmitted Cutover Customer Mobile Service Number (MSN) Movement	RSBD_CTVR_CMM
Withdrawn Customer Mobile Service Number (MSN) Movement	WTHD_CMM
Rejected Withdrawn Customer Mobile Service Number (MSN) Movement	RJTD_WTHD_CMM
Resubmitted Withdrawn Customer Mobile Service Number (MSN) Movement	RSBD_WTHD_CMM
Involved Party Mobile Service Number (MSN) Movement Progress	INVP_MM_PRGS
Involved Party Resubmitted Cutover Customer Mobile Service Number (MSN) Movement Progress	INVP_RSBD_CTVR_CMM_PRGS
Involved Party Resubmitted Withdrawn Customer Mobile Service Number (MSN) Movement Progress	INVP_RSBD_WTHD_CMM_PRGS
Involved Party Carrier Reroute Broadcast Mobile Service Number (MSN) Movement Progress	INVP_CRR_RBMM_PRGS
Mobile Service Number (MSN) Movement Performance Measurement Rule	MM_PRF_MSMT_RL
Mobile Service Number (MSN) Movement Progress Performance Measure	MM_PRGS_PRF_MSR
Carrier Reroute Broadcast Mobile Service Number (MSN) Movement Progress Performance Measure	CRR_RBMM_PRGS_PRF_MSR

Table 6 - Mapping of Enterprise Model Business Entity Types to DRS Database Tables

The data stored against each of the above business entity types and database tables is entered, processed, stored and maintained once and data is captured from its source. Hence data consistency and correctness of the data is fully maintained in the DRS.

Similarly, on reviewing the DRS' design documents and physical database schema developed from the Enterprise Model at the more detailed level, down to database attributes within each of the above DRS database tables, it has been found that in the DRS, the MSN Movement-related entity types implemented as tables and attribute types are shared across the different MNP functional components. It is evident that the shared entity types and attribute types have been implemented consistently and once only in the DRS. For a detailed understanding of these shared attribute types, refer to Appendix I - The DRS Conceptual Schema and Appendix J - The DRS Physical Database Schema.

Since the DRS was implemented as a replacement for the MNPS for MNP Reporting, in excess of 350 additional reports have been developed by the end-users without any involvement of the Information Technology professionals and without any change to the database structure or computer programs in the DRS. The original 15 reports developed in the MNPS have since been discontinued. Further information about these original reports is found in Appendix F - Data Differences between the MNPS and the DRS.

On mapping the MNPS' design documents and physical database schema to the Enterprise Model, it was found that the MNPS' business entity types are not implemented consistently and once only. The following is a list of MSN Movement-related entity types implemented in MNPS that are not shared across different architectural components:

- T002_Request_Type
- T014_Number_Movement_Type

- T005_Request_Tx_Type
- T008_Msg_Type
- T003_Request_Status (c.f. MSN Movement subtypes & subsets)
- T007_Request_Tx_Status
- T009_Tx_Audit_Entry_Type
- T301_Request
- T302_Request_Tx
- T308_Mobile_Nbr
- T309_Nbr_Movement
- T314_Customer_Detail

As the MNPS stores its data redundantly, the data stored against each of the above entity types will be entered, processed, stored and maintained redundantly and it is impossible to maintain consistency and hence correctness of the data if this issue is not addressed. For example, the raw XML message is received and dumped to table T302_Request_Tx. The data is then redundantly stored into table T301_Request based on a secondary index, “Request_Id”. The “Request_Type_Code” is then determined according to the rules established in table T002_Request_Type. The only Request types defined in this table are “Port”, “Giveback” and “Technology Transfer”. The Request Type largely overlaps with another table, T014_Number_Movement_Type, which has values of “Port”, “Giveback”, “Technology Transfer” and "Churn”. This denotes a high level of data redundancy and a lack of data sharing. The values in these two tables are roughly equivalent to the type of MSN

Movement in the Enterprise Model, which includes the following business entity types:

- Port-In MSN Movement
- Port-Out MSN Movement
- Technology Transfer Churn MSN Movement
- Churn MSN Movement
- Customer MSN Movement Reversal
- Giveback-In MSN Movement
- Giveback-Out MSN Movement

The MSN Movement entity types described in the Enterprise Model are essential for data sharing to be achieved within the context of the MNP business initiative and sharing across the other Churn systems.

Similarly, on mapping the MNPS' design documents and physical database schema to the Enterprise Model at the more detailed level, down to database attribute types, it was found that the MNPS' attributes are not implemented consistently and once only. Table 7 – Sample MNPS Database Tables and Attributes Stored Redundantly, shows the MSN Movement-related entity types implemented as tables and attributes in MNPS, which are stored redundantly. For a detailed examination of the MNPS' database design, refer to Appendix E - The Existing MNPS Architecture.

T003_Request_Status

REQUEST_STATUS_CODE	REQUEST_STATUS_DESC
NOTF CNFM	Notification Confirmed
CTVR CNFM	Cutover Confirmed
REJECTED	Rejected
RECEIVED	Received
WITHDRAWN	Withdrawn
EXPIRED	Expired
COMPLETED	Completed

T002_Request_Type

REQUEST_TYPE_CODE	REQUEST_TYPE_DESC
PORT	Port
GIVEBACK	Giveback
TECH TFR	Technology Transfer

T007_Request_Tx_Status

REQUEST_TX_STATUS_CODE	REQUEST_TX_STATUS_DESC
INITIATED	Initiated
CONFIRMED	Confirmed
REJECTED	Rejected

T005_Request_Tx_Type

REQUEST_TX_TYPE_CODE	REQUEST_TX_TYPE_DESC
PN	Port Notification
PCN	Port Cutover Notification
PWN	Port Withdrawal Notification
PEN	Port Expiry Notification
BPCN	Broadcast Port Cutover Notification
GBN	Giveback Notification
BGBN	Broadcast Giveback Notification
BTTN	Broadcast Technology Type Notification

T014_Number_Movement_Type

NBR_MOVEMENT_TYPE_CODE	NBR_MOVEMENT_TYPE_DESC
PORT	Port
CHURN	Churn
GIVEBACK	Giveback
TECH TFR	Technology Transfer

T009_TX_Audit_Entry_Type

TX_AUDIT_ENTRY_TYPE_COD	TX_AUDIT_ENTRY_TYPE_DES
RECEIVED	Received
SENT	Sent
CONFIRMED	Confirmed
REJECTED	Rejected
COMPLETED	Completed

Table 7 – Sample MNPS Database Tables and Attributes Stored Redundantly

The data stored against each of the above MNPS database tables will be entered, processed, stored and maintained redundantly and it is impossible to maintain consistency and hence correctness of the data. Specifically, the overlap and redundancy of data described in table T002_Request_Type and T014_Number_Movement_Type is obvious. Similarly, the redundancy among T003_Request_Status, T007_Request_Tx_Status and T009_TX_Audit_Entry_Type is equally obvious, and T005_Request_Tx_Type is a subset of T008_Msg_Type, combined with the fact that all related business rules are hard-coded in application code in violation of the International Standards Organisation's (ISO) 100% Principle.

Furthermore, to determine whether the Port and Giveback MSN movements are Port-In or Port-Out and Giveback-In or Giveback-Out respectively, an additional attribute is created in Table T301 Request, named "Direction". However, a Technology Transfer is neither "In" nor "Out" as it does not involve any MSN Movement between network providers or service providers. Hence, this data is stored redundantly in the MNPS for Technology Transfer and none of these business rules can be enforced at the schema level, thereby violating the 100% Principle.

To identify an MSN Movement in the MNPS involves three tables and many attributes, stored redundantly with essential business rules unable to be supported. Hence, data sharing is not possible and cannot be achieved in the MNPS.

On the basis of the architectural assessments above, the DRS has been assigned by the evaluation team, a raw score of “10” on a relative scale of 1 to 10 with respect to the Data Sharing criterion. This raw score of “10” is input into the Figure-of-Merit analysis. On the same basis, the MNPS has been assigned by the evaluation team, a raw score of “2” on a relative scale of 1 to 10 with respect to the Data Sharing Criterion. This raw score of “2” is input into the Figure-of-Merit analysis.

In conclusion, the architectural assessments support the hypothesis that an information system designed and implemented in accordance with the Enterprise Model is more likely to support data sharing, planned and controlled data redundancy and a high degree of data consistency than one that is not.

6.7 Comparative Evaluation - Other Criteria

There are two other criteria that are important for the performance of any system. They are data definition and naming conventions, and system documentation. This section discusses the results of the comparative evaluation of the DRS and MNPS according to these criteria.

The meaning of data has to be clearly defined based on the business concepts being represented by the data. The usage of data and its representation have to be clearly defined in order to have good design of systems and their associated databases. Proper data definition must also be supported by good naming conventions that reflect the meaning of the data being named.

The evidence resulting from the case study supports the value of the Enterprise Model, as the DRS implements a consistent set of data definitions described at the enterprise level across all business functions. These data definitions and naming conventions are based on the International Standard of conceptualisation, ensuring maximum sharing of the data and minimal data redundancy. In particular, the MSN Movement-related entity types are shared across the different MNP business functions. In contrast, the MNPS developed without the top-down guidance and holistic view of the business provided by an Enterprise Model, has been implemented with a high level of data redundancy and a lack of data sharing.

Documentation must be comprehensive, up-to-date and complete in order to facilitate ongoing operations and maintenance of the systems. In the absence of good documentation it is not possible to ensure the integrity of the system and the correctness of the data.

Again, the evidence resulting from the case study supports the value of the Enterprise Model, as the database table definitions and attribute types of the DRS can be mapped directly from the Enterprise Model to the physical DRS database schema implemented, and documented at every level. In contrast, the MNPS developed without the top-down guidance and holistic view of the business provided by an Enterprise Model, has been implemented without adequate documentation, such as most of the business rules being hard-coded in application programs without proper documentation. Where a business rule is not implemented consistently and once only, then it is not possible to maintain consistency and hence correctness of the MNPS' data.

If the above two aspects are not properly addressed, they in turn adversely affect the information system with respect to the architectural evaluation criteria. In the comparative study it was found that all three existing MNP-related information systems, the MNPS, its client Wholesale Mobile Connect and the Mobile Provisioning System all suffer from the inadequacy of these two aspects. Both the MNPS and Wholesale Mobile Connect were developed using the latest object-oriented systems design techniques. Each of these systems was documented with detailed Process Models and Use Case Models but does not have a Class Diagram or Object Model defined at the conceptual (business) level and they were developed without the top-down guidance and holistic view of the business provided by an Enterprise Model. Neither system was developed on the basis of an Enterprise Model, that is, top-down, business driven and customer focused. The observation of the Regulator and key MNP managers has been that no other network provider or service provider in the Australian market has been able to implement the ACIF Code and in particular, the performance measurements with SLAs. Hence, the Telecommunications Service Provider has been given responsibility for managing the industry from a regulatory reporting perspective.

6.8 Conclusion

In conclusion, the case study findings support the important claims made for an Enterprise Modelling based approach to information systems development. First, the Enterprise Modelling based approach leads to the development of business systems that operate in concert with one another based on some shared data, such that no redundant data will be created. The benefit of an update to the data will be shared across all business systems using the data. Without the benefit of top-down guidance from the Enterprise Model, it is extremely difficult to achieve any degree of integration.

Second, data integrity can only be assured by first coming up with a data architecture, as part of the Enterprise Model, by performing data modelling to capture all the relevant business policies and business rules which forms a basis for designing the databases. Unless the Enterprise Model is used as a basis for subsequent data modelling, this will ultimately corrupt the data and thus undermine the validity of the business systems that use the data.

Third, without first coming up with a business process architecture, as part of the Enterprise Model, through process modelling that forms a basis for developing program modules or components for the business systems, components that are common across different business systems are unlikely to be identified. This leads to reinventing of the wheel – development of the program components that can otherwise be reused from some already developed components.

The comparative evaluation of the two business systems clearly rates the DRS ahead of the MNPS in each of the four architectural evaluation criteria. Table 8 – Business Systems Comparative Results Summary Using Figure-of-Merit Analysis summarises the results of the architectural evaluation performed in this case study.

ARCHITECTURAL EVALUATION CRITERION	**WEIGHTING FACTOR**	**UNITISED SCORE**	
		MNP	DRS
1. Architectural Principles	1.50	0.92	2.08
2. Fundamental Business Rules	2.00	0.62	3.08
3. Functional Scope & Interfaces	1.25	0.77	1.54
4. Data Sharing, Data Redundancy & Data Consistency	1.75	0.54	2.69
TOTAL SCORE		**2.85**	**9.39**

Table 8 - Business Systems Comparative Results Summary Using Figure-of-Merit Analysis

Based on Figure-of-Merit analysis, using weighting factors and scoring out of ten, the relative strengths of the two business systems are reflected by their respective unitised scores as follows:

- The DRS scored 9.39 out of ten, that is, a 93.90% compliance with the Architectural Evaluation Criteria.

- The MNPS scored 2.85 out of ten, that is, a 28.50% compliance with the Architectural Evaluation Criteria.

The result of the findings for the DRS is that it meets all required business requirements and it is architecturally sound with its ability to adapt in meeting changing business needs over time. On the other hand, the result of the findings for the MNPS is that it does not meet the currently defined set of business requirements and it is not architecturally sound. The MNPS foundation ensures that it will not be capable of adaptation in meeting perceived future business needs. This architectural failure of the MNPS means that information systems integration is not possible now or in the future and its poor data integrity will continue to become more prevalent as the system is modified over time.

The MNP Evaluation Team determined the weighting factors, which rated the relative significance of Fundamental Business Rules and Data Sharing as the two most important architectural evaluation criteria with a weighting of “2” and “1.75” respectively. As part of the comparative evaluation of the DRS and the MNPS, the DRS attained a perfect score (10 out of 10) in each criterion, whereas the MNPS attained a very low score in each criterion. The DRS also achieved higher scores than the MNPS for the other architectural evaluation criteria.

This result indicates that the DRS, due to its flexibility, will be less costly to maintain during its life than other systems, such as the MNPS, which are not architecturally sound. In fact, the high score achieved by the DRS for meeting all Fundamental Business Rules, shows that it is five times more compliant than the MNPS with respect to Fundamental Business Rules.

The high score achieved by the DRS for Data Sharing, shows that it is five times more compliant than the MNPS with respect to Data Sharing. This high score for Data Sharing, together with Architectural Principles, indicates that the DRS is loosely coupled but highly cohesive and hence, the DRS achieves the high level of business systems integration required.

The main hypothesis of this research is that an information system designed and implemented in accordance with the Enterprise Model is superior to an information system that does not use an Enterprise Model as its basis of development. The information system designed on the basis of an Enterprise Model will be naturally integrated with the other information systems and sub-systems, and its data will have a high degree of data integrity. This main hypothesis is supported by the case study findings.

This chapter has addressed the following key questions:

- How are the case study results analysed and interpreted?
- What are the case study findings and do they support the major hypothesis?

The observation of the Regulator and the Group Manager, Wholesale Customer Transfers, has been that no other network provider or service provider in the Australian market has been able to implement the ACIF Code and in particular, the performance measurements with Service Level Agreements. As a result of the success of the DRS, the case study company was given responsibility for managing the industry from a regulatory reporting perspective.

In the following chapter, the major outcomes of Enterprise Modelling considered as a component of an 'optimal' Information Systems Architecture will be discussed, together with the uses of an Enterprise Model in terms of future research.

Chapter 7 Conclusion and Future Research

7.1 Introduction

This chapter first summarises the findings of the comparative evaluation of the DRS and MNPS and the findings from the data analysis. It then addresses important areas of future research relevant to Enterprise Modelling, with particular emphasis on the uses of an Enterprise Model.

7.2 Summary of Findings

The findings of this thesis support the claims made for the Enterprise Modelling approach achieving successful information systems integration and high data integrity. An Enterprise Model is the basis for determining an organisation's Information Systems Architecture, which in turn provides the business with guidance for identifying, planning, scoping and developing information systems that dovetail together and support the business functions, as shown by the DRS. In any enterprise, where business functions are duplicated, data is also duplicated. Duplicated data leads to data redundancy that in many cases is unnecessary and often leads to data currency, synchronisation and data integrity problems, as shown by the MNPS. The use of the Enterprise Model eliminates and avoids these problems, and as shown by the case study business systems, an Enterprise Model is the key to successful business systems integration.

The major findings of this thesis are summarised as follows:

- *Evidence of Real-life Enterprise Modelling*

  The evidence resulting from the case study supports the view that an Enterprise Model can be developed in a real-life environment using the Enterprise Modelling Approach.

- *Evidence of Usefulness of Enterprise Modelling*

  The comparative evaluation provides confirmatory evidence of the usefulness of the Enterprise Modelling Approach in achieving a high level of information systems integration and a high degree of data integrity.

- *Additional Evidence of Usefulness of Enterprise Modelling*

  The Telecommunications Service Provider provides additional evidence of the usefulness of the Enterprise Modelling Approach as it replaced the MNPS with the DRS. Since the DRS was implemented as a replacement for the MNPS for MNP Reporting, in excess of 350 additional reports have been developed by the end-users without any involvement of the Information Technology professionals and without any change to the database structure or computer programs of the DRS.

- *Major Deficiencies in Commonly Used Approaches*

  The identification of the major deficiencies in commonly used approaches in developing information systems architectures and the need for a better approach to ensure integrated information systems architectures.

- *Major Performance Problems Resulting from the Lack of Information Systems Integration*

  The identification of the major performance problems that result from a lack of information systems integration, due to the inability of commonly used information systems architecture approaches in identifying, scoping and fully defining the boundaries of its information systems. This in turn, leads to a high level of data redundancy and poor quality information.

- *Derivation of Architectural Evaluation Criteria*

  The derivation of a number of architectural evaluation criteria from the literature, which provides insight into the ways of evaluating information systems, even though it does not talk specifically about evaluation criteria. These architectural evaluation criteria focus on the outcomes to be achieved in order to deliver an optimal information systems architecture. As a result of this work, the Telecommunications Service Provider has adopted these evaluation criteria as their standard in software package evaluation.

- *Support of Widely Accepted Architectural Principles*

  The evidence resulting from the case study supports the value that an information system designed and implemented in accordance with the Enterprise Model is more likely to support widely accepted architectural principles than one that is not.

- *Support of Fundamental Business Rules*

  The evidence resulting from the case study supports the value of the Enterprise Model as the DRS supports all of the fundamental business rules. The MNPS developed without the top-down guidance and holistic view of the business provided by an Enterprise Model, supports few of the fundamental business rules. In summary, an information system designed and implemented in accordance with the Enterprise Model is more likely to support the fundamental business rules than one that is not.

- *Support of Well-defined Functional Scope and Interfaces*

  The evidence resulting from the case study supports the value of the Enterprise Model, as the DRS implementation is flexible enough to support other business functions into its scope. The DRS fully supports the MNP initiative's required functionality and also accommodates future expansion to support changes in Service Level Agreements (SLA) into the scope of MNP Reporting. On the other hand, the MNPS does not fully support existing functionality as it does not support SLA reporting. In summary, an information system designed and implemented in accordance with the Enterprise Model is more likely to have a well-defined functional scope and interface specification than one that is not.

- *Support of Data Sharing, Planned and Controlled Data Redundancy and Data Consistency*

  The evidence resulting from the case study supports the value of the Enterprise Model, as the DRS implements the shared business entity types consistently and once only. In contrast, the MNPS developed without the top-down guidance and holistic view of the business provided by an Enterprise Model, has been implemented with a high level of uncontrolled data redundancy and a lack of data sharing. In summary, an information system designed and implemented in accordance with the Enterprise Model is more likely to support data sharing, planned and controlled data redundancy and a high degree of data consistency than one that is not.

- *Evidence of Problems Eliminated by Use of an Enterprise Model*

  The case study provides further evidence that the problems of a lack of information systems integration and poor data integrity can be eliminated by the use of an Enterprise Model. An information system designed on the basis of an Enterprise Model will be naturally integrated with the other information systems and its data will have a high degree of data integrity.

- *Ability to Define Scope and Boundary of Information Systems*

  The Enterprise Modelling Approach to information systems development provides the ability to define the scope and boundary of each information system, in context of the strategic direction of the business, before any detailed requirements analysis is performed. This ensures that each information system defined as part of the Information Systems Architecture is scoped strategically and in consideration of the information flows and information dependencies, thereby defining the priorities and dependencies among each of the information systems to be implemented.

- *Creation of Strategic Information Technology Environment*

  The case study result indicates that organisations that build their information systems architecture based on an Enterprise Model are more likely to create an environment that is typified by a high degree of data sharing, planned and controlled data redundancy and process redundancy. It is also typified by a well-structured information systems architecture with strategic alignment of information technology with the business and consistently defined information systems. These organisations are also more likely to achieve data consistency and high quality data, as the basis of management decision-making. This position is supported by the literature and confirmed by this case study research.

- *Superiority of the DRS*

  The case study result indicates that no other industry player has been able to develop a purpose-built operational application that performs the level of functionality of the DRS. The Regulator has consistently used the DRS to identify the non-compliance of all of the purpose-built MNP operational applications implemented by the other industry players, both network providers and service providers.

- *Reduction in Maintenance Costs*

  The case study result indicates that the DRS, due to its flexibility, will be less costly to maintain during its life than other systems, such as the MNPS, which are not architecturally sound.

The major hypothesis of this thesis that the use of the Enterprise Model results in improved performance of an organisation’s information systems is supported by the findings of the case study, with the DRS outperforming the MNPS in all four architectural evaluation criteria. The DRS is proof of this improved performance by achieving the outcomes of an ‘optimal’ Information Systems Architecture, evidenced by DRS integration through the sharing of data and high data integrity where the correctness and completeness of information and data consistency are prevalent.

7.3 Future Research into Uses of an Enterprise Model

The uses of an Enterprise Model described in this section have been identified by the researcher based on extensive industry experience in using the Enterprise Modelling Approach and the needs of a number of enterprises around the world. The researcher has explored the literature regarding these uses over several years without success. It appears that existing research has not defined an Enterprise Modelling approach that is well accepted and proven, to the extent that further uses can be researched. Research to-date has focused on defining an Information

Systems Architecture, which is a critical first step but the logical progression is to identify the uses of an Enterprise Model. Hence, future research opportunities exist and should be conducted into how an Enterprise Model can be used to support a business in the areas identified below.

7.3.1 Data-Centric Business Process Re-engineering (BPR)

Ideally, Enterprise Modelling and BPR can be performed concurrently, as insightful information can be shared between the two activities. The Enterprise Model is used to highlight dysfunctional business processes from an information perspective and also provides an insight for data sharing. BPR uses this information to select business processes to be re-engineered, using the Enterprise Model to ensure that processes are not duplicated and minimal information flows across organisational units are involved. Once the business process has been re-designed, an updated view of the business from the re-designed perspective can be fed into the Enterprise Model.

The Data-centric Business Process Re-engineering approach, based on an Enterprise Model has recently been successfully implemented by the researcher in the Telecommunications Service Provider and the Australian Department of Defence. The re-engineered human resource business processes in the Department of Defence were successfully achieved in seven weeks, based on the Human Resource Enterprise Model. In contrast, numerous computer companies had attempted, unsuccessfully, to re-engineer the human resource business processes over a period of many years, using the traditional bottom-up approach. However, the researcher has not been able to identify any research in the literature in the area of BPR using similar approaches, which makes this approach an ideal candidate for future research.

7.3.2 Package-Based Application Systems Evaluation

Packages are rarely implemented as stand-alone systems. There is increasingly a requirement for the packaged system to interface to a number of business systems. This immediately raises additional considerations other than the immediate question, that is, whether the package will perform the required functions. The following considerations are important in evaluating package-based solutions:

- What functions does the package perform that is outside the scope of the business system? In the aim towards integrating and unifying systems, the implementation of systems with overlapping functionality needs to be avoided.

- What functions required by the business are not supported by the package? The identification of these ‘missing functions’ highlights the necessity to provide extra effort to build-in the functionality around the constraints of the package design.

Mapping the functionality of the package against the Enterprise Model enables these considerations to be evaluated. The Enterprise Model contains a comprehensive list of business functions as well as the interaction among business functions (that is, the information flows) that are required among the various business systems.

Where a package is wholly or in part non-compliant, options for modifying the package to make it compliant should be identified and evaluated. Any evaluation should also take account of the rapidly changing face of Information Technology. The concept of standards-based architectural development is now a widely accepted approach. The issue is one of timing and migration rather than direction. Rapid advances towards these standards are occurring for commercially available applications and systems software and it will be increasingly possible to buy and / or build standards compliant solutions. Decisions made now will have an impact over the next five to ten years and any assessment of options should be made within this context.

In summary, mapping the functionality of a software package to the Enterprise Model will assist in determining which package has the closest ‘fit’ to the business needs, taking into account ‘missing’ and overlapping functionality. Apart from the development of standards, there is no evidence in the literature of any advances in using an Enterprise Model to perform software package evaluation.

7.3.3 Architectural Gap Analysis

Architectural gap analysis is based on the Information Systems Architecture, which is a high-level conceptual plan of how to integrate business systems that are required to work together in order to meet the information needs of the business. The plan includes ensuring that the business systems dovetail together, appearing as a single, unified, cohesive business system. Developing the information systems architecture is the next natural step forward towards building business systems that support the business and ensuring that the business systems are integrated without duplication of data and avoiding the overlap of business functions.

In the development of information systems architectures, a technique called architectural gap analysis is used to map the existing business systems against the Enterprise Model. This highlights ‘gaps’ that exist between the Enterprise Model and the business’ existing systems. For each of the ‘gaps’ identified, a detailed study of information flows is performed in order to understand the information dependencies that exist among the current and potential systems. This information is used to assist in the determination of the phasing-in and phasing-out of systems components as part of migration planning, as follows:

- the phase-out dates of current business systems and databases
- the phase-in dates of future business systems as identified in the information systems architecture, and
- the impact that the phasing-in of new business systems and phasing-out of old business systems will have on other related systems and data.

Analysing how these business systems will interface to the existing and future information systems architecture allows for the up-front identification of interim measures that may need to be put in place, for example, data capture mechanisms and translation tables. As a result, Information Technology management will be aware, in advance, of the need to plan for such interim measures and will be able to take into account the costs associated with selected interim measures.

Using the Enterprise Model to perform architectural gap analysis as the basis for developing strategic information systems plans and migration plans is an ideal candidate for further research of real practical significance to enterprises.

7.3.4 The Role of Data Warehousing in Improving Data Quality

The Enterprise Model should be used as the basis to identify Executive Information Systems (EIS) and Decision Support Systems (DSS) to facilitate senior management in their planning and decision-making, based on the fundamental data generated by the operational business systems. These EIS and DSS are typically candidates for implementation in a Data Warehousing System. The achievement of integration in a Data Warehousing System is also dependent on matching the individual applications' key attributes to the strategic attributes of the kernel business entities defined and modelled as part of the Enterprise Model. This approach can also be used to enforce the fundamental business rules that are not enforced in the individual applications. The enforcement of these fundamental business rules on data insertion and update into the data warehouse guarantees data integrity and ensures the high level of data quality demanded by enterprises today.

This approach in using an Enterprise Model in Data Warehousing is a new and original approach, and is an ideal candidate for further research. The Enterprise Model also provides strategic guidance towards the development of all enterprise business systems plus information on the scope and functionality of each Candidate Business System.

7.4 Conclusion

It is claimed that an Enterprise Model is essential for an organisation to achieve a high level of information systems integration. Integration must be achieved in order to overcome the common problems of information systems architectures and to reap the benefits of data sharing, minimal data redundancy, software reusability and high data integrity. An Enterprise Model is the basis for achieving an 'optimal' information systems architecture, which has as attributes Data Integrity and Functional Integration. Data Integrity refers to the correctness, completeness and consistency of the information provided by an organisation's information systems, while Functional Integration refers to the degree of data sharing, enforcement of the business rules and the level of planned and controlled data redundancy in an organisation's information systems.

As a result of the success of the DRS in achieving information systems integration, the Enterprise Modelling approach has been adopted by the Telecommunications Service Provider as the 'best' approach in developing one integrated set of all analytic and reporting data. The Enterprise Model has been accepted as a key basis in developing the strategic, fully integrated set of information systems. Since its deployment, the DRS has evolved, incrementally, into one shared database comprising an integrated, enterprise view of sixteen (16) core applications, with data across the Enterprise fully integrated for consistent and complete operational reporting, management information and external reporting to regulatory bodies out of one integrated system, the DRS.

This thesis has described a new approach; simply named "*Enterprise Modelling*" that provides the basis for successful integration of information systems. This new approach has considerable advantages over existing Enterprise Architecture approaches as it is process-based, business-driven and customer focussed, yet data centric and semantically sound; organisation and technology independent but practical. In short, the Enterprise Modelling Approach works extremely well being understood by business executives and information technology people alike, resulting in integrated information systems able to be implemented in a fraction of the time and cost it takes to implement traditional non-integrated systems.

The Enterprise Model is the basis of the blueprint for building information systems that facilitates the business in achieving its integration objectives while remaining focussed by using the 'big picture' as the foundation. As shown in the case study, by achieving the integration objectives of the business, the full set of business requirements has been met by the DRS and in contrast, has not been met by the MNPS. Additionally, the interaction of the business functions on the data has been properly implemented in the DRS, whereas, in the MNPS, no consideration has been given to this aspect. This means that the DRS has been implemented with high-cohesion among its business functions, but loosely coupled resulting in a high degree of adaptability to future business change. This future change has been experienced with the development of in excess of 350 new reports without any change required to the DRS computer programs or its underlying database.

The findings support the main hypothesis of this research in that an information system designed and implemented in accordance with the Enterprise Model is superior to an information system that does not use an Enterprise Model as its basis of development. The information system designed on the basis of an Enterprise Model will be naturally integrated with the other information systems and its data will have a high degree of data integrity. Specifically, the findings support each of the following subsidiary hypotheses:

- An information system designed and implemented in accordance with the Enterprise Model is more likely to support widely accepted architectural principles than one that is not.
- An information system designed and implemented in accordance with the Enterprise Model is more likely to support the fundamental business rules than one that is not.
- An information system designed and implemented in accordance with the Enterprise Model is more likely to have a well-defined functional scope and interface specification than one that is not.
- An information system designed and implemented in accordance with the Enterprise Model is more likely to support data sharing, planned and controlled data redundancy and a high degree of data consistency than one that is not.

The DRS designed and developed on the basis of the Enterprise Model, is superior to the alternative MNPS with respect to each of the architectural evaluation criteria.

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Appendices

Appendix A - List of Organisations Using the Enterprise Model

	ORGANISATION NAME
1	Queensland Rail (Utility)
2	Department of Defence
3	Telstra Corporation
4	United Transport Services (UTS)
5	Yarra Valley Water Ltd
6	Commonwealth Bank of Australia
7	Office of Training and Further Education (OTFE)
8	Australian Associated Motor Insurers Ltd (AAMI Ltd)
9	Melbourne Water Corporation (MWC)
10	Mobil Oil Australia
11	Coles Myer Ltd
12	ANZ Banking Corporation Ltd
13	Australian Reinsurance
14	Australia Post
15	BHP Co Ltd
16	St. Johns River Water Management District (SJRWMD in Florida, USA)
17	National Medical Care Inc. (A Division of W.R. Grace in Boston, MA, USA)
18	DHL International Ltd (Asia Pacific Super Region)

Appendix B - The Enterprise Model

Appendix C - Interview Questions Pertaining to Enterprise Modelling

	QUESTIONS FOR GROUP MANAGING DIRECTOR AND DIRECT REPORTS
1	What is your Group's mission? Is there a formal mission statement? What is the role played by your Group? What useful purpose does your Group serve?
2	What are the major stakeholders of your Group? In what sense is each of these a stakeholder?
3	What are the major external entities that your group interacts with and what are the interactions?
4	Can you please describe your strategic vision for your group?
5	What are your specific goals for your group in the short, medium and long-term?
6	What do you consider as the shortfalls, inadequacies and areas for improvement in the current harnessing and management of information resources?
7	What do you consider as the key performance factors for this Enterprise Modelling project?
8	Is there anything to read up on to gain further knowledge on the business of your Group for the purpose of this Enterprise Modelling project?
	QUESTIONS FOR DEPARTMENT MANAGERS, EXECUTIVES AND LINE MANAGERS
1	What is your department's mission? Is there a formal mission statement, a charter or terms of reference? What is the role played by your department? What useful purpose does your department serve? What is your department's raison d'etre?
2	Who are your department's generic customers/beneficiaries, both within your division and outside? What services does it provide to each of these generic customers/beneficiaries?
3	Who are your department's generic suppliers, both within your division and outside? What services do they provide to your department?
4	What are the major external entities other than the generic customers and suppliers that your department interacts with and what are the interactions?
5	Could you summarise the functions performed by your department?
6	Could you indicate the nature and degree of involvement your department has in any major company wide programs?
7	How many people do you have in your department? How many of them are professional?
8	What are the specific goals for your department in the short, medium and long term?
9	What do you consider as the shortfalls, inadequacies and areas for improvement in the current harnessing and management of information resources?
10	What do you consider to be the key performance factors for the Data Repository System (DRS) project?
11	Is there anything to read up on to gain further knowledge on the business of your department for the purpose of this project?
	ADDITIONAL QUESTIONS FOR INFORMATION TECHNOLOGY (IT) MANAGERS
1	Currently how many information resource people are there? What sort of information management functions are outsourced or managed internally?
2	Are there any guidelines or policies that govern the outsourcing of your Group/your division's functions?

Appendix D - The ACIF MNP IT Specification

Australian Communications Industry Forum (2001) *Mobile Number Portability IT Specification - Part 1: Transaction Analysis [Internet].* Available from: <http://www.acif.org.au/__data/page/3269/G573-1_2004_Dec.pdf> [Accessed 10 September 2003].

Mobile Number Portability

ACIF
Transaction Analysis Specification
OCRP Working Committee 19

Implementation Date	25/09/2001
Version	PBD1 G573
Date	12/12/2000

FINAL

Page 1

DOCUMENT CONTROL SHEET

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Version Control

Issue No	Issue Date	Nature of Amendment
1	12/06/2000	First version of the ACIF Specification based on the ACIF code. Note document not complete
2	04/08/2000	Second version of the ACIF Specification based on the ACIF code version 4 changes applied by the operations group. Note document not complete
3	07/08/2000	Third version of the ACIF Specification based on the ACIF code version 6 changes applied by the operations group. Removal of suspended service
4	15/08/2000	Fourth version of the ACIF MNP IT Specification is based on the draft ACIF MNP Operations Code DR ACIF 570 August 2000.
5	18/08/2000	Fifth version of the ACIF MNP IT Specification is based on the draft ACIF MNP Operations Code DR ACIF 570 August 2000. Flow diagrams and extra validation have been included.
6	18/08/2000	Six version of the ACIF MNP IT Specification is based on the draft ACIF MNP Operations Code DR ACIF 570 August 2000. Process Flow has been modified and extra Validations include
7	23/08/2000	Seventh version of the ACIF MNP IT Specification is based on the draft ACIF MNP Operations Code DR ACIF 570 August 2000. Validation section updated

Issue No	**Issue Date**	**Nature of Amendment**
8	24/08/2000	Eighth version of the ACIF MNP IT Specification is based on the draft ACIF MNP Operations Code DR ACIF 570 August 2000. Validations, Section 8, Data Dictionary and Appendices have been reviewed and updated.
9	30/8/2000	Ninth version of the ACIF MNP IT Specification is based on the draft ACIF MNP Operations Code DR ACIF 570 August 2000. Validations have been modified.
10	03/11/2000	Tenth version of the ACIF MNP IT Specification is based on the draft Ballot ACIF MNP Operations Code PBD4C570 October 2000.
11	17/11/2000	Eleventh version of the ACIF MNP IT Specification is based on the draft Ballot ACIF MNP Operations Code PBD4C570 October 2000. Complete review of document, and Context and dataflow diagrams updated, xml definitions added, Reject Codes updated
12	26/11/2000	Twelfth version of the ACIF MNP IT Specification includes XML update, VISIO diagrams updated, Definition mapping.
13	29/11/2000	13th version of the ACIF MNP IT Specification is based on the draft Ballot ACIF MNP Operations Code PBD8C570 October 2000. XML DTD revised, validations amended, Reject Codes updated, Code Set tables updated.
14	04/12/2000	Fourteenth version of the Specification is based on the PBD9 version of the ACIF MNP Operations Code November 2000. The MNP Code Definitions Section has been added. The Data Flow Diagrams have been updated.
15	11/12/2000	Fifteenth version of the Specification is based on the PBD9 version of the MNP Code. Editorial amendments made and formatting fixed, Appendices updated. Data flow diagrams and dependency diagrams updated. Data Dictionary amended.

TABLE OF CONTENTS

1. Purpose

The purpose of this document is to identify the functional and technical baseline requirements for the support of the ACIF Mobile Number Portability Operations Code – OCRP Working Committee 19 that pertains to Mobile Number Portability.

2. Scope

The scope of this document is to define the MNP Interface requirements between Mobile Carriers, Network Providers, and Mobile Carriers and their CSPs, as defined in the Draft ACIF Mobile Number Portability Operations Code.

The Ported Number Register Guideline is a separate document, and must be read and implemented in conjunction with this Specification.

References

- Draft ACIF Mobile Number Portability Operations Code, PBD9 ACIF 570 November 2000.
- Draft MNP IT Architecture (November 2000)
- CSP Code list (ACIF) (TBC)
- Codes Sets (ACIF) (TBC)

3. Business Concepts to be Supported

The following section outlines the core MNP concepts that are required by industry. These concepts describe the types of high level actions that will be required for MNP.

Business Concepts	*Business Concept Description*
Number Movement between two different Mobile Carrier Networks	A customer wishes to take their MSN from their current CSP (i.e. Losing) to another CSP (i.e. Gaining) where the MSN movement is between two different networks.

4. Business Concepts Versus Business Scenario

The following table identifies the core Business Scenarios (types of actions) to be supported for MNP.

Business Concepts	*Business Scenario*	*Business Scenario Description*
MSN Movement between two different Mobile Carrier Networks and Target Technology	Port	A Customer wishes to take their MSN from their current CSP (Losing CSP) to another CSP (Gaining CSP).
	Reversal	A Customer advises that a Port is unauthorised and wishes to take their MSN back to the previous CSP.
	Give Back	After a Customer cancels their Ported MSN and on completion of the minimum Quarantine period, the CSP (Recipient CSP) Gives Back the MSN to the Donor CSP
	Technology Transfer	A Customer wishes to take their MSN from their current Network Technology to another with the same Network Provider

5. Business Scenarios Versus Business Events

Port or Technology Transfer of an MSN

Event	CSP	Carrier Network	Network Type	Event Description	Movement Description
1.	Different	Different	Different	An MSN moves from one CSP to another on a different Carrier's Network with a different Target Technology.	Port and Technology Transfer
2.	Different	Different	Same	An MSN moves from one CSP to another, on a different Carrier's Network with the same Target Technology.	Port
3.	Different	Same	Same	An MSN moves from one CSP to another, on the same Carrier's Network with the same Target Technology.	Port (Transfer)
4.	Different	Same	Different	An MSN moves from one CSP to another on the same Carrier's Network with a different Target Technology.	Port and Technology Transfer
5.	Same	Different	Different	An MSN remains with the same CSP, on a different Carrier's Network with a different Target Technology.	Port and Technology Transfer
6.	Same	Different	Same	An MSN remains with the same CSP, on a different Carrier's Network with the same Target Technology.	Port
7.	Same	Same	Different	An MSN remains with the same CSP, on the same Carrier's Network with a different Target Technology.	Technology Transfer

Give Back of an MSN

Event	CSP	Carrier Network	Network Type	Event Description	Movement Description
1.	Different	Different	Different	An MSN moves from one CSP to another on a different Carrier's Network with a different Target Technology.	Give Back
2.	Different	Different	Same	An MSN moves from one CSP to another, on a different Carrier's Network with the same Target Technology.	Give Back
3.	Different	Same	Same	An MSN moves from one CSP to another, on the same Carrier's Network with the same Target Technology.	Give Back
4.	Different	Same	Different	An MSN moves from one CSP to another on the same Carrier's Network with a different Target Technology.	Give Back
5.	Same	Different	Different	An MSN remains with the same CSP, on a different Carrier's Network with a different Target Technology.	Give Back
6.	Same	Different	Same	An MSN remains with the same CSP, on a different Carrier's Network with the same Target Technology.	Give Back
7.	Same	Same	Different	An MSN remains with the same CSP, on the same Carrier's Network with a different Target Technology.	Give Back

6. Industry Dialogue Definitions

The following section, based on the commonality of data between business events, will identify the types of Intercarrier Models that will be required to be supported for each group of similar business events.

Movement Type	Industry Dialogue Models
Port and Technology Transfer	Port
Port	Port
Port (Transfer)	Port
Technology Transfer	Technology Transfer
Reversal	Port
Give Back	Give Back

7. Givens

1. The Request ID must always be associated with an MSN and must be unique for each Port, Give Back or Technology Transfer request.
2. In cases where transactions fail a resend facility must be available following escalation.
3. A resend is only sent when it is agreed between the two involved parties that the previously sent transaction has not been received.
4. In the event of a failure due to systems being misaligned, all parties will need to prepare their system prior to resending the failed transaction.
5. Disputed Rejection Advices and Confirmation Advices will be handled manually via operational escalation.
6. An unrecognisable transaction is a transaction that is corrupt and is not able to be processed. The sending party is responsible for resending the transaction following operational escalation.
7. Any reference to “rejected parties” in this Specification will be derived from the XML definitions. (GCSP, GMC, LMC, LCSP, RMC, RCSP, DMC and DCSP only)
8. Mobile Carrier to Mobile Carrier and Mobile Carrier to Network Providers interaction will be over a Common Network using XML.
9. Carrier to CSP interactions may choose to use the common network and XML or their existing infrastructure arrangements.
10. The Logical Context Diagram and the associated description do not differentiate between the sending and transiting of data.
11. The Process Flow Diagrams differentiate between the sending and transiting of data.
12. Common Validations are always performed prior to process Validations.
13. During the Port Cutover process, the Losing Mobile Carrier will have the ability to create a warning code to be sent to the Losing CSP for further validation however in this situation the Port Cutover Notification will not be rejected by the Losing Mobile Carrier, but sent to the LCSP for further validation.
14. A Port Notification that is rejected during the validation process by any party will be considered to be inactive and will need to be resubmitted with a new Request ID. However, any rejections on the transit leg will be handled by operational escalation.
15. When the Port Notification is successfully validated by the LCSP the Port Notification becomes “Confirmed and Active”. As each subsequent involved party receives and successfully validates the Port Notification Confirmation Advice the Port Notification becomes “Confirmed and Active” prior to transiting.

16. Initiated transactions are validated and then sent to the next involved party. While, Confirmed or Rejected transactions which a received by an involved party are validated using the appropriate common validations and then transited to the next party.
17. Losing Parties involved in Porting may themselves undertake those Validations that are performed by the subsequent party in the Port process for that transaction if an agreement exists. Where such an agreement exists, the returning transaction will reflect the involvement of both parties.
18. After receiving a transaction each party involved in Porting updates its system to reflect the appropriate status.
19. The Involved Parties in the XML message are always in a sending chronological order. The last entry in the Involved Parties field is always the last handler of the message. The time stamp of the last handler must always match the time stamp in the message header.
20. The status handling of the events follow the transaction dependency diagram.
21. The Rejecting Party is a logical attribute and is defined in the XML DTD as either the Rejecting CSP or the Rejecting MC.
22. The XML DTD in section 12.1 should be read in conjunction with the Logical Context Tables and in section 9 to determine the mandatory attributes for each message type.

8. Systems Availability

1. Standard Time means:

   a). Australian Eastern Standard Time (GMT plus 10 hours) or

   b) when any Eastern State commences Daylight Savings time it is GMT plus 11 hours.

2. Standard Hours of Operation means 8 a.m. to 8 p.m (Standard Time), from Monday to Friday, and 10 a.m. to 6 p.m. (Standard Time) on Saturday, unless otherwise agreed between CSPs on a bilateral basis.

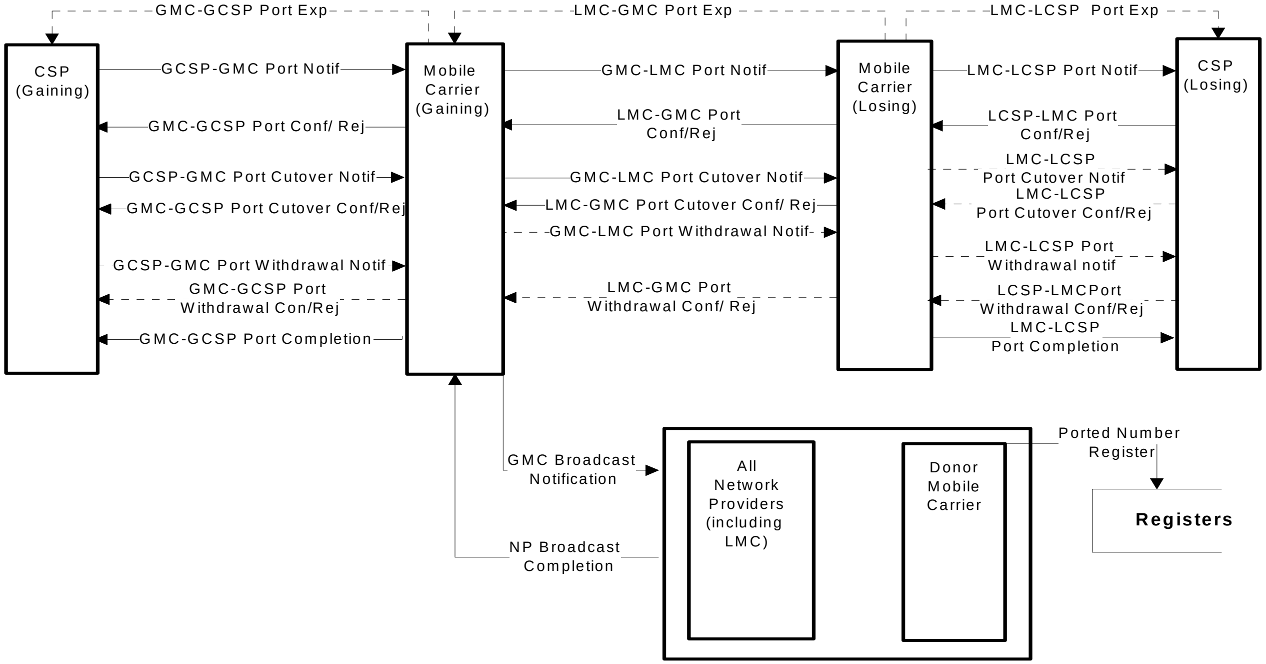
3. This Industry Code describes an automated process between Mobile Carriers, and between Mobile Carriers and industry participants who route mobile calls. Parties who have obligations under this Industry Code must use their best endeavours to ensure the availability and performance of their systems such that they can meet their requirements under this Industry Code. This includes but is not limited to an obligation on a CSP that the systems for Porting out must be at least as available as the systems for Porting in. Where a participant's systems experience an unplanned outage, the participant is not required to provide a manual alternative other than those specified, if any, in the MNP Operations Manual.

4. During the Standard Hours of Operation, the maximum transaction times as described in Appendix A apply. Transactions received outside Standard Hours of Operation must be completed within the maximum transaction time from the re-commencement of Standard Hours of Operation. Transactions that have been received in less than the maximum transaction time for that transaction before the end of the Standard Hours of Operation must be completed within the maximum transaction time from the start of the Standard Hours of Operation of the next Business Day. NOTE: This does not mean that the transaction cannot be completed within the same Business Day.

5. Recovery from Unplanned Outages will be defined in the MNP Operations Manual.

9. Logical Context Diagrams for each Industry Dialogue Model

This section identifies the data flows i.e. business transactions required for each Industry Dialogue Model i.e. business event.
PORT CONTEXT DIAGRAM



Note the "- - - - - "implies data flows if a Port does not proceed, while "________" implies mandatory data flows and all transactions require a receipt. Receipt Advices have not been shown in the diagram to assist readability.

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PORT NOTIFICATION

Doc Ref	Data Flow	Data Flow Description	Core Data Attribute Across Business Events
1.	GCSP-GMC Port Notification	Gaining CSP initiates the Port of an MSN by sending a Port Notification to the Gaining Mobile Carrier.	• Request ID • MSN • Account/Reference Number • Date of Birth • Previous Request ID • Gaining CSP ID • CA Authorisation Date
2.	GMC-GCSP Port Notification Receipt Advice	Gaining Mobile Carrier sends a Receipt Advice to the Gaining CSP confirming that the Port Notification has been received	• Request ID
3.	GMC-LMC Port Notification	Gaining Mobile Carrier sends the Port Notification to the Losing Mobile Carrier	• Request ID • MSN • Account/Reference Number • Date of Birth • Previous Request ID • Gaining CSP ID • Gaining MC ID • CA Authorisation Date
4.	LMC-GMC Port Notification Receipt Advice	Losing Mobile Carrier sends a Receipt Advice to the Gaining Mobile Carrier confirming that the Port Notification has been received.	• Request ID
5.	LMC-LCSP Port Notification	Losing Mobile Carrier sends the Port Notification to the LCSP.	• Request ID • MSN • Account/Reference Number • Date of Birth • Previous Request ID • Gaining CSP ID • Gaining MC ID • Losing MC ID • CA Authorisation Date
6.	LCSP-LMC Port Notification Receipt Advice	Losing CSP sends a Receipt Advice to their Losing Mobile Carrier confirming that the Port Notification has been received	• Request ID

Doc Ref	Data Flow	Data Flow Description	Core Data Attribute Across Business Events
7.	LCSP-LMC Port Notification Confirmation	Losing CSP sends a Port Notification Confirmation to their Losing Mobile Carrier confirming that the MSN is able to be Ported as validated by the Losing CSP.	• Request ID • Gaining CSP ID • Gaining MC ID • Losing MC ID • Losing CSP ID
8.	LMC-LCSP Port Notification Confirmation Receipt Advice	Losing Mobile Carrier sends a Receipt Advice to their Losing CSP confirming that the Port Confirmation Advice has been received.	• Request ID
9.	LMC-GMC Port Notification Confirmation	Losing Mobile Carrier sends a Port Notification Confirmation Advice to the Gaining Mobile Carrier confirming that the MSN can be Ported as validated by both the Losing CSP and the Losing Mobile Carrier.	• Request ID • Gaining CSP ID • Gaining MC ID • Losing MC ID • Losing CSP ID
10.	GMC - LMC Port Notification Confirmation Receipt Advice	Gaining Mobile Carrier sends a Receipt Advice to the Losing Mobile Carrier confirming that the Port Notification Confirmation Advice has been received.	• Request ID
11.	GMC-GCSP Port Notification Confirmation	Gaining Mobile Carrier sends a Port Notification Confirmation Advice to the Gaining CSP confirming that the MSN is able to be Ported as validated by both the Losing Mobile Carrier and Losing CSP.	• Request ID • Gaining CSP ID • Gaining MC ID • Losing MC ID • Losing CSP ID
12.	GCSP - GMC Port Notification Confirmation Receipt Advice	Gaining CSP sends a Receipt Advice to the Gaining Mobile Carrier confirming that the Port Notification Confirmation Advice has been received.	• Request ID

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Doc Ref	Data Flow	Data Flow Description	Core Data Attribute Across Business Events
13.	GMC-GCSP Port Notification Rejection	Gaining Mobile Carrier sends a Port Notification Rejection to the Gaining CSP notifying that the MSN is not able to be Ported as validated and rejected by either the Gaining Mobile Carrier, Losing Mobile Carrier or Losing CSP	• Request ID • Gaining CSP ID • Gaining MC ID • Losing MC ID • Losing CSP ID • Rejecting Party ID • Reject Code
14.	GCSP - GMC Port Notification Rejection Receipt Advice	Gaining CSP sends a Receipt Advice to their Gaining Mobile Carrier confirming that the Port Rejection Advice has been received.	• Request ID
15.	LMC-GMC Port Notification Rejection	Losing Mobile Carrier sends a Port Notification Rejection Advice to the Gaining Mobile Carrier notifying that the MSN can not be Ported as validated and rejected by either Losing Mobile Carrier or Losing CSP.	• Request ID • Gaining CSP ID • Gaining MC ID • Losing MC ID • Losing CSP ID • Rejecting Party ID • Reject Code
16.	GMC -LMC Port Notification Rejection Receipt Advice	Gaining Mobile Carrier sends a Receipt Advice to their Losing Mobile Carrier confirming that the Port Rejection Advice has been received.	• Request ID
17.	LCSP-LMC Port Notification Rejection	Losing CSP sends a Port Notification Rejection to the Losing Mobile Carrier notifying that the MSN is not able to be Ported as validated by the Losing CSP.	• Request ID • Gaining CSP ID • Gaining MC ID • Losing MC ID • Losing CSP ID • Rejecting Party ID • Reject Code
18.	LMC-LCSP Port Notification Rejection Receipt Advice	Losing Mobile Carrier sends a Receipt Advice to their Losing CSP confirming that the Port Rejection Advice has been received.	• Request ID

PORT CUTOVER NOTIFICATION

Doc Ref	Data Flow	Data Flow Description	Core Data Attribute Across Business Events
1.	GCSP-GMC Port Cutover Notification	Gaining CSP sends Port Cutover Notification to the Gaining Mobile Carrier.	• Request ID • Gaining CSP ID
2.	GMC-GCSP Port Cutover Notification Receipt Advice	Gaining Mobile Carrier sends a Receipt Advice to the Gaining CSP confirming that the Port Cutover Notification has been received.	• Request ID
3.	GMC-LMC Port Cutover Notification	Gaining Mobile Carrier sends Port Cutover Notification to the Losing Mobile Carrier.	• Request ID • Gaining CSP ID • Gaining MC ID
4.	LMC-GMC Port Cutover Notification Receipt Advice	Losing Mobile Carrier sends a Receipt Advice to the Gaining Mobile Carrier confirming that the Port Cutover Notification has been received.	• Request ID
5.	LMC-LCSP Port Cutover Notification	Losing Mobile Carrier sends Port Cutover Notification to the Losing CSP.	• Request ID • Gaining CSP ID • Gaining MC ID • Losing MC ID • Warning Code
6.	LCSP-LMC Port Cutover Notification Receipt Advice	Losing CSP sends a Receipt Advice to the Losing Mobile Carrier confirming that the Port Cutover Notification has been received.	• Request ID
7.	LCSP- LMC Port Cutover Notification Confirmation	Losing Mobile Carrier sends Port Cutover Notification Confirmation Advice to the Losing CSP.	• Request ID • Gaining CSP ID • Gaining MC ID • Losing MC ID • Losing CSP ID
8.	LMC - LCSP Port Cutover Notification Confirmation Receipt Advice	Losing Mobile Carrier sends a Receipt Advice to the Losing CSP confirming that the Port Cutover Notification Confirmation has been received.	• Request ID
9.	LMC-GMC Port Cutover Notification Confirmation	Losing Mobile Carrier sends a Port Cutover Notification Confirmation advice to the Gaining Mobile Carrier notifying that the MSN being Ported is able to be cutover as validated by the Losing Mobile Carrier or the Losing CSP.	• Request ID • Gaining CSP ID • Gaining MC ID • Losing MC ID • Losing CSP ID
10.	GMC-LMC Port Cutover Notification Confirmation Receipt Advice	Gaining Mobile Carrier sends a Receipt Advice to the Losing Mobile Carrier confirming that the Port Cutover Notification Confirmation has been received.	• Request ID

Doc Ref	Data Flow	Data Flow Description	Core Data Attribute Across Business Events
11.	GMC-GCSP Port Cutover Notification Confirmation	Gaining Mobile Carrier sends Port Cutover Notification Confirmation to the Gaining CSP.	• Request ID • Gaining CSP ID • Gaining MC ID • Losing MC ID • Losing CSP ID
12.	GCSP-GMC Port Cutover Notification Confirmation Receipt Advice	Gaining CSP sends a Receipt Advice to the Gaining Mobile Carrier confirming that the Port Cutover Notification Confirmation has been received.	• Request ID
13.	GMC-GCSP Port Cutover Notification Rejection	Gaining Mobile Carrier sends a Port Cutover Notification Rejection advice to the Gaining CSP notifying that the MSN being Ported is not able to be cutover as validated and rejected by either the Gaining Mobile Carrier, Losing Mobile Carrier or Losing CSP.	• Request ID • Gaining CSP ID • Gaining MC ID • Losing MC ID • Losing CSP ID • Rejecting Party ID • Reject Code
14.	GCSP-GMC Port Cutover Notification Rejection Receipt Advice	Gaining CSP sends a Receipt Advice to the Gaining Mobile Carrier confirming that the Port Cutover Notification Rejection has been received.	• Request ID
15.	LMC-GMC Port Cutover Notification Rejection	Losing Mobile Carrier sends a Port Cutover Notification Rejection advice to the Gaining Mobile Carrier notifying that the MSN being Ported is not able to be cutover as validated by the Losing Mobile Carrier or Losing CSP	• Request ID • Gaining CSP ID • Gaining MC ID • Losing MC ID • Losing CSP ID • Rejecting Party ID • Reject Code
16.	GMC-LMC Port Cutover Notification Rejection Receipt Advice	Gaining Mobile Carrier sends a Port Cutover Notification Rejection Receipt Advice to the Losing Mobile Carrier confirming that the Port Cutover Notification Rejection advice has been received.	• Request ID
17.	LCSP-LMC Port Cutover Notification Rejection	Losing CSP sends a Port Cutover Notification Rejection advice to the Losing Mobile Carrier notifying that the MSN being Ported is not able to be cutover as validated by the Losing CSP.	• Request ID • Gaining CSP ID • Gaining MC ID • Losing MC ID • Losing CSP ID • Rejecting Party ID • Reject Code
18.	LMC-LCSP Port Cutover Notification Rejection Receipt Advice	Losing Mobile Carrier sends a Port Cutover Notification Rejection Receipt Advice to the Losing CSP confirming that the Port Cutover Notification Rejection advice has been received.	• Request ID

BROADCAST PORT CUTOVER NOTIFICATION

Doc Ref	Data Flow	Data Flow Description	Core Data Attribute Across Business Events
1.	GMC-NP Broadcast Port Cutover Notification	Gaining Mobile Carrier sends a Broadcast Port Cutover Notification to all Network Providers (including the Losing Mobile Carrier) to advise them to implement the Port.	• Request ID • MSN • Gaining MC ID • Target Technology
2.	NP-GMC Broadcast Port Cutover Notification Receipt Advice	Network Providers send a Broadcast Port Cutover Notification Receipt Advice to the Gaining Mobile Carrier confirming that the Broadcast Port Cutover Notification has been received.	• Request ID
3.	NP-GMC Broadcast Port Cutover Completion Advice	Network Providers must inform the Gaining Mobile Carrier that the Port Cutover has been completed by returning a Broadcast Port Cutover Completion Advice to the Gaining MC.	• Request ID
4.	GMC- NP Broadcast Port Cutover Completion Receipt Advice	Gaining Mobile Carrier sends a Receipt Advice to the Network Providers confirming that the Broadcast Completion has been received.	• Request ID

PORT CUTOVER COMPLETION ADVICE

Doc Ref	Data Flow	Data Flow Description	Core Data Attribute Across Business Events
1.	GMC – GCSP Port Cutover Completion Advice	Gaining Mobile Carrier sends a Port Cutover Completion Advice to the GCSP to confirm that they have sent a Broadcast Notification to the Network Providers.	• Request ID • Gaining MC ID
2.	GCSP–GMC Port Cutover Completion Receipt Advice	Gaining CSP sends a Receipt Advice to their Gaining Mobile Carrier confirming that the Port Cutover Completion Advice has been received	• Request ID
3.	LMC–LCSP Port Cutover Completion Advice	Losing Mobile Carrier sends a Port Cutover Completion Advice to the Losing CSP to confirm that the Port has been completed.	• Request ID • Losing MC ID
4.	LCSP–LMC Port Cutover Completion Receipt Advice	Losing CSP sends a Receipt Advice to their Losing Mobile Carrier confirming that the Port Cutover Completion Advice has been received.	• Request ID

PORT WITHDRAWAL NOTIFICATION

Doc Ref	Data Flow	Data Flow Description	Core Data Attribute Across Business Events
1.	GCSP-GMC Port Withdrawal Notification	Gaining CSP withdraws a Port Notification by sending a Port Withdrawal Notification to the Gaining Mobile Carrier	• Request ID • Gaining CSP ID
2.	GMC-GCSP Port Withdrawal Notification Receipt Advice	Gaining Mobile Carrier sends a Receipt Advice to the Gaining CSP confirming that the Port Withdrawal Notification has been received.	• Request ID
3.	GMC-LMC Port Withdrawal Notification	Gaining Mobile Carrier sends a Port Withdrawal Notification to the Losing Mobile Carrier.	• Request ID • Gaining CSP ID • Gaining MC ID
4.	LMC-GMC Port Withdrawal Notification Receipt Advice	Losing Mobile Carrier sends a Receipt Advice to the Gaining Mobile Carrier confirming that the Port Withdrawal Notification has been received.	• Request ID
5.	LMC-LCSP Port Withdrawal Notification	Losing Mobile Carrier sends a Port Withdrawal Notification to the Losing CSP.	• Request ID • Gaining CSP ID • Gaining MC ID • Losing MC ID
6.	LCSP-LMC Port Withdrawal Notification Receipt Advice	Losing CSP sends a Receipt Advice to the Losing Mobile Carrier confirming that the Port Withdrawal Notification has been received.	• Request ID
7.	LCSP-LMC Port Withdrawal Notification Confirmation	Losing CSP sends a Port Withdrawal Notification Confirmation Advice to the Losing Mobile Carrier confirming that the request to Port the MSN is able to be withdrawn as validated by the Losing CSP.	• Request ID • Gaining CSP ID • Gaining MC ID • Losing MC ID • Losing CSP ID
8.	LMC-LCSP Port Withdrawal Notification Confirmation Receipt Advice	Losing Mobile Carrier sends a Receipt Advice to the Losing CSP confirming that the Port Withdrawal Notification Confirmation Advice has been received.	• Request ID
9.	LMC-GMC Port Withdrawal Notification Confirmation	Losing Mobile Carrier sends a Port Withdrawal Notification Confirmation to the Gaining Mobile Carrier confirming that the request to Port the MSN is able to be withdrawn as validated by the Losing CSP and Losing Mobile Carrier.	• Request ID • Gaining CSP ID • Gaining MC ID • Losing MC ID • Losing CSP ID
10.	GMC-LMC Port Withdrawal Notification Confirmation Receipt Advice	Gaining Mobile Carrier sends a Receipt Advice to the Losing Mobile Carrier confirming that the Port Withdrawal Notification Confirmation Advice has been received.	• Request ID

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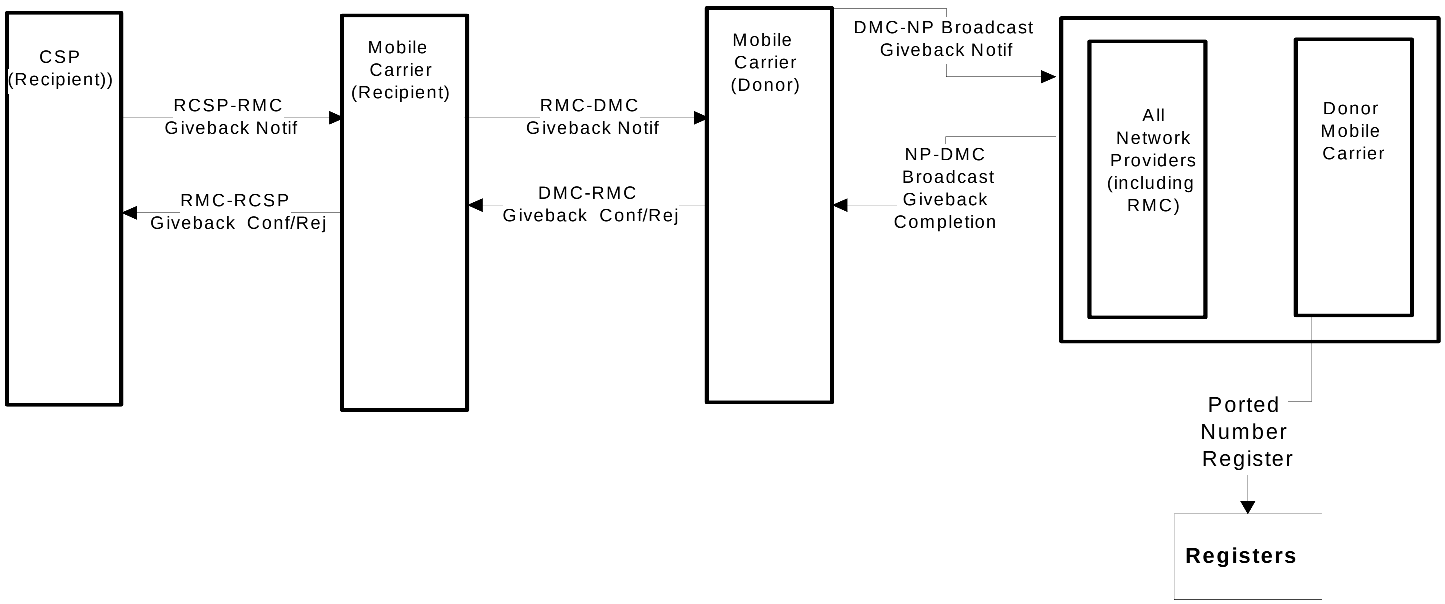
Doc Ref	**Data Flow**	**Data Flow Description**	**Core Data Attribute Across Business Events**
11.	GMC-GCSP Port Withdrawal Notification Confirmation	Gaining Mobile Carrier sends a Port Withdrawal Notification Confirmation Advice to the Gaining CSP confirming that the request to Port the MSN is able to be withdrawn as validated by the Losing CSP and Losing Carrier.	• Request ID • Gaining CSP ID • Gaining MC ID • Losing MC ID • Losing CSP I
12.	GCSP-GMC Port Withdrawal Notification Confirmation Receipt Advice	Gaining CSP sends a Receipt Advice to the Gaining Mobile Carrier confirming that the Port Withdrawal Notification Confirmation Advice has been received.	• Request ID
13.	GMC-GCSP Port Withdrawal Notification Rejection	Gaining Mobile Carrier sends a Port Withdrawal Notification Rejection Advice to the Gaining CSP notifying that the request to withdraw the Port Notification has been rejected by the Gaining Mobile Carrier, Losing Mobile Carrier or Losing CSP	• Request ID • Gaining CSP ID • Gaining MC ID • Losing MC ID • Losing CSP ID • Rejecting Party ID • Reject Code
14.	GCSP-GMC Port Withdrawal Notification Rejection Receipt Advice	Gaining CSP sends a Receipt Advice to the Gaining Mobile Carrier confirming that the Port Withdrawal Notification Rejection Advice has been received.	• Request ID
15.	LMC-GMC Port Withdrawal Notification Rejection	Losing Mobile Carrier sends a Port Withdrawal Notification Rejection Advice to the Gaining Mobile Carrier notifying that the request to withdraw the Port Notification has been rejected by the Losing Mobile Carrier or Losing CSP.	• Request ID • Gaining CSP ID • Gaining MC ID • Losing MC ID • Losing CSP ID • Rejecting Party ID • Reject Code
16.	GMC-LMC Port Withdrawal Notification Rejection Receipt Advice	Gaining Mobile Carrier sends a Receipt Advice to the Losing Mobile Carrier confirming that the Port Withdrawal Notification Rejection Advice has been received.	• Request ID
17.	LCSP-LMC Port Withdrawal Notification Rejection	Losing CSP sends a Port Withdrawal Notification Rejection Advice to the Losing Mobile Carrier notifying that the request to withdraw the Port Notification has been rejected by the Losing CSP.	• Request ID • Gaining CSP ID • Gaining MC ID • Losing MC ID • Losing CSP ID • Rejecting Party ID • Reject Code
18.	LMC-LCSP Port Withdrawal Notification Rejection Receipt Advice	Losing Mobile Carrier sends a Receipt Advice to the Losing CSP confirming that the Port Withdrawal Notification Rejection Advice has been received.	• Request ID

PORT EXPIRY NOTIFICATION

Doc Ref	Data Flow	Data Flow Description	Core Data Attribute Across Business Events
1.	LMC–GMC Port Expiry Notification	Losing Mobile Carrier sends a Port Expiry Notification to the Gaining Mobile Carrier if the Port Notification is active and confirmed and the Port Notification timeframe has expired.	• Request ID • Losing MC ID
2.	GMC–LMC Port Expiry Notification Receipt Advice	Gaining Mobile Carrier sends a Receipt Advice to the Losing Mobile Carrier confirming that the Port Expiry Notification has been received.	• Request ID
3.	GMC-GCSP Port Expiry Notification	Gaining Mobile Carrier sends a Port Expiry Notification to the Gaining CSP informing them that the Port Notification has expired	• Request ID • Losing MC ID • Gaining MC ID
4.	GCSP–GMC Port Expiry Notification Receipt Advice	Gaining Mobile Carrier sends a Receipt Advice to the Losing Mobile Carrier confirming that the Port Expiry Notification has been received.	• Request ID
5.	LMC – LCSP Port Expiry Notification	Losing Mobile Carrier sends a Port Expiry Notification to the Losing CSP informing them that the Port Notification has expired	• Request ID • Losing MC ID
6.	LCSP–LMC Port Expiry Notification Receipt Advice	Losing CSP sends a Receipt Advice to the Losing Mobile Carrier confirming that the Port Expiry Notification has been received.	• Request ID

GIVE BACK CONTEXT DIAGRAM



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GIVE BACK NOTIFICATION

Doc Ref	Data Flow	Data Flow Description	Core Data Attribute Across Business Events
1.	RCSP-RMC Give Back Notification	Recipient CSP initiates the Give Back of an MSN by sending a Give Back Notification to the Recipient Mobile Carrier after the expiry of the Quarantine period.	• Request ID • Recipient CSP ID • MSN • Cancellation Date • Give Back Reason
2.	RMC-RCSP Give Back Notification Receipt Advice	Recipient Mobile Carrier sends a Receipt Advice to the Recipient CSP confirming that the Give Back Notification has been received.	• Request ID
3.	RMC-RCSP Give Back Notification Confirmation Advice	Recipient Mobile Carrier sends a Give Back Notification Confirmation Advice to the Recipient CSP notifying that the request to Give Back the MSN has been confirmed after validation by the Recipient Mobile Carrier.	• Request ID • Recipient CSP ID • Recipient MC ID
4.	RCSP-RMC Give Back Notification Confirmation Receipt Advice	Recipient CSP sends a Receipt Advice to the Recipient Mobile Carrier confirming that the Give Back Notification Confirmation Advice has been received.	• Request ID
5.	RMC-RCSP Give Back Notification Rejection Advice	Recipient Mobile Carrier sends a Give Back Notification Rejection Advice to the Recipient CSP notifying that the request to Give Back the MSN has been rejected after validation by the Recipient Mobile Carrier.	• Request ID • Recipient CSP ID • Recipient MC ID • Rejecting Party • Reject Code
6.	RCSP-RMC Give Back Notification Rejection Receipt Advice	Recipient CSP sends a Receipt Advice to the Recipient Mobile Carrier confirming that the Give Back Notification Rejection Advice has been received.	• Request ID
7.	RMC-DMC Give Back Notification	Recipient Mobile Carrier sends the Give Back Notification to the Donor Mobile Carrier.	• Request ID • Recipient CSP ID • Recipient MC ID • MSN • Cancellation Date • Give Back Reason
8.	DMC-RMC Give Back Notification Receipt Advice	Donor Mobile Carrier sends a Receipt Advice to the Recipient Mobile Carrier confirming that the Give Back Notification has been received.	• Request ID

Doc Ref	**Data Flow**	**Data Flow Description**	**Core Data Attribute Across Business Events**
9.	DMC-RMC Give Back Notification Confirmation Advice	Donor Mobile Carrier sends a Give Back Notification Confirmation advice to the Recipient Mobile Carrier notifying that the request to Give Back the MSN has been confirmed after validation by the Donor Mobile Carrier.	• Request ID • Recipient CSP ID • Recipient MC ID • Donor MC ID •
10.	RMC-DMC Give Back Notification Confirmation Receipt Advice	Recipient Mobile Carrier sends a Receipt Advice to the Donor Mobile Carrier confirming that the Give Back Notification Confirmation Advice has been received.	• Request ID
11.	DMC-RMC Give Back Notification Rejection Advice	Donor Mobile Carrier sends a Give Back Notification Rejection Advice to the Recipient Mobile Carrier notifying that the request to Give Back the MSN has been rejected after validation by the Donor Mobile Carrier.	• Request ID • Recipient CSP ID • Recipient MC ID • Donor MC ID • Rejecting Party • Reject Code
12.	RMC-DMC Give Back Notification Rejection Receipt Advice	Recipient Mobile Carrier sends a Receipt Advice to the Donor Mobile Carrier confirming that the Give Back Notification Rejection Advice has been received.	• Request ID

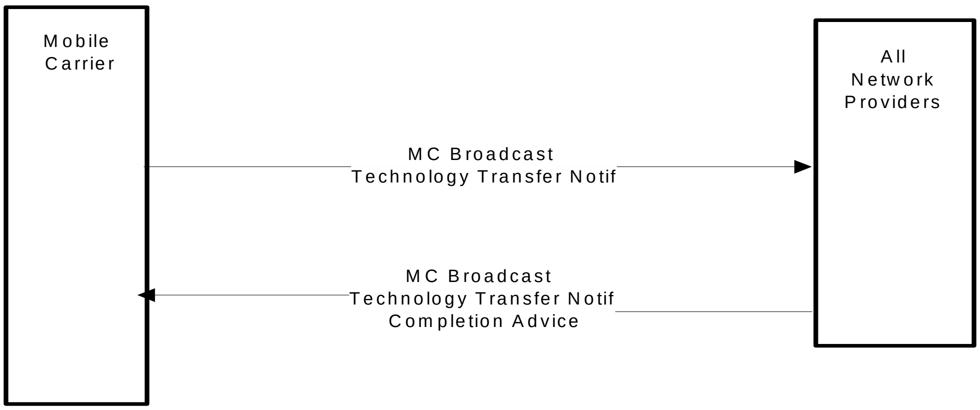
BROADCAST GIVE BACK NOTIFICATION

Doc Ref	Data Flow	Data Flow Description	Core Data Attribute Across Business Events
1.	DMC-NP Broadcast Give Back Notification	Donor Mobile Carrier sends a Broadcast Give Back Notification to all Network Providers (including the Recipient Mobile Carrier) to advise them to implement the Give Back.	Request ID MSN Network Provider ID Target Technology
2.	NP-DMC Broadcast Give Back Receipt Advice	All Network Providers send a Broadcast Give Back Receipt Advice to the Donor Mobile Carrier confirming that the Broadcast Give Back Notification has been received.	Request ID

BROADCAST GIVE BACK COMPLETION

Doc Ref	Data Flow	Data Flow Description	Core Data Attribute Across Business Events
1.	NP-DMC Broadcast Give Back Completion	All Network Providers send a Broadcast Give Back Completion Advice to the Donor Mobile Carrier to advise that they have implemented the return of the MSN to the Donor Mobile Carrier in their Network.	Request ID Network Provider ID
2.	DMC-NP Broadcast Give Back Completion Receipt Advice	Donor Mobile Carrier sends a Receipt Advice to all Network Providers confirming that the Broadcast Give Back Notification has been received.	Request ID

TECHNOLOGY TRANSFER CONTEXT DIAGRAM



TECHNOLOGY TRANSFER TABLE

Doc Ref	Data Flow	Data Flow Description	Core Data Attribute Across Business Events
1.	MC-NP Broadcast Technology Transfer Notification	A Mobile Carrier sends a Broadcast Technology Transfer Notification to all Network Providers to advise them of the Technology Transfer of that MSN.	• Request ID • MSN • Mobile Carrier ID • Target Technology
2.	NP-MC Broadcast Technology Transfer Receipt Advice	All Network Providers send a Broadcast Technology Transfer Receipt Advice to the Mobile Carrier confirming that the Broadcast Technology Transfer Notification has been received.	• Request ID
3.	NP-MC Broadcast Technology Transfer Completion Advice	All Network Providers send a Broadcast Technology Transfer Completion Advice to the Mobile Carrier to advise that they have updated their systems.	• Request ID • Network Provider ID
4.	MC-NP Broadcast Technology Transfer Completion Receipt Advice	Mobile Carrier sends a Receipt Advice to all Network Providers confirming that the Broadcast Technology Transfer Notification has been received.	• Request ID

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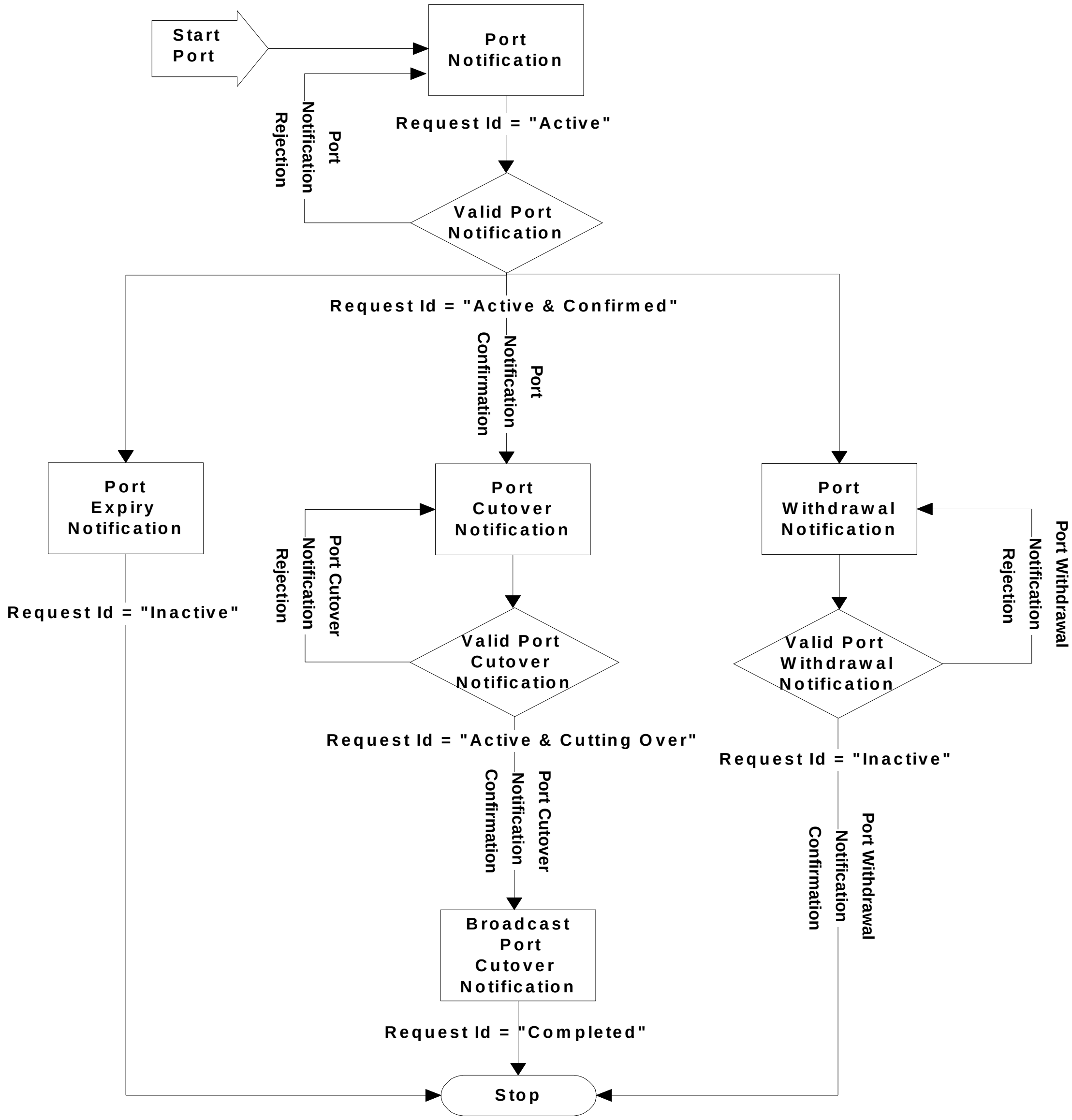
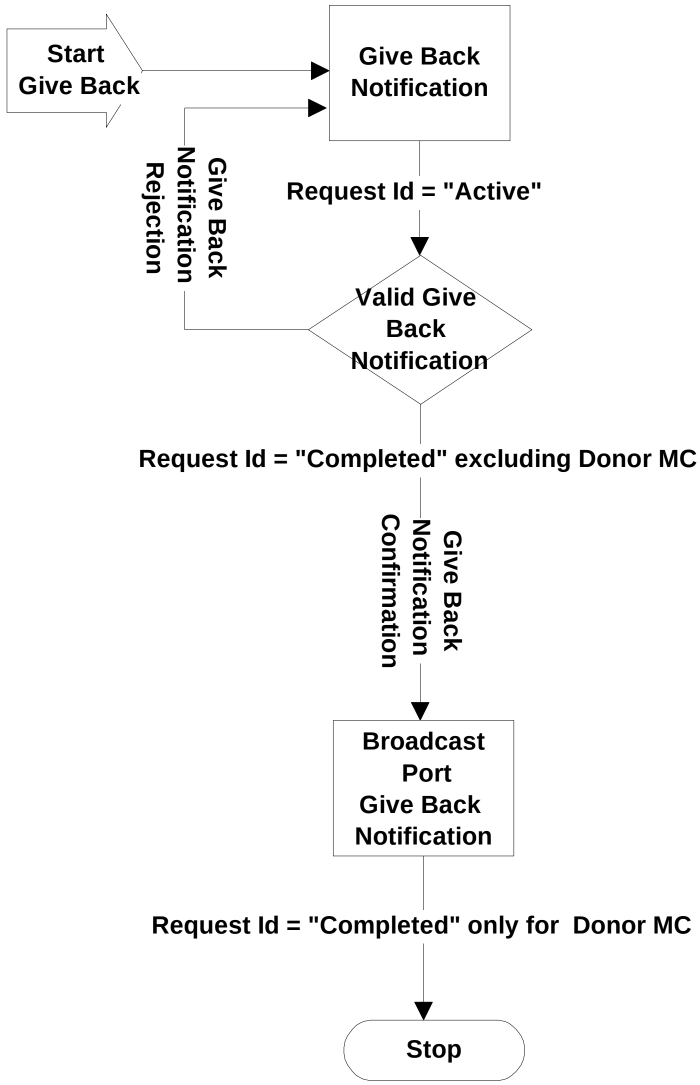
10. MNP Porting Transaction Sequence Dependencies

Port Event



Give Back Event



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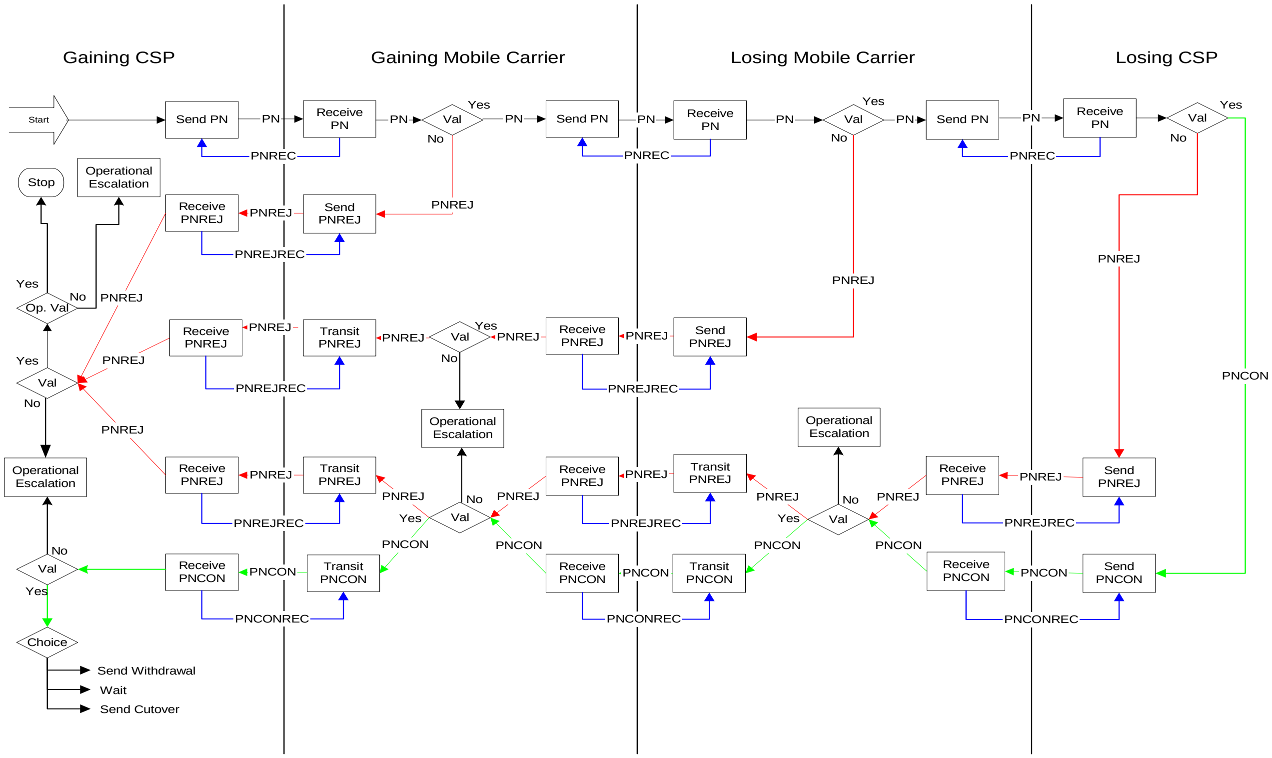
11. Event Processing

Port Process Diagrams and Validations

Port Notification - Diagram



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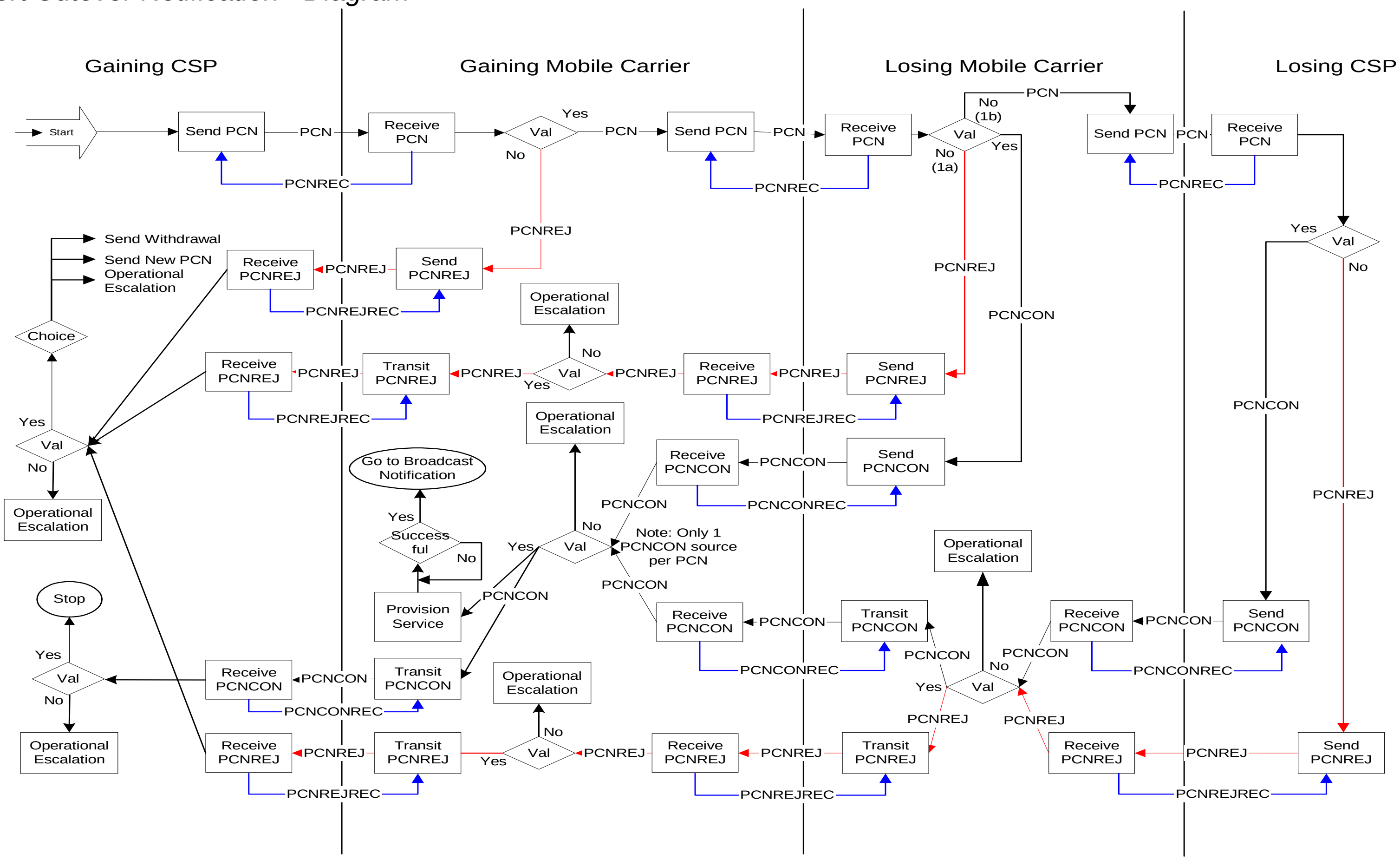
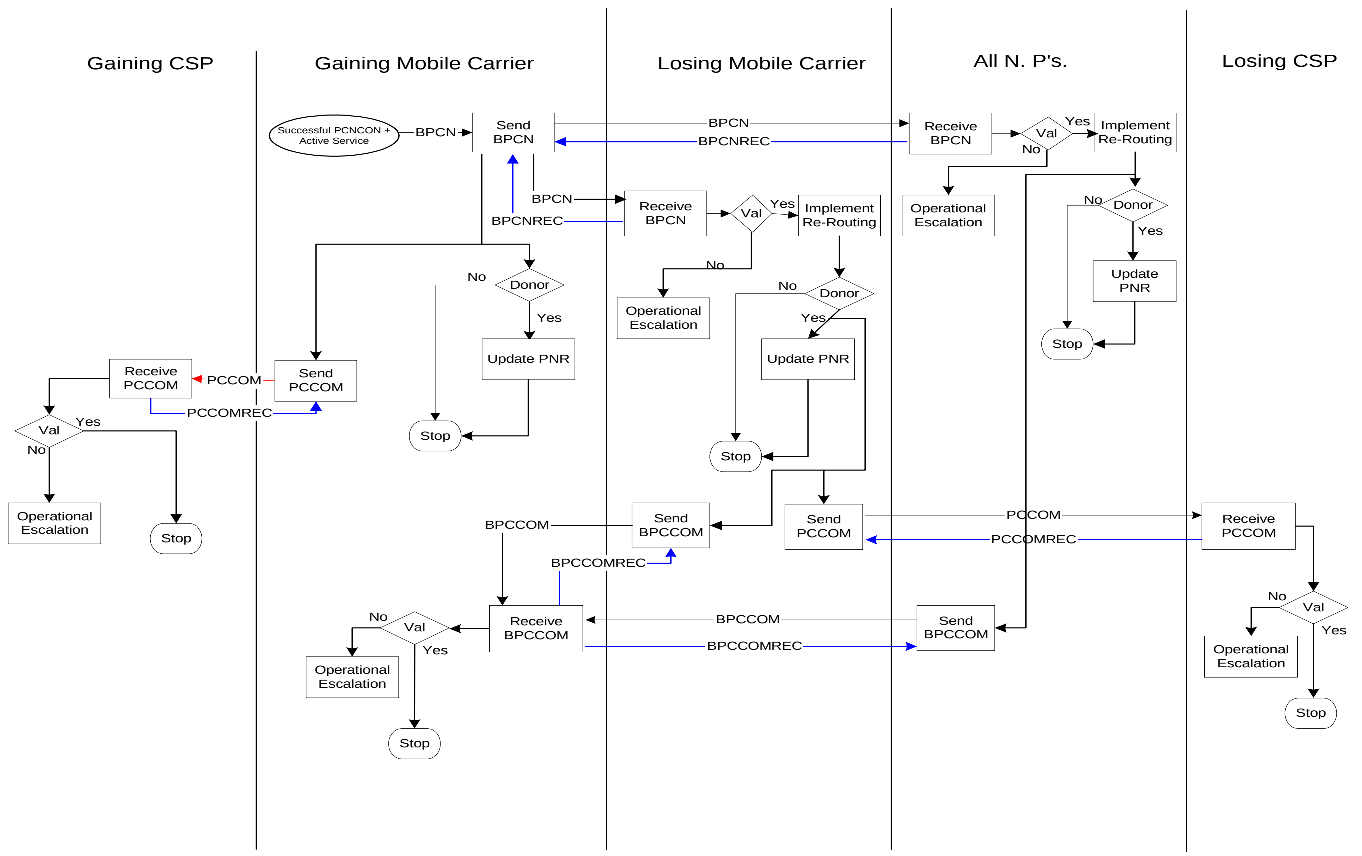
Port Cutover Notification - Diagram



Broadcast Port Cutover Notification – Diagram



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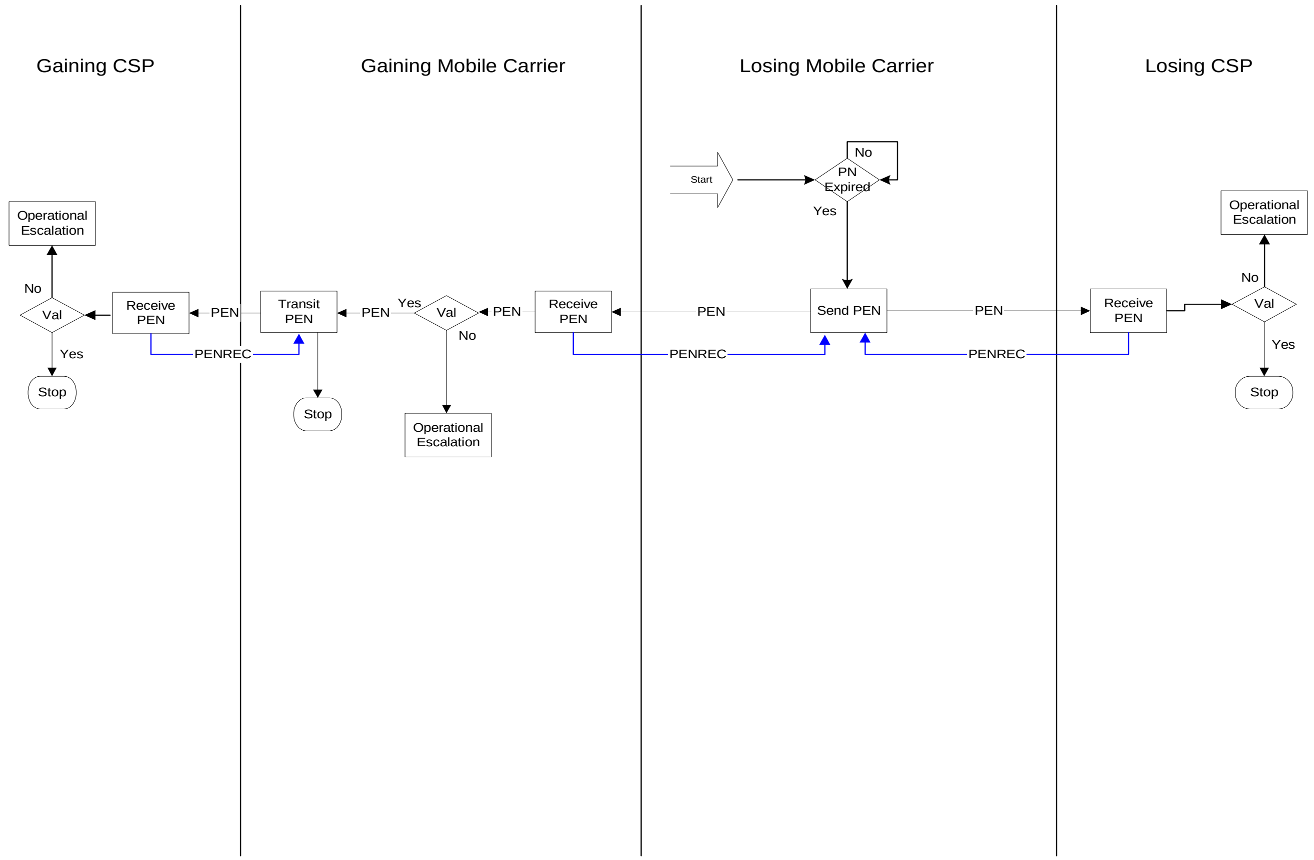
Port Expiry Notification - Diagram



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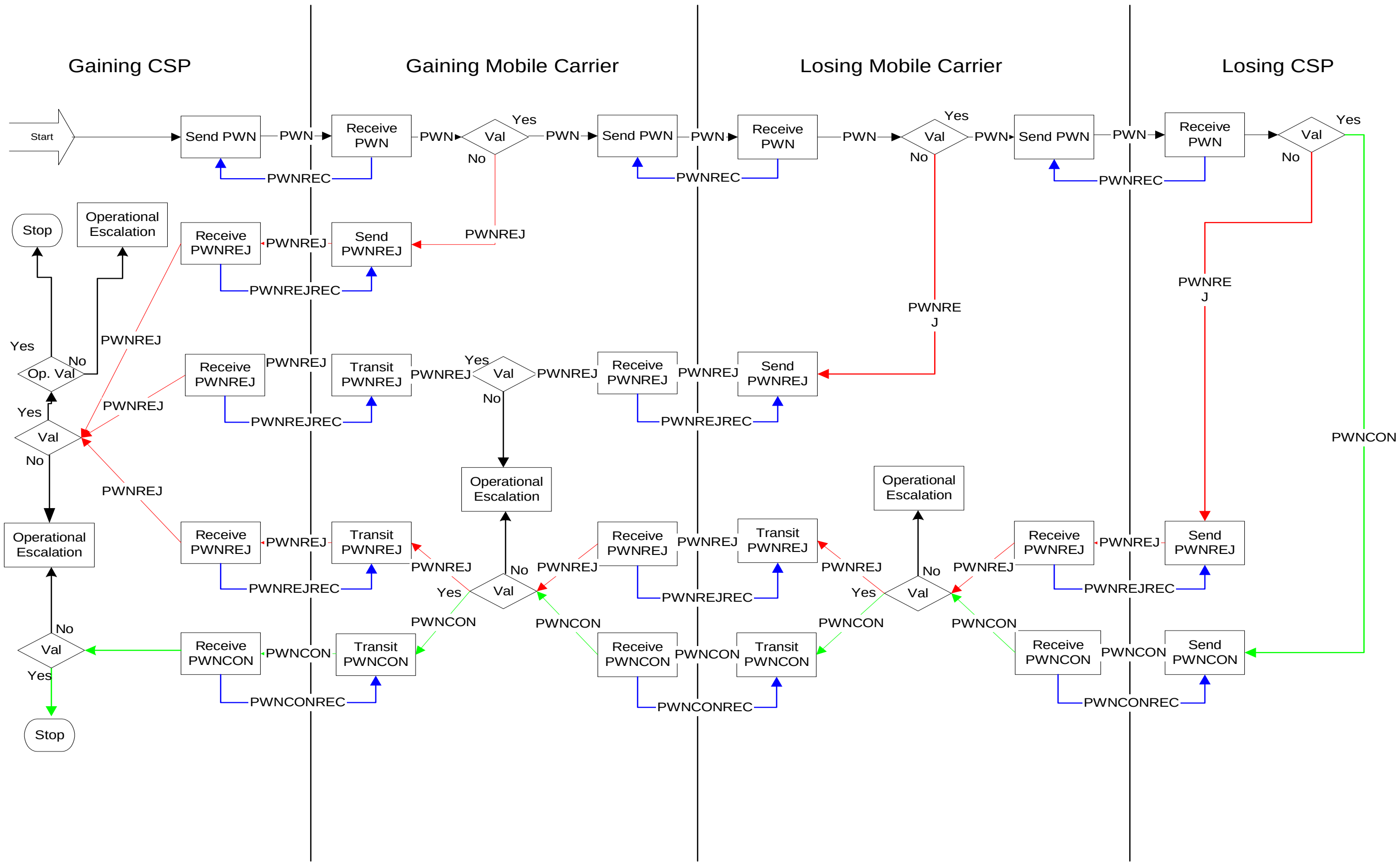
Port Withdrawal Notification – Diagram



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Common Validations - Table

	Process Name	Validations	Reject code
1.	Common Validations	1. Data attributes do not conform to data definitions. 2. Request ID is not unique for a Port, Give Back or Technology Transfer request 3. Transaction out of sequence	1. 020 2. 077 3. 059

Port Notification - Table

	Process Name	Validations	Reject code
1.	Gaining CSP: **Sends Port Notification**	Trigger Point Event Commencement	
2.	Outcome / action	1. Gaining CSP sends a Port Notification to the Gaining Mobile Carrier	
3.	Gaining Mobile Carrier: **Receives Port Notification**	Trigger Point	
4.	Outcome / action	1. Gaining Mobile Carrier sends a Port Notification Receipt Advice to the Gaining CSP within 1 minute of receipt of the Port Notification	
5.	Gaining Mobile Carrier : **Validation**	1. The number is not an MSN 2. The MSN has not been allocated to a Mobile Carrier 3. The Losing Mobile Carrier is the Gaining Mobile Carrier 4. See Common Validations	1. 001 2. 013 3. 052
6.	Outcome / action	1. Gaining Mobile Carrier validates the Port Notification and if found to be valid will send the Port Notification to the appropriate Losing Mobile Carrier for further Validations within 5 minutes of receipt of the Port Notification. 2. Gaining Mobile Carrier validates the Port Notification and if found to be invalid will send a Port Notification Rejection Advice back to the Gaining CSP within 5 minutes of receipt of the Port Notification. (Refer 23)	
7.	Losing Mobile Carrier: **Receives Port Notification**	Trigger Point	
8.	Outcome / action	1. Losing Mobile Carrier sends a Port Notification Receipt Advice to the Gaining Mobile Carrier within 1 minute of receipt of the Port Notification	
9.	Losing Mobile Carrier : **Validation**	1. The MSN has not been allocated to the Losing Mobile Carrier 2. See Common Validations	1. 013

	Process Name	Validations	Reject code
10.	Outcome / action	1. Losing Mobile Carrier validates the Port Notification and if found to be valid will send the Port Notification onto the appropriate Losing CSP for further Validations within 5 minutes of receipt of the Port Notification. 2. Losing Mobile Carrier validates the Port Notification and if found to be invalid will send a Port Notification Rejection back to the Gaining Mobile Carrier within 5 minutes of receipt of the Port Notification (Refer 21)	
11.	Losing CSP: **Receives Port Notification**	Trigger Point	
12.	Outcome / action	1. Losing CSP sends a Port Notification Receipt Advice to the Losing Mobile Carrier within 1 minute of receipt of the Port Notification	
13.	Losing CSP: **Validation**	1. The Losing CSP does not hold the MSN. 2. The Losing CSP has not Issued the MSN. 3. The MSN is currently in the process of being Ported or Transferred. 4. The CA Authorisation Date is greater than 30 days prior to the receipt of the Port Notification. 5. The CA Authorisation Date is not greater than the current date (i.e. receipt date) **When Previous Request ID is not provided = Port** 6. Account/reference or Date of Birth number not held 7. The MSN is not associated with the given Account/Reference number. 8. The MSN is not associated with the given Date of Birth. **Or** **When Previous Request ID is provided = Reversal** 9. The MSN is not associated with the given Previous Request ID that was completed. 10. See Common Validations	1. 016 2. 003 3. 008 4. 067 5. 067 6. 058 7. 017 8. 070 9. 071
14.	Outcome / action	1. Losing CSP validates the Port Notification and if found to be valid will send the Port Notification Confirmation Advice to the Losing Mobile Carrier within 15 minutes of receipt of the Port Notification. 2. Losing CSP validates the Port Notification and if found to be invalid will send a Port Notification Rejection Advice to the Losing Mobile Carrier within 15 minutes of receipt of the Port Notification	

15.	Losing Mobile Carrier: **Receives Port Notification Confirmation/ Rejection**	Trigger Point	
16.	Outcome / action	1. Losing Mobile Carrier sends a Port Notification Confirmation/Rejection Receipt Advice to the losing CSP within 1 minute of receipt of the Port Notification Confirmation/Rejection Advice.	
17.	Losing Mobile Carrier : **Validation**	1. The Request ID is not active 2. See Common Validations	1. 041
18.	Outcome / action	1. Losing Mobile Carrier transits the Port Notification Confirmation/Rejection Advice to the Gaining Mobile Carrier within 1 minute of receipt of the Port Notification Confirmation/Rejection Advice. 2. Confirmation of the Port Notification will commence the expiry count down. 3. The expiry date for a confirmed Port Notification will be set to 30 calendar days from the date of Customer Authorisation.	
19.	Gaining Mobile Carrier: **Receives Port Notification Confirmation/ Rejection**	Trigger Point	
20.	Outcome / action	1. Gaining Mobile Carrier sends a Port Notification Confirmation/Rejection Receipt Advice to the Losing Mobile Carrier within 1 minute of receipt of the Port Notification Confirmation/Rejection Advice.	
21.	Gaining Mobile Carrier: **Validation**	1. See Common Validations	
22.	Outcome / action	1. Gaining Mobile Carrier transits a Port Notification Confirmation/Rejection Advice to the Gaining CSP within 1 minute of receipt of the Port Notification Confirmation/Rejection Advice.	
23.	Gaining CSP: **Receives Port Notification Confirmation/ Rejection**	Trigger Point	
24.	Outcome / action	1. Gaining CSP sends a Port Notification Confirmation/Rejection Receipt Advice to the Gaining Mobile Carrier within 1 minute of receipt of the Port Notification Confirmation/Rejection Advice.	
25.	Gaining CSP: **Validation**	1. See Common Validations	
26.	Outcome / action	1. If the Port Notification is confirmed and active the Port may proceed. 2. If the Port is rejected the Gaining CSP may submit a new Port Notification.	

Port Cutover Notification - Table

	Process Name	**Validations**	**Reject code**
1.	Gaining CSP: **Sends Port Cutover Notification**	Trigger Point	
2.	Outcome / action	1. Gaining CSP sends a Port Cutover Notification to the Gaining Mobile Carrier	
3.	Gaining Mobile Carrier: Receives Port Cutover Notification	Trigger Point	
4.	Outcome / action	1. Gaining Mobile Carrier sends a Port Cutover Notification Receipt Advice to the Gaining CSP within 1 minute of receipt of the Port Notification	
5.	Gaining Mobile Carrier : Validation	1. The Request ID is not confirmed and active 2. See Common Validations	1. 035
6.	Outcome / action	1. Gaining Mobile Carrier validates the Port Cutover Notification and if found to be valid will send the Port Cutover Notification to the appropriate Losing Mobile Carrier for further Validations within 5 minutes of receipt of the Port Cutover Notification. 2. Gaining Mobile Carrier validates the Port Cutover Notification and if found to be invalid will send a Port Cutover Notification Rejection to the Gaining CSP within 5 minutes of receipt of the Port Cutover Notification (Refer 25)	
7.	Losing Mobile Carrier: **Receives Port Cutover Notification**	Trigger Point	
8.	Outcome / action	1. Losing Mobile Carrier sends a Port Cutover Notification Receipt Advice to the Gaining Mobile Carrier within 1 minute of receipt of the Port Cutover Notification.	
9.	Losing Mobile Carrier : **Validation**	1. The Request ID is not confirmed and active 2. MSN not currently connected to the Losing Mobile Carrier's network **(warning code)** 3. See Common Validations	1. 035 2. WC1

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	Process Name	Validations	Reject code
10.	Outcome / action	1. Losing Mobile Carrier validates the Port Cutover Notification. 2. If found to be valid the Losing Mobile Carrier will send a Port Cutover Notification Confirmation Advice to the Gaining Mobile Carrier within 5 minutes of receipt of the Port Cutover Notification (Refer 19) 3. If found to be invalid for rule (1) the Losing Mobile Carrier will send a Port Cutover Notification Rejection Advice to the Gaining Mobile Carrier within 5 minutes of receipt of the Port Cutover Notification (Refer 21) 4. If found to be invalid for rule (2) the Losing Mobile Carrier will send the Port Cutover Notification to the Losing CSP for further validation (Refer 13)	
11.	Losing CSP: **Receives Port Cutover Notification**	Trigger Point	
12.	Outcome / action	Losing CSP sends a Port Cutover Notification Receipt Advice to the Losing Mobile Carrier within 1 minute of receipt of the Port Cutover Notification.	
13.	Losing CSP : Validation	1. The Request ID is not confirmed and active 2. The Losing CSP has not Issued the MSN 3. See Common Validations	1. 035 2. 003
14.	Outcome / action	1. If found to be valid the Losing CSP will send a Port Cutover Notification Confirmation Advice back to the Losing Mobile Carrier within 15 minutes of receipt of the Port Cutover Notification. 2. If found to be invalid for the Losing CSP will send a Port Cutover Notification Rejection Advice to the Losing Mobile Carrier within 15 minutes of receipt of the Port Cutover Notification.	
15.	Losing Mobile Carrier: **Receives Port Cutover Notification Confirmation/ Rejection**	Trigger Point	
16.	Outcome / action	1. Losing Mobile Carrier sends a Port Cutover Notification Confirmation/Rejection Receipt Advice to the Losing CSP within 1 minute of receipt of the Port Cutover Notification Confirmation/Rejection Advice.	
17.	Losing Mobile Carrier: **Validation**	1. See Common Validations	
18.	Outcome / action	1. Losing Mobile Carrier transits the Port Cutover Notification Confirmation/Rejection Advice to the Gaining Mobile Carrier within 1 minute of receipt of the Port Cutover Confirmation/Rejection Advice.	

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	Process Name	Validations	Reject code
19.	Gaining Mobile Carrier: **Receives Port Cutover Confirmation**	Trigger Point	
20.	Outcome / action	1. Gaining Mobile Carrier sends a Port Cutover Notification Confirmation Receipt Advice to the Losing Mobile Carrier within 1 minute of receipt of the Port Cutover Notification Confirmation Advice. 2. Gaining Mobile Carrier provisions the mobile service on their network. Note: Refer Broadcast Port Cutover Notification)	
21.	Gaining Mobile Carrier: **Receives Port Cutover Rejection**	Trigger Point	
22.	Outcome / action	1. Gaining Mobile Carrier sends a Port Cutover Notification Rejection Receipt Advice to the Losing Mobile Carrier within 1 minute of receipt of the Port Cutover Notification Rejection Advice.	
23.	Gaining Mobile Carrier: **Validations**	1. See Common Validations	
24.	Outcome / action	Gaining Mobile Carrier transits a Port Cutover Notification Rejection Advice to the Gaining CSP within 1 minute of receipt of the Port Cutover Notification Rejection Advice	
25.	Gaining CSP: **Receives Port Cutover Confirmation**	Trigger Point	
26.	Outcome / action	1. Gaining CSP sends a Port Cutover Notification Confirmation Receipt Advice to the Gaining Mobile Carrier within 1 minute of receipt of the Port Cutover Notification Confirmation Advice. 2. The Gaining CSP may undertake an Operational Escalation.	
27.	Gaining CSP: **Receives Port Cutover Rejection**	Trigger Point	
28.	Outcome / action	1. Gaining CSP sends a Port Cutover Notification Rejection Receipt Advice to the Gaining Mobile Carrier within 1 minute of receipt of the Port Cutover Notification Rejection Advice. 2. The Gaining CSP may Withdraw the Port Notification, send another Port Cutover Notification or undertake an Operational Escalation.	

Broadcast Port Cutover Notification - Table

	Process Name	**Validations**	**Reject code**
1.	Gaining Mobile Carrier **:Send Broadcast Port Cutover Notification**	Trigger point – Receipt of a Port Cutover Notification Confirmation Advice	
2.	Outcome / action	1. The Gaining Mobile Carrier will provision service in its Network. 2. The Gaining Mobile Carrier will send a Broadcast Port Cutover Notification to all Network Providers within 2 hours of the receipt of the Port Cutover Notification Confirmation Advice, and up until 20 minutes prior to the end of Standard Hours of Operation. If within 20 minutes prior to the end of Standard Hours of Operation, the Gaining Mobile Carrier will send the Broadcast Port Cutover Notification at the commencement of Standard Hours of Operations the next business day. 3. Within 1 minute of sending the Broadcast Port Cutover Notification, the Gaining Mobile Carrier will send a Port Cutover Completion Advice to the GCSP.	
3.	All Network Providers : **Receive Broadcast Port Cutover Notification**	Trigger point	
4.	Outcome / action	1. All Network Providers send a Broadcast Port Cutover Notification Receipt to the Gaining Mobile Carrier within 1 minute of receipt of the Broadcast Port Cutover Notification.	
5.	All Network Providers: **Validation**	1. Data attributes do not conform to data definitions.	1. 020
6.	Outcome / action	1. All Network Providers validate the Broadcast Port Cutover Notification and if found to be valid all Network Providers will implement re-routing on their Networks. 2. All Network Providers validate the Broadcast Port Cutover Notification and if found to be invalid, the Network Providers will undertake an Operational Escalation.	
7.	All Network Providers : **Implement Re-routing**	Trigger point	
8.	Outcome / action	1. All Network Providers will establish Re-routing on their Networks and then send a Broadcast Port Cutover Notification Completion Advice back to the Gaining Mobile Carrier within 15 minutes of receipt of the Broadcast Port Cutover Notification.	

	Process Name	Validations	Reject code
9.	Gaining Mobile Carrier : **Receives Broadcast Port Cutover Completion**	Trigger point	
10.	Outcome / action	1. Gaining Mobile Carrier sends a Broadcast Port Cutover Completion Receipt Advice to the Network Provider within 1 minute of receipt of the Broadcast Port Cutover Completion. 2. On receiving all Broadcast Port Cutover Completion Advices from all the Network Providers the Port request will be considered completed and inactive.	
11.	Gaining Mobile Carrier: **Validation**	1. See Common Validations	
12.	Outcome / action	1. Gaining Mobile Carrier validates the Broadcast Port Cutover Completion Advice and if found to be valid the Port request will be considered completed and inactive. 2. Gaining Mobile Carrier validates the Broadcast Port Cutover Completion Advice and if found to be invalid will undertake an Operational Escalation to the Network Provider.	
13.	Gaining CSP: **Receives Port Cutover Completion Advice**	Trigger point	
14.	Outcome / action	1. Gaining CSP will send a Port Cutover Completion Receipt Advice to the Gaining Mobile Carrier within 1 minute of receipt of the Port Cutover Completion Advice.	
15.	Gaining CSP: **Validation**	1. See Common Validations	
16.	Outcome / action	1. Gaining CSP validates the Port Cutover Completion Advice and if found to be valid the Port request will be considered completed and inactive. 2. Gaining CSP validates the Port Cutover Completion Advice and if found to be invalid will undertake an Operational Escalation to the Gaining Mobile Carrier.	
17.	Losing Mobile Carrier : **Send Port Cutover Completion Advice**	Trigger point	
18.	Outcome / action	1. Losing Mobile Carrier will send a Port Cutover Completion Advice to the Losing CSP within 1 minute of sending the Broadcast Port Cutover Completion Advice.	
19.	Losing CSP: **Receives Port Cutover Completion Advice**	Trigger Point	

	Process Name	Validations	Reject code
20.	Outcome / action	1. Losing CSP sends a Port Cutover Completion Receipt Advice to the Losing Mobile Carrier within 1 minute of receipt of the Port Cutover Completion Advice.	
21.	Losing CSP: **Validation**	1. See Common Validations	
22.	Outcome / action	1. Losing CSP validates the Port Cutover Completion Advice and if found to be valid the Port request will be considered completed and inactive. 2. Losing CSP validates the Port Cutover Completion Advice and if found to be invalid will undertake an Operational Escalation to the Losing Mobile Carrier.	
23.	**Donor: Updates Register**	Trigger point	
24.	Outcome / action	1. Once the Donor Mobile Carrier has established Re-routing the Donor Mobile Carrier will update its Ported Number Register.	

Port Withdrawal Notification - Table

	Process Name	Validations	Reject code
1.	Gaining CSP: **Sends Port Withdrawal Notification**	Trigger Point - Port no longer required by customer.	
2.	Outcome / action	1. Gaining CSP sends a Port Withdrawal Notification to the Gaining Mobile Carrier.	
3.	Gaining Mobile Carrier: **Receives Port Withdrawal Notification**	Trigger Point	
4.	Outcome / action	1. Gaining Mobile Carrier sends a Port Withdrawal Notification Receipt Advice to the Gaining CSP within 1 minute of receipt of the Port Withdrawal Notification.	
5.	Gaining Mobile Carrier : **Validation**	1. Request ID not confirmed and active 2. See Common Validations	1. 035
6.	Outcome / action	1. Gaining Mobile Carrier validates the Port Withdrawal Notification and if found to be valid will send the Port Withdrawal Notification onto the appropriate Losing Mobile Carrier for further Validations within 5 minutes of receipt of the Port Withdrawal Notification. 2. Gaining Mobile Carrier validates the Port Withdrawal Notification and if found to be invalid will send a Port Withdrawal Notification Rejection Advice back to the Gaining CSP within 5 minutes of receipt of the Port Withdrawal Notification. (Refer 23)	
7.	Losing Mobile Carrier: **Receives Port Withdrawal Notification**	Trigger Point	
8.	Outcome / action	1. Losing Mobile Carrier sends a Port Withdrawal Notification Receipt Advice to the Gaining Mobile Carrier within 1 minute of receipt of the Port Withdrawal Notification	
9.	Losing Mobile Carrier : **Validation**	1. Request ID not confirmed and active 2. See Common Validations	1. 035

	Process Name	Validations	Reject code
10.	Outcome / action	1. Losing Mobile Carrier validates the Port Withdrawal Notification and if found to be valid will send the Port Withdrawal Notification onto the appropriate Losing CSP for further Validations within 5 minutes of receipt of the Port Withdrawal Notification. 2. Losing Mobile Carrier validates the Port Withdrawal Notification and if found to be invalid will send a Port Withdrawal Notification Rejection back to the Gaining Mobile Carrier within 5 minutes of receipt of the Port Withdrawal Notification (Refer 21)	
11.	Losing CSP: **Receives Port Withdrawal Notification**	Trigger Point	
12.	Outcome / action	1. Losing CSP sends a Port Withdrawal Notification Receipt Advice to the Losing Mobile Carrier within 1 minute of receipt of the Port Withdrawal Notification	
13.	Losing CSP : **Validation**	1. Request ID not confirmed and active 2. See Common Validations	1. 035
14.	Outcome / action	1. Losing CSP validates the Port Withdrawal Notification and if found to be invalid will send a Port Withdrawal Notification Rejection Advice to the Losing Mobile Carrier within 15 minutes of receipt of the Port Withdrawal Notification 2. Losing CSP validates the Port Withdrawal Notification and if valid will make the Port Notification inactive in their systems and send the Port Withdrawal Notification Confirmation Advice to the Losing Mobile Carrier within 15 minutes of receipt of the Port Withdrawal Notification.	
15.	Losing Mobile Carrier: **Receives Port Withdrawal Notification Confirmation/ Rejection**	Trigger Point	
16.	Outcome / action	1. Losing Mobile Carrier sends a Port Withdrawal Notification Confirmation/Rejection Receipt Advice to the Losing CSP within 1 minute of receipt of the Port Withdrawal Notification Confirmation/Rejection Advice.	
17.	Losing Mobile Carrier: **Validate**	1. The Request ID is not active 2. See Common Validations	1. 041

18.	Outcome / action	1. Losing Mobile Carrier validates the Port Withdrawal Notification Confirmation/Rejection Advice and if found to be valid transits the Port Withdrawal Notification Confirmation/Rejection Advice to the Gaining Mobile Carrier within 1 minute of receipt of the Port Withdrawal Notification Confirmation/Rejection Advice. 2. Losing Mobile Carrier validates the Port Withdrawal Notification Confirmation/Rejection Advice and if found to be invalid will undertake an Operational Escalation to the LCSP.	
19.	Gaining Mobile Carrier: **Receives Port Withdrawal Notification Confirmation/ Rejection**	Trigger Point	
20.	Outcome / action	1. Gaining Mobile Carrier sends a Port Withdrawal Notification Confirmation/Rejection Receipt Advice to the Losing Mobile Carrier within 1 minute of receipt of the Port Withdrawal Notification Confirmation/Rejection Advice.	
21.	Gaining Mobile Carrier: **Validation**	1. The Request ID is not active 2. See Common Validations	1. 041
22.	Outcome / action	1.Gaining Mobile Carrier validates the Port Withdrawal Notification Confirmation/Rejection Advice and if found to be valid transits Port Withdrawal Notification Confirmation/Rejection Advice to the Gaining CSP within 1 minute of receipt of the Port Withdrawal Notification Confirmation/Rejection Advice. 2. Gaining Mobile Carrier validates the Port Withdrawal Notification Confirmation/Rejection Advice and if found to be invalid will undertake an Operational Escalation to the Losing Mobile Carrier.	
23.	Gaining CSP: **Receives Port Withdrawal Notification Confirmation/ Rejection**	Trigger Point	
24.	Outcome / action	1. Gaining CSP sends a Port Withdrawal Notification Confirmation/Rejection Receipt Advice to the Gaining Mobile Carrier within 1 minute of receipt of the Port Withdrawal Notification Confirmation/Rejection Advice.	
25.	Gaining CSP: **Validation**	1. The Request ID is not active 2. See Common Validations	1. 041
26.	Outcome / action	1. Gaining CSP validates the Port Withdrawal Notification and if found to be invalid will undertake an Operational Escalation to the Gaining Mobile Carrier.	

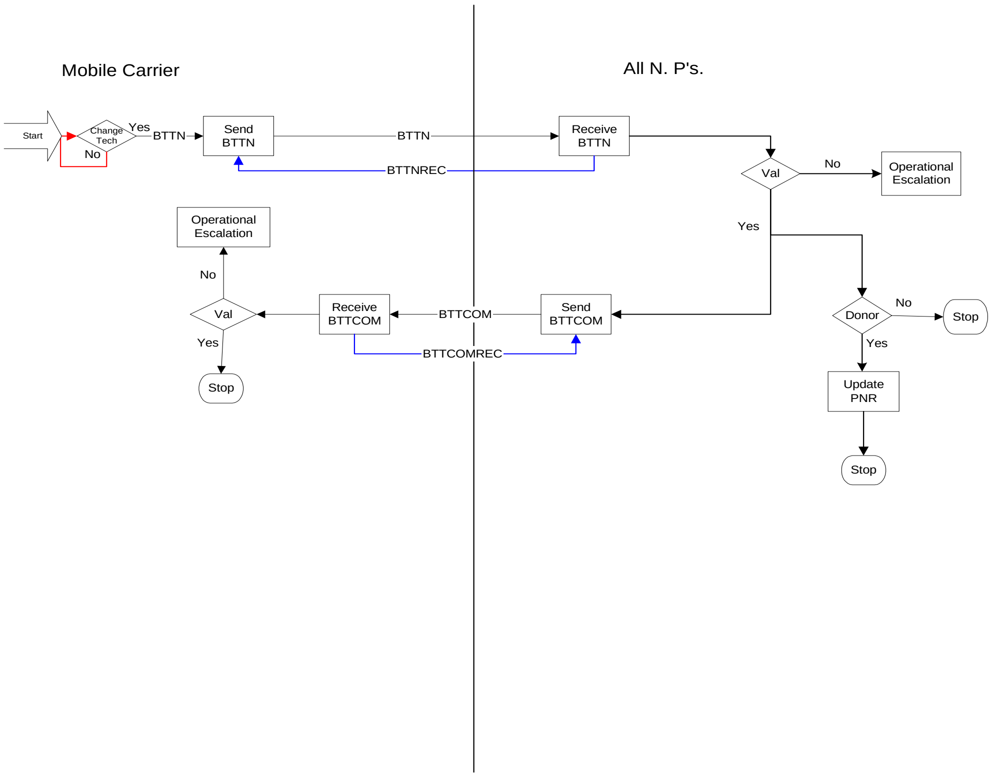
Port Expiry Notification - Table

	Process Name	Validations	Reject code
1.	Losing Mobile Carrier : **Sends Port Expiry Notification**	Trigger point	
2.	Outcome / action	1. Losing Mobile Carrier sends a Port Expiry Notification to the Gaining Mobile Carrier and the Losing CSP 30 Calendar days from the CA Authorisation Date. Where that day is not a business day the Port Expiry Notification will be sent on the next business day.	
3.	Gaining Mobile Carrier : **Receives Port Expiry Notification**	Trigger point	
4.	Outcome / action	1. Gaining Mobile Carrier sends a Port Expiry Notification Receipt Advice to the Losing Mobile Carrier within 1 minute of receipt of the Port Expiry Notification.	
5.	Gaining Mobile Carrier : **Validation**	1. See Common Validations	
6.	Outcome / action	1. Gaining Mobile Carrier validates the Port Expiry Notification and if found to be valid the Port request will be made inactive. 2. Gaining Mobile Carrier validates the Port Expiry Notification and if found to be valid will transit the Port Expiry Notification to the Gaining CSP. 3. Gaining Mobile Carrier validates the Port Expiry Notification and if found to be invalid will undertake an Operational Escalation to the Losing Mobile Carrier	
7.	Gaining CSP : **Receives Port Expiry Notification**	Trigger point	
8.	Outcome / action	1. Gaining CSP sends a Port Expiry Receipt to the Gaining Mobile Carrier within 1 minute of receipt of the Port Expiry Notification.	
9.	Gaining CSP: **Validation**	1. See Common Validations	
10.	Outcome / action	1. Gaining CSP validates the Port Expiry Notification and if found to be valid the Port request will be made inactive. 2. Gaining CSP validates the Port Expiry Notification and if found to be invalid will undertake an Operational Escalation to the Gaining Mobile Carrier.	
11.	Losing CSP : **Receives Port Expiry Notification**	Trigger point	

	Process Name	Validations	Reject code
12.	Outcome / action	Losing CSP sends an Port Expiry Notification Receipt to the Losing Mobile Carrier within 1 minute of receipt of the Expiry Notification. Once an Expiry Notification is received the Port request is made inactive.	
13.	Losing CSP: **Validation**	See Common Validations	
14.	Outcome / action	Losing CSP validates the Port Expiry Notification and if found to be valid the Port request will be made inactive. Losing CSP validates the Port Expiry Notification and if found to be invalid will undertake an Operational Escalation to the Losing Mobile Carrier.	

Technology Transfer Process Diagrams and Validations

Broadcast Technology Transfer Notification - Diagram

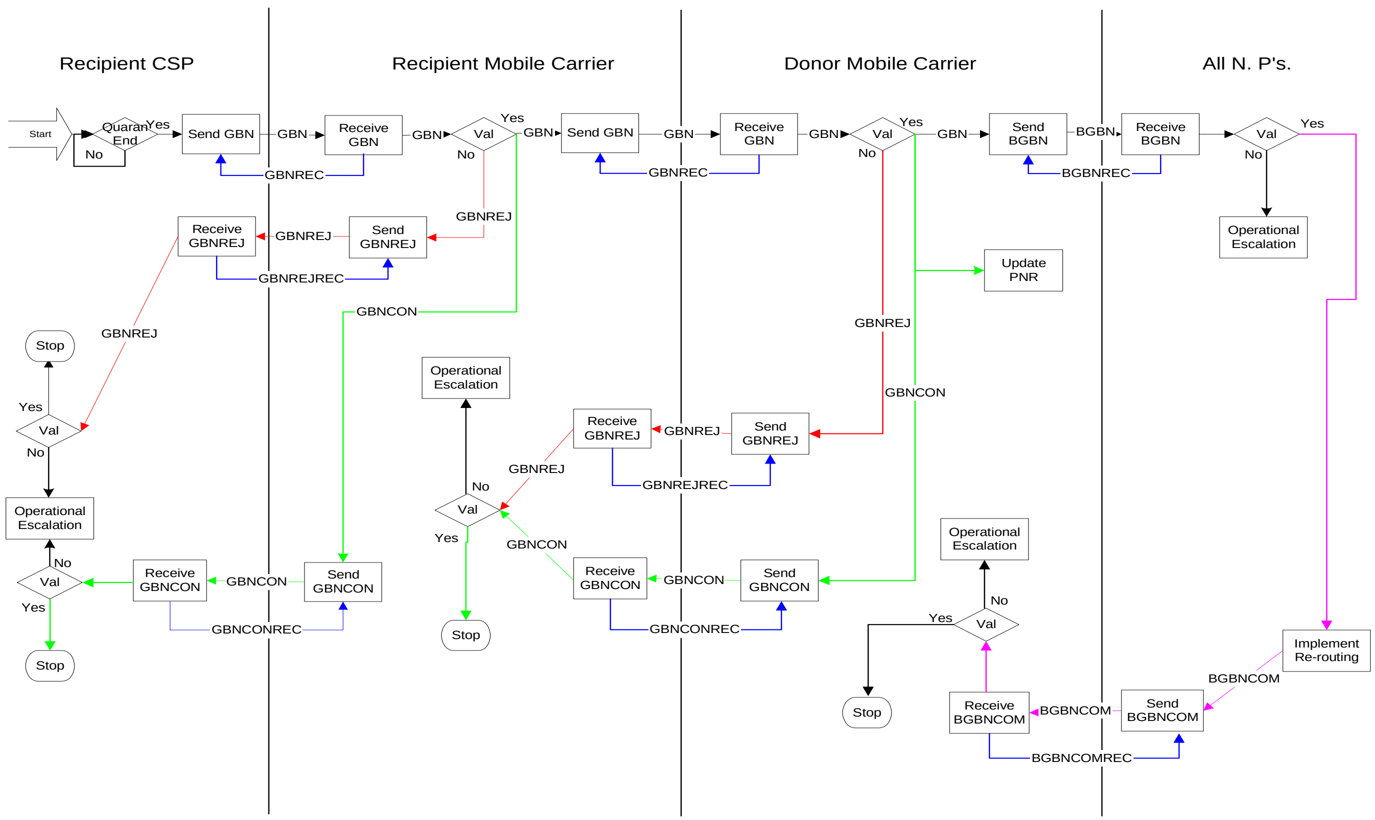


Broadcast Technology Transfer Notification - Table

	Process Name	Validations	Reject code
1.	Mobile Carrier: **Sends Broadcast Technology Transfer Notification**	Trigger Point - Change of Network Type for a given MSN	
2.	Outcome / action	1. The Mobile Carrier will send a Broadcast Technology Transfer Notification to all Network Providers up until 20 minutes prior to the end of Standard Hours of Operation. If the Broadcast Technology Transfer Notification is not sent within 20 minutes prior to the end of Standard Hours of Operation, the Mobile Carrier will send the Broadcast Technology Transfer Notification at the commencement of Standard Hours of Operation the next business day.	
3.	All Network Providers : **Receive Broadcast Technology Transfer Notification**	Trigger point	
4.	Outcome / action	1. All Network Providers send a Broadcast Technology Transfer Notification Receipt Advice to the Mobile Carrier within 1 minute of receipt of the Broadcast Technology Transfer Notification.	
5.	All Network Providers: **Validation**	1. Data attributes do not conform to data definitions.	1. 020
6.	Outcome / action	1. All Network Providers validate the Broadcast Technology Transfer Notification and if found to be valid all Network Providers will update their systems. 2. All Network Providers validate the Broadcast Technology Transfer Notification and if found to be invalid, the Network Providers will undertake an Operational Escalation.	
7.	All Network Providers : **Update Systems**	Trigger point	
8.	Outcome / action	1. All Network Providers will update their systems to record the Technology Transfer for the given MSN and then send a Broadcast Technology Transfer Notification Completion Advice back to the Mobile Carrier within 15 minutes of receipt of the Broadcast Technology Transfer Notification.	

	Process Name	Validations	Reject code
9.	Mobile Carrier: **Receives Broadcast Technology Transfer Completion**	Trigger point	
10.	Outcome / action	1. Mobile Carrier sends a Broadcast Technology Transfer Completion Receipt Advice to the Network Providers within 1 minute of receipt of the Broadcast Technology Transfer Completion Advice.	
11.	Gaining Mobile Carrier: **Validation**	1. See Common Validations	
12.	Outcome / action	1. On receiving all Broadcast Technology Transfer Notification Advices from all relevant Network Providers and if found to be valid the Technology Transfer request will be completed. 2. Mobile Carrier validates the Broadcast Technology Transfer Completion Advice and if found to be invalid will undertake an Operational Escalation to the appropriate Network Provider/s.	
13.	**Donor Updates Register**	Trigger point	
14.	Outcome / action	1. Once the Donor Mobile Carrier has updated its systems to record the Technology Transfer for the given MSN, The Donor Mobile Carrier will update its Ported Number Register.	

Give Back Diagrams and Validations



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Give Back - Table

	Process Name	Validations	Reject code
1.	Recipient CSP: **Sends Give Back Notification**	Trigger point = minimum quarantine period ended	
2.	Outcome / action	1. Recipient CSP sends a Give Back Notification to the Recipient Mobile Carrier on the next Business Day following expiry of the relevant Quarantine period.	
3.	Recipient Mobile Carrier **:Receives Give Back Notification**	Trigger point	
4.	Outcome / action	1. Recipient Mobile Carrier sends a Give Back Receipt Advice to the Recipient CSP within 1 minute of receipt of the Give Back Notification.	
5.	Recipient Mobile Carrier: **Validation**	1. The Recipient Mobile Carrier does not have the MSN on its network for the Recipient CSP 1. MSN active on Mobile Network 3. Recipient Mobile Carrier is Donor Mobile Carrier 4. See Common Validations	016 038 014
6.	Outcome / action	1. Recipient Mobile Carrier validates the Give Back Notification and if valid sends a Give Back Notification Confirmation Advice to the Recipient CSP within 5 minutes of receipt of the Give Back Notification. 2. Recipient Mobile Carrier validates the Give Back Notification and if invalid sends a Give Back Notification Rejection Advice to the Recipient CSP within 5 minutes of receipt of the Give Back Notification. 3. Recipient Mobile Carrier validates the Give Back Notification and if valid sends the Give Back Notification to the Donor Mobile Carrier for further validation within 5 minutes of receipt of the Give Back Notification.	
7.	Recipient CSP: **Receives Give Back Notification Confirmation/ Rejection**	Trigger point	
8.	Outcome / action	1. Recipient CSP sends a Give Back Notification Confirmation/Rejection Receipt Advice to the Recipient Mobile Carrier within 1 minute of receipt of the Give Back Notification Confirmation/Rejection Advice.	
9.	Recipient CSP: Validation	1. See Common Validations	

	Process Name	Validations	Reject code
10.	Outcome / action	1. The Recipient CSP must update their systems or undertake an Operational Escalation.	
11.	Recipient Mobile Carrier: **Sends Give Back Notification**	Trigger point	
12.	Outcome / action	Recipient Mobile Carrier sends a Give Back Notification to the Donor Mobile Carrier within 1 minute of receipt of the Give Back Notification.	
13.	Donor Mobile Carrier : **Receives Give Back Notification**	Trigger point	
14.	Outcome / action	1. Donor Mobile Carrier sends a Give Back Notification Receipt Advice to the Recipient Mobile Carrier within 1 minute of receipt of the Give Back Notification.	
15.	Donor Mobile Carrier : **Validation**	1. The MSN is not within the allocated number range 2. MSN not Ported 3. See Common Validations	1. 013 2. 078
16.	Outcome / action	1. Donor Mobile Carrier validates the Give Back Notification and if valid sends a Give Back Notification Confirmation Advice to the Recipient Mobile Carrier within 5 minutes of receipt of the Give Back Notification. 2. Donor Mobile Carrier validates the Give Back Notification and if valid sends Broadcast Give Back Notification to all Network Providers within 5 minutes of receipt of the Give Back Notification and update systems. 3. Donor Mobile Carrier validates the Give Back Notification and if invalid sends a Give Back Notification Rejection Advice to the Recipient Mobile Carrier within 5 minutes of receipt of the Give Back Notification.	
17.	Recipient Mobile Carrier: **Receives Give Back Notification Confirmation/ Rejection**	Trigger point	
18.	Outcome / action	1. Recipient Mobile Carrier sends a Give Back Notification Confirmation/Rejection Receipt Advice to the Donor Mobile Carrier within 1 minute of receipt of the Give Back Notification Confirmation/Rejection Advice.	
19.	Recipient Mobile Carrier: **Validation**	1. See Common Validations	

20.	Outcome / action	1. The Recipient Mobile Carrier validates the Give Back Notification Confirmation/Rejection Advice and if valid will update their systems. 2. The Recipient Mobile Carrier validates the Give Back Notification Confirmation/Rejection Advice and if invalid may undertake an Operational Escalation.	
21.	**All Network Providers:** Receive Broadcast Give Back Notification	Trigger point	
22.	Outcome / action	1. All Network Providers send a Broadcast Give Back Notification Receipt Advice to the Donor Mobile Carrier within 1 minute of receipt of the Broadcast Give Back Notification.	
23.	All Network Providers: **Validation**	1. Data attributes do not conform to data definitions.	1. 020
24.	Outcome / action	1. All Network Providers validate the Broadcast Give Back Notification and if found to be valid the Network Providers implement re-routing on their Networks. 2. All Network Providers validate the Broadcast Give Back Notification and if found to be invalid, the Network Providers will undertake an Operational Escalation.	
25.	All Network Providers: **Implement Re-routing**	Trigger point	
26.	Outcome / action	1. All Network Providers will establish Re-routing on their Networks and then send a Broadcast Give Back Notification Completion Advice back to the Donor Mobile Carrier within 15 minutes of receipt of the Broadcast Give Back Notification.	
27.	Donor Mobile Carrier: **Receives Broadcast Give Back Completion Advice**	Trigger point	
28.	Outcome / action	1. The Donor Mobile Carrier sends all Broadcast Give Back Completion Receipt Advice to the Network Providers within 1 minute of receipt of the Broadcast Give Back Completion Advice.	
29.	Donor Mobile Carrier **Validation**	1. See Common Validations	
30.	Outcome / action	1. Donor Mobile Carrier validates the Broadcast Give Back Completion Advice and if found to be valid will update its register. 2.Donor Mobile Carrier validates the Broadcast Give Back Completion Advice and if found to be invalid will undertake an Operational Escalation to the Network Provider.	
31.	**Donor Updates Register**	Trigger point	
32.	Outcome / action	1. Following the Broadcast Give Back Notification the Donor Mobile Carrier updates their Ported Number Register.	

12. XML Messaging Transaction Formats

This section defines document type descriptions (DTD) of MNP messages. All messages

The following DTD listing is the physical definition of all the logical data flows between all relevant players.

Message DTD

```
<?xml version="1.0" encoding="UTF-8"?>
<!--Port Message DTD-->
<!ELEMENT PortMessage (PortMessageHeader, CustomerIdentity, InvolvedParties)>
<!ELEMENT PortMessageHeader EMPTY>
<!ATTLIST PortMessageHeader
        MessageType CDATA #REQUIRED
        RequestID CDATA #REQUIRED
        previousRequestID CDATA #IMPLIED
        Status CDATA #REQUIRED
        RejectReasonCode CDATA #IMPLIED
        WarningCode CDATA #IMPLIED
        TargetTechnology CDATA #IMPLIED
        GiveBackReasonCode CDATA #IMPLIED
        TimeStamp CDATA #REQUIRED
>
<!ELEMENT CustomerIdentity EMPTY>
<!ATTLIST CustomerIdentity
        MSN CDATA #REQUIRED
        AccountReference CDATA #IMPLIED
        CustomerDOB CDATA #IMPLIED
        CADate CDATA #REQUIRED
>
<!ELEMENT InvolvedParties EMPTY>
<!ATTLIST InvolvedParties
        GainingCSP CDATA #IMPLIED
        GCSPStamp CDATA #IMPLIED
        GainingMC CDATA #IMPLIED
        GMCStamp CDATA #IMPLIED
        LosingMC CDATA #IMPLIED
        LosingMCStamp CDATA #IMPLIED
        LosingCSP CDATA #IMPLIED
        LCSPStamp CDATA #IMPLIED
        DonorMC CDATA #IMPLIED
        DonorMCStamp CDATA #IMPLIED
        RecipientMC CDATA #IMPLIED
        RecipientMCStamp CDATA #IMPLIED
        RecipientCSP CDATA #IMPLIED
        RecipientCSPStamp CDATA #IMPLIED
        NetworkProvider CDATA #IMPLIED
        NetworkProviderStamp CDATA #IMPLIED
        RejectingMC CDATA #IMPLIED
        RejectingCSP CDATA #IMPLIED
>
```

Sample Message Flow

Port Notification - Gaining CSP to Gaining MC


```
<?xml version="1.0" encoding="UTF-8"?>
<!DOCTYPE PortMessage SYSTEM "C:\XML\PortMessage DTD.dtd">
<PortMessage>
	<PortMessageHeader
		MessageType="PN"
		RequestID="0011200011160000000001"
		Status="INITIATE"
		TimeStamp="200011160919567"
	/>
	<CustomerIdentity
		MSN="0402123456"
		CADate="20001116"
		AccountReference="888777666"
	/>
	<InvolvedParties
		GainingCSP="0011"
		GCSPStamp="200011160919567"
	/>
</PortMessage>
```


Receipt Advice – Gaining MC to Gaining CSP


```
<?xml version="1.0" encoding="UTF-8"?>
<!DOCTYPE PortMessage SYSTEM "C:\XML\PortMessage DTD.dtd">
<PortMessage>
	<PortMessageHeader
		MessageType="PN"
		RequestID="0011200011160000000001"
		Status="RECEIPT"
		TimeStamp="200011160920102"
	/>
	<CustomerIdentity
		MSN="0402123456"
		CADate="20001116"
		AccountReference="888777666"
	/>
	<InvolvedParties
		GainingCSP="0011"
		GCSPStamp="200011160919567"
		GainingMC="0003"
		GMCStamp="200011160920102"
	/>
</PortMessage>
```

Port Notification – Gaining MC to Losing MC

```
<?xml version="1.0" encoding="UTF-8"?>
<!DOCTYPE PortMessage SYSTEM "C:\XML\PortMessage DTD.dtd">
<PortMessage>
	<PortMessageHeader
		MessageType="PN"
		RequestID="00112000111600000000 1"
		Status="INITIATE"
		TimeStamp="200011160920122"
	/>
	<CustomerIdentity
		MSN="0402123456"
		CADate="20001116"
		AccountReference="888777666"
	/>
	<InvolvedParties
		GainingCSP="0011"
		GCSPStamp="200011160919567"
		GainingMC="0003"
		GMCStamp="200011160920122"
	/>
</PortMessage>
```

Receipt Advice – Losing MC to Gaining MC

```
<?xml version="1.0" encoding="UTF-8"?>
<!DOCTYPE PortMessage SYSTEM "C:\XML\PortMessage DTD.dtd">
<PortMessage>
	<PortMessageHeader
		MessageType="PN"
		RequestID="00112000111600000000 1"
		Status="RECEIPT"
		TimeStamp="200011160920102"
	/>
	<CustomerIdentity
		MSN="0402123456"
		CADate="20001116"
		AccountReference="888777666"
	/>
	<InvolvedParties
		GainingCSP="0011"
		GCSPStamp="200011160919567"
		GainingMC="0003"
		GMCStamp="200011160920102"
	/>
</PortMessage>
```

Port Notification – Losing MC to Losing CSP


```xml
<?xml version="1.0" encoding="UTF-8"?>
<!DOCTYPE PortMessage SYSTEM "C:\XML\PortMessage DTD.dtd">
<PortMessage>
	<PortMessageHeader
		MessageType="PN"
		RequestID="0011200011160000000001"
		Status="INITIATE"
		TimeStamp="200011160921302"
	/>
	<CustomerIdentity
		MSN="0402123456"
		CADate="20001116"
		AccountReference="888777666"
	/>
	<InvolvedParties
		GainingCSP="0011"
		GCSPStamp="200011160919567"
		GainingMC="0003"
		GMCStamp="200011160920836"
		LosingMC="0002"
		LMCStamp="200011160921302"
	/>
</PortMessage>
```


Receipt Advice – Losing CSP to Losing MC


```xml
<?xml version="1.0" encoding="UTF-8"?>
<!DOCTYPE PortMessage SYSTEM "C:\XML\PortMessage DTD.dtd">
<PortMessage>
	<PortMessageHeader
		MessageType="PN"
		RequestID="0011200011160000000001"
		Status="RECEIPT"
		TimeStamp="200011160921632"
	/>
	<CustomerIdentity
		MSN="0402123456"
		CADate="20001116"
		AccountReference="888777666"
	/>
	<InvolvedParties
		GainingCSP="0011"
		GCSPStamp="200011160919567"
		GainingMC="0003"
		GMCStamp="200011160920836"
		LosingMC="0002"
		LMCStamp="200011160921455"
		LosingCSP=”0023”
		LCSPStamp=”200011160921632”
	/>
</PortMessage>
```


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Port Notification Confirmation Advice – Losing CSP to Losing MC


```
<?xml version="1.0" encoding="UTF-8"?>
<!DOCTYPE PortMessage SYSTEM "C:\XML\PortMessage DTD.dtd">
<PortMessage>
	<PortMessageHeader
		MessageType="PN"
		RequestID="00112000111600000000 1"
		Status="CONFIRMED"
		TimeStamp="200011160924751"
	/>
	<CustomerIdentity
		MSN="0402123456"
		CADate="20001116"
		AccountReference="888777666"
	/>
	<InvolvedParties
		GainingCSP="0011"
		GCSPStamp="200011160919567"
		GainingMC="0003"
		GMCStamp="200011160920836"
		LosingMC="0002"
		LMCStamp="200011160921455"
		LosingCSP=”0023”
		LCSPStamp=”200011160924751”
	/>
</PortMessage>
```


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13. Message Data Dictionary

1. All numeric fields are right justified and leading zero filled.
2. All character fields are left justified and leading and trailing blanks suppressed.

Attribute Name	**Length/ Format**	**Description**
AccountReferenceNumber	CHAR (25)	A Customer Account/Reference Number held with the Losing CSP relating to the MSN being Ported. Either Account/Reference number or Customer Date of Birth must be supplied in a Port Notification transaction.
CAAuthorisationDate	NUM (8)	The date the Customer authorised the Gaining CSP to Port their MSN. Mandatory on all messages Date format is CCYYMMDD. Example: 20000121 for 21st January 2000.
CustomerDOB	NUM (8)	Customer Date of Birth. . Either Account/Reference number or Customer Date of Birth must be supplied in a Port Notification transaction. Date format is CCYYMMDD. Example: 20000121 for 21st January 2000.
DonorMC	NUM (4)	An ID identifying the Mobile Carrier (MC) giving back the MSN. This is an industry standard 4 digit ID attached to each MCSP- e.g.0001-CWO ; 0002-TELSTRA. A list of all Australian MCs and their respective IDs is maintained by ACIF and is available on its web site-http://www.acif.org.au
DonorMCStamp	NUM (17)	The time the message was sent to the hundredth of a second. Format: CCYYMMDDHHMMSSNNN
GainingCSP	NUM (4)	An ID identifying the mobile carriage service provider (MCSP) gaining the MSN. This is an industry standard 4 digit ID attached to each MCSP- e.g. 0001-Optus; 0002-TELSTRA. A list of all Australian MCSPs and their respective IDs is maintained by ACIF and is available on its web site- http://www.acif.org.au
GainingMC	NUM (4)	An ID identifying the Mobile Carrier (MC) gaining the MSN. This is an industry standard 4 digit ID attached to each MCSP- e.g. CWO : 0001-TELSTRA, 0002. A list of all Australian MCs and their respective IDs is maintained by ACIF and is available on its web site- http://www.acif.org.au
GCSPStamp	NUM (17)	The time the message was sent to the hundredth of a second. Format: CCYYMMDDHHMMSSNNN
GiveBackReasonCode	NUM (3)	A code identifying the reason for Give Back. Required only if the MessageType is “GBN” (Give Back Notification) Options are Standard (001) or Nuisance (002)
GMCStamp	NUM (17)	The time the message was sent to the hundredth of a second. Format: CCYYMMDDHHMMSSNNN

Attribute Name	**Length/ Format**	**Description**
LCSPStamp	NUM (17)	The time the message was sent to the hundredth of a second. Format: CCYYMMDDHHMMSSNNN
LMCStamp	NUM (17)	The time the message was sent to the hundredth of a second.Format: CCYYMMDDHHMMSSNNN
LosingCSP	NUM (4)	An ID identifying the mobile carriage service provider (MCSP) losing the MSN. This is an industry standard 4 digit ID attached to each MCSP- e.g. 0001-Optus; 0002-TELSTRA. A list of all Australian MCSPs and their respective IDs is maintained by ACIF and is available on its web site-http://www.acif.org.au.
LosingMC	NUM (4)	An ID identifying the Mobile Carrier (MC) losing the MSN. This is an industry standard 4 digit ID attached to each MCSP- e.g. 0001-CWO ; 0002-TELSTRA. A list of all Australian MCs and their respective IDs is maintained by ACIF and is available on its web site-http://www.acif.org.au
MessageType	CHAR (9)	The porting message type abbreviation. See port message abbreviation table. Mandatory on all messages.
MSN	NUM (10)	Mobile service (telephone) number (MSN) involved in a porting transaction. Mandatory on all messages. Example: 0412123456
NetworkProvider	NUM (4)	An ID identifying the Network Provider that participated in the Port by altering its routing tables. This is an industry standard 4 digit ID attached to each NP- e.g. 0001-CWO ; 0002-TELSTRA. A list of all Australian NPs and their respective IDs is maintained by ACIF and is available on its web site-http://www.acif/org.au
NPStamp	NUM (17)	The time the message was sent to the hundredth of a second.Format: CCYYMMDDHHMMSSNNN
PreviousRequestID	NUM(21)	An existing unique system generated numeric identifier, which is used in a Port Reversal transaction to identify the invalid Port for a given MSN. Where the Previous Request ID is provided the Account/Reference Number and Date of Birth fields must be blank. Format: CSPID = 4 digits, Date = 8 digits (CCYYMMDD), Number = 9 digits. Example: 000120001113000000001
RCSPStamp	NUM (17)	The time the message was sent to the hundredth of a second. Format: CCYYMMDDHHMMSSNNN
RecipientMC	NUM (4)	An ID identifying the current Mobile Carrier (MC) holding the MSN. This is an industry standard 4 digit ID attached to each MCSP- e.g.0001-CWO; 0002-TELSTRA. A list of all Australian MCs and their respective IDs is maintained by ACIF and is available on its web site-http://www.acif.org.au

Attribute Name	Length/ Format	Description
RecipientMCStamp	NUM (17)	The time the message was sent to the hundredth of a second. Format: CCYYMMDDHHMMSSNNN
RecipientCSP	NUM (4)	An ID identifying the mobile carriage service provider (MCSP) holding the MSN. This is an industry standard 4 digit ID attached to each MCSP- e.g. 0001-CWO ; 0002-TELSTRA. A list of all Australian MCSPs and their respective IDs is maintained by ACIF and is available on its web site- http://www.acif.org.au
RecipientCSPStamp	NUM (17)	The time the message was sent to the hundredth of a second. Format: CCYYMMDDHHMMSSNNN
RejectingCSP	NUM (4)	An ID identifying the mobile carriage service provider (MCSP) which sent the rejection message. This is an industry standard 4 digit ID attached to each MCSP- e.g. 0001-Optus; 0002-TELSTRA. A list of all Australian MCSPs and their respective IDs is maintained by ACIF and is available on its web site- http://www.acif.org.au.
RejectingMC	NUM (4)	An ID identifying the Mobile Carrier (MC) which sent the rejection message. This is an industry standard 4 digit ID attached to each MCSP- e.g. 0001-CWO ; 0002-TELSTRA. A list of all Australian MCs and their respective IDs is maintained by ACIF and is available on its web site http://www.acif.org.au.
RejectReasonCode	NUM (3)	A code identifying the reason for rejection of a port request. Required only if Status is "REJECTED" A list of all possible reject reason codes is available in Appendix B -Reject Codes
RequestID	NUM(21)	A unique system generated numeric identifier created by the originating computer system, which is used in all porting transactions associated with a Mobile Service Number. Mandatory on all messages. Format: CSPID = 4 digits, Date = 8 digits (CCYYMMDD), Number = 9 digits. Example: 000120001113000000001
RMCStamp	NUM (17)	The time the message was sent to the hundredth of a second.Format: CCYYMMDDHHMMSSNNN
Status	CHAR(9)	The status associated with the porting message. See port message status list in Appendix C Code Sets. Mandatory on all messages.
TargetTechnology	CHAR(5)	A code identifying the target technology for the port
TimeStamp	NUM(17)	The time the message was sent to the hundredth of a second. Mandatory on all messages. Format: CCYYMMDDHHMMSSNNN
WarningCode	NUM(3)	A code sent from a Mobile Carrier to its CSP to undertake further validation. See list in Appendix C Code Sets.

Appendix I Maximum Transaction Response Times

Transaction	Direction of Transaction	Maximum response time
Port Notification		
Port Notification	GCSP to GMC	5 Minutes
Port Notification	GMC to LMC	5 Minutes
Port Notification	LMC to LCSP	5 Minutes
Port Notification Confirmation	LCSP to LMC	15 Minute
Port Notification Confirmation transit	LMC to GMC	1 Minute
Port Notification Confirmation transit	GMC to GCSP	1 Minute
Port Notification Rejection	GMC to GCSP	5 Minutes
Port Notification Rejection	LMC to GMC	5 Minutes
Port Notification Rejection	LCSP to LMC	15 Minutes
Port Notification Rejection transit	LMC to GMC	1 Minute
Port Notification Rejection transit	GMC to GCSP	1 Minute

Port Cutover Notification		
Port Cutover Notification	GCSP to GMC	5 Minutes
Port Cutover Notification	GMC to LMC	1 Minute
Port Cutover Notification	LMC to LCSP	5 Minutes
Port Cutover Notification Rejection	GMC to GCSP	1 Minute
Port Cutover Notification Rejection	LMC to GMC	5 Minutes
Port Cutover Notification Rejection	LCSP to LMC	15 Minutes
Port Cutover Notification Rejection transit	LMC to GMC	1 Minute
Port Cutover Notification Rejection transit	GMC to GCSP	1 Minute
Port Cutover Notification Confirmation	LMC to GMC	5 Minutes
Port Cutover Notification Confirmation	LCSP to LMC	15 Minutes
Port Cutover Notification Confirmation transit	LMC to GMC	1 Minute
Port Cutover Notification Confirmation transit	GMC to LMC	1 Minute
Port Cutover Notification Confirmation transit	GMC – GCSP	1 Minute
Broadcast Port Cutover Notification	GMC to NPs	2 hours (Note: Within 2 hours of the Port Cutover Confirmation being received from the LMC)
Broadcast Port Cutover Completion Advice	NPs to GMC	15 Minutes from receipt of BN
Port Cutover Completion Advice	GMC to GCSP	1 Minute
Port Cutover Completion Advice	LMC to LCSP	1 Minute

Port Withdrawal Notification		
Port Withdrawal Notification	GCSP to GMC	1 hour (1 hour from receipt of Customer's instruction to cancel Port Request)
Port Withdrawal Notification	GMC to LMC	5 Minutes
Port Withdrawal Notification	LMC to LCSP	5 Minutes
Port Withdrawal Notification Rejection	GMC to GCSP	5 Minutes
Port Withdrawal Notification Rejection	LMC to GMC	5 Minutes
Port Withdrawal Notification Rejection	LCSP to LMC	15 Minutes
Port Withdrawal Notification Rejection transit	LMC to GMC	1 Minute
Port Withdrawal Notification Rejection transit	GMC to GCSP	1 Minute
Port Withdrawal Notification Confirmation	LCSP to LMC	15 Minutes
Port Withdrawal Notification Confirmation transit	LMC to GMC	1 Minute
Port Withdrawal Notification Confirmation transit	GMC to GCSP	1 Minute

Port Expiry Notification		
Port Expiry Notification	LMC – GMC	5 Minutes
Port Expiry Notification	GMC – GCSP	1 Minute
Port Expiry Notification	LMC to LCSP	5 Minutes

Give Back Notification		
Give Back Notification	RCSP to RMC	5 Minutes
Give Back Notification	RMC to DMC	5 Minutes
Give Back Notification Confirmation Advice	RMC to RCSP	5 minutes
Give Back Notification Rejection Advice	RMC - RCSP	5 minutes
Give Back Notification Confirmation Advice	DMC - RMC	5 minutes
Give Back Notification Rejection Advice	DMC to RMC	5 minutes
Broadcast Give Back Notification	DMC to NPs	5 Minutes
Broadcast Give Back Completion Advice	NPs to DMC	15 Minutes

Appendix II Reject Codes

	Reject Reason	Code
1.	Not an MSN	001
2.	MSN not Issued	003
3.	Port in progress	008
4.	MSN not allocated to a Mobile Carrier	013
5.	Recipient Mobile Carrier is the Donor Mobile Carrier	014
6.	MSN not held	016
7.	MSN not associated with Account/Reference Number	017
8.	Data attributes do not conform to Data Definitions	020
9.	Request ID not confirmed and active	035
10.	MSN active on Network	038
11.	Request ID not Active	041
12.	Request ID not valid for Reversal	048
13.	Service is currently with the Gaining Mobile Carrier	052
14.	Account/Reference Number or Date of Birth not held	058
15.	Port Message Type out of sequence	059
16.	Invalid CA Authorisation Date	067
17.	MSN not associated with Date of Birth	070
18.	MSN not associated with Previous Request ID	071
19.	Request ID not unique	077
20.	MSN not Ported	078

Appendix III Codes Sets

Message Type

Message Type ID	**Description**
PN	Port Notification
PCN	Port Cutover Notification
PCCOM	Port Cutover Completion Advice
BPCN	Broadcast Port Cutover Notification
PWN	Port Withdrawal Notification
GBN	Give Back Notification
BGBN	Broadcast Give Back Notification
BGBCOM	Broadcast Give Back Completion Advice
PEN	Port Expiry Notification
BTTN	Broadcast Technology Transfer Notification
BTTCOM	Broadcast Technology Transfer Completion Advice

Refer to ACIF Website for current list. The list is current as of [to be inserted]

Valid Transaction Status

Transaction Status must always be in upper case

Status Types
INITIATED
CONFIRMED
REJECTED
COMPLETED
RECEIPT

Porting Message Construction

Message	Abbrev	Message Type	Status
Broadcast Give Back Notification	BGBN	BGBN	INITIATED
Broadcast Give Back Notification Completion	GBNCON	BGBN	CONFIRMED
Broadcast Port Cutover Completion Advice	BPCCOM	BPCCOM	COMPLETED
Broadcast Port Cutover Notification	BPCN	BPCN	INITIATED
Broadcast Technology Transfer Completion Advice	BTTCOM	BTTCOM	COMPLETED
Broadcast Technology Transfer Notification	BTTN	BTTN	INITIATED
Give Back Notification	GBN	GBN	INITIATED
Give Back Notification Confirmation Advice	GBNCON	GBN	CONFIRMED
Give Back Notification Rejection Advice	GBNREJ	GBN	REJECTED
Port Cutover Completion Advice	PCCOM	PCCOM	COMPLETED
Port Cutover Notification	PCN	PCN	INITIATED
Port Cutover Notification Confirmation Advice	PCNCON	PCN	CONFIRMED
Port Cutover Notification Rejection Advice	PCNREJ	PCN	REJECTED
Port Expiry Notification	PEN	PEN	INITIATED
Port Notification	PN	PN	INITIATED
Port Notification Confirmation Advice	PNCON	PN	CONFIRMED
Port Notification Rejection Advice	PNREJ	PN	REJECTED
Port Withdrawal Notification	PWN	PWN	INITIATED
Port Withdrawal Notification Confirmation	PWNCON	PWN	CONFIRMED
Port Withdrawal Notification Rejection	PWNREJ	PWN	REJECTED
Receipt Advice	RA	BGBN BPCN BTTCOM BTTN GBN PCCOM PCN PEN PN PWN	RECEIPT

Give Back Reason Codes

Give Back Reason Code	Explanation
001	Standard
002	MSN Cancelled due to nuisance calls

Warning Codes

Warning Code	Explanation
WC1	MSN not active on LMC Network

Mobile Carriers

The Code Set for Mobile Carriers is maintained by ACIF and is available on its web site - http://www.acif.org.au.

Mobile Carriage Service Providers

The Code Set for Mobile CSPs is maintained by ACIF and is available on its web site - http://www.acif.org.au.

Network Providers

The Code Set for Mobile NPs is maintained by ACIF and is available on its web site - http://www.acif.org.au.

Target Technology Codes

The Code Set for Target Technology is maintained by ACIF and is available on its web site - http://www.acif.org.au..

Appendix IV - Definition Mapping

Ops Code Definitions	IT Spec Definitions	IT Spec Acronyms
Port Notification	**Port Notification**	
Port Notification	Port Notification	PN
Port Notification Receipt Advice	Port Notification Receipt Advice	PNREC
Port Notification Confirmation	Port Notification Confirmation Advice	PNCON
Port Notification Confirmation Receipt Advice	Port Notification Confirmation Receipt Advice	PBCONREC
Port Notification Rejection	Port Notification Rejection Advice	PNREJ
Port Notification Rejection Receipt Advice	Port Notification Rejection Receipt Advice	PNREJREC
Port Cutover Notification	**Port Cutover Notification**	
Port Cutover Notification	Port Cutover Notification	PCN
Port Cutover Notification Receipt Advice	Port Cutover Notification Receipt Advice	PCNREC
Port Cutover Confirmation	Port Cutover Notification Confirmation Advice	PCNCON
Port Cutover Confirmation Receipt Advice	Port Cutover Notification Confirmation Receipt Advice	PCNCONREC
Port Cutover Rejection	Port Cutover Notification Rejection Advice	PCR
Port Cutover Rejection Receipt Advice	Port Cutover Notification Rejection Receipt Advice	PCRREC
Broadcast Notification	**Broadcast Port Cutover Notification**	
Broadcast Notification	Broadcast Port Cutover Notification	BPCN
Broadcast Notification Receipt Advice	Broadcast Port Cutover Notification Receipt Advice	BPCNREC
Broadcast Completion Advice	Broadcast Port Cutover Completion Advice	BPCCOM
Broadcast Completion Receipt Advice	Broadcast Port Cutover Completion Receipt Advice	BPCCOMREC
Port Completion Advice	Port Cutover Completion Advice	PCCOM
Port Completion Advice Receipt Advice	Port Cutover Completion Receipt Advice	PCCOMREC

Ops Code Definitions	IT Spec Definitions	IT Spec Acronyms
Withdrawal Notification	**Port Withdrawal Notification**	
Withdrawal Notification	Port Withdrawal Notification	PWN
Withdrawal Notification Receipt Advice	Port Withdrawal Notification Receipt Advice	PWNREC
Withdrawal Confirmation	Port Withdrawal Notification Confirmation	PWNCON
Withdrawal Confirmation Receipt Advice	Port Withdrawal Notification Confirmation Receipt Advice	PWNCONREC
Withdrawal Rejection	Port Withdrawal Notification Rejection	PWNEJ
Withdrawal Rejection Receipt Advice	Port Withdrawal Notification Receipt Advice	PWNREC
Expiry Notification	**Port Expiry Notification**	
Expiry Notification	Port Expiry Notification	PEN
Expiry Notification Receipt Advice	Port Expiry Notification Receipt Advice	PENREC
Give Back Notification	**Give Back Notification**	
Give Back Notification	Give Back Notification	GBN
Give Back Notification Receipt Advice	Give Back Notification Receipt Advice	GBNREC
Give Back Confirmation Advice	Give Back Notification Confirmation Advice	GBNCON
Give Back Confirmation Receipt Advice	Give Back Notification Confirmation Receipt Advice	GBNCONREC
Give Back Rejection Advice	Give Back Notification Rejection Advice	GBNREJ
Give Back Rejection Receipt Advice	Give Back Notification Rejection Receipt Advice	GBNREJREC
Broadcast Give Back Notification	**Broadcast Give Back Notification**	
Broadcast Give Back Notification	Broadcast Give Back Notification	BGBN
Broadcast Give Back Notification Receipt Advice	Broadcast Give Back Receipt Advice	BGBNREC
Give Back Completion	Broadcast Give Back Notification Completion Advice	BGBNCOM
Give Back Completion Receipt Advice	Broadcast Give Back Completion Receipt Advice	BGBNCOMREC

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Ops Code Definitions	**IT Spec Definitions**	**IT Spec Acronyms**
N/A	**Broadcast Technology Transfer Notification**	
NOT IN CODE	Broadcast Technology Transfer Notification	BTTN
NOT IN CODE	Broadcast Technology Transfer Receipt Advice	BTTREC
NOT IN CODE	Broadcast Technology Transfer Completion Advice	BTTCOM
NOT IN CODE	Broadcast Technology Transfer Completion Receipt Advice	BTTCOMREC

Appendix V MNP Operations Code Definitions

Please note that Section references within these definitions apply to the MNP Code, and not this Specification

Act means the Telecommunications Act 1997.
Broadcast Completion Advice means an electronic advice sent from the recipient to the Gaining Mobile Carrier to confirm that they have received and processed a Broadcast Notification in accordance with Section 5 to initiate a Port.
Broadcast Give Back Notification means an electronic advice sent from the Donor Mobile Carrier to the Network Providers or Portability Service Suppliers, to advise them to implement a return of the MSN to the Donor Mobile Carrier in their network and operating systems.
Broadcast Notification means an electronic notification sent from the Gaining Mobile Carrier to other Network Providers or Portability Service Suppliers to advise them to implement a Port.
Business Day means any day from Monday to Saturday (inclusive) other than a day which is gazetted or otherwise declared or made a National Public Holiday in all States of Australia and the Australian Capital Territory and the Northern Territory, or as otherwise agreed on a bilateral basis between CSPs.
Cancelled is when the contract for the use of an MSN which has been Issued to a Customer has been terminated.
Carriage Service Provider has the same meaning as in the Act.
Carrier has the same meaning as in the Act.
CSP ID means an identification code allocated to a CSP. NOTE: It is expected that CSP IDs will be recorded in an ACIF Data Dictionary.
Customer Authorisation means an authorisation by the Customer or their agent to Port an MSN containing the minimum requirements specified in Section 7.
Customer means a person to whom an MSN is Issued.
Donor CSP means the CSP to which an MSN has been allocated under the Numbering Plan.
Donor Mobile Carrier means the Mobile Carrier to which a block of MSNs allocated to a Donor CSP is assigned for call routing purposes.
Expiry Notification means an electronic notification sent from the Losing Mobile Carrier to the Gaining Mobile Carrier and Losing CSP that an accepted Port Notification has expired in accordance with Section 5. The Gaining
Gaining CSP means the CSP to which an MSN has been or is to be Ported.
Gaining Mobile Carrier means the Mobile Carrier whose Network will be used by the Gaining CSP for the termination of calls to the MSN which has been or is to be Ported.
Give Back Completion means an electronic advice sent from all parties who receive a Broadcast Give Back Notification to the Donor Mobile Carrier to advise that they have implemented a return of the MSN to the Donor Mobile Carrier in their network and operating systems.
Give Back means the return of a Ported MSN from a Recipient CSP to the Donor CSP in accordance with Section 6.
Give Back Notification Confirmation Advice (DMC-RMC) means an electronic confirmation sent by the Donor Mobile Carrier to the Recipient Mobile Carrier in response to a Give Back Notification indicating that the Give Back has been accepted on the basis of the validation criteria described in Section 6.
Give Back Notification Confirmation Advice (RMC-RCSP) means an electronic confirmation sent by the Recipient Mobile Carrier to the Recipient CSP in response to a Give Back Notification indicating that the Give Back has been accepted on the basis of the validation criteria described in Section 6.
Give Back Notification means an electronic advice sent from the Recipient CSP to the Donor CSP via the Recipient Mobile Carrier and Donor Mobile Carrier to notify that the MSN is to be returned to the Donor CSP.

Give Back Notification Rejection Advice (DMC-RMC) means an electronic rejection sent by the Donor Mobile Carrier to the Recipient Mobile Carrier in response to a Give Back Notification indicating that the Give Back has been rejected on the basis of the validation criteria described in Section 6.
Give Back Notification Rejection Advice (RMC-RCSP) means an electronic rejection sent by the Recipient Mobile Carrier to the Recipient CSP in response to a Give Back Notification indicating that the Give Back has been rejected on the basis of the validation criteria described in Section 6.
Give Back Request ID means a unique identifier generated by the Recipient CSP which is used in all Give Back transactions associated with a particular Give Back of an MSN to the Donor Mobile Carrier.
Issued means when a Customer is informed by a Mobile CSP of the MSN(s) to be used in conjunction with a mobile service and the Customer has a contractual agreement with that Mobile CSP for the use of that MSN(s). NOTE: MSNs that have been reserved under a contractual agreement are regarded as Issued MSNs.
Losing CSP means the CSP from which an MSN has been or is to be Ported.
Losing Mobile Carrier means the Mobile Carrier whose network is currently used by the Losing CSP for the termination of calls to an MSN which has been or is to be Ported.
MNP Operations Manual means a document intended to be published by ACIF, and which will outline the processes and escalation procedures between industry participants involved in Porting.
Mobile Carriage Service Provider means a party who provides a Public Mobile Telecommunications Service to a Customer. Mobile CSPs have a contractual, including billing, relationship with the Customer and, directly or indirectly, with a Mobile Carrier.
Mobile Carrier means a Carrier that operates a Mobile Network. Mobile Carrier must send the Expiry Notification to the Gaining CSP on receipt of this advice from the Losing Mobile Carrier.
Mobile Network means the facilities operated by a Carrier for the purposes of providing Public Mobile Telecommunications Services.
Mobile Number Portability means the Porting of MSN(s), from a Losing CSP to a Gaining CSP, or from one Mobile Carrier to another Mobile Carrier.
Mobile Service Number means a number that has been allocated under the Numbering Plan to a CSP for the provision of a Public Mobile Telecommunications Service. Although all allocated MSNs used for a Public Mobile Telecommunications Service are Portable, only those numbers Issued to the Customer are able to be Ported by the Customer.
National Public Holiday means New Year’s Day, Australia Day, Good Friday, Easter Day (i.e. Easter Sunday), ANZAC Day and Christmas Day.
Network means a Carrier’s or CSP’s system, or series of systems, that carries, or is capable of carrying communications by means of guided or unguided electromagnetic energy.
Network Provider means an OASD, a TrSD or a PSD.
Numbering Plan means the Telecommunications Numbering Plan 1997.
Originating Access Service Deliverer means a CSP that provides outgoing services that connect Customers to other telecommunications services.
Port Completion Advice (GMC *&63) means an electronic advice sent from the Gaining Mobile Carrier to the Gaining CSP to confirm that they have sent a Broadcast Notification in accordance with Section 5 to initiate a Port.
Port Completion Advice (LMC /&63) means an electronic advice sent from the Losing Mobile Carrier to the Losing CSP to confirm that they have received and processed a Broadcast Notification in accordance with Section 5 to initiate a Port.
Port Cutover Confirmation means an electronic confirmation sent to the Gaining Mobile Carrier by the Losing Mobile Carrier indicating that the Port Cutover Notification has been accepted on the basis of the validation criteria described in Section 5.
Port Cutover Notification means an electronic notification that is submitted by the Gaining CSP to initiate a Port. A Port Cutover Notification is sent to the Gaining Mobile Carrier then the Losing Mobile Carrier for validation on the basis of the criteria described in Section 5.

Port Cutover Rejection means an electronic rejection sent to the Gaining Mobile Carrier by the Losing Mobile Carrier indicating that a Port Cutover Notification has been rejected on the basis of the validation criteria described in Section 5.

Port means the transfer of MSNs between CSPs, or Mobile Carriers, using MNP processes. The words Porting and Ported have corresponding meanings.

Port Notification Confirmation means an electronic confirmation sent to the Gaining CSP by the Losing CSP via the Losing Mobile Carrier and Gaining Mobile Carrier in response to a Port Notification indicating that the Port Notification has been accepted on the basis of the validation criteria described in Section 5.

Port Notification means an electronic notification which is submitted by the Gaining CSP to initiate the validation of a Port request. A Port Notification is sent to the Gaining Mobile Carrier then the Losing Mobile Carrier and then to the Losing CSP for validation on the basis of the criteria described in Section 5.

Port Notification Rejection means an electronic rejection sent to the Gaining CSP by the party who rejected the Port Notification on the basis of the validation criteria described in Section 5. This must be sent via the Losing Mobile Carrier and Gaining Mobile Carrier.

Port Request ID means a unique identifier generated by the Gaining CSP which is used in all subsequent Porting transactions associated with a particular Port of an MSN.

Portability Service Supplier means a Carrier or CSP or their agent who provides supporting services to Carriers and/or Carriage Service Providers in the provision and operation of MNP. For example, Port administration services, Ported number reference databases and network services for call routing.

Ported Number Register means a register of Portable MSNs as required under the Numbering Plan.

Previous CSP means the CSP from which a MSN has been Ported and now initiates a Reversal on the authorisation from the Customer. The Previous CSP would have been the Losing CSP in the original Port transaction and will become the Gaining CSP in the Reversals transaction.

Prime Service Deliverer means in respect of a Standard Telephone Service, the service deliverer selected by the Customer for the carriage of all pre-selectable calls originating from that Standard Telephone Service.

Public Mobile Telecommunications Service has the meaning given by the Act.

Quarantine means the status of an MSN that has been Issued to a Customer and has been Cancelled, and is not to be Issued again except under circumstances provided for under the Numbering Plan as varied by Section 6 of this Industry Code.

Receipt Advice means an electronic advice sent by a party who has received a Port transaction to the party from whom they received the transaction to confirm delivery of the transaction.

Recipient CSP means the CSP holding an MSN which has been Ported.

Recipient MC means the Mobile Carrier whose network is currently used by the Recipient CSP for the termination of calls to an MSN which has been Ported. NOTE: ACIF intends publishing an Industry Guideline about the registers of Ported MSNs.

Related Services means a services which is associated with the primary MSN, but uses another number which has been Issued to the Customer. For example fax and data services.

Reversal means a Port back to the Previous CSP to rectify an unauthorised Port.

Standard Hours of Operation means 8 a.m. to 8 p.m. (Standard Time) from Monday to Friday, and 10 a.m. to 6 p.m. (Standard Time) on Saturday, unless otherwise agreed between CSPs on a bilateral basis.

Standard Telephone Service has the meaning given by Section 6 of the Telecommunications Consumer Protection & Services Standards Act 1999.

Standard Time means: (a) Australian Eastern Standard Time (GMT plus 10 hours): or (b) if Eastern Daylight Saving Time (GMT plus 11 hours) is in effect and when any eastern seaboard State has introduced Daylight Saving Time, at that time.

Transfer means the move of an MSN from one CSP to another but using the same Mobile Carrier. This move may involve a change of Network.

Transit Service Deliverer means a CSP that connects or interconnects with other CSPs.
Withdrawal Notification Confirmation means an electronic confirmation sent to the Gaining CSP from the Losing CSP via the Gaining Mobile Carrier and Losing Mobile Carrier indicating that the Withdrawal Notification has been accepted in accordance with the validation criteria described in Section 5.
Withdrawal Notification means an electronic notification initiated by the Gaining CSP to cancel a confirmed and active Port Notification prior to a Port Cutover Notification or Expiry Notification. A Withdrawal Notification will be sent via the Gaining Mobile Carrier and the Losing Mobile Carrier to the Losing CSP and will be validated in accordance with Section 5 .
Withdrawal Notification Rejection means an electronic rejection sent to the Gaining CSP from the Losing CSP via the Gaining Mobile Carrier and Losing Mobile Carrier indicating that a Withdrawal Notification has been rejected in accordance with the validation criteria described in Section 5.

Appendix E - The Existing MNPS Architecture

The following MNPS Business Reference Data outline the contents of the existing MNPS' Database Tables:

T201_Carrier

CARRIER_ID	CARRIER_CODE	CARRIER_DESC	EFFECTIVE_FROM_DATE	EFFECTIVE_TO_DATE	MOBILE_CARRIER_IND	TERMINATING_ACCESS_CODE
0001	OPT	Cable & Wireless Optus	01-JAN-2001	31-DEC-9999	T	1456
0002	TEL	Telstra	01-JAN-2001	31-DEC-9999	T	1411
0003	AAP	AAPT	01-JAN-2001	31-DEC-9999	F	1469
0014	HUT	Hutchison Telecoms (Orange)	01-JAN-2001	31-DEC-9999	T	1425
0084	0084	Vodafone Pacific Ltd	01-JAN-2001	31-DEC-9999	T	1415
0083	CON	Concentrix	01-JAN-2001	31-DEC-9999	F	
0092	PDO	Paradigm One	01-JAN-2001	31-DEC-9999	F	
1010	LEA1	Law Enforcement Agency 1	01-JAN-2001	31-DEC-9999	F	

T013_Technology_Type

TECHNOLOGY_TYPE_CODE	TECHNOLOGY_TYPE_SHORT_N	TECHNOLOGY_TYPE_DESC
001	GSM	GSM
002	CDMA	CDMA
003	UMTS	UMTS (3rd generation mobile)

T016_Carrier_Nbr_Range

NBR_RANGE_START	NBR_RANGE_END	TECHNOLOGY_TYPE_CODE	CARRIER_ID
0417000000	0417999999	001	0002
0418000000	0418999999	001	0002
0419000000	0419999999	001	0002
0407000000	0407999999	001	0002
0408000000	0408999999	001	0002
0409000000	0409999999	001	0002
0438000000	0438999999	001	0002
0439000000	0439999999	001	0002
0427000000	0427999999	002	0002
0428000000	0428999999	002	0002
0429000000	0429999999	002	0002
0411000000	0411999999	001	0001
0412000000	0412999999	001	0001
0413000000	0413999999	001	0001
0401000000	0401999999	001	0001
0402000000	0402999999	001	0001
0403000000	0403999999	001	0001
0414000000	0414999999	001	0084
0415000000	0415999999	001	0084
0416000000	0416999999	001	0084
0404000000	0404999999	001	0084
0405000000	0405999999	001	0084
0400000000	0400999999	001	0002
0424000000	0424099999	002	0003
0424400000	0424499999	002	0003
0424600000	0424699999	002	0003
0425000000	0425999999	002	0014
0421000000	0421999999	001	0001
0422000000	0422999999	001	0001
0410000000	0410999999	001	0084

T202_Carriage_Service_Provider

CSP_ID	CSP_CODE	CSP_DESC	SP_ID
0001	OPT	Cable & Wireless Optus	OPTUS
0002	TEL	Telstra	MNET
0003	AAP	AAPT	CELAR
0004	GLO	Global One	
0005	WOX	WorldxChange	WXL
0006	PRM	Primus Telecommunications	PRMUS
0007	SPG	PowerTel	
0008	RSL	RSL Com (1)	RSLCM
0009	NOR	Northgate	
0010	ONE	One.Tel	NRGON
0011	CAV	Caveo	
0012	WCM	MCI WorldCom	
0013	TFI	Telstra Five	
0014	HUT	Hutchison Telecoms	HUTCH
0015	KDD	KDD	KDD
0016	RSC	RSL Com (2)	
0017	PGE	Pacific Gateway Exchange	
0018	IHU	IHUG (Internet Group Ltd)	
0019	EIS	EISA	
0020	AOZ	Aozitel	
0021	PRO	Prodigy Coms	
0022	NEW	Newtel Net	
0023	ONT	One.Tel Ltd (2)	
0024	FIN	Finkelp	
0025	FLO	FLOW Communications	
0026	IIT	Chime Communications (formerly iiTel Pty Ltd)	
0027	ALT	Alterna	
0028	ACT	TransACT	
0029	IPT	IPTEL	
0030	DAV	Southern Cross Telco (formerly Davnet)	DAVNT
0031	VIV	VivaNET	
0032	DIN	Dingo Blue	
0033	ACA	ACAY	
0034	OCE	Oceana	
0035	SMI	SMI Telecom	
0036	NOM	Nomad	NOMAD
0037	TOT	Totaltel	
0038	AUS	Austcomm	
0039	BTA	BT Australia	
0040	CBD	CBD Information Technology	
0041	CIT	CITEC	
0042	COR	CorpTel	

CSP_ID	CSP_CODE	CSP_DESC	SP_ID
0043	ECL	Eclipse	
0044	MAC	Macquarie Corp Telecoms	
0045	MER	Meridan Communications	
0046	PAT	Pahth Telecommunications	PAHTH
0047	QAI	QAI – Southern Cross Telco	
0048	QIC	QICC Pty Ltd	
0049	SAT	Saturn Global	
0050	DYN	Dynamic Bell	
0051	UNI	Unifi Communication Australia	
0052	UUN	Uunet	
0053	NEC	NEC	
0054	PIN	Pacific Internet	
0055	NET	Netspace Networks Pty Ltd	
0056	NTG	National Telecoms Group Limited	
0057	ALW	AlwaysOnline Pty Ltd (formerly Firstlink IS Pty Ltd)	
0058	ISP	ISP Limited	
0059	PSI	PSINet Australia Pty Ltd	
0060	VNT	Vianet Communications	
0061	HWY	Highway 1	
0062	NTY	Netway Pty Ltd	
0063	SEN	SENet	
0064	AGL	Agile Pty Ltd	
0065	CHT	Chariot	
0066	GBD	Global Dial	
0067	PRI	Primus (2nd ARM)	
0068	AOL	Asia Online Australia	
0069	CTL	Cable| & Telecoms Ltd	
0070	DAT	Datafast Telecommunications	
0071	DTA	Datasource Network Australia Limited	
0072	MUL	Multelink Australia Pty Ltd	
0073	UEC	Uecomm Pty Ltd	
0074	ACC	Access Net Internet Services	
0075	XYZ	XYZed Limited	
0076	RDS	Request DSL	
0077	OMN	Omni Plus Pty Ltd	
0078	INT	Internex Australia	
0079	GRE	Green Phone Incorporated	
0080	NCB	NetComm Limited	
0081	SIS	Saise Telecommunications	
0082	EWT	New Tel	
0083	CON	Concentrix Pty Ltd	
0084	0084	Vodafone Pacific Limited	
0085	QLA	Qala (Australia) Pty Ltd	
0086	TSI	Telstra Six	
0087	PER	Total Peripherals Pty Ltd	

CSP_ID	CSP_CODE	CSP_DESC	SP_ID
0088	ECO	EcomTel	
0089	AUB	Austar United Broadband Pty Ltd	AUSTR
0090	LCR	LCR Telecoms	
0091	IMP	Impaq Australia Pty Ltd	
0092	PDO	Paradigm One	
0099	EQU	People telecom (formerly Equest Telecoms)	
0100	TWH	Telstra Wholesale	
1001	1001	Cellular One	
1002	1002	AAPT – Mobile	
1003	1003	Virgin Mobile	
1004	1004	B Digital Ltd	
1005	1005	Vodafone Pty Ltd	
1006	1006	United Customer Management Solutions	
1007	1007	Pracom Limited	
1008	1008	Mobile Innovations	
1009	1009	GSM Rentafone	
1010	1010	LEA1	
1011	1011	LEA2 (reserved, TBC)	

T017_Rejection_Reason

REJECTION_REASON_CODE	RJECTION_REASON_DESC
001	Not an MSN
003	MSN not Issued
008	Port in progress
013	MSN not allocated to a Mobile Carrier
014	Recipient Mbl Carrier is the Donor Mbl Carrier
016	MSN not held
017	MSN not associated with Account/Reference Number
020	Data attributes do not conform to Data Definitions
035	Request ID not confirmed and active
038	MSN active on Network
041	Request ID not Active
052	Service is currently with the Gaining Mbl Carrier
058	Account/Reference Number or Date of Birth not held
059	Port Message Type out of sequence
067	Invalid CA Authorisation Date
070	MSN not associated with Date of Birth
071	MSN not associated with Previous Request ID
077	Request ID not unique
078	MSN not Ported
079	Incorrect Destination Party
080	Port Reversal is greater than six months

T015_Error

ERROR_CODE	ERROR_MSG	REJECTION_REASON_CODE
0001	Invalid SP Id	
0005	Cannot determine recipient CSP Id.	
0007	No carrier for MSN	
0008	Data format error	
0020	Active Request Not Found	035
0021	Sending Party Not Losing Party	020
0022	Not Awaiting Confirmation	035
0023	Request Id not unique	077
0024	Unallocated Msn	013
0025	Allocated Msn	
0026	Invalid Authorisation Date	067
0027	Invalid Previous Request Id	071
0028	Reversal Period Expired	080
0029	Invalid Data Type	020
0031	MSN Not associated with DOB	070
0032	MSN Not associated with Account/Reference	017
0033	Invalid Response Code	
0034	Invalid CSP Translation	
0035	Technology Type not Found	
0036	Unconfirmed PN	035
0037	Active PEN Exist	059
0038	Active PCN Exist	059
0039	Active PWN Exist	059
0040	Port Request Expired	035
0041	Active Activity Exists	
0042	Activity not Active	
0043	Activity not open	
0044	Request Not Active	035
0045	Invalid Carrier Id	020
0046	Invalid CSP Id	020
0047	Invalid Rejection Reason	020
0048	Invalid Sending Party	020
0049	Invalid Destination Party	079
0050	Sending party Id is not Gaining party Id	020
0051	Not Awaiting Completion	
0052	Mismatch in Carrier Id	
0053	Mismatch in MSN	
0054	Cutover unconfirmed	
0055	Request Not Found	
0056	Not Awaiting Rejection	
0057	Not Awaiting Receipt	
0058	Invalid Mobile Carrier Id	

ERROR_CODE	ERROR_MSG	REJECTION_REASON_CODE
0059	Invalid PSTN Query Status Code	
0060	Unprovisioned MSN	016
0061	Unissued msn	003
0062	Msn Not Pending Port	
0063	Rejection Reason Not Found	
0064	MSN is the subject of an active request	020
0065	Invalid Network Provider Id	020
0066	MICA error response	
0067	MSN not found	
0068	Requested date must be within the last 12	
0069	Invalid Expiry Date	059
0070	Duplicate BPCN	020
0071	Active BPCN exists	020
0072	Conflicting Data Attributes	020
0073	Cannot Determine Losing Mobile Carrier	020
0074	Conflicting Losing Mobile Carrier	020
0075	Invalid Gaining Mobile Carrier	020
0076	Unassociated Request Gaining Mobile Carrier	020
0077	No records found	
0079	BGBN unconfirmed	
0080	Invalid Donor MC	
0081	Undetermined Recipient MC	
0082	Conflicting Recipient MC	
0083	Invalid Recipient MC	
0084	Unassociated Request Recipient MC	
0087	Unassociated Request Donor MC	
0088	MSN Not Ported	078
0089	MC cannot be determined	
0090	Duplicate BGBN	
0091	Cancellation Reason not found	
0092	Invalid Receipt Transaction	
0093	Invalid Donor Giveback	013
0094	PCA received before Technology Transfer	
0095	Account Reference Not Held	058
0096	DOB Not Held	058

T003_Request_Status

REQUEST_STATUS_CODE	REQUEST_STATUS_DESC
NOTF CNFM	Notification Confirmed
CTVR CNFM	Cutover Confirmed
REJECTED	Rejected
RECEIVED	Received
WITHDRAWN	Withdrawn
EXPIRED	Expired
COMPLETED	Completed

T002_Request_Type

REQUEST_TYPE_CODE	REQUEST_TYPE_DESC
PORT	Port
GIVEBACK	Giveback
TECH TFR	Technology Transfer

T007_Request_Tx_Status

REQUEST_TX_STATUS_CODE	REQUEST_TX_STATUS_DESC
INITIATED	Initiated
CONFIRMED	Confirmed
REJECTED	Rejected

T005_Request_Tx_Type

REQUEST_TX_TYPE_CODE	REQUEST_TX_TYPE_DESC
PN	Port Notification
PCN	Port Cutover Notification
PWN	Port Withdrawal Notification
PEN	Port Expiry Notification
BPCN	Broadcast Port Cutover Notification
GBN	Giveback Notification
BGBN	Broadcast Giveback Notification
BTTN	Broadcast Technology Type Notification

T014_Number_Movement_Type

NBR_MOVEMENT_TYPE_CODE	NBR_MOVEMENT_TYPE_DESC
PORT	Port
CHURN	Churn
GIVEBACK	Giveback
TECH TFR	Technology Transfer

T004_Cancellation_Reason

CANCELLATION_REASON_COD	CANCELLATION_REASON_SHORTNAME	CANCELLATION_REASON_DES
001	STANDARD	Standard
002	NUISANCE	MSN Cancelled due to

T009_TX_Audit_Entry_Type

TX_AUDIT_ENTRY_TYPE_COD	TX_AUDIT_ENTRY_TYPE_DES
RECEIVED	Received
SENT	Sent
CONFIRMED	Confirmed
REJECTED	Rejected
COMPLETED	Completed

T010_TX_Activity_Entry_Type

TX_ACTIVITY_ENTRY_TYPE_ CODE	TX_ACTIVITY_ENTRY_TYPE_ DESC
REDO	Redo
REDO MAN	Manual after Redo
MANUAL	Manual
ORIGINAL	Original

T011_TX_Activity_Status

TX_ACTIVITY_STATUS_CODE	TX_ACTIVITY_STATUS_DESC
REDO	Redo
REDO MAN	Manual after Redo
OPEN	Open
MANUAL	Manual
COMPLETED	Completed

T012_Activity

ACTIVITY_ID	ACTIVITY_CODE	ACTIVITY_DESC
1	RC_SEN_RSP	Port Notification Service Enquiry
2	RC_AEN_RSP	Port Notification Account Enquiry
5	RC_SEC_RSP	Port Cutover Service Enquiry
6	RC_BPCN	Validate Broadcast Port Cutover Notification
7	RC_PSTN_ID	PSTN IN Reroute Response
8	RC_PSTN_ST	PSTN IN Status Response
9	RC_MED_RSP	Mediator Update Response
20	RC_SRV_CNC	Service Cancellation
21	RC_MPS_ERR	MICA Error Response
22	VAL_PEN	Validate Port Expiry Notification
23	RC_GBN_NTF	Receive GiveBack Notification
24	RC_TTF_ACT	Technology Transfer Activation
25	VAL_BTTN	Validate Broadcast Tech Trnsf Notification
26	VAL_BGBN	Validate Broadcast Giveback Notification
27	VAL_BPCN	Validate Broadcast Port Cutover Notification
28	RC_GBN_REJ	Receive Giveback Notification Rejection
29	RC_BGBN	Receive Broadcast Giveback Notification

T008_MSG_TYPE

RELEASE	MSG_TYPE_CODE	MSG_TYPE_DESC
1.0	PN	'Port Notification'
1.0	PNREC	'Port Notification Receipt'
1.0	PNCON	'Port Notification Confirmation'
1.0	PNCONREC	'Port Notification Confirmation Receipt'
1.0	PNREJ	'Port Notification Rejection'
1.0	PNREJREC	'Port Notification Rejection Receipt'
1.0	PCN	'Port Cutover Notification'
1.0	PCNREC	'Port Cutover Notification Receipt'
1.0	PCNCON	'Port Cutover Notification Confirmation'
1.0	PCNCONREC	'Port Cutover Notification Confirmation Receipt'

RELEASE	MSG_TYPE_CODE	MSG_TYPE_DESC
1.0	PCNREJ	'Port Cutover Notification Rejection'
1.0	PCNREJREC	'Port Cutover Notification Rejection Receipt'
1.0	PWN	'Port Withdrawal Notification'
1.0	PWNREC	'Port Withdrawal Notification Receipt'
1.0	PWNCON	'Port Withdrawal Notification Confirmation'
1.0	PWNCONREC	'Port Withdrawal Notification Confirmation Receipt'
1.0	PWNREJ	'Port Withdrawal Notification Rejection'
1.0	PWNREJREC	'Port Withdrawal Notification Rejection Receipt'
1.0	PEN	'Port Expiry Notification'
1.0	PENREC	'Port Expiry Notification Receipt'
1.0	BCN	'Broadcast Cutover Notification'
1.0	BPCN	'Broadcast Port Cutover Notification'
1.0	BPCNREC	'Broadcast Port Cutover Notification Receipt'
1.0	BPCCOM	'Broadcast Port Cutover Completion'
1.0	BPCCOMREC	'Broadcast Port Cutover Completion Receipt'
1.0	BTTN	'Broadcast Technology Transfer Notification'
1.0	BTTNREC	'Broadcast Technology Transfer Notification Receipt'
1.0	BTTCOM	'Broadcast Technology Transfer Completion'
1.0	BTTCOMREC	'Broadcast Technology Transfer Completion Receipt'
1.0	GBN	'Giveback Notification'
1.0	GBNREC	'Giveback Notification Receipt'
1.0	GBNCON	'Giveback Notification Confirmation'
1.0	GBNCONREC	'Giveback Notification Confirmation Receipt'
1.0	GBNREJ	'Giveback Notification Rejection'
1.0	GBNREJREC	'Giveback Notification Rejection Receipt'
1.0	BGBN	'Broadcast Giveback Notification'
1.0	BGBNREC	'Broadcast Giveback Notification Receipt'
1.0	BGBCOM	'Broadcast Giveback Completion'
1.0	BGBCOMREC	'Broadcast Giveback Completion Receipt'
1.0	PAE	'Port Churn Enquiry'
1.0	WPAE	'WMC Port Churn Enquiry'
1.0	SEN	'Service Enquiry Notification'
1.0	SEC	'Service Enquiry Cutover'
1.0	AEN	'Account Enquiry Notification'
1.0	PNR	'Mica Rejection Notification'
1.0	PNC	'Mica Port Notification Confirmation'
1.0	PCR	'Port Cutover Rejection'
1.0	BCC	'Broadcast Cutover Completion'
1.0	TTN	'Tech transfer Notification'
1.0	LSR	'Losing Service Provider Response'
1.0	PCA	'Port Cutover Advice'
1.0	GRI	'Get Request Id'
1.0	EN	'Expiry Notification'
1.0	WN	'Withdrawal Notification'
1.0	WC	'Withdrawal Confirmation'

RELEASE	MSG_TYPE_CODE	MSG_TYPE_DESC
1.0	WR	'Withdrawal Rejection'
1.0	MNPC	'Mobile Activation Notification'
1.0	ACTIVATE	'Activate PSTN'
	DEACTIVATE	'Deactivate PSTN'
1.0	STATUS	'Query Current PSTN Request Status'
1.0	MODIFY	'Modify PSTN'
1.0	PCC	'Port Cutover Confirmation'
1.2		
1.0	CCR	'Call charge request'
1.1	POC	'PO and PI – Reversal Cutover Confirmation'
1.0	PHE	'Port History Enquiry'
1.2	PTH	Port Transaction History
1.2	NRN	Number Range Notification

Appendix F - Data Differences between the MNPS and the DRS

The following spreadsheet highlights the data differences between the MNPS and the DRS:

NO.	REPORT NAME	PHYSICAL REPORT NAME	MNPS DATA USED	BUSINESS ENTITY TYPES AS EXPRESSED IN THE CONCEPTUAL SCHEMA (BASED ON THE ENTERPRISE MODEL)	FEASIBILITY OF REPORTING OUT OF THE DATA REPOSITORY SYSTEM (DRS)
1	Performance (SLA) Report	RPT_01_06_08: Sheet ACA_Rpt: MNP Daily Report: A. % Ports Completed within 3 hours B. % Rejects	MNP Daily Report A. % Ports Completed T301_Request T302_Request_TX T003_Request_Status T002_Request_Type T005_Request_TX_Type B. % Rejects T301_Request T302_Request_TX T003_Request_Status T002_Request_Type T005_Request_TX_Type	MNP Daily Report A. % Ports Completed Involved Party MSN Movement Progress MSN Movement Progress Performance Measure MSN Movement Performance Measurement Rule B. % Rejects MSN Movement Customer MSN Movement	All required data available from existing strategic tables.
2	Industry Reject Report (RPT09)	RPT_02: RPT09 – Total Rejects Summary	T301_Request T302_Request_TX T003_Request_Status	MSN Movement Customer MSN Movement Rejected Customer MSN Movement Rejected Cutover Customer MSN Movement Rejected Withdrawn Customer MSN Movement Resubmitted Cutover Customer MSN Movement Resubmitted Withdrawn Customer MSN Movement	All required data available from existing strategic tables.

NO.	REPORT NAME	PHYSICAL REPORT NAME	MNPS DATA USED	BUSINESS ENTITY TYPES AS EXPRESSED IN THE CONCEPTUAL SCHEMA (BASED ON THE ENTERPRISE MODEL)	FEASIBILITY OF REPORTING OUT OF THE DATA REPOSITORY SYSTEM (DRS)
3	Gain / Loss Report	RPT_03_07: Sheet: Gain Loss: Port Loss/Gain Summary	T301_Request T302_Request_TX T003_Request_Status T007_Request_TX_Status T002_Request_Type T005_Request_TX_Type	MSN Movement Customer MSN Movement Customer MSN Movement Reversal	All required data available from existing strategic tables.
4	TOA Reports: Completed Ports (RPTTM5) Rejects (RPTT09)	1. RPT_04_comp_ports: RPTTM5 – MNP Daily Summary (TOA) 2. RPT_04_rejects: RPTT09 – Total Rejects Summary – TOA	1. MNP Daily Summary (TOA) T302_Request_TX T007_Request_TX_Status T002_Request_Type T005_Request_TX_Type 2. Total Rejects Summary - TOA T301_Request T302_Request_TX T003_Request_Status T007_Request_TX_Status T002_Request_Type T005_Request_TX_Type	1. MNP Daily Summary (TOA) MSN Movement Customer MSN Movement Cutover Customer MSN Movement 2. Total Rejects Summary - TOA MSN Movement Customer MSN Movement Rejected Customer MSN Movement Rejected Cutover Customer MSN Movement Rejected Withdrawn Customer MSN Movement Resubmitted Cutover Customer MSN Movement Resubmitted Withdrawn Customer MSN Movement	All required data available from existing strategic tables.
5	SLA Report	No Report Identifiable	Any reports required must be hard-coded, as the data structure does not support Service Level Agreements (SLA).		All required data available from existing strategic tables to produce SLA reports in real-time and on exception.

NO.	REPORT NAME	PHYSICAL REPORT NAME	MNPS DATA USED	BUSINESS ENTITY TYPES AS EXPRESSED IN THE CONCEPTUAL SCHEMA (BASED ON THE ENTERPRISE MODEL)	FEASIBILITY OF REPORTING OUT OF THE DATA REPOSITORY SYSTEM (DRS)
6	Queue Movement Report	RPT_01_06_08: 1. Sheet Queue Movement: MNP Queue Movement Summary 2. Sheet Queue Movement BTTNs: MNP BTTN Queue Movement Summary	1. MNP Queue Movement Summary T301_Request T302_Request_TX T003_Request_Status T007_Request_TX_Status T002_Request_Type T005_Request_TX_Type 2. MNP BTTN Queue Movement Summary T301_Request T302_Request_TX T003_Request_Status T007_Request_TX_Status T002_Request_Type T005_Request_TX_Type	1. MNP Queue Movement Summary Customer MSN Movement Involved Party MSN Movement Progress Involved Party Carrier Reroute Broadcast MSN Movement Progress 2. MNP BTTN Queue Movement Summary Network MSN Movement Involved Party Carrier Reroute Broadcast MSN Movement Progress	All required data available from existing strategic tables.
7	Metrics Report	RPT_03_07: Sheet: Summary Wholesale-Retail: MNP Monthly Stats/MNP Monthly Summary Report –High Level	T301_Request T302_Request_TX T003_Request_Status T007_Request_TX_Status T002_Request_Type T005_Request_TX_Type	MSN Movement Customer MSN Movement Customer MSN Movement Reversal	All required data available from existing strategic tables.

NO.	REPORT NAME	PHYSICAL REPORT NAME	MNPS DATA USED	BUSINESS ENTITY TYPES AS EXPRESSED IN THE CONCEPTUAL SCHEMA (BASED ON THE ENTERPRISE MODEL)	FEASIBILITY OF REPORTING OUT OF THE DATA REPOSITORY SYSTEM (DRS)
8	Daily ACA Report: ACA Report Queue Movement (PN, PCN, PWN & BPCN) Queue Movement (BTTN)	RPT_01_06_08: 1. Sheet ACA_Rpt: MNP Daily Report: A. % Ports Completed within B. 3 hours % Rejects 2. Sheet Queue Movement: MNP Queue Movement Summary 3. Sheet Queue Movement BTTNs: MNP BTTN Queue Movement Summary	1. MNP Daily Report A. % Ports Completed T301_Request T302_Request_TX T003_Request_Status T002_Request_Type T005_Request_TX_Type B. % Rejects T301_Request T302_Request_TX T003_Request_Status T002_Request_Type T005_Request_TX_Type 2. MNP Queue Movement Summary T301_Request T302_Request_TX T003_Request_Status T007_Request_TX_Status T002_Request_Type T005_Request_TX_Type 3. MNP BTTN Queue Movement Summary T301_Request T302_Request_TX T003_Request_Status T007_Request_TX_Status T002_Request_Type T005_Request_TX_Type	MNP Daily Report A. % Ports Completed Involved Party MSN Movement Progress MSN Movement Progress Performance Measure MSN Movement Performance Measurement Rule B. % Rejects MSN Movement Customer MSN Movement 2. MNP Queue Movement Summary Customer MSN Movement Involved Party MSN Movement Progress Involved Party Carrier Reroute Broadcast MSN Movement Progress 3. MNP BTTN Queue Movement Summary Network MSN Movement Involved Party Carrier Reroute Broadcast MSN Movement Progress	All required data available from existing strategic tables.

NO.	REPORT NAME	PHYSICAL REPORT NAME	MNPS DATA USED	BUSINESS ENTITY TYPES AS EXPRESSED IN THE CONCEPTUAL SCHEMA (BASED ON THE ENTERPRISE MODEL)	FEASIBILITY OF REPORTING OUT OF THE DATA REPOSITORY SYSTEM (DRS)
9	Weekly ACA Report: ACA Report Queues	RPT_09: 1. Sheet ACA_Rpt: MNP Daily Report: A. % Ports Completed within 3 hours B. % Rejects 2. Sheet Queues: Queues [Reporting Date <Date>]	1. MNP Daily Report A. % Ports Completed T301_Request T302_Request_TX T003_Request_Status T002_Request_Type T005_Request_TX_Type B. % Rejects T301_Request T302_Request_TX T003_Request_Status T002_Request_Type T005_Request_TX_Type 2. Queues [Reporting Date <Date>] T301_Request T302_Request_TX T003_Request_Status T007_Request_TX_Status T002_Request_Type T005_Request_TX_Type	MNP Daily Report A. % Ports Completed Involved Party MSN Movement Progress MSN Movement Progress Performance Measure MSN Movement Performance Measurement Rule B. % Rejects MSN Movement Customer MSN Movement 2. Queues [Reporting Date <Date>] Customer MSN Movement Involved Party MSN Movement Progress Involved Party Carrier Reroute Broadcast MSN Movement Progress	All required data available from existing strategic tables.
10	Delayed Transaction (Queue Reports)	RPT_10: Queues <Date>	T301_Request T302_Request_TX T003_Request_Status T007_Request_TX_Status T002_Request_Type T005_Request_TX_Type	Customer MSN Movement Involved Party MSN Movement Progress Involved Party Carrier Reroute Broadcast MSN Movement Progress	All required data available from existing strategic tables.

NO.	REPORT NAME	PHYSICAL REPORT NAME	MNPS DATA USED	BUSINESS ENTITY TYPES AS EXPRESSED IN THE CONCEPTUAL SCHEMA (BASED ON THE ENTERPRISE MODEL)	FEASIBILITY OF REPORTING OUT OF THE DATA REPOSITORY SYSTEM (DRS)
11	Alarm Files: PN, PCN & PWN Incomplete by Carrier (Port-In) BPCN Incomplete…. Port-Out &…. Port-In by Business Party BTTN Incomplete by Business Party Third Party & Port-Out Queues	RPT_11_PN_PCN_PWN RPT_11_BPCN_Port_In RPT_11_BPCN_Port_Out RPT_11_BTTN RPT_11_Third_Party	RPT_11_PN_PCN_PWN T301_Request T302_Request_TX T003_Request_Status T007_Request_TX_Status T002_Request_Type T005_Request_TX_Type RPT_11_BPCN_Port_In T301_Request T302_Request_TX T003_Request_Status T007_Request_TX_Status T002_Request_Type T005_Request_TX_Type RPT_11_BPCN_Port_Out T301_Request T302_Request_TX T003_Request_Status T007_Request_TX_Status T005_Request_Type T005_Request_TX_Type RPT_11_BTTN T301_Request T302_Request_TX T003_Request_Status T007_Request_TX_Status T005_Request_Type T005_Request_TX_Type RPT_11_Third_Party T301_Request T302_Request_TX T003_Request_Status T007_Request_TX_Status T005_Request_Type T005_Request_TX_Type	RPT_11_PN_PCN_PWN MSN Movement Customer MSN Movement Involved Party MSN Movement Progress RPT_11_BPCN_Port_In MSN Movement Customer MSN Movement Involved Party Carrier Reroute Broadcast MSN Movement Progress RPT_11_BPCN_Port_Out MSN Movement Customer MSN Movement Involved Party Carrier Reroute Broadcast MSN Movement Progress RPT_11_BTTN MSN Movement Network MSN Movement Involved Party Carrier Reroute Broadcast MSN Movement Progress RPT_11_Third_Party MSN Movement Customer MSN Movement Involved Party MSN Movement Progress Involved Party Carrier Reroute Broadcast MSN Movement Progress	Report 11.5 requires the Gaining Mobile Carrier for Third Party MSN Movements. This is not currently available from the existing strategic tables. All other required data is available from existing strategic tables.

NO.	REPORT NAME	PHYSICAL REPORT NAME	MNPS DATA USED	BUSINESS ENTITY TYPES AS EXPRESSED IN THE CONCEPTUAL SCHEMA (BASED ON THE ENTERPRISE MODEL)	FEASIBILITY OF REPORTING OUT OF THE DATA REPOSITORY SYSTEM (DRS)
12	LEA Report	Rpt_12	T302_Request_TX T007_Request_TX_Status T005_Request_TX_Type	MSN Movement Customer MSN Movement Reroute Broadcast MSN Movement Involved Party Carrier Reroute Broadcast MSN Movement Progress	All required data available from existing strategic tables.
13	TOA Expiries	Rpt_13	T301_Request T302_Request_TX T003_Request_Status T007_Request_TX_Status T005_Request_Type T005_Request_TX_Type	MSN Movement Customer MSN Movement	All required data available from existing strategic tables.
14	TOA Outstandings: Summary for Transaction Type Outstanding Details	1.Rpt_14_summary 2. Rpt_14_details	1. Rpt_14_summary T301_Request T302_Request_TX T003_Request_Status T007_Request_TX_Status T005_Request_Type T005_Request_TX_Type 2. Rpt_14_details T301_Request T302_Request_TX T003_Request_Status T007_Request_TX_Status T005_Request_Type T005_Request_TX_Type	1. Rpt_14_summary MSN Movement Customer MSN Movement Involved Party Customer MSN Movement Progress Involved Party Reroute Broadcast MSN Movement Progress 2. Rpt_14_details MSN Movement Customer MSN Movement Involved Party Customer MSN Movement Progress Involved Party Reroute Broadcast MSN Movement Progress	All required data available from existing strategic tables.
15	PCN with no BPCN Report	Rpt_15	T301_Request T302_Request_TX T003_Request_Status T007_Request_TX_Status T005_Request_TX_Type	MSN Movement Customer MSN Movement Cutover Customer MSN Movement Reroute Broadcast MSN Movement	All required data available from existing strategic tables.

NO.	REPORT NAME	PHYSICAL REPORT NAME	MNPS DATA USED	BUSINESS ENTITY TYPES AS EXPRESSED IN THE CONCEPTUAL SCHEMA (BASED ON THE ENTERPRISE MODEL)	FEASIBILITY OF REPORTING OUT OF THE DATA REPOSITORY SYSTEM (DRS)
TBA – Not Spec-ified	Incomplete Ports with more than 5 "Notes"	Notes_011226: Incomplete Ports with >=5 Notes	T301_Request T003_Request_Status T005_Request_Type T311_Note	MSN Movement Customer MSN Movement	Operational Application Notes are NOT available from existing strategic tables. All other required data is available from existing strategic tables.

CURRENT MNPS REPORTING ISSUES

GENERAL MNPS REPORT ISSUES

No reports specified for MSN Movement Types: Churn & Giveback.

Most reports are limited to MSN Movement Type of Port, not factoring in Reversals to provide true reporting of Valid Ports.

Date & Time (Timestamp) fields on these reports are formatted with Date displayed only, even though the fields contain both date & time. Also, in some cases, the field is labelled time only but this is also formatted to display date only.

There are a number of reports where the Data Repository System does not require accessing detailed tables. Due to the poor MNPS data structures, all reports require accessing the message level / transaction tables. This access is directly proportional to performance due to the size of these tables.

The message level / transaction tables in the MNPS data structures are not properly conceptualised in business terms and therefore require complex and in some cases, hard-coded SQL / report code to be implemented.

No Drill-down capability is capable of being provided in the current reports.

SPECIFIC MNPS REPORT ISSUES

Report No. 1 Issue

Total Ports only covers Completed & Rejected Port-In movements & Port-Out movements. No record of Withdrawn or Expired Port-In movements & Port-Out movements. No record of other MSN Movement Types such as Churn & Technology Transfer.

Report No. 2 Issues

No association of Rejects to MSN Movement Type, e.g., Reject for Port-In?

No identification of Rejecting Party, i.e., is it the Mobile Carrier or the Mobile Carriage Service Provider?

Report No. 4 Issues

Daily Summary of completed ports summarises ports to and from TOA (Retail) at the highest level, i.e. completed port, and at a subset of transaction type level. The subset of transaction type being only Port Notification & Port Cutover. Notification cannot reconcile up to highest level of summarisation; namely, completed ports to and from TOA. This is due to the fact that these two transaction types can exist for incomplete or rejected MSN Movements.

Why is the Daily Summary providing summary information against only two transaction types that cannot reconcile to the overall ports to and from TOA?

Appendix G - The MNPS' Compliance with the Fundamental Business Rules

RULE ID	FUNDAMENTAL BUSINESS RULE DESCRIPTION	MNPS SUPPORT
1.	An Event may be a Mobile Service Number (MSN) Movement.	NO
2a.	An MSN Movement may be a Customer MSN Movement, a Customer MSN Movement Reversal, a Network MSN Movement, an End-User Unallocated MSN Movement or a Completed MSN Movement.	NO
2b.	An MSN Movement may at once be a Customer MSN Movement and a Completed MSN Movement; a Customer MSN Movement Reversal and a Completed MSN Movement; a Network MSN Movement and a Completed MSN Movement; an End-User Unallocated MSN Movement and a Completed MSN Movement.	NO
2c.	If an MSN Movement is a Customer MSN Movement then it cannot at once be a Network MSN Movement and vice versa; it cannot at once be a Customer MSN Movement Reversal and vice versa; and it cannot at once be an End-User Unallocated MSN Movement and vice versa.	NO
2d.	A Customer MSN Movement may become a Customer MSN Movement Reversal and a Customer MSN Movement Reversal must first be a Customer MSN Movement.	NO
2e.	A Customer MSN Movement may be an End-User Allocated MSN Movement or a Non-Network MSN Movement.	NO
2f.	If a Customer MSN Movement is an End-User Allocated MSN Movement then it cannot at once be a Non-Network MSN Movement and vice versa.	NO
2g.	An End-User Allocated MSN Movement may be a Port-In MSN Movement, a Port-Out MSN Movement or a Technology Transfer Churn MSN Movement.	NO
2h.	A Non-Network MSN Movement is a Churn MSN Movement.	NO
2i.	If an End-User Allocated MSN Movement is a Port-In MSN Movement it cannot at once be a Port-Out MSN Movement and vice versa.	YES
2j.	If an End-User Allocated MSN Movement is a Technology Transfer Churn MSN Movement then it cannot at once be a Port-In MSN Movement and vice versa.	YES
2k.	If an End-User Allocated MSN Movement is a Technology Transfer Churn MSN Movement then it cannot at once be a Port-Out MSN Movement and vice versa.	YES
3a.	A Customer MSN Movement may be an Unacknowledged Customer MSN Movement, an Acknowledged Customer MSN Movement, a Rejected Customer MSN Movement, an Approved Customer MSN Movement, a Cutover Customer MSN Movement, a Withdrawn Customer MSN Movement, or an Expired Customer MSN Movement.	NO
3b.	If a Customer MSN Movement is an Unacknowledged Customer MSN Movement then it cannot at once be an Acknowledged Customer MSN Movement and vice versa.	NO
3c.	If a Customer MSN Movement is an Unacknowledged Customer MSN Movement then it cannot at once be an Approved Customer MSN Movement and vice versa.	NO
3d.	If a Customer MSN Movement is an Acknowledged Customer MSN Movement then it cannot at once be an Approved Customer MSN Movement and vice versa.	NO
3e.	If a Customer MSN Movement is a Rejected Customer MSN Movement then it cannot at once be an Approved Customer MSN Movement and vice versa.	YES
3f.	If a Customer MSN Movement is a Cutover Customer MSN Movement then it must be at once an Approved Customer MSN Movement.	NO
4a.	A Cutover Customer MSN Movement may be an Unacknowledged Cutover Customer MSN Movement, an Acknowledged Cutover Customer MSN Movement, a Rejected Cutover Customer MSN Movement or an Approved Cutover Customer MSN Movement.	NO
4b.	If a Cutover Customer MSN Movement is an Unacknowledged Cutover Customer MSN Movement then it cannot at once be an Acknowledged Cutover Customer MSN Movement and vice versa.	NO

RULE ID	FUNDAMENTAL BUSINESS RULE DESCRIPTION	MNPS SUPPORT
4c.	If a Cutover Customer MSN Movement is an Unacknowledged Cutover Customer MSN Movement then it cannot at once be an Approved Cutover Customer MSN Movement and vice versa.	NO
4d.	If a Cutover Customer MSN Movement is an Acknowledged Cutover Customer MSN Movement then it cannot at once be an Approved Cutover Customer MSN Movement and vice versa.	NO
4e.	If a Cutover Customer MSN Movement is a Rejected Cutover Customer MSN Movement then it cannot at once be an Approved Cutover Customer MSN Movement and vice versa.	YES
5a.	A Withdrawn Customer MSN Movement may be an Unacknowledged Withdrawn Customer MSN Movement, an Acknowledged Withdrawn Customer MSN Movement, a Rejected Withdrawn Customer MSN Movement or an Approved Withdrawn Customer MSN Movement.	NO
5b.	If a Withdrawn Customer MSN Movement is an Unacknowledged Withdrawn Customer MSN Movement then it cannot at once be an Acknowledged Withdrawn Customer MSN Movement and vice versa.	NO
5c.	If a Withdrawn Customer MSN Movement is an Unacknowledged Withdrawn Customer MSN Movement then it cannot at once be an Approved Withdrawn Customer MSN Movement and vice versa.	NO
5d.	If a Withdrawn Customer MSN Movement is an Acknowledged Withdrawn Customer MSN Movement then it cannot at once be an Approved Withdrawn Customer MSN Movement and vice versa.	NO
5e.	If a Withdrawn Customer MSN Movement is a Rejected Withdrawn Customer MSN Movement then it cannot at once be an Approved Withdrawn Customer MSN Movement and vice versa.	YES
5f.	If a Customer MSN Movement is a Withdrawn Customer MSN Movement then it must be at once an Approved Customer MSN Movement.	NO
5g.	If a Customer MSN Movement is a Withdrawn Customer MSN Movement then it cannot at once be an Approved Cutover Customer MSN Movement and vice versa.	NO
6a.	An Expired Customer MSN Movement may be an Unacknowledged Expired Customer MSN Movement or an Acknowledged Expired Customer MSN Movement.	NO
6b.	If an Expired Customer MSN Movement is an Unacknowledged Expired Customer MSN Movement then it cannot at once be an Acknowledged Expired Customer MSN Movement and vice versa.	NO
6c.	If a Customer MSN Movement is an Expired Customer MSN Movement then it must be at once an Approved Customer MSN Movement.	NO
6d.	If a Customer MSN Movement is an Expired Customer MSN Movement then it cannot at once be an Approved Cutover Customer MSN Movement and vice versa.	YES
7a.	A Rejected Customer MSN Movement must relate to one Rejecting Losing Mobile Carrier or one Rejecting Gaining Mobile Carrier or one Rejecting Losing Carriage Service Provider, while a Rejecting Losing Mobile Carrier may relate to more than one Rejected Customer MSN Movement, a Rejecting Gaining Mobile Carrier may relate to more than one Rejected Customer MSN Movement, and a Rejecting Losing Carriage Service Provider may relate to more than one Rejected Customer MSN Movement.	NO
7b.	A Rejected Customer MSN Movement must be associated with one Reject Reason and a Reject Reason may apply to more than one Rejected Customer MSN Movement.	YES
8a.	An Acknowledged Cutover Customer MSN Movement may have more than one Resubmitted Cutover Customer MSN Movement and a Resubmitted Cutover Customer MSN Movement must relate to one Acknowledged Cutover Customer MSN Movement.	NO
8b.	A Rejected Cutover Customer MSN Movement may have more than one Resubmitted Cutover Customer MSN Movement and a Resubmitted Cutover Customer MSN Movement must relate to one Rejected Cutover Customer MSN Movement.	NO

RULE ID	FUNDAMENTAL BUSINESS RULE DESCRIPTION	MNPS SUPPORT
8c.	A Rejected Cutover Customer MSN Movement must relate to one Rejecting Losing Mobile Carrier or one Rejecting Gaining Mobile Carrier or one Rejecting Losing Carriage Service Provider, while a Rejecting Losing Mobile Carrier may relate to more than one Rejected Cutover Customer MSN Movement, a Rejecting Gaining Mobile Carrier may relate to more than one Rejected Cutover Customer MSN Movement, and a Rejecting Losing Carriage Service Provider may relate to more than one Rejected Cutover Customer MSN Movement.	NO
8d.	A Rejected Cutover Customer MSN Movement must be associated with one Reject Reason and a Reject Reason may apply to more than one Rejected Cutover Customer MSN Movement.	YES
9a.	An Acknowledged Withdrawn Customer MSN Movement may have more than one Resubmitted Withdrawn Customer MSN Movement and a Resubmitted Withdrawn Customer MSN Movement must relate to one Acknowledged Withdrawn Customer MSN Movement.	NO
9b.	A Rejected Withdrawn Customer MSN Movement may have more than one Resubmitted Withdrawn Customer MSN Movement and a Resubmitted Withdrawn Customer MSN Movement must relate to one Rejected Withdrawn Customer MSN Movement.	NO
9c.	A Rejected Withdrawn Customer MSN Movement must relate to one Rejecting Losing Mobile Carrier or one Rejecting Gaining Mobile Carrier or one Rejecting Losing Carriage Service Provider, while a Rejecting Losing Mobile Carrier may relate to more than one Rejected Withdrawn Customer MSN Movement, a Rejecting Gaining Mobile Carrier may relate to more than one Rejected Withdrawn Customer MSN Movement, and a Rejecting Losing Carriage Service Provider may relate to more than one Rejected Withdrawn Customer MSN Movement.	NO
9d.	A Rejected Withdrawn Customer MSN Movement must be associated with one Reject Reason and a Reject Reason may apply to more than one Rejected Withdrawn Customer MSN Movement.	YES
10a.	A Customer MSN Movement Reversal may be an End-User Allocated MSN Movement Reversal or a Non-Network MSN Movement Reversal.	NO
10b.	If a Customer MSN Movement Reversal is an End-User Allocated MSN Movement Reversal then it cannot at once be a Non-Network MSN Movement Reversal and vice versa.	NO
10c.	An End-User Allocated MSN Movement Reversal may be a Port-In MSN Movement Reversal, a Port-Out MSN Movement Reversal or a Technology Transfer Churn MSN Movement Reversal.	NO
10d.	A Non-Network MSN Movement Reversal is a Churn MSN Movement Reversal.	NO
10e.	If an End-User Allocated MSN Movement Reversal is a Port-In MSN Movement Reversal then it cannot at once be a Port-Out MSN Movement Reversal and vice versa.	YES
10f.	If an End-User Allocated MSN Movement Reversal is a Technology Transfer Churn MSN Movement Reversal then it cannot at once be a Port-In MSN Movement Reversal and vice versa.	NO
10g.	If an End-User Allocated MSN Movement Reversal is a Technology Transfer MSN Movement Reversal then it cannot at once be a Port-Out MSN Movement Reversal and vice versa.	NO
11a.	A Customer MSN Movement Reversal may be an Unacknowledged Customer MSN Movement Reversal, an Acknowledged Customer MSN Movement Reversal, a Rejected Customer MSN Movement Reversal, an Approved Customer MSN Movement Reversal, a Cutover Customer MSN Movement Reversal, a Withdrawn Customer MSN Movement Reversal, or an Expired Customer MSN Movement Reversal.	NO
11b.	If a Customer MSN Movement Reversal is an Unacknowledged Customer MSN Movement Reversal then it cannot at once be an Acknowledged Customer MSN Movement Reversal and vice versa.	NO
11c.	If a Customer MSN Movement Reversal is an Unacknowledged Customer MSN Movement Reversal then it cannot at once be an Approved Customer MSN Movement Reversal and vice versa.	NO
11d.	If a Customer MSN Movement Reversal is an Acknowledged Customer MSN Movement Reversal then it cannot at once be an Approved Customer MSN Movement Reversal and vice versa.	NO

RULE ID	FUNDAMENTAL BUSINESS RULE DESCRIPTION	MNPS SUPPORT
11e.	If a Customer MSN Movement Reversal is a Rejected Customer MSN Movement Reversal then it cannot at once be an Approved Customer MSN Movement Reversal and vice versa.	YES
11f.	If a Customer MSN Movement Reversal is a Cutover Customer MSN Movement Reversal then it must be at once an Approved Customer MSN Movement Reversal.	NO
12a.	A Cutover Customer MSN Movement Reversal may be an Unacknowledged Cutover Customer MSN Movement Reversal, an Acknowledged Cutover Customer MSN Movement Reversal, a Rejected Cutover Customer MSN Movement Reversal or an Approved Cutover Customer MSN Movement Reversal.	NO
12b.	If a Cutover Customer MSN Movement Reversal is an Unacknowledged Cutover Customer MSN Movement Reversal then it cannot at once be an Acknowledged Cutover Customer MSN Movement Reversal and vice versa.	NO
12c.	If a Cutover Customer MSN Movement Reversal is an Unacknowledged Cutover Customer MSN Movement Reversal then it cannot at once be an Approved Cutover Customer MSN Movement Reversal and vice versa.	NO
12d.	If a Cutover Customer MSN Movement Reversal is an Acknowledged Cutover Customer MSN Movement Reversal then it cannot at once be an Approved Cutover Customer MSN Movement Reversal and vice versa.	NO
12e.	If a Cutover Customer MSN Movement Reversal is a Rejected Cutover Customer MSN Movement Reversal then it cannot at once be an Approved Cutover Customer MSN Movement Reversal and vice versa.	YES
13a.	A Withdrawn Customer MSN Movement Reversal may be an Unacknowledged Withdrawn Customer MSN Movement Reversal, an Acknowledged Withdrawn Customer MSN Movement Reversal, a Rejected Withdrawn Customer MSN Movement Reversal or an Approved Withdrawn Customer MSN Movement Reversal.	NO
13b.	If a Withdrawn Customer MSN Movement Reversal is an Unacknowledged Withdrawn Customer MSN Movement Reversal then it cannot at once be an Acknowledged Withdrawn Customer MSN Movement Reversal and vice versa.	NO
13c.	If a Withdrawn Customer MSN Movement Reversal is an Unacknowledged Withdrawn Customer MSN Movement Reversal then it cannot at once be an Approved Withdrawn Customer MSN Movement Reversal and vice versa.	NO
13d.	If a Withdrawn Customer MSN Movement Reversal is an Acknowledged Withdrawn Customer MSN Movement Reversal then it cannot at once be an Approved Withdrawn Customer MSN Movement Reversal and vice versa.	NO
13e.	If a Withdrawn Customer MSN Movement Reversal is a Rejected Withdrawn Customer MSN Movement Reversal then it cannot at once be an Approved Withdrawn Customer MSN Movement Reversal and vice versa.	NO
13f.	If a Customer MSN Movement Reversal is a Withdrawn Customer MSN Movement Reversal then it must be at once an Approved Customer MSN Movement Reversal.	NO
13g.	If a Customer MSN Movement Reversal is a Withdrawn Customer MSN Movement Reversal then it cannot at once be an Approved Cutover Customer MSN Movement Reversal and vice versa.	NO
14a.	An Expired Customer MSN Movement Reversal may be an Unacknowledged Expired Customer MSN Movement Reversal or an Acknowledged Expired Customer MSN Movement Reversal.	NO
14b.	If an Expired Customer MSN Movement Reversal is an Unacknowledged Expired Customer MSN Movement Reversal then it cannot at once be an Acknowledged Expired Customer MSN Movement Reversal and vice versa.	NO
14c.	If a Customer MSN Movement Reversal is an Expired Customer MSN Movement Reversal then it must be at once an Approved Customer MSN Movement Reversal.	NO
14d.	If a Customer MSN Movement Reversal is an Expired Customer MSN Movement Reversal then it cannot at once be an Approved Cutover Customer MSN Movement Reversal and vice versa.	NO
15a.	An Acknowledged Cutover Customer MSN Movement Reversal may have more than one Resubmitted Cutover Customer MSN Movement Reversal and a Resubmitted Cutover Customer MSN Movement Reversal must relate to one Acknowledged Cutover Customer MSN Movement Reversal.	NO

RULE ID	FUNDAMENTAL BUSINESS RULE DESCRIPTION	MNPS SUPPORT
15b.	A Rejected Cutover Customer MSN Movement Reversal may have more than one Resubmitted Cutover Customer MSN Movement Reversal and a Resubmitted Cutover Customer MSN Movement Reversal must relate to one Rejected Cutover Customer MSN Movement Reversal.	NO
15c.	A Rejected Cutover Customer MSN Movement Reversal must relate to one Rejecting Losing Mobile Carrier or one Rejecting Gaining Mobile Carrier or one Rejecting Losing Carriage Service Provider, while a Rejecting Losing Mobile Carrier may relate to more than one Rejected Cutover Customer MSN Movement Reversal, a Rejecting Gaining Mobile Carrier may relate to more than one Rejected Cutover Customer MSN Movement Reversal, and a Rejecting Losing Carriage Service Provider may relate to more than one Rejected Cutover Customer MSN Movement Reversal.	NO
16a.	An Acknowledged Withdrawn Customer MSN Movement Reversal may have more than one Resubmitted Withdrawn Customer MSN Movement Reversal and a Resubmitted Withdrawn Customer MSN Movement Reversal must relate to one Acknowledged Withdrawn Customer MSN Movement Reversal.	NO
16b.	A Rejected Withdrawn Customer MSN Movement Reversal may have more than one Resubmitted Withdrawn Customer MSN Movement Reversal and a Resubmitted Withdrawn Customer MSN Movement Reversal must relate to one Rejected Withdrawn Customer MSN Movement Reversal.	NO
16c.	A Rejected Withdrawn Customer MSN Movement Reversal must relate to one Rejecting Losing Mobile Carrier or one Rejecting Gaining Mobile Carrier or one Rejecting Losing Carriage Service Provider, while a Rejecting Losing Mobile Carrier may relate to more than one Rejected Withdrawn Customer MSN Movement Reversal, a Rejecting Gaining Mobile Carrier may relate to more than one Rejected Withdrawn Customer MSN Movement Reversal, and a Rejecting Losing Carriage Service Provider may relate to more than one Rejected Withdrawn Customer MSN Movement Reversal.	NO
17a.	A Customer MSN Movement may have more than one Involved Party MSN Movement Progress and an Involved Party MSN Movement Progress must be associated with one Customer MSN Movement.	YES
17b.	A Customer MSN Movement Reversal may have more than one Involved Party MSN Movement Progress and an Involved Party MSN Movement Progress must be associated with one Customer MSN Movement Reversal.	YES
17c.	An End-User Unallocated MSN Movement may have more than one Involved Party MSN Movement Progress and an Involved Party MSN Movement Progress must be associated with one End-User Unallocated MSN Movement.	NO
17d.	An MSN Movement Industry Dialogue Type may have more than one Involved Party MSN Movement Progress and an Involved Party MSN Movement Progress must be associated with one MSN Movement Industry Dialogue Type.	NO
17e.	An Involved Party MSN Movement Progress may at once be an Involved Party MSN Movement Current Progress or an Involved Party MSN Movement Previous Progress.	NO
17f.	An Involved Party MSN Movement Previous Progress must be associated with one Involved Party MSN Movement Current Progress.	NO
18a.	A Resubmitted Cutover Customer MSN Movement may have more than one Involved Party Resubmitted MSN Movement Progress and an Involved Party Resubmitted MSN Movement Progress must be associated with one Resubmitted Cutover Customer MSN Movement.	NO
18b.	An MSN Movement Industry Dialogue Type may have more than one Involved Party Resubmitted MSN Movement Progress and an Involved Party Resubmitted MSN Movement Progress must be associated with one MSN Movement Industry Dialogue Type.	NO
18c.	An Involved Party Resubmitted MSN Movement Progress may at once be an Involved Party Resubmitted MSN Movement Current Progress or an Involved Party Resubmitted MSN Movement Previous Progress.	NO
18d.	An Involved Party Resubmitted MSN Movement Previous Progress must be associated with one Involved Party Resubmitted MSN Movement Current Progress.	NO
19a.	A Resubmitted Withdrawn Customer MSN Movement may have more than one Involved Party Resubmitted Withdrawn Customer MSN Movement Progress and an Involved Party Resubmitted Withdrawn Customer MSN Movement Progress must be associated with one Resubmitted Withdrawn Customer MSN Movement.	NO

RULE ID	FUNDAMENTAL BUSINESS RULE DESCRIPTION	MNPS SUPPORT
19b.	An MSN Movement Industry Dialogue Type may have more than one Involved Party Resubmitted Withdrawn Customer MSN Movement Progress and an Involved Party Resubmitted Withdrawn Customer MSN Movement Progress must be associated with one MSN Movement Industry Dialogue Type.	NO
19c.	An Involved Party Resubmitted Withdrawn Customer MSN Movement Progress may at once be an Involved Party Resubmitted Withdrawn Customer MSN Movement Current Progress or an Involved Party Resubmitted Withdrawn Customer MSN Movement Previous Progress.	NO
19d.	An Involved Party Resubmitted Withdrawn Customer MSN Movement Previous Progress must be associated with one Involved Party Resubmitted Withdrawn Customer MSN Movement Current Progress.	NO
20a.	An MSN Movement Message Type may have more than one MSN Movement Industry Dialogue Type and an MSN Movement Industry Dialogue Type must belong to one MSN Movement Message Type.	NO
21a.	A Business Party may be an MSN Movement Sending Party or an MSN Movement Receiving Party but not both.	NO
21b.	An MSN Movement Sending Party Type may have more than one MSN Movement Sending Party and an MSN Movement Sending Party must belong to one MSN Movement Sending Party Type.	NO
21c.	An MSN Movement Receiving Party Type may have more than one MSN Movement Receiving Party and an MSN Movement Receiving Party must belong to one MSN Movement Receiving Party Type.	NO
22a.	A Business Party may be a Rejecting Party.	NO
22b.	A Rejecting Party may be a Rejecting Mobile Carrier or a Rejecting Carriage Service Provider but not both.	NO
22c.	A Rejecting Mobile Carrier may be a Rejecting Losing Mobile Carrier or a Rejecting Gaining Mobile Carrier but not both.	NO
22d.	A Rejecting Carriage Service Provider is a Rejecting Losing Carriage Service Provider.	NO
23a.	An MSN Movement Industry Dialogue Type may at once be a Current MSN Movement Industry Dialogue Type or a Previous MSN Movement Industry Dialogue Type.	NO
23b.	A Current MSN Movement Industry Dialogue Type may have more than one Previous MSN Movement Industry Dialogue Type associated with it and a Previous MSN Movement Industry Dialogue Type must be for one Current MSN Movement Industry Dialogue Type.	NO
23c.	A Current MSN Movement Industry Dialogue Type may have more than one MSN Movement Performance Measurement Rule and an MSN Movement Performance Measurement Rule must relate to one Current MSN Movement Industry Dialogue Type.	NO
23d.	A Previous MSN Movement Industry Dialogue Type may have more than one MSN Movement Performance Measurement Rule and a MSN Movement Performance Measurement Rule must relate to one Previous MSN Movement Industry Dialogue Type.	NO
24a.	An Involved Party MSN Movement Current Progress may have one or more than one MSN Movement Progress Performance Measure and an MSN Movement Progress Performance Measure must belong to one Involved Party MSN Movement Current Progress.	NO
24b.	An Involved Party MSN Movement Previous Progress may have more than one MSN Movement Progress Performance Measure and an MSN Movement Progress Performance Measure must belong to one Involved Party MSN Movement Previous Progress.	NO
24c.	An Involved Party Resubmitted Cutover Customer MSN Movement Current Progress may have more than one MSN Movement Progress Performance Measure and an MSN Movement Progress Performance Measure may belong to one Involved Party Resubmitted Cutover Customer MSN Movement Current Progress.	NO

RULE ID	FUNDAMENTAL BUSINESS RULE DESCRIPTION	MNPS SUPPORT
24d.	An Involved Party Resubmitted Cutover Customer MSN Movement Previous Progress may have more than one MSN Movement Progress Performance Measure and an MSN Movement Progress Performance Measure may belong to one Involved Party Resubmitted Cutover Customer MSN Movement Previous Progress.	NO
24e.	An Involved Party Resubmitted Withdrawn Customer MSN Movement Current Progress may have more than one MSN Movement Progress Performance Measure and an MSN Movement Progress Performance Measure may belong to one Involved Party Resubmitted Withdrawn Customer MSN Movement Current Progress.	NO
24f.	An Involved Party Resubmitted Withdrawn Customer MSN Movement Previous Progress may have more than one MSN Movement Progress Performance Measure and an MSN Movement Progress Performance Measure may belong to one Involved Party Resubmitted Withdrawn Customer MSN Movement Previous Progress.	NO
24g.	An MSN Movement Performance Measurement Rule may have more than one MSN Movement Progress Performance Measure and an MSN Movement Progress Performance Measure must belong to one MSN Movement Performance Measurement Rule.	NO
25a.	An Involved Party Carrier Reroute Broadcast MSN Movement Current Progress may have one or more than one Reroute Broadcast Cutover MSN Movement Progress Performance Measure and a Reroute Broadcast Cutover MSN Movement Progress Performance Measure must belong to one Involved Party Carrier Reroute Broadcast MSN Movement Current Progress.	NO
25b.	An Involved Party MSN Movement Previous Progress may have more than one Reroute Broadcast Cutover MSN Movement Progress Performance Measure and a Reroute Broadcast Cutover MSN Movement Progress Performance Measure must belong to one Involved Party MSN Movement Previous Progress.	NO
25c.	An MSN Movement Performance Measurement Rule may have more than one Reroute Broadcast Cutover MSN Movement Progress Performance Measure and a Reroute Broadcast Cutover MSN Movement Progress Performance Measure must belong to one MSN Movement Performance Measurement Rule.	NO
26a.	An Involved Party Carrier Reroute Broadcast MSN Movement Previous Progress may have more than one Reroute Broadcast MSN Movement Progress Performance Measure and a Reroute Broadcast MSN Movement Progress Performance Measure must belong to one Involved Party Carrier Reroute Broadcast MSN Movement Previous Progress.	NO
26b.	An Involved Party Carrier Reroute Broadcast MSN Movement Current Progress may have more than one Reroute Broadcast MSN Movement Progress Performance Measure and a Reroute Broadcast MSN Movement Progress Performance Measure may belong to one Involved Party Carrier Reroute Broadcast MSN Movement Current Progress.	NO
26c.	An MSN Movement Performance Measurement Rule may have more than one Reroute Broadcast MSN Movement Progress Performance Measure and a Reroute Broadcast MSN Movement Progress Performance Measure must belong to one MSN Movement Performance Measurement Rule.	NO
27a.	A Giveback Reason may be associated with more than one End-User Unallocated MSN Movement and an End-User Unallocated MSN Movement must be associated with one Giveback Reason.	NO
27b.	An End-User Unallocated MSN Movement must either be a Giveback-In MSN Movement or a Giveback-Out MSN Movement but not both.	YES
28a.	A Reroute Broadcast MSN Movement must either be an End-User Allocated MSN Movement, a Network MSN Movement or an End-User Unallocated MSN Movement but not more than one of these types.	NO
28b.	A Reroute Broadcast MSN Movement must either be an Initiated Reroute Broadcast MSN Movement or a Completed Reroute Broadcast MSN Movement but not both.	YES
28c.	A Reroute Broadcast MSN Movement must be associated with more than one Carrier Reroute Broadcast MSN Movement and a Carrier Reroute Broadcast MSN Movement must be associated with one Reroute Broadcast MSN Movement.	NO
29a.	A Carrier Reroute Broadcast MSN Movement must either be an Initiated Carrier Reroute Broadcast MSN Movement or a Completed Carrier Reroute Broadcast MSN Movement but not both.	NO

RULE ID	FUNDAMENTAL BUSINESS RULE DESCRIPTION	MNPS SUPPORT
29b.	A Carrier Reroute Broadcast MSN Movement may have more than one Involved Party Carrier Reroute Broadcast MSN Movement Progress and an Involved Party Carrier Reroute Broadcast MSN Movement Progress must be associated with one Carrier Reroute Broadcast MSN Movement.	NO
29c.	An MSN Movement Industry Dialogue Type may have more than one Involved Party Carrier Reroute Broadcast MSN Movement Progress and an Involved Party Carrier Reroute Broadcast MSN Movement Progress must be associated with one MSN Movement Industry Dialogue Type.	NO
30a.	An Involved Party Carrier Reroute Broadcast MSN Movement Progress may at once be an Involved Party Carrier Reroute Broadcast MSN Movement Current Progress or an Involved Party Carrier Reroute Broadcast MSN Movement Previous Progress.	NO
30b.	An Involved Party Carrier Reroute Broadcast MSN Movement Previous Progress must be associated with one Involved Party Carrier Reroute Broadcast MSN Movement Current Progress.	NO
30c.	An Involved Party Carrier Reroute Broadcast MSN Movement Current Progress may have one or more than one Reroute Broadcast MSN Movement Progress Performance Measure and a Reroute Broadcast MSN Movement Progress Performance Measure must belong to one Involved Party Carrier Reroute Broadcast MSN Movement Current Progress.	NO
30d.	An Involved Party Carrier Reroute Broadcast MSN Movement Previous Progress may have more than one Reroute Broadcast MSN Movement Progress Performance Measure and a Reroute Broadcast MSN Movement Progress Performance Measure must belong to one Involved Party Carrier Reroute Broadcast MSN Movement Previous Progress.	NO
30e.	An MSN Movement Performance Measurement Rule may have more than one Reroute Broadcast MSN Movement Progress Performance Measure and a Reroute Broadcast MSN Movement Progress Performance Measure must belong to one MSN Movement Performance Measurement Rule.	NO
31a.	A Carrier may be associated with more than one Carrier Reroute Broadcast MSN Movement and a Carrier Reroute Broadcast MSN Movement must be associated with one Carrier.	NO
31b.	A Carrier may be a Mobile Carrier.	YES
31c.	A Mobile Carrier may be a Gaining Mobile Carrier, a Losing Mobile Carrier, a Current Mobile Carrier, or an Original Mobile Carrier.	NO
31d.	An Original Mobile Carrier may be associated with more than one Mobile Service Number and a Mobile Service Number must be associated with one Original Mobile Carrier.	NO
31e.	An Original Mobile Carrier may be associated with more than one End-User Unallocated MSN Movement and an End-User Unallocated MSN Movement must be associated with one Original Mobile Carrier.	NO
31f.	A Current Mobile Carrier may be associated with more than one Mobile Service Number and a Mobile Service Number must be associated with one Current Mobile Carrier.	NO
31g.	A Current Mobile Carrier may be associated with more than one End-User Unallocated MSN Movement and an End-User Unallocated MSN Movement must be associated with one Current Mobile Carrier.	NO
31h.	A Gaining Mobile Carrier may be associated with more than one Customer MSN Movement and a Customer MSN Movement must be associated with one Gaining Mobile Carrier.	YES
31i.	A Losing Mobile Carrier may be associated with more than one Customer MSN Movement and a Customer MSN Movement must be associated with one Losing Mobile Carrier.	YES
32a.	A Carriage Service Provider may be a Gaining Carriage Service Provider, a Losing Carriage Service Provider, or a Current Carriage Service Provider.	NO
32b.	A Gaining Carriage Service Provider may be associated with more than one Customer MSN Movement and a Customer MSN Movement must be associated with one Gaining Carriage Service Provider.	YES
32c.	A Losing Carriage Service Provider may be associated with more than one Customer MSN Movement and a Customer MSN Movement must be associated with one Losing Carriage Service Provider.	YES

RULE ID	FUNDAMENTAL BUSINESS RULE DESCRIPTION	MNPS SUPPORT
32d.	A Current Carriage Service Provider may be associated with more than one End-User Unallocated MSN Movement and an End-User Unallocated MSN Movement must be associated with one Current Carriage Service Provider.	NO
33a.	A Technology Type may be a Current Technology Type, a Target Technology Type, or an Original Technology Type.	YES
33b.	A Current Technology Type may be associated with more than one Mobile Service Number and a Mobile Service Number must be associated with one Current Technology Type.	NO
33c.	An Original Technology Type may be associated with more than one End-User Unallocated MSN Movement and an End-User Unallocated MSN Movement must be associated with one Original Technology Type.	NO
33d.	A Target Technology Type may be associated with more than one Network MSN Movement and a Network MSN Movement must be associated with one Target Technology Type.	YES
33e.	A Target Technology Type may be associated with more than one End-User Allocated MSN Movement and an End-User Allocated MSN Movement must be associated with one Target Technology Type.	YES
34a.	A MSN Movement Performance Measurement Rule may have more than one MSN Movement Performance Measurement Rule Classification and a MSN Movement Performance Measurement Rule Classification must relate to one MSN Movement Performance Measurement Rule.	NO
34b	A MSN Movement Performance Measurement Rule Classification Type may have more than one MSN Movement Performance Measurement Rule Classification and a MSN Movement Performance Measurement Rule Classification must relate to one MSN Movement Performance Measurement Rule Classification Type.	NO
34c.	A Sending Party Type may relate to more than one MSN Movement Performance Measurement Rule Classification and a MSN Movement Performance Measurement Rule Classification may relate to one Sending Party Type.	NO
34d.	A Receiving Party Type may relate to more than one MSN Movement Performance Measurement Rule Classification and a MSN Movement Performance Measurement Rule Classification may relate to one Receiving Party Type.	NO
34e.	A MSN Movement Performance Measurement Rule Classification must relate to one Sending Party Type or one Receiving Party Type.	NO

Appendix H - The DRS' Compliance with the Fundamental Business Rules

RULE ID	FUNDAMENTAL BUSINESS RULE DESCRIPTION	DRS SUPPORT
1.	An Event may be a Mobile Service Number (MSN) Movement.	YES
2a.	An MSN Movement may be a Customer MSN Movement, a Customer MSN Movement Reversal, a Network MSN Movement, an End-User Unallocated MSN Movement or a Completed MSN Movement.	YES
2b.	An MSN Movement may at once be a Customer MSN Movement and a Completed MSN Movement; a Customer MSN Movement Reversal and a Completed MSN Movement; a Network MSN Movement and a Completed MSN Movement; an End-User Unallocated MSN Movement and a Completed MSN Movement.	YES
2c.	If an MSN Movement is a Customer MSN Movement then it cannot at once be a Network MSN Movement and vice versa; it cannot at once be a Customer MSN Movement Reversal and vice versa; and it cannot at once be an End-User Unallocated MSN Movement and vice versa.	YES
2d.	A Customer MSN Movement may become a Customer MSN Movement Reversal and a Customer MSN Movement Reversal must first be a Customer MSN Movement.	YES
2e.	A Customer MSN Movement may be an End-User Allocated MSN Movement or a Non-Network MSN Movement.	YES
2f.	If a Customer MSN Movement is an End-User Allocated MSN Movement then it cannot at once be a Non-Network MSN Movement and vice versa.	YES
2g.	An End-User Allocated MSN Movement may be a Port-In MSN Movement, a Port-Out MSN Movement or a Technology Transfer Churn MSN Movement.	YES
2h.	A Non-Network MSN Movement is a Churn MSN Movement.	YES
2i.	If an End-User Allocated MSN Movement is a Port-In MSN Movement it cannot at once be a Port-Out MSN Movement and vice versa.	YES
2j.	If an End-User Allocated MSN Movement is a Technology Transfer Churn MSN Movement then it cannot at once be a Port-In MSN Movement and vice versa.	YES
2k.	If an End-User Allocated MSN Movement is a Technology Transfer Churn MSN Movement then it cannot at once be a Port-Out MSN Movement and vice versa.	YES
3a.	A Customer MSN Movement may be an Unacknowledged Customer MSN Movement, an Acknowledged Customer MSN Movement, a Rejected Customer MSN Movement, an Approved Customer MSN Movement, a Cutover Customer MSN Movement, a Withdrawn Customer MSN Movement, or an Expired Customer MSN Movement.	YES
3b.	If a Customer MSN Movement is an Unacknowledged Customer MSN Movement then it cannot at once be an Acknowledged Customer MSN Movement and vice versa.	YES
3c.	If a Customer MSN Movement is an Unacknowledged Customer MSN Movement then it cannot at once be an Approved Customer MSN Movement and vice versa.	YES
3d.	If a Customer MSN Movement is an Acknowledged Customer MSN Movement then it cannot at once be an Approved Customer MSN Movement and vice versa.	YES
3e.	If a Customer MSN Movement is a Rejected Customer MSN Movement then it cannot at once be an Approved Customer MSN Movement and vice versa.	YES
3f.	If a Customer MSN Movement is a Cutover Customer MSN Movement then it must be at once an Approved Customer MSN Movement.	YES

RULE ID	FUNDAMENTAL BUSINESS RULE DESCRIPTION	DRS SUPPORT
4a.	A Cutover Customer MSN Movement may be an Unacknowledged Cutover Customer MSN Movement, an Acknowledged Cutover Customer MSN Movement, a Rejected Cutover Customer MSN Movement or an Approved Cutover Customer MSN Movement.	YES
4b.	If a Cutover Customer MSN Movement is an Unacknowledged Cutover Customer MSN Movement then it cannot at once be an Acknowledged Cutover Customer MSN Movement and vice versa.	YES
4c.	If a Cutover Customer MSN Movement is an Unacknowledged Cutover Customer MSN Movement then it cannot at once be an Approved Cutover Customer MSN Movement and vice versa.	YES
4d.	If a Cutover Customer MSN Movement is an Acknowledged Cutover Customer MSN Movement then it cannot at once be an Approved Cutover Customer MSN Movement and vice versa.	YES
4e.	If a Cutover Customer MSN Movement is a Rejected Cutover Customer MSN Movement then it cannot at once be an Approved Cutover Customer MSN Movement and vice versa.	YES
5a.	A Withdrawn Customer MSN Movement may be an Unacknowledged Withdrawn Customer MSN Movement, an Acknowledged Withdrawn Customer MSN Movement, a Rejected Withdrawn Customer MSN Movement or an Approved Withdrawn Customer MSN Movement.	YES
5b.	If a Withdrawn Customer MSN Movement is an Unacknowledged Withdrawn Customer MSN Movement then it cannot at once be an Acknowledged Withdrawn Customer MSN Movement and vice versa.	YES
5c.	If a Withdrawn Customer MSN Movement is an Unacknowledged Withdrawn Customer MSN Movement then it cannot at once be an Approved Withdrawn Customer MSN Movement and vice versa.	YES
5d.	If a Withdrawn Customer MSN Movement is an Acknowledged Withdrawn Customer MSN Movement then it cannot at once be an Approved Withdrawn Customer MSN Movement and vice versa.	YES
5e.	If a Withdrawn Customer MSN Movement is a Rejected Withdrawn Customer MSN Movement then it cannot at once be an Approved Withdrawn Customer MSN Movement and vice versa.	YES
5f.	If a Customer MSN Movement is a Withdrawn Customer MSN Movement then it must be at once an Approved Customer MSN Movement.	YES
5g.	If a Customer MSN Movement is a Withdrawn Customer MSN Movement then it cannot at once be an Approved Cutover Customer MSN Movement and vice versa.	YES
6a.	An Expired Customer MSN Movement may be an Unacknowledged Expired Customer MSN Movement or an Acknowledged Expired Customer MSN Movement.	YES
6b.	If an Expired Customer MSN Movement is an Unacknowledged Expired Customer MSN Movement then it cannot at once be an Acknowledged Expired Customer MSN Movement and vice versa.	YES
6c.	If a Customer MSN Movement is an Expired Customer MSN Movement then it must be at once an Approved Customer MSN Movement.	YES
6d.	If a Customer MSN Movement is an Expired Customer MSN Movement then it cannot at once be an Approved Cutover Customer MSN Movement and vice versa.	YES
7a.	A Rejected Customer MSN Movement must relate to one Rejecting Losing Mobile Carrier or one Rejecting Gaining Mobile Carrier or one Rejecting Losing Carriage Service Provider, while a Rejecting Losing Mobile Carrier may relate to more than one Rejected Customer MSN Movement, a Rejecting Gaining Mobile Carrier may relate to more than one Rejected Customer MSN Movement, and a Rejecting Losing Carriage Service Provider may relate to more than one Rejected Customer MSN Movement.	YES
7b.	A Rejected Customer MSN Movement must be associated with one Reject Reason and a Reject Reason may apply to more than one Rejected Customer MSN Movement.	YES

RULE ID	FUNDAMENTAL BUSINESS RULE DESCRIPTION	DRS SUPPORT
8a.	An Acknowledged Cutover Customer MSN Movement may have more than one Resubmitted Cutover Customer MSN Movement and a Resubmitted Cutover Customer MSN Movement must relate to one Acknowledged Cutover Customer MSN Movement.	YES
8b.	A Rejected Cutover Customer MSN Movement may have more than one Resubmitted Cutover Customer MSN Movement and a Resubmitted Cutover Customer MSN Movement must relate to one Rejected Cutover Customer MSN Movement.	YES
8c.	A Rejected Cutover Customer MSN Movement must relate to one Rejecting Losing Mobile Carrier or one Rejecting Gaining Mobile Carrier or one Rejecting Losing Carriage Service Provider, while a Rejecting Losing Mobile Carrier may relate to more than one Rejected Cutover Customer MSN Movement, a Rejecting Gaining Mobile Carrier may relate to more than one Rejected Cutover Customer MSN Movement, and a Rejecting Losing Carriage Service Provider may relate to more than one Rejected Cutover Customer MSN Movement.	YES
8d.	A Rejected Cutover Customer MSN Movement must be associated with one Reject Reason and a Reject Reason may apply to more than one Rejected Cutover Customer MSN Movement.	YES
9a.	An Acknowledged Withdrawn Customer MSN Movement may have more than one Resubmitted Withdrawn Customer MSN Movement and a Resubmitted Withdrawn Customer MSN Movement must relate to one Acknowledged Withdrawn Customer MSN Movement.	YES
9b.	A Rejected Withdrawn Customer MSN Movement may have more than one Resubmitted Withdrawn Customer MSN Movement and a Resubmitted Withdrawn Customer MSN Movement must relate to one Rejected Withdrawn Customer MSN Movement.	YES
9c.	A Rejected Withdrawn Customer MSN Movement must relate to one Rejecting Losing Mobile Carrier or one Rejecting Gaining Mobile Carrier or one Rejecting Losing Carriage Service Provider, while a Rejecting Losing Mobile Carrier may relate to more than one Rejected Withdrawn Customer MSN Movement, a Rejecting Gaining Mobile Carrier may relate to more than one Rejected Withdrawn Customer MSN Movement, and a Rejecting Losing Carriage Service Provider may relate to more than one Rejected Withdrawn Customer MSN Movement.	YES
9d.	A Rejected Withdrawn Customer MSN Movement must be associated with one Reject Reason and a Reject Reason may apply to more than one Rejected Withdrawn Customer MSN Movement.	YES
10a.	A Customer MSN Movement Reversal may be an End-User Allocated MSN Movement Reversal or a Non-Network MSN Movement Reversal.	YES
10b.	If a Customer MSN Movement Reversal is an End-User Allocated MSN Movement Reversal then it cannot at once be a Non-Network MSN Movement Reversal and vice versa.	YES
10c.	An End-User Allocated MSN Movement Reversal may be a Port-In MSN Movement Reversal, a Port-Out MSN Movement Reversal or a Technology Transfer Churn MSN Movement Reversal.	YES
10d.	A Non-Network MSN Movement Reversal is a Churn MSN Movement Reversal.	YES
10e.	If an End-User Allocated MSN Movement Reversal is a Port-In MSN Movement Reversal then it cannot at once be a Port-Out MSN Movement Reversal and vice versa.	YES
10f.	If an End-User Allocated MSN Movement Reversal is a Technology Transfer Churn MSN Movement Reversal then it cannot at once be a Port-In MSN Movement Reversal and vice versa.	YES
10g.	If an End-User Allocated MSN Movement Reversal is a Technology Transfer MSN Movement Reversal then it cannot at once be a Port-Out MSN Movement Reversal and vice versa.	YES

RULE ID	FUNDAMENTAL BUSINESS RULE DESCRIPTION	DRS SUPPORT
11a.	A Customer MSN Movement Reversal may be an Unacknowledged Customer MSN Movement Reversal, an Acknowledged Customer MSN Movement Reversal, a Rejected Customer MSN Movement Reversal, an Approved Customer MSN Movement Reversal, a Cutover Customer MSN Movement Reversal, a Withdrawn Customer MSN Movement Reversal, or an Expired Customer MSN Movement Reversal.	YES
11b.	If a Customer MSN Movement Reversal is an Unacknowledged Customer MSN Movement Reversal then it cannot at once be an Acknowledged Customer MSN Movement Reversal and vice versa.	YES
11c.	If a Customer MSN Movement Reversal is an Unacknowledged Customer MSN Movement Reversal then it cannot at once be an Approved Customer MSN Movement Reversal and vice versa.	YES
11d.	If a Customer MSN Movement Reversal is an Acknowledged Customer MSN Movement Reversal then it cannot at once be an Approved Customer MSN Movement Reversal and vice versa.	YES
11e.	If a Customer MSN Movement Reversal is a Rejected Customer MSN Movement Reversal then it cannot at once be an Approved Customer MSN Movement Reversal and vice versa.	YES
11f.	If a Customer MSN Movement Reversal is a Cutover Customer MSN Movement Reversal then it must be at once an Approved Customer MSN Movement Reversal.	YES
12a.	A Cutover Customer MSN Movement Reversal may be an Unacknowledged Cutover Customer MSN Movement Reversal, an Acknowledged Cutover Customer MSN Movement Reversal, a Rejected Cutover Customer MSN Movement Reversal or an Approved Cutover Customer MSN Movement Reversal.	YES
12b.	If a Cutover Customer MSN Movement Reversal is an Unacknowledged Cutover Customer MSN Movement Reversal then it cannot at once be an Acknowledged Cutover Customer MSN Movement Reversal and vice versa.	YES
12c.	If a Cutover Customer MSN Movement Reversal is an Unacknowledged Cutover Customer MSN Movement Reversal then it cannot at once be an Approved Cutover Customer MSN Movement Reversal and vice versa.	YES
12d.	If a Cutover Customer MSN Movement Reversal is an Acknowledged Cutover Customer MSN Movement Reversal then it cannot at once be an Approved Cutover Customer MSN Movement Reversal and vice versa.	YES
12e.	If a Cutover Customer MSN Movement Reversal is a Rejected Cutover Customer MSN Movement Reversal then it cannot at once be an Approved Cutover Customer MSN Movement Reversal and vice versa.	YES
13a.	A Withdrawn Customer MSN Movement Reversal may be an Unacknowledged Withdrawn Customer MSN Movement Reversal, an Acknowledged Withdrawn Customer MSN Movement Reversal, a Rejected Withdrawn Customer MSN Movement Reversal or an Approved Withdrawn Customer MSN Movement Reversal.	YES
13b.	If a Withdrawn Customer MSN Movement Reversal is an Unacknowledged Withdrawn Customer MSN Movement Reversal then it cannot at once be an Acknowledged Withdrawn Customer MSN Movement Reversal and vice versa.	YES
13c.	If a Withdrawn Customer MSN Movement Reversal is an Unacknowledged Withdrawn Customer MSN Movement Reversal then it cannot at once be an Approved Withdrawn Customer MSN Movement Reversal and vice versa.	YES
13d.	If a Withdrawn Customer MSN Movement Reversal is an Acknowledged Withdrawn Customer MSN Movement Reversal then it cannot at once be an Approved Withdrawn Customer MSN Movement Reversal and vice versa.	YES
13e.	If a Withdrawn Customer MSN Movement Reversal is a Rejected Withdrawn Customer MSN Movement Reversal then it cannot at once be an Approved Withdrawn Customer MSN Movement Reversal and vice versa.	YES
13f.	If a Customer MSN Movement Reversal is a Withdrawn Customer MSN Movement Reversal then it must be at once an Approved Customer MSN Movement Reversal.	YES

RULE ID	FUNDAMENTAL BUSINESS RULE DESCRIPTION	DRS SUPPORT
13g.	If a Customer MSN Movement Reversal is a Withdrawn Customer MSN Movement Reversal then it cannot at once be an Approved Cutover Customer MSN Movement Reversal and vice versa.	YES
14a.	An Expired Customer MSN Movement Reversal may be an Unacknowledged Expired Customer MSN Movement Reversal or an Acknowledged Expired Customer MSN Movement Reversal.	YES
14b.	If an Expired Customer MSN Movement Reversal is an Unacknowledged Expired Customer MSN Movement Reversal then it cannot at once be an Acknowledged Expired Customer MSN Movement Reversal and vice versa.	YES
14c.	If a Customer MSN Movement Reversal is an Expired Customer MSN Movement Reversal then it must be at once an Approved Customer MSN Movement Reversal.	YES
14d.	If a Customer MSN Movement Reversal is an Expired Customer MSN Movement Reversal then it cannot at once be an Approved Cutover Customer MSN Movement Reversal and vice versa.	YES
15a.	An Acknowledged Cutover Customer MSN Movement Reversal may have more than one Resubmitted Cutover Customer MSN Movement Reversal and a Resubmitted Cutover Customer MSN Movement Reversal must relate to one Acknowledged Cutover Customer MSN Movement Reversal.	YES
15b.	A Rejected Cutover Customer MSN Movement Reversal may have more than one Resubmitted Cutover Customer MSN Movement Reversal and a Resubmitted Cutover Customer MSN Movement Reversal must relate to one Rejected Cutover Customer MSN Movement Reversal.	YES
15c.	A Rejected Cutover Customer MSN Movement Reversal must relate to one Rejecting Losing Mobile Carrier or one Rejecting Gaining Mobile Carrier or one Rejecting Losing Carriage Service Provider, while a Rejecting Losing Mobile Carrier may relate to more than one Rejected Cutover Customer MSN Movement Reversal, a Rejecting Gaining Mobile Carrier may relate to more than one Rejected Cutover Customer MSN Movement Reversal, and a Rejecting Losing Carriage Service Provider may relate to more than one Rejected Cutover Customer MSN Movement Reversal.	YES
16a.	An Acknowledged Withdrawn Customer MSN Movement Reversal may have more than one Resubmitted Withdrawn Customer MSN Movement Reversal and a Resubmitted Withdrawn Customer MSN Movement Reversal must relate to one Acknowledged Withdrawn Customer MSN Movement Reversal.	YES
16b.	A Rejected Withdrawn Customer MSN Movement Reversal may have more than one Resubmitted Withdrawn Customer MSN Movement Reversal and a Resubmitted Withdrawn Customer MSN Movement Reversal must relate to one Rejected Withdrawn Customer MSN Movement Reversal.	YES
16c.	A Rejected Withdrawn Customer MSN Movement Reversal must relate to one Rejecting Losing Mobile Carrier or one Rejecting Gaining Mobile Carrier or one Rejecting Losing Carriage Service Provider, while a Rejecting Losing Mobile Carrier may relate to more than one Rejected Withdrawn Customer MSN Movement Reversal, a Rejecting Gaining Mobile Carrier may relate to more than one Rejected Withdrawn Customer MSN Movement Reversal, and a Rejecting Losing Carriage Service Provider may relate to more than one Rejected Withdrawn Customer MSN Movement Reversal.	YES
17a.	A Customer MSN Movement may have more than one Involved Party MSN Movement Progress and an Involved Party MSN Movement Progress must be associated with one Customer MSN Movement.	YES
17b.	A Customer MSN Movement Reversal may have more than one Involved Party MSN Movement Progress and an Involved Party MSN Movement Progress must be associated with one Customer MSN Movement Reversal.	YES
17c.	An End-User Unallocated MSN Movement may have more than one Involved Party MSN Movement Progress and an Involved Party MSN Movement Progress must be associated with one End-User Unallocated MSN Movement.	YES
17d.	An MSN Movement Industry Dialogue Type may have more than one Involved Party MSN Movement Progress and an Involved Party MSN Movement Progress must be associated with one MSN Movement Industry Dialogue Type.	YES

RULE ID	FUNDAMENTAL BUSINESS RULE DESCRIPTION	DRS SUPPORT
17e.	An Involved Party MSN Movement Progress may at once be an Involved Party MSN Movement Current Progress or an Involved Party MSN Movement Previous Progress.	YES
17f.	An Involved Party MSN Movement Previous Progress must be associated with one Involved Party MSN Movement Current Progress.	YES
18a.	A Resubmitted Cutover Customer MSN Movement may have more than one Involved Party Resubmitted MSN Movement Progress and an Involved Party Resubmitted MSN Movement Progress must be associated with one Resubmitted Cutover Customer MSN Movement.	YES
18b.	An MSN Movement Industry Dialogue Type may have more than one Involved Party Resubmitted MSN Movement Progress and an Involved Party Resubmitted MSN Movement Progress must be associated with one MSN Movement Industry Dialogue Type.	YES
18c.	An Involved Party Resubmitted MSN Movement Progress may at once be an Involved Party Resubmitted MSN Movement Current Progress or an Involved Party Resubmitted MSN Movement Previous Progress.	YES
18d.	An Involved Party Resubmitted MSN Movement Previous Progress must be associated with one Involved Party Resubmitted MSN Movement Current Progress.	YES
19a.	A Resubmitted Withdrawn Customer MSN Movement may have more than one Involved Party Resubmitted Withdrawn Customer MSN Movement Progress and an Involved Party Resubmitted Withdrawn Customer MSN Movement Progress must be associated with one Resubmitted Withdrawn Customer MSN Movement.	YES
19b.	An MSN Movement Industry Dialogue Type may have more than one Involved Party Resubmitted Withdrawn Customer MSN Movement Progress and an Involved Party Resubmitted Withdrawn Customer MSN Movement Progress must be associated with one MSN Movement Industry Dialogue Type.	YES
19c.	An Involved Party Resubmitted Withdrawn Customer MSN Movement Progress may at once be an Involved Party Resubmitted Withdrawn Customer MSN Movement Current Progress or an Involved Party Resubmitted Withdrawn Customer MSN Movement Previous Progress.	YES
19d.	An Involved Party Resubmitted Withdrawn Customer MSN Movement Previous Progress must be associated with one Involved Party Resubmitted Withdrawn Customer MSN Movement Current Progress.	YES
20a.	An MSN Movement Message Type may have more than one MSN Movement Industry Dialogue Type and an MSN Movement Industry Dialogue Type must belong to one MSN Movement Message Type.	YES
20b.	An MSN Movement Sending Party Type may have more than one MSN Movement Industry Dialogue Type and an MSN Movement Industry Dialogue Type must belong to one MSN Movement Sending Party Type.	YES
20c.	An MSN Movement Receiving Party Type may have more than one MSN Movement Industry Dialogue Type and an MSN Movement Industry Dialogue Type must belong to one MSN Movement Receiving Party Type.	YES
21a.	A Business Party may be an MSN Movement Sending Party or an MSN Movement Receiving Party but not both.	YES
21b.	An MSN Movement Sending Party Type may have more than one MSN Movement Sending Party and an MSN Movement Sending Party must belong to one MSN Movement Sending Party Type.	YES
21c.	An MSN Movement Receiving Party Type may have more than one MSN Movement Receiving Party and an MSN Movement Receiving Party must belong to one MSN Movement Receiving Party Type.	YES
22a.	A Business Party may be a Rejecting Party.	YES
22b.	A Rejecting Party may be a Rejecting Mobile Carrier or a Rejecting Carriage Service Provider but not both.	YES
22c.	A Rejecting Mobile Carrier may be a Rejecting Losing Mobile Carrier or a Rejecting Gaining Mobile Carrier but not both.	YES

RULE ID	FUNDAMENTAL BUSINESS RULE DESCRIPTION	DRS SUPPORT
22d.	A Rejecting Carriage Service Provider is a Rejecting Losing Carriage Service Provider.	YES
23a.	An MSN Movement Industry Dialogue Type may at once be a Current MSN Movement Industry Dialogue Type or a Previous MSN Movement Industry Dialogue Type.	YES
23b.	A Current MSN Movement Industry Dialogue Type may have more than one Previous MSN Movement Industry Dialogue Type associated with it and a Previous MSN Movement Industry Dialogue Type must be for one Current MSN Movement Industry Dialogue Type.	YES
23c.	A Current MSN Movement Industry Dialogue Type may have more than one MSN Movement Performance Measurement Rule and an MSN Movement Performance Measurement Rule must relate to one Current MSN Movement Industry Dialogue Type.	YES
23d.	A Previous MSN Movement Industry Dialogue Type may have more than one MSN Movement Performance Measurement Rule and a MSN Movement Performance Measurement Rule must relate to one Previous MSN Movement Industry Dialogue Type.	YES
24a.	An Involved Party MSN Movement Current Progress may have one or more than one MSN Movement Progress Performance Measure and an MSN Movement Progress Performance Measure must belong to one Involved Party MSN Movement Current Progress.	YES
24b.	An Involved Party MSN Movement Previous Progress may have more than one MSN Movement Progress Performance Measure and an MSN Movement Progress Performance Measure must belong to one Involved Party MSN Movement Previous Progress.	YES
24c.	An Involved Party Resubmitted Cutover Customer MSN Movement Current Progress may have more than one MSN Movement Progress Performance Measure and an MSN Movement Progress Performance Measure may belong to one Involved Party Resubmitted Cutover Customer MSN Movement Current Progress.	YES
24d.	An Involved Party Resubmitted Cutover Customer MSN Movement Previous Progress may have more than one MSN Movement Progress Performance Measure and an MSN Movement Progress Performance Measure may belong to one Involved Party Resubmitted Cutover Customer MSN Movement Previous Progress.	YES
24e.	An Involved Party Resubmitted Withdrawn Customer MSN Movement Current Progress may have more than one MSN Movement Progress Performance Measure and an MSN Movement Progress Performance Measure may belong to one Involved Party Resubmitted Withdrawn Customer MSN Movement Current Progress.	YES
24f.	An Involved Party Resubmitted Withdrawn Customer MSN Movement Previous Progress may have more than one MSN Movement Progress Performance Measure and an MSN Movement Progress Performance Measure may belong to one Involved Party Resubmitted Withdrawn Customer MSN Movement Previous Progress.	YES
24g.	An MSN Movement Performance Measurement Rule may have more than one MSN Movement Progress Performance Measure and an MSN Movement Progress Performance Measure must belong to one MSN Movement Performance Measurement Rule.	YES
25a.	An Involved Party Carrier Reroute Broadcast MSN Movement Current Progress may have one or more than one Reroute Broadcast Cutover MSN Movement Progress Performance Measure and a Reroute Broadcast Cutover MSN Movement Progress Performance Measure must belong to one Involved Party Carrier Reroute Broadcast MSN Movement Current Progress.	YES
25b.	An Involved Party MSN Movement Previous Progress may have more than one Reroute Broadcast Cutover MSN Movement Progress Performance Measure and a Reroute Broadcast Cutover MSN Movement Progress Performance Measure must belong to one Involved Party MSN Movement Previous Progress.	YES

RULE ID	FUNDAMENTAL BUSINESS RULE DESCRIPTION	DRS SUPPORT
25c.	An MSN Movement Performance Measurement Rule may have more than one Reroute Broadcast Cutover MSN Movement Progress Performance Measure and a Reroute Broadcast Cutover MSN Movement Progress Performance Measure must belong to one MSN Movement Performance Measurement Rule.	YES
26a.	An Involved Party Carrier Reroute Broadcast MSN Movement Previous Progress may have more than one Reroute Broadcast MSN Movement Progress Performance Measure and a Reroute Broadcast MSN Movement Progress Performance Measure must belong to one Involved Party Carrier Reroute Broadcast MSN Movement Previous Progress.	YES
26b.	An Involved Party Carrier Reroute Broadcast MSN Movement Current Progress may have more than one Reroute Broadcast MSN Movement Progress Performance Measure and a Reroute Broadcast MSN Movement Progress Performance Measure may belong to one Involved Party Carrier Reroute Broadcast MSN Movement Current Progress.	YES
26c.	An MSN Movement Performance Measurement Rule may have more than one Reroute Broadcast MSN Movement Progress Performance Measure and a Reroute Broadcast MSN Movement Progress Performance Measure must belong to one MSN Movement Performance Measurement Rule.	YES
27a.	A Giveback Reason may be associated with more than one End-User Unallocated MSN Movement and an End-User Unallocated MSN Movement must be associated with one Giveback Reason.	YES
27b.	An End-User Unallocated MSN Movement must either be a Giveback-In MSN Movement or a Giveback-Out MSN Movement but not both.	YES
28a.	A Reroute Broadcast MSN Movement must either be an End-User Allocated MSN Movement, a Network MSN Movement or an End-User Unallocated MSN Movement but not more than one of these types.	YES
28b.	A Reroute Broadcast MSN Movement must either be an Initiated Reroute Broadcast MSN Movement or a Completed Reroute Broadcast MSN Movement but not both.	YES
28c.	A Reroute Broadcast MSN Movement must be associated with more than one Carrier Reroute Broadcast MSN Movement and a Carrier Reroute Broadcast MSN Movement must be associated with one Reroute Broadcast MSN Movement.	YES
t29a.	A Carrier Reroute Broadcast MSN Movement must either be an Initiated Carrier Reroute Broadcast MSN Movement or a Completed Carrier Reroute Broadcast MSN Movement but not both.	YES
29b.	A Carrier Reroute Broadcast MSN Movement may have more than one Involved Party Carrier Reroute Broadcast MSN Movement Progress and an Involved Party Carrier Reroute Broadcast MSN Movement Progress must be associated with one Carrier Reroute Broadcast MSN Movement.	YES
29c.	An MSN Movement Industry Dialogue Type may have more than one Involved Party Carrier Reroute Broadcast MSN Movement Progress and an Involved Party Carrier Reroute Broadcast MSN Movement Progress must be associated with one MSN Movement Industry Dialogue Type.	YES
30a.	An Involved Party Carrier Reroute Broadcast MSN Movement Progress may at once be an Involved Party Carrier Reroute Broadcast MSN Movement Current Progress or an Involved Party Carrier Reroute Broadcast MSN Movement Previous Progress.	YES
30b.	An Involved Party Carrier Reroute Broadcast MSN Movement Previous Progress must be associated with one Involved Party Carrier Reroute Broadcast MSN Movement Current Progress.	YES
30c.	An Involved Party Carrier Reroute Broadcast MSN Movement Current Progress may have one or more than one Reroute Broadcast MSN Movement Progress Performance Measure and a Reroute Broadcast MSN Movement Progress Performance Measure must belong to one Involved Party Carrier Reroute Broadcast MSN Movement Current Progress.	YES

RULE ID	FUNDAMENTAL BUSINESS RULE DESCRIPTION	DRS SUPPORT
30d.	An Involved Party Carrier Reroute Broadcast MSN Movement Previous Progress may have more than one Reroute Broadcast MSN Movement Progress Performance Measure and a Reroute Broadcast MSN Movement Progress Performance Measure must belong to one Involved Party Carrier Reroute Broadcast MSN Movement Previous Progress.	YES
30e.	An MSN Movement Performance Measurement Rule may have more than one Reroute Broadcast MSN Movement Progress Performance Measure and a Reroute Broadcast MSN Movement Progress Performance Measure must belong to one MSN Movement Performance Measurement Rule.	YES
31a.	A Carrier may be associated with more than one Carrier Reroute Broadcast MSN Movement and a Carrier Reroute Broadcast MSN Movement must be associated with one Carrier.	YES
31b.	A Carrier may be a Mobile Carrier.	YES
31c.	A Mobile Carrier may be a Gaining Mobile Carrier, a Losing Mobile Carrier, a Current Mobile Carrier, or an Original Mobile Carrier.	YES
31d.	An Original Mobile Carrier may be associated with more than one Mobile Service Number and a Mobile Service Number must be associated with one Original Mobile Carrier.	YES
31e.	An Original Mobile Carrier may be associated with more than one End-User Unallocated MSN Movement and an End-User Unallocated MSN Movement must be associated with one Original Mobile Carrier.	YES
31f.	A Current Mobile Carrier may be associated with more than one Mobile Service Number and a Mobile Service Number must be associated with one Current Mobile Carrier.	YES
31g.	A Current Mobile Carrier may be associated with more than one End-User Unallocated MSN Movement and an End-User Unallocated MSN Movement must be associated with one Current Mobile Carrier.	YES
31h.	A Gaining Mobile Carrier may be associated with more than one Customer MSN Movement and a Customer MSN Movement must be associated with one Gaining Mobile Carrier.	YES
31i.	A Losing Mobile Carrier may be associated with more than one Customer MSN Movement and a Customer MSN Movement must be associated with one Losing Mobile Carrier.	YES
32a.	A Carriage Service Provider may be a Gaining Carriage Service Provider, a Losing Carriage Service Provider, or a Current Carriage Service Provider.	YES
32b.	A Gaining Carriage Service Provider may be associated with more than one Customer MSN Movement and a Customer MSN Movement must be associated with one Gaining Carriage Service Provider.	YES
32c.	A Losing Carriage Service Provider may be associated with more than one Customer MSN Movement and a Customer MSN Movement must be associated with one Losing Carriage Service Provider.	YES
32d.	A Current Carriage Service Provider may be associated with more than one End-User Unallocated MSN Movement and an End-User Unallocated MSN Movement must be associated with one Current Carriage Service Provider.	YES
33a.	A Technology Type may be a Current Technology Type, a Target Technology Type, or an Original Technology Type.	YES
33b.	A Current Technology Type may be associated with more than one Mobile Service Number and a Mobile Service Number must be associated with one Current Technology Type.	YES
33c.	An Original Technology Type may be associated with more than one End-User Unallocated MSN Movement and an End-User Unallocated MSN Movement must be associated with one Original Technology Type.	YES
33d.	A Target Technology Type may be associated with more than one Network MSN Movement and a Network MSN Movement must be associated with one Target Technology Type.	YES
33e.	A Target Technology Type may be associated with more than one End-User Allocated MSN Movement and an End-User Allocated MSN Movement must be associated with one Target Technology Type.	YES

RULE ID	FUNDAMENTAL BUSINESS RULE DESCRIPTION	DRS SUPPORT
34a.	A MSN Movement Performance Measurement Rule may have more than one MSN Movement Performance Measurement Rule Classification and a MSN Movement Performance Measurement Rule Classification must relate to one MSN Movement Performance Measurement Rule.	YES
34b.	A MSN Movement Performance Measurement Rule Classification Type may have more than one MSN Movement Performance Measurement Rule Classification and a MSN Movement Performance Measurement Rule Classification must relate to one MSN Movement Performance Measurement Rule Classification Type.	YES
34c.	A Sending Party Type may relate to more than one MSN Movement Performance Measurement Rule Classification and a MSN Movement Performance Measurement Rule Classification may relate to one Sending Party Type.	YES
34d.	A Receiving Party Type may relate to more than one MSN Movement Performance Measurement Rule Classification and a MSN Movement Performance Measurement Rule Classification may relate to one Receiving Party Type.	YES

Appendix I - The DRS Conceptual Schema

Appendix J - The DRS Physical Database Schema

Appendix K - Project Evaluation and Selection in Information Systems Strategic Planning

Ng, M. W. (1988) Project Evaluation and Selection in Information Systems Strategic Planning. *Proceedings of the Australian Computer Society Annual Conference*. Melbourne.

PROJECT EVALUATION AND SELECTION IN INFORMATION SYSTEMS STRATEGIC PLANNING

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PROJECT EVALUATION AND SELECTION IN INFORMATION SYSTEMS STRATEGIC PLANNING

ABSTRACT

Conventional cost benefit analysis is inadequate for evaluating projects for selection in information systems strategic planning.

An alternative project evaluation methodology that takes into account of four categories of factors, viz. quantifiable benefits, intangible benefits, relevance to corporate objectives and significance to technical necessity is propounded.

The three major steps of the methodology are explicated. These steps are:

i. Project Valuation

ii. Figure of Merit Analysis

iii. Investment Analysis

Finally, some issues related to project selection are discussed.

KEYWORDS

Information systems, strategic planning, project evaluation, project selection, cost benefit analysis, figure of merit analysis, investment analysis.

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PROJECT EVALUATION AND SELECTION IN INFORMATION SYSTEMS STRATEGIC PLANNING

1. INTRODUCTION

This paper propounds a project evaluation methodology based on a coherent set of techniques well tried out in real-life conditions. The methodology enables rational selection of projects in information systems strategic planning (ISSP).

The methodology can be applied when a list of candidate projects are identified as a result of an ISSP study, which may include strategic alignment with corporate objectives, critical success factors analysis, enterprise modelling or user projects nomination, etc. This paper, however, does not cover any of the aforesaid activities but assumes the availability of any relevant data as a result of such activities.

2. INADEQUACIES OF CONVENTIONAL COST BENEFIT ANALYSIS IN ISSP

If one attempts to apply conventional cost benefit analysis in project evaluation and selection in ISSP, one would be confronted with the following problems:

i. No detailed estimates for project costs and quantifiable benefits are available at the stage of ISSP, which has, typically, a planning horizon of five to eight years.

ii. Even if detailed estimates were available (chances are they are contrived), to conduct a detailed cost benefit analysis using such voluminous data for a large number of candidate projects in ISSP would be the tail wagging the dog – hardly a viable proposition. (The project duration of an entire ISSP project is typically six months).

iii. With the proliferation of information technology into the higher echelons of corporations, it is increasingly difficult to justify many projects purely on financial grounds. This is largely due to the inability to quantify in dollar terms the value of a piece of information used by senior management. Furthermore, a shift in emphasis towards intangibles such as public perception and customer relations can often justify projects in defiance of financial analysis. Similarly, the need for building some technological infra-structure in support of other information systems can justify certain technology-related projects that cannot be financially justified on their own.

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iv. The end-results from a detailed cost benefit analysis on the candidate projects are an overkill for the purpose of ISSP and are therefore not suitable for submission to an ISSP steering committee or similar high-level body.

Conventional cost benefit analysis is impotent in tackling the above problems. The project evaluation methodology expounded in the following sections specifically addresses these issues.

3. THE PROJECT EVALUATION METHODOLOGY

It is inherent in any soft systems (systems when human factors are essential) that they are not amenable to objective and quantitative scientific analysis. While this methodology does not purport to be an exact science based purely on objective analysis, it does, nevertheless, attempt to remove arbitrary subjectivity as much as possible and quantify the otherwise unquantifiable.

The methodology evaluates each candidate project according to the following four categories of factors:

i. Quantifiable Benefits
These include all benefits that can be quantified in dollar terms. Their total effect is captured in the present value benefit (PVB) described below.

ii. Intangible Benefits
These are the benefits that cannot be quantified in dollar terms. They can, however, be itemized as key factors and subject to figure of merit analysis as discussed below.

iii. Relevance to Corporate Objectives
The key corporate objectives can be itemized as key factors before applying figure of merit analysis as discussed below.

iv. Significance to Technical Necessity
Key technical issues such as the need for distributed data or data communications facilities etc. can be itemized as key factors before applying figure of merit analysis as discussed below.

The project evaluation methodology consists of the following steps:

1. Project Valuation

i. Estimate the most likely economic life span (ELS) of each of the candidate projects. The economic life span of a project is the duration in which the project is useful to the organization in the sense that its contribution to the well-being of the organization exceeds the cost in sustaining it. ELS is usually measured in years from the inception of a project to the point where it ceases to be useful. The ELS's of information systems projects typically range from four to ten years.

ii. Estimate the costs of development (i.e. investment) of each candidate project for each year within the ELS of the project.

iii. Estimate the net cash flow, i.e., the quantifiable benefit in dollar terms less the costs of sustaining the project for each candidate project for each year within the ELS of the project.

iv. Calculate the net present value (NPV) of each candidate project as follows:

$$NPV = PVB - PVI$$

$$\text{where } PVB = \sum_{t=1}^{n} \frac{NCF_t}{(1/R)^t}$$

$$PVI = \sum_{t=1}^{n} \frac{I_t}{(1/R)^t}$$

PVB = Present Value Benefit
NCF_t = Net Cash Flow in Year t
R = Opportunity Cost of Capital
n = Economic Life Span in Years
PVI = Present Value Investment

NB: This can be done with the help of an electronic spreadsheet

2. Figure of Merit Analysis

i. Examine the range of PVB's for all the candidate projects. Divide the range into ten parts. If the PVB of a project falls within the lowest part of the range, assign a score of 1 to the project. If it is the second lowest part, assign a score of 2 and so on, up to 10. These scores are in effect the figure of merit (FOM) of the projects with respect to quantifiable benefits.

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ii. Examine the range of PVI's for all the candidate projects. Divide the range into ten parts and assign a score from 1 to 10 for each of the projects according to its PVI similarly to (i) above. This is called the figure of investment (FOI).

iii. For the other three categories of factors, viz. intangible benefits, relevance to corporate objectives and significance to technical necessity, itemize the key factors (KF's) within each of the three categories.

iv. Within each category, consider the relative significance of the key factors. Assign a weighting factor (WF) to each of the key factors to reflect its relative significance within the category.
N.B. Relatively insignificant factors may be weeded out or combined together to form a more significant factor to avoid the crowding out effect on the more significant factors. Also, the KF's within a category must be considered together in totality to enable holistic assignment of weighting factors to reflect their true relative significance.

v. Within each of the three categories of factors, calculate the unitizing factor (UF) as follows:

$$\text{UF} = \frac{\text{Sum of WF's in category}}{\text{Number of WF's in category}}$$

vi. For each of the candidate projects, assign a raw score on a relative scale of 1 to 10 with respect to each of the KF's for each category.

vii. Unitise the raw score as follows:

$$\text{Unitized Score} = \frac{\text{Raw Score x WF}}{\text{UF}}$$

viii. For each candidate project, calculate the average unitized score (AUS) for each category as follows:

$$\text{AUS} = \frac{\text{Sum of unitized scores in category}}{\text{Number of KF's in category}}$$

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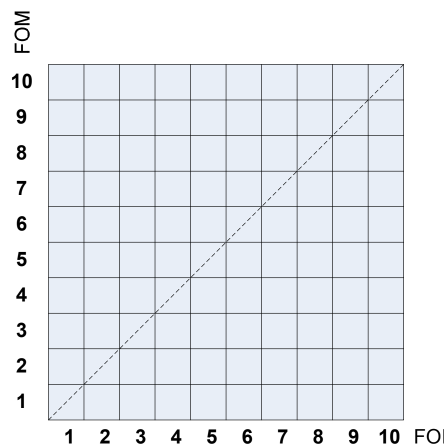
The AUS for a category of a project is the ultimate indication of how well a project is rated against the category of factors. The AUS is thus the figure of merit (FOM) with respect to the category.
N.B. The tedious chore of calculating the AUS's can be fully automated by an electronic spreadsheet. The crucial points are the identification of key factors and the assignment of weighting factors.

3. Investment Analysis

i. Construct a 10 x 10 grid for each category as follows:



FOM = Figure of Merit
FOI = Figure of Investment

ii. Based on the results of figure of merit analysis, each candidate project can be assigned to a particular square in the grid for each category. The dotted diagonal line indicates a linear constraint that dichotomises projects into those in the upper triangle and those in the lower triangle. Projects located in the upper triangle are deemed to be superior to those in the lower triangle with respect to the category of factors under consideration. These project investment analysis grids very succinctly depict the rating of a project and are singularly suitable for top management consumption as is the case for ISSP submissions.

4. Project Selection

Once the project investment analysis grids are prepared, the project evaluation results are ready for submission to an ISP steering committee or similar body for final project selection and approval.

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Project interdependencies in terms of prerequisites, mutual contingency and mutual exclusivity should be highlighted. User stipulations of urgency and importance of candidate projects should also be taken into consideration in the selection process.

In justifying the selection of a project, a low figure of merit in one category must be compensated for by a high figure of merit in other categories.

5. Conclusion

Experience in using this approach indicates that it does not have the inadequacies of conventional cost benefit analysis discussed in Section 2 above.

Appendix L - Interviews Conducted

Interviews by Organisation Chart Function

DIVISION	ORGANISATION CHART FUNCTION	POSITION TITLE	INTERVIEW DATE	NUMBER INTERVIEWED
Wholesale	Business Executive	Managing Director	29/08/2001	1
Wholesale	Business Executive	Chief of Operations	29/08/2001	1
Wholesale	Business Executive	Chief Financial Officer	30/08/2001	1
Wholesale	Business Executive	Chief Information Officer	30/08/2001	1
Wholesale	Business Executive	Head of Business Development	31/08/2001	1
Wholesale	Business Executive	Head of Business Planning	31/08/2001	1
Wholesale	Business Executive	Head of Sales	31/08/2001	1
Wholesale	Business Executive	Head of Commercial Operations	03/09/2001	
Wholesale	National Sales and Marketing	Group Manager	03/09/2001	1
Wholesale	Products	General Manager	03/09/2001	1
Wholesale	Human Resources	General Manager	04/09/2001	1
Wholesale	Customer Transfers Team Adelaide	Group Manager	04/09/2001	3
Wholesale	Churn Wholesale Strategy	Group Manager	05/09/2001	1
Wholesale	Churn Modelling and Analysis	Group Manager	05/09/2001	2
Wholesale	Churn Modelling and Analysis	Operational Analyst	05/09/2001	2
Wholesale	Churn Systems and Processes	Group Manager	06/09/2001	1
Wholesale	Churn Turnaround Initiative	Churn Coordination Manager	06/09/2001	2
Wholesale	Customer Transfers Team Canberra	Operational Analyst	07/09/2001	2
Wholesale	Business Market Development	Group Manager	07/09/2001	2
Wholesale	Finance	Group Manager	10/09/2001	1
Wholesale	Finance	State Accountant	10/09/2001	6

DIVISION	ORGANISATION CHART FUNCTION	POSITION TITLE	INTERVIEW DATE	NUMBER INTERVIEWED
Wholesale	Human Resources	Group Manager	11/09/2001	1
Wholesale	Contestable Market	Group Manager	11/09/2001	3
Wholesale	Business Development	Group Manager	12/09/2001	2
Wholesale	Pricing	Group Manager	12/09/2001	2
Wholesale	Business	State Manager	13/09/2001	6
Wholesale	Customer Services - Performance and Services	Manager	13/09/2001	1
Wholesale	Billing Integrity and Billing Disputes	Manager	14/09/2001	1
Wholesale	Customer Operations	General Manager	14/09/2001	1
Country Wide	Consumer Segment	Group Manager	17/09/2001	2
Country Wide	Small and Medium Enterprises (SME) Segment	Group Manager	17/09/2001	2
Country Wide	Acquisition	Operational Analyst	18/09/2001	3
Country Wide	Information Solutions Group Analytics	IT Reporting Manager	19/09/2001	2
Country Wide	Revenue and Business Analysis	Finance Manager	19/09/2001	1
Country Wide	Reporting Processes and Systems	Operational Analyst	20/09/2001	3
Country Wide	Finance	Group Manager	21/09/2001	1
BigPond	Back of House Operations	Operations Manager	24/09/2001	2
Retail	Broadband Solutions	Group Manager	24/09/2001	2
Retail	Broadband Business Intelligence	Group Manager	25/09/2001	2
Retail	Broadband Commercial and Strategy	Group Manager	25/09/2001	1
Retail	Consumer and Marketing Segment	Group Manager	26/09/2001	2
Retail	Consumer and Marketing Segment	SME Manager	28/09/2001	2
Retail	Consumer and Marketing Segment	Youth Segment Manager	28/09/2001	1
Retail	Consumer and Marketing Segment	Reporting & Analytics Manager	02/10/2001	5
Retail	Business Management and Investment	Group Manager	03/10/2001	1

DIVISION	ORGANISATION CHART FUNCTION	POSITION TITLE	INTERVIEW DATE	NUMBER INTERVIEWED
Retail	Consumer Marketing Relationship Mgmt	Relationship Manager	03/10/2001	3
Retail	Consumer and Marketing Retention	Consumer Retention Manager	04/10/2001	2
Retail	Consumer and Marketing Acquisition	Consumer Acquisition Manager	04/10/2001	2
Retail	Business Management and Investment	Investment Analyst	05/10/2001	2
Retail	Business and Government	Marketing Group Manager	10/10/2001	2
Retail	Business and Government	Beacon/Pre Churn Manager	11/10/2001	3
Retail	Business and Government	Operations Manager	12/10/2001	2
Retail	Business and Government	Sales Operations Manager	12/10/2001	2
Retail	Business and Government	Market Planning and Analysis Group Manager	15/10/2001	2
Retail	Business Strategy and Development Planning	Group Manager	15/10/2001	2
Retail	Churn Reporting and Analysis	Manager	16/10/2001	2
Retail	Churn Modelling Analytics and Prediction	Manager	16/10/2001	2
Retail	Churn	Operations Analyst	17/10/2001	2
Retail	Finance	Group Manager	17/10/2001	1
Retail	External Reporting	Manager	18/10/2001	2
Retail	External Tenders	Market Analyst	18/10/2001	1

Interviews of IT Vendor by Role

DIVISION	IT VENDOR ROLE	INTERVIEW DATE	NUMBER INTERVIEWED
Wholesale	Churn Applications Analyst	22 & 23/10/2001	6
Wholesale	IT Vendor Project Manager	24/10/2001	3
Wholesale	Systems Architect	25/10/2001	2
Wholesale	Business Analyst	26/10/2001	3
Wholesale	Technical Architect	29/10/2001	2