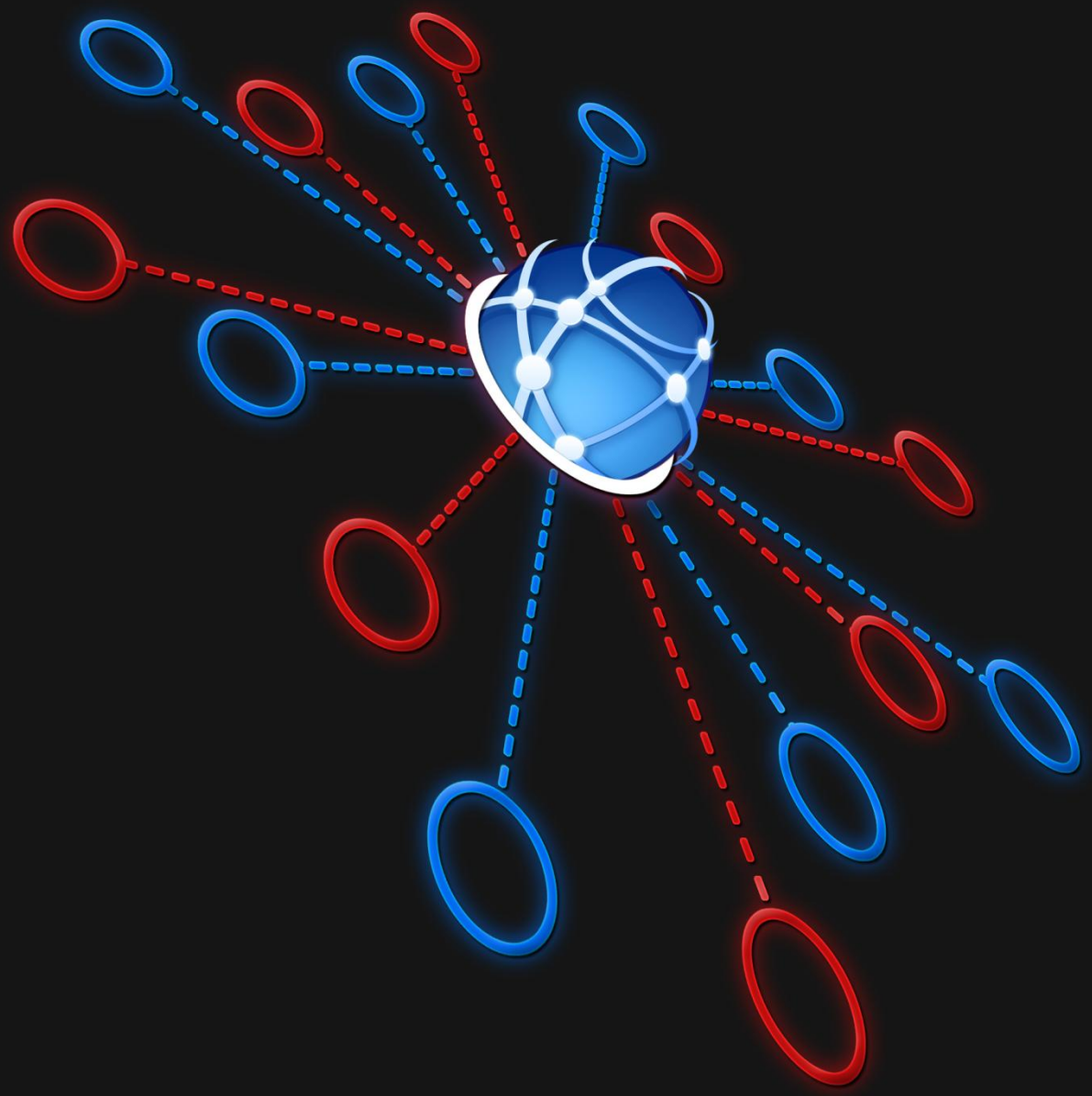
Management of Technology Master Thesis

The Role of IT networks in Mergers and Acquisitions

Designing a support tool for the decision making process of IT network integration preparation



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Preface

This thesis is submitted in partial fulfillment of the requirements for the Master of Science degree in Management of Technology at Delft University of Technology. This thesis is the result of a research project carried out at Accenture in The Netherlands, at the department of Network Enabled Solutions.

Looking back at the project, I would like to make a few remarks and provide a reflection on the process. Because I completed my studies with relative ease, I wanted to maximize the learning experience from my graduation project. For that reason I chose to perform my graduation project at a company and perform research into a subject that I was relatively unfamiliar with. This gave me the opportunity to work in a business environment and perform a research that could contribute to both science and practice. Moreover, it gave me the opportunity to learn more about the business in which I aspired a job.

This research aimed to create a design for a support tool that assists network experts in the preparation of network integration in M&A, by providing integration strategies for network integration problems in M&A. To gain an understanding of the subject and the problems involved, I had to conduct a preliminary literature study. The project turned out to be quite a learning experience. It was challenging to connect the original assignment of the company to the scientific literature. Multiple attempts at a research proposal were necessary to start the project. The literature search into the varying subjects of this research consumed a lot of time. Literature about mergers and acquisitions was abundant and resulted in being drowned in the many different aspects of mergers and acquisitions, such as cultural and organizational fit. Much time and research into this area was invested, only to find out that this was of lesser importance to the research questions. Scientific literature about network integration in the context of mergers and acquisitions seemed to be lacking. However, professional literature and educational material provided the starting point for preparing network integration and the problems faced in this process. Moreover, it provided me with knowledge that could be useful for my future career.

It was difficult to determine in advance the form of the decision making model that would be used in the support tool. During the literature study, I selected a decision making model. This model was chosen, because I felt it could apply to the decision making process in network integration preparation. The company wanted me to further elaborate this model to enable practical applicability. On the other hand, scientific interest is more aimed towards the comparison of different decision making models, instead of elaborating on a single model. A big challenge was finding a compromise between the interests of the business and science.

To approach the design, a design process from scientific literature was used. This method provided me with a process to perform the design of a tool, of which the purpose and requirements were not fully clear beforehand. The steps of the process provided grip on the design. Each subsequent step of the design process provided more clarity about the final tool, but also resulted in feedback loops to previous stages of the process. This forced me to rethink parts of the design as the project progressed. Gradually, the requirements for components of the design became clear, further shaping the design. The design that is provided in this thesis can help future discussions about the requirements for the support tool become less abstract.

In most research, desk research is followed by field research. In this research, these steps were performed twice – desk, field, desk, field – to better evaluate the design process. The first combination of desk and field research was aimed at exploring the subject. The second combination of desk and field research was aimed at processing the previously found results into a design and subsequently verifying them. However, this method caused some delays because each phase needed to be finished before the next could commence. Additionally, finding a sufficient number of experts for the field research was difficult, because there are not many experts with relevant and adequate experience in the field. Moreover, discoveries during the project caused changes to the setup of the research itself. Combined with the previously mentioned approach, these advancing insights have caused some delays.

In the end, I am satisfied with the current results, even though I had greater plans in mind at the start of the project. If I had to do this project again, I would have done things differently. However, this is mostly the case when looking retrospectively. The results presented in this thesis could provide an exploratory insight for the future discussion about the design of the tool. Hopefully, the reader will enjoy reading this thesis.

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Management summary

The situation of two companies in a merger presents unique challenges to IT network integration, because both companies have an existing IT network. These networks might not be compatible and would need to be changed to be able to support the combined business process after the merger has taken place. Research on mergers and acquisitions has been mainly focused on organizational and cultural aspects and many mergers seem to fail to achieve their expected goals. Moreover, no systematic research has been performed into the role of IT networks in M&A. As modern companies seem to be dependent on their IT assets and IT networks, failure to integrate those assets could also contribute to M&A failures. The literature suggests that proper preparation of IT integration could decrease the chance of M&A failure. Therefore, the focus of this research is to determine how to support the preparation process of IT network integration in a merger. Therefore, the main research question is defined as: "How can companies prepare and manage the integration of IT networks in M&A to enable the combined business process and achieve the expected M&A goals?"

A design approach is performed in this research to design a tool that supports network experts in the preparation process of network integration. The methods that have been used in this research include a literature review of the relevant subjects, namely mergers and acquisitions, IT networks, IT network integration, decision support systems and decision support tools. Gathering qualitative data for this research has been done through interviews with network experts. In total 14 interviews were conducted with experts from within and outside Accenture, spread over two rounds of interviews. The results of the literature study and the interviews will be used to design the support tool that satisfies the goal of this research.

This thesis report covers information about what mergers and acquisitions are; what the IT networks of companies are; what is important for the integration of those networks; and how decision support systems and decision support tools can be used to design a tool that assists with IT network integration in M&A. This thesis also provides a process model that describes the steps for preparing network integration in M&A. Moreover, the decision making process that is the most important part of those steps is provided in decision trees. For each of the common problems in IT network integration, the decision tree helps the decision maker to evaluate the most important decision criteria and subsequently results in an appropriate integration strategy. The process model and the decision trees have been combined in a design: the Network Integration Support Tool (NIST).

In conclusion, merging companies can prepare for the integration of their networks by following several steps as described in the process model. The first step begins with thoroughly analyzing the starting configuration of the networks. From this analysis, it will become clear which parts of those networks are in conflict and need to be combined into an integrated whole, defined in step two. The third step is to determine the integration strategy for each of those conflicts. Determining the integration strategy is supported by a model in the form of decision trees that provide insight in the decision making process. The final step is the creation of an integration plan that can be used to execute the IT network integration in M&A. The network expert can be assisted in these tasks, by using the Network Integration Support Tool.

Definitions of concepts

This section contains an overview of the most commonly used abbreviations and definitions used throughout this thesis.

Name	Explanation
IT Network	The data and telephony network of a company. Throughout this thesis referred to as network or IT network, unless specifically indicated otherwise. The IT network is defined as the Local Area Network, the Wide Area Network and the Telephony network of a company. These components are part of the physical infrastructure of the information technology infrastructure of a company.
IT Network Integration	The process in which two previously independent IT networks are combined into an integral whole, while aiming to achieve synergies by harmonizing IT network components.
Network Integration Support Tool (NIST)	A tool that helps network experts during the preparation process of IT network integration in mergers and acquisitions. Throughout this thesis referred to as "the tool" or NIST, unless specifically indicated otherwise. The network integration support tool contains a process model that provides the steps for preparing IT network integration. Moreover, it contains several decision support models (in the form of decision trees) to assist the user of the tool in the decision making process of IT network integration preparation.
IT Network Integration Issues	Possible problems that are faced in IT network integration in mergers and acquisitions. The possible problems are differences or conflicts between the different components of the IT networks of companies. Throughout this thesis referred to as integration issues, unless specifically indicated otherwise.
Integration Strategy	A strategy that specifies the approach to solve a given integration issue. In this thesis, the integration strategy defines the level of integration or harmonization of the various components of an IT network.
Decision tree	A decision tree is a method to present various options and their potential outcomes. Outcomes can be quantifiable, but others might be less concrete. In this thesis, the decision tree is a model that facilitates the decision making process with the evaluation of several decision criteria, to select an integration strategy for an integration issue. The decision trees presented in this thesis provide insight into various decision making processes for several IT network integration issues.
Mergers and acquisitions (M&A)	Mergers and acquisitions. Mergers and acquisitions are combinations of two or more companies into a single company.
Decision Support System (DSS)	A decision support system is a system which assists decision makers in the decision making process by providing information and decision making support. Decision support systems are characterized as interactive computer based systems or applications designed to assist decision makers by utilizing models and data to solve problems. Decision support systems contain decision support tools (models) to facilitate the decision making process. The design presented in this thesis could be implemented in software to create a decision support system.
Decision Support Tool (DST)	A decision support tool is a method that helps decision makers visually represent the cause-and-effect relationships of various decisions. It provides a distillation of the thinking process that decision-making involves and can be used to help narrow down choices. In this thesis, the decision support tool that is used to visually represent the decision making process is a decision tree.
Process Model	A process model is a series of actions taking place in a definite manner. In this thesis the process model describes the steps that are taken to prepare the integration of IT networks. The process model is part of the design for the decision support system.

1. Introduction

Mergers and acquisitions are very common in modern business and companies see this activity as the way to increase their market share and grow faster than organic growth. A company seeking to buy another company has to have the financial resources to do so. The financial resources involved in mergers and acquisitions (M&A) have been increasing exponentially since early 1980, reaching to record breaking volumes between 1985 and 1989 (McKiernan and Merali, 1995).The sheer number of M&As today even exceeds the records of the merger wave of the 1980s, with a total worth of 2.4 trillion dollars in 1998 which was a 50% increase over the previous year. Towards the year 2000 this figure even rose to 3.5 trillion dollars (Ghaury and Buckley, 2003), showing ever increasing amounts of financial resources involved in M&A activity.

Even though the amount of financial resources involved in M&A has been increasing all the time, research indicates that many mergers and acquisitions fail to reach the desired benefits for their shareholders (Cording et al., 2002; Cartwright and Schoenberg, 2006). The reasons for M&A failure are diverse and are often attributed to problems with cultural fit (Cartwright and Cooper, 1993) and organizational fit (Datta, 1991).

An under investigated part of merger and acquisition success is the role of information technology (IT). As a consequence of the increase number of M&As worldwide, more and more firms are facing the challenge of integrating their operations, finances, personnel, cultures, but also their information technology assets (Alaranta and Henningsson, 2007). This suggests that poor information technology integration can also be a cause of merger and acquisition failure. The problem of poor information technology integration has been recognized in literature and by the business. One of the most critical challenges companies face during a merger is the integration of their information systems resulting in delays, lost opportunities and decreased revenues (Harrell and Higgins, 2002). A research by Bloor Research, among IT-managers and CIOs, claims that only one in five mergers and acquisitions pay attention to IT infrastructure integration. This results in a failure of integrating the most important systems within three months (Toet, 2008). Accenture's research among 150 CIOs shows that in 36% of the cases merger and acquisition failure could be attributed to poor IT integration (Accenture, 2008).

Part of the information technology integration is the integration of the IT network infrastructure, from here on referred to as IT network. The IT network is the basis on which all information technology services operate, such as email, voice communications and file exchange. Therefore, before an integration of services can be done the IT network must be carefully integrated.

In modern companies, the IT networks are very important to the operation of the business. A merger may not be successful if IT network integration is inadequately planned and not well aligned with the overall integration strategy (Giacomazzi et al., 1997; Alaranta and Henningsson, 2007). Problems that originate from integrating two previously independent IT networks are mainly caused by choices about changes to the company's IT network structure after the merger. First, technical difficulties are caused by physical integration of IT networks and issues with data compatibility. Second, there are organizational problems. The technical difficulties could be solved with investment in equipment, but need to be carefully considered and planned. Organizational problems are more difficult to solve and are often underestimated, but can be tackled with good planning, sufficient time and a strong management (Giacomazzi et al., 1997; Alaranta and Kautz, 2007).

This research is about the role of IT networks in mergers and acquisitions, more specifically: how to aid the integration of these IT networks. As mentioned before, the focus is on the infrastructure aspect of the network. When two companies merge, the IT networks can be consolidated but in some cases the networks are kept separate. When IT networks are integrated between merging companies, some parts of their networks will change, be replaced, or disappear. This suggests that there are a number of integration strategies for IT networks. Obviously, the integration of IT networks is dependent on factors of technical nature, but can also depend on factors of M&A, amongst others differences in scale or political influences. For instance, decision making on IT network configuration has been found to be subject to political influences in which the buyer often dominates the negotiations (Mehta and Hirschheim, 2004).

The required actions for the integration of IT networks are often overlooked in the planning phase of an M&A, resulting in a delayed integration which leads to operational problems. Examples of problems are:

- The transition takes too long, resulting in operating processes coming to a halt;
- Overlap in systems and data, e.g. similar information is stored in two different locations;
- Sources of information are not companywide, e.g. the online phone directory only holds information about a part of the company;
- Communication systems turn out to be incompatible, e.g. email systems cannot be integrated or phone networks are not interoperable.

Therefore, when the integration of the IT networks are not well planned and prepared, the expected gains of mergers and acquisitions are less likely to be obtained (McKiernan and Merali, 1995). Improved integration preparation and management could solve problems with the integration of IT networks (Mehta and Hirschheim, 2004). Improved preparation for IT network integration could be done through the aid of computerized systems, more specifically in the form of a decision support system. Accenture, an IT consultancy firm, assists companies to prepare for IT network integration and has an interest in a system or tool that supports them to accomplish this task.

A scientific literature search into IT network integration, and in particular preparation and management strategies, has proven to be unsuccessful. Scientific literature is lacking models and tools that describe the necessary steps to prepare for the integration of the IT networks of companies in M&A and achieve synergies. Additionally, the decision making process that is involved in the preparation process of IT network integration is unclear. However, a model for integrating information systems (different from information technology) was found that could be useful for this study. In this model the researchers link decision criteria such as growth objectives, company structure, situation variables and information system requirements to integration strategies for information systems (Giacomazzi et al., 1997). These factors show similarities to the important factors that could be involved in IT network integration in M&A. Therefore this model could be the foundation for the decision making model for the preparation of IT network integration.

1.1. Problem statement

To obtain benefits from an M&A, companies need to create synergies between the merging companies and find a way to exploit them. As companies are becoming more and more dependent on IT for their operation, companies in M&A find themselves confronted with the integration of their IT networks. To remove one of the obstacles in M&A activity, companies need to carefully consider their IT network. The merging companies can have very different and even incompatible IT network configurations and strategies, which need to be integrated into a combined IT network. Moreover, the IT networks must

remain operational during the M&A process to allow the business to keep functioning. Therefore, companies in M&A need to prepare and manage the integration of their IT networks to be able to support the business. The required actions for the integration of IT networks are often overlooked in the preparation phase of an M&A, which leads to operational problems. Quick solutions can offer relief in the short term, but can cause new problems at a later time. Therefore, it is important that the integration of IT networks is well prepared and thoroughly planned, before or soon after the M&A takes place. Before any integration actions can be taken, the strategic direction of the integration must be determined.

The research is performed at Accenture in the Netherlands. Accenture is the principal of the assignment and is interested in improving the integration preparation process of IT networks of merging companies. Accenture is specifically interested in a tool that helps them to determine the strategic approach to integration problems, which they encounter when integrating the IT networks of merging companies. To facilitate in determining the strategic approach for various IT network integration problems, this research focuses on the general decision making process of IT network integration preparation. To a lesser extent it focuses on the specific content of the decisions, because the content can be dependent on the type of network and type of company.

1.2. Research objectives and research questions

Given the problem statement, the research objective is formulated as follows:

> *The research project aims to propose a design for a tool that can assist network experts with the decision making process for the preparation of IT network integration in mergers and acquisitions.*

The end result of this research is the design of a support tool or program that can assist network experts to determine the integration strategy for integration problems, supporting the preparation of IT network integration in M&A. The support tool design describes the steps to prepare for network integration and provides a model to support the decision making process.

The objective as stated above, addresses the preparation process and decision making process of IT network integration in M&A by using a tool. Based on the objective, the following main research question is formulated:

- How can companies prepare and manage the integration of IT networks in M&A to enable the combined business process and achieve the expected M&A goals?

To research how companies can prepare and manage the integration of IT networks in M&A, the main question is divided into four sub questions.

Sub questions

1) *What is the current scientific knowledge about mergers and acquisitions, IT networks and network integration, and the relation between them?*

The first research sub question is a literature review, focused on mergers and acquisitions and IT networks and network integration, and the relation between them. A description of a merger/acquisition is given together with IT network integration knowledge to create a clear understanding of the concepts and definitions used in this thesis.

2) *Can the concept of decision support systems be used to design a tool that can be used to support the preparation of the integration of IT networks in M&A?*

The second research sub question is a literature study into decision support systems and decision support tools. This question is aimed at developing a tool for the preparation of IT network integration in M&A. This is done by looking at the concept of decision support systems and tools that could be adapted to be used for the preparation of IT network integration in mergers and acquisitions.

3) *What are the requirements for the design of a support tool for the preparation of IT network integration in M&A?*

The third research sub question is aimed at finding the requirements for the design of a decision support system based on findings in literature and empirical data. The requirements are divided into functional, contextual and user requirements. Moreover, the requirements and design of the decision support tool are validated and complemented by industry experts.

4) *What support tool can be designed for the preparation of IT network integration in M&A?*

The requirements found in sub question 3 should indicate how to design the decision support tool. The fourth question is aimed at designing a tool which assists network experts integrate IT networks in M&A and achieve the goals of the integration. Answering all four sub questions will answer the main research question, because the sub questions provide a tool that helps network experts prepare for IT network integration in M&A.

1.3. Relevance

Managerial relevance

The results of this thesis will be applicable to the company where this study takes place. Accenture, as the principal of this research, is interested in improving the IT network integration preparation process.

The result of this research can assist IT network experts at Accenture to prepare for IT network integration in mergers and acquisitions by providing a structure for the preparation process. Moreover, the result will assist network experts in the decision making process of determining an integration strategy, for common IT network integration problems encountered in IT network integration projects. Care will be taken to obtain a more general result, therefore opening opportunities for the result to be applicable for network experts at other companies.

The result will be accompanied by a design for a support tool. This design of the tool could be used to implement it in software. The design will describe the functions of the tool that allows it to assist network experts in the preparation process. Additionally, the design will contain models that assist the network experts in the decision making process for selecting integration strategies for common integration problems.

The results of this study could provide network experts with a better way to prepare for IT network integration in mergers and acquisitions. Improved IT network integration could help the acquiring and acquired company to enable the combined business process at an earlier stage after the M&A transaction has taken place.

Scientific relevance

Much research has been done into M&A, however with little specific focus on IT network integration. M&A literature mainly deals with cultures, organizational structures and business processes (Jemison and Sitkin, 1986; DiGeorgio, 2002). Lack of information about IT network integration could have consequences for the success of an M&A. It has been noted in the literature that one of the reasons for poor post acquisition performance has been caused by companies failing to consider all implications of consolidating IT systems (McKiernan and Merali, 1995). However the theories proposed are not directly applicable to this research, because it does not include both technical and managerial challenges of IT network integration. This research aims to find factors that contribute to IT network integration and combine these in a decision making support tool. Improved IT network integration could lead to a reduction in M&A failure. Therefore this research into IT network integration adds value to M&A literature.

1.4. Scope

The focus of this research is on the integration of IT networks in M&A and how this can aid in achieving the M&A goals. To place the IT network into perspective, it is important to understand that the IT network is part of a company's IT infrastructure. Ward and Peppard (2002b) claim that defining the IT infrastructure and its components is becoming more difficult as technology evolves and becomes increasingly a business utility. Some authors argue for a definition of IT infrastructure as "the enabling base of shared IT capabilities which provide the foundation for other business systems" (McKay and Brockway, 1989). Ward and Peppard (2002b) state that the physical infrastructure is part of the IT infrastructure. The physical infrastructure, which consists of a range of network, hardware and base software products and services, deployed to enable applications and the general use of technology to function successfully. A component is considered as being part of the physical infrastructure if it is being used by more than one application or by a wide range of people (Ward and Peppard, 2002b). Therefore the enabling base of network capabilities that provide the foundation for other systems to function is the focus of this research: Local Area Networks, Wide Area Networks and Telephony networks.

One can argue whether telephony networks should be part of the network, because they do not provide a foundation for other systems to function. However, telephony networks used to be separated from the local and wide area network. Recent technological developments have caused the integration of telephony into the network. Moreover, this topic is of interest to Accenture and has therefore been added to the scope.

It could be argued as well that some software applications can also be part of the physical infrastructure, because they provide a foundation for other systems to function. However, this research does not focus on the integration of software applications. The integration process of the companies in M&A is also not part of the scope.

To design a tool for the integration of IT networks in M&A, the design process of Verschuren & Hartog (2005) will be followed. The scope of the research includes the first four steps in this design process and excludes the last two steps in the design process. The design process will be explained in the next paragraph.

1.5. Research approach

The research is aimed at designing a tool for a specific purpose. To approach this research project, four of the six stages of the design cycle by Verschuren & Hartog (2005) are used. The authors describe the steps that are taken to develop and evaluate an artifact (in this case a support tool) that provides a solution to a given problem (in this case the preparation of IT network integration in M&A). The six stages are as follows:

1. First hunch
2. Requirements and assumptions
3. Structural specifications
4. Prototype
5. Implementation (out of scope)
6. Evaluation (out of scope)

The scope of this research ends at the prototype phase, because of time limitations. To get a clear picture of the approach of the research, an explanation of the performed stages is given below. For each stage of the design cycle, an elaboration is given of the required steps of doing research to obtain the necessary information for the design (Verschuren and Doorewaard, 2007). The entire research process is displayed in Figure 1, which can be found at the end of this paragraph.

1. First hunch

In this stage, the goals of the tool will be specified. By analyzing the goals a first hunch for a solution can be defined. In this stage the question of "what should network experts be able to do with this tool?" will is answered. Pre-data gathering interviews with network experts at Accenture have revealed that the solution should be in the form of a decision support tool that should assist network experts in the preparation of the integration process of IT networks. This preparation could be done by determining an integration strategy for common problems in IT network integration in mergers and acquisitions. This process can be specified as the process of going from one situation, in which:

- there are two separate companies;
- no M&A has taken place;
- the IT networks of both companies are not integrated.

To a situation in which:

- there is one merged company;
- the M&A has taken place;
- the IT networks of both companies have been integrated into a single network.

It is important to note that the support tool only assists in the preparation of the integration of the IT networks, not the M&A itself. Moreover, the goals of the tool and the objective and scope of the research have been defined in cooperation with Accenture, because Accenture has knowledge and overview of the field. This guarantees practical applicability and feasibility.

2. Requirements and assumptions

To achieve the goals set for the tool, the requirements and assumptions are established in this stage. To be able to design the tool, it is essential to find the requirements and assumptions defined for the tool. In this stage the requirements and assumptions of the tool are defined that fulfill the framework of goals which have been defined in the previous stage. There is a distinction between functional requirements

and assumptions, user requirements and assumptions, and contextual requirements and assumptions (Verschuren and Hartog, 2005).

Functional requirements define the functions that the tool should be able to fulfill. The functional requirements will be obtained through a literature study into M&A, IT networks, network integration and decision support tools. An example: which functions should the tool provide to aid the user in the preparation process? The user requirements define the requirements set by the users of the tool. The user requirements are defined based on the profile of the user that will be using the tool. An example: who is the intended user and when will he be using the tool? The contextual requirements define the political, economical, legal and social environment. The contextual requirements define the contents of the tool, the problems that need to be tackled, the possible solutions for those problems and the decision criteria that are used to make decisions about solutions. These requirements will be obtained through a literature study into M&A, IT networks and from pre data gathering interviews with network experts. An example: what are the common problems that are encountered when integrating two previously independent IT networks?

The assumptions are the presumptions which the designer has to make for the functional, contextual and user requirements for the design of the tool. These assumptions will be validated during the validation of the design of the tool. An example: a set of integration strategies for IT networks or the course of the network integration preparation process.

In this stage, the requirements which have been found in the literature study will be validated in six interviews with IT network integration experts. Since the research is performed at Accenture, experts from within Accenture will be used. A criticism to this approach could be that this could result in a biased outcome of the research. Therefore, to try to obtain a more accurate and complete result, also experts from outside Accenture will be used. In the first round of interviews, three experts from Accenture will be consulted and three from outside Accenture. These experts are able to validate the requirements, because of their experience in network integration projects. Therefore the information they provide is considered relevant. The focus of these interviews is on the completion of the set of functional requirements. In addition, these interviews are aimed at finding contextual requirements, which will be used in a later stage of the research. In these interviews, the network experts will also be asked for missing requirements to be able to complete the overview. The validated and supplemented list of requirements is used in the next stage to make the first design of the tool.

3. Structural specifications

In this stage of the design cycle, the structural specifications will be defined based on the validated and supplemented requirements and assumptions from the previous stage. The structural specifications are broken down in the functional and contextual design.

The functional design of the tool will be defined in this stage. The tool follows the steps that have to be taken in preparing the integration of IT networks. These steps, which consist of a sequence of process descriptions of the IT network integration preparation process, will be defined and elaborated in this research.

The contextual design of the tool will be based on the contextual requirements found in the previous stage. In this research, the contextual design is framed in a model that facilitates a structured decision making process, to link possible solutions/strategies to network integration problems. This is achieved by evaluating a set of decision criteria. The contextual design is considered the core of the tool.

4. Prototype

The fourth step in the design cycle is the creation of a design for the tool. In this stage, some "mock-ups" of the tool will be designed, to show the users what the tool will look like. In this case, it is about the schematic display of the steps of the integration preparation process and the corresponding sub processes (functional design). Additionally, the decision making core of the tool will be designed (contextual design). This will result in the support model that will be used to assist the users (network experts) in the preparation process of network integration.

A second round of validation will be executed in this stage. The contextual design will be validated by interviews with network experts. The core of the tool is a model that allows the user to select an integration strategy for the components of the IT network. Therefore, the focus of the second round of interviews is on the contextual requirements that will be used in a decision support model that is the core of the tool. Similar to the first round of interviews, experts from both inside and outside Accenture will be used. In total, eight interviews will be held and again half of the experts will be from Accenture. The support model will be validated in these interviews, by asking them if the designed processes can be recognized in, or can be applicable to practice. Suggestions and remarks from the validation will be processed into a refined version of the tool. The refined design is the "final" version of the tool and completes the research project.

5. Implementation

In this stage of the design cycle the tool is implemented, based on the design. As stated before, this is not part of this research.

6. Evaluation

In this stage of the design cycle the tool is used for what it was designed for: assisting network experts prepare the integration of IT networks. The implemented tool can then be evaluated in practice, but is considered to take more time than is available in this project. Therefore, this is not part of the research.

The entire research approach has been illustrated in Figure 1.

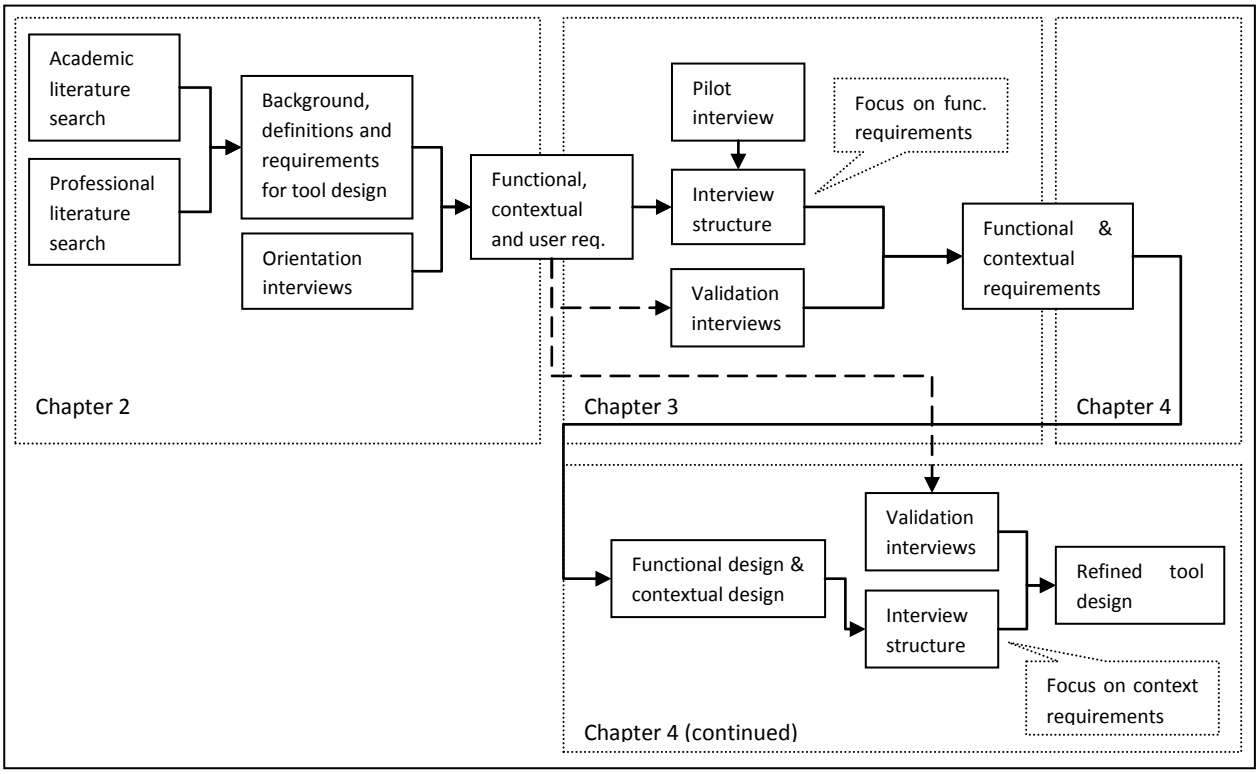

Figure 1: Research approach

1.6. Thesis outline

This thesis is written in five chapters. The chapters follow the design process which has been described in the previous paragraph. The chapters in this report are as follows:

1. Introduction
2. Literature review
3. Gathering requirements for the design
4. Decision support tool design
5. Conclusions and recommendations

The **first chapter** contains the introduction to the research theme, the problem statement, the goals and scope, the research questions and the project approach.

The **second chapter** contains the results of the literature study into mergers and acquisitions, IT networks and the integration of those networks, and decision support tools. It provides the necessary background, definitions and conceptual framework that will be used in this report. This chapter will result in a list of preliminary list of requirements for the design of the tool. This chapter is concluded with an overview of the relevant concepts for the design of the tool and addresses research questions one and two.

The **third chapter** starts with a summary of the functional, contextual and user requirements for the design of the tool. These have been discovered through the literature study and orientation interviews. The chapter continues with the validation and supplementing of these requirements through (the first round of) interviews with experts. In this round of interviews, the focus is on the completion of the functional requirements for the design of the tool. In addition, it is aimed at creating an overview of the contextual requirements for the design. The contextual requirements are used and validated in the fourth chapter. The methodology – the operationalization of concepts, the interview approach and data analysis – is given. The chapter is concluded with a list of requirements for the design of a decision support tool for the preparation of IT network integration in M&A and answers research question three.

The **fourth chapter** starts with a first design for the decision support tool, based on the requirements that have been found in the chapter three. This chapter contains the validation that is used for refining the tool. The methodology for the (second round of) interviews is described in this chapter, after which the results are analyzed. The focus of this round of interviews is on the validation of the contextual requirements and how they have been applied in the tool. The results of the interviews are then processed into a refined design of the tool. The endpoint for this chapter is the design of the decision support tool and answers the fourth research question.

The **fifth** and last chapter contains the conclusions and recommendations of the research and answers the main research question. This chapter will also contain the reflection and discussion of the research results.

Table 1 shows an overview of the chapters and their contents. The research question that is answered in a chapter is shown in the “RQ”-column. The “design process”-column indicates which step of the design process (Verschuren and Hartog, 2005) is treated in that chapter.

Table 1: Overview of thesis chapters

Ch	Contents	RQ	Design process
1	Introduction, problem statement, goal and scope of the research, research questions and project approach.		First hunch
2	Literature review on mergers and acquisitions, IT network and integration, and decision support tools to find requirements for the design of the tool. Definitions of concepts in the thesis and background on the three subjects.	1 & 2	Requirements and assumptions
3	Requirements for the design of the tool that follow from the literature study and expert interviews. Methodology for validation of requirements.	3	Requirements and assumptions, structural specifications
4	First version of the tool design. Methodology of validation. The refined version of the tool design, based on validation interviews of the first version of the design.	4	Prototype
5	Answers to research questions, conclusions and recommendations.	Main	

2. Literature review

In this chapter, the theoretical background of the subjects which are related to the topic of this thesis is presented. This is done to provide the reader with a fundamental understanding of the subjects involved in this research and to clarify the definitions of the terms used in this thesis. This chapter starts with a general explanation of mergers and acquisitions (M&A) and provides a basic understanding of the subject. After dealing with M&A, this chapter continues with an explanation of IT networks and the network integration preparation process. The third and last part of this chapter is about decision support systems and is aimed at finding or creating a suitable support tool to assist the preparation of network integration.

The aim of this research is the designing of a tool that helps network experts prepare for network integration in mergers and acquisitions. The topics which are relevant for achieving this goal will be discussed as they form the building blocks of the design and shape the conceptual framework of this thesis. These building blocks are part of the functional, contextual and user requirements for the design of the tool (Verschuren and Hartog, 2005). To be able to design the tool, four things are needed. (1) insight into the preparation process of integrating two networks. What steps are taken in this process to achieve the goal of integration two networks? (2) insight into the common problems of network integration. What are the possible conflicts between the networks of two merging companies? (3) insight into possible integration strategies to solve integration problems. (4) insight into the decision criteria for selecting an integration strategy.

Literature research results in a preliminary overview of the relevant concepts, which will be validated and complemented through expert interviews. This will be described in chapter 3.

Last but not least, this chapter is aimed at answering the first two research sub questions:

1) *What is the current scientific knowledge about mergers and acquisitions, IT network integration and the relation between them?*
2) *Can the concept of decision support systems be used to design a tool that can be used to support the preparation of the integration of IT networks in M&A?*

This chapter is created by searching the available academic literature through journal databases such as Emerald Insight, ScienceDirect, JSTOR, Springerlink, EBSCO, Wiley and Google Scholar. Forward and backward searching techniques have also been applied to gain an overview of specific areas of knowledge. The literature review is based on a review of recent and well-cited articles published in international journals. In areas where academic literature is lacking, professional literature has been used to obtain the information necessary for this research.

2.1. Mergers and Acquisitions

Before going into the topic of integrating IT networks in mergers and acquisitions, it is important to get a clear view of what an M&A is, and its relation with IT network integration. Therefore this section starts with a general explanation of mergers and acquisitions and elaborates on the M&A process and steps that this process follows. This is followed by the different reasons why companies pursue M&A activity and the explanation of different types of mergers and acquisitions. This section is concluded by reviewing some integration strategies for M&As, which could provide the context of IT network integration in M&A.

The keywords that have been used to search for relevant topics include: *mergers and acquisitions, merger and acquisition process, M&A critical success, merger and acquisition synergies, merger and acquisition integration* and *merger and acquisition types*.

2.1.1. What are Mergers and Acquisitions?

In the review article of Cartwright and Schoenberg (2006) it can be concluded that mergers and acquisitions have been widely documented in literature. The authors argue that three streams of research exist: strategic fit, organizational fit and the acquisition process itself. They also conclude that the failure rates of mergers and acquisitions have remained fairly high over the years, despite the research into this subject (Cartwright and Schoenberg, 2006). Mergers and acquisitions are an economic activity which involves the buying and selling of entire companies. Even though mergers and acquisitions are often mentioned in one breath, there is a difference between them. Mergers are defined as the combination of the assets of two previously separate firms into a single entity. In an acquisition (also known as takeover or buyout) the control of the assets of the acquired company (target) is transferred to the acquirer (bidder) and the target disappears. Mergers are supposedly between equal partners, however many mergers have one dominant party whereby these mergers obtain characteristics of an acquisition. Moreover, the number of 'mergers' in 'mergers and acquisitions' is very small (Ghaury and Buckley, 2003). Literature recognizes the difference between mergers and acquisitions, but often the term merger is used to describe both activities (Granlund, 2003; Mehta and Hirschheim, 2004; Wijnhoven et al., 2006). Similarly, in this thesis the term merger or acquisition will also be used to describe both mergers and acquisitions.

Mergers and acquisitions are processes that occur in stages, with a start and an end at certain points in time. However, the literature does not formally deal with the question of the starting point of an M&A. Some authors argue that an M&A starts as early as the selection of the target, after which the process continues with the due diligence, negotiations, closing of the deal and post-closure (Very and Schweiger, 2001). The stages of M&A can also be defined as transaction, transition and integration (Schweiger, 1999) or as pre-combination, combination and post-combination respectively (Marks and Marvis, 1998). Although the differences in definitions of the stages of the M&A process exist, the overall meaning of the stages is very similar. Therefore, in this thesis the different stages of M&A are defined as:

1. Pre-merger due diligence;
2. Deal closure, and
3. Post-merger integration.

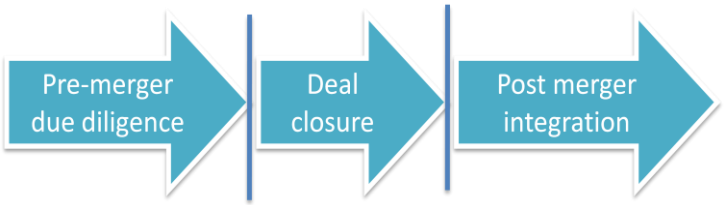

Figure 2: The stages of an M&A process

Figure 2 shows the M&A integration process and the stages defined in this process. Each stage contains a different set of activities, which will be explained briefly. (1) The pre-merger due diligence stage is aimed at finding a limited number of suitable candidates with a strong strategic fit. This is followed by the target analysis in which the target company is valued, making contact with the target board and finding out if a deal can be made. During this phase the target company is evaluated for organizational fit and cultural fit, but seldom IT fit. In addition, the assets of the target company are investigated to get a clear view of what the bidder is buying. This includes tangible assets such as machines and facilities, but also intangibles such as the available knowledge inside the target. (2) The deal closing stage is the stage in which the negotiations with different stakeholders take place. During these negotiations, different topics are discussed such as: price negotiation, obtaining warranties for the stakeholders, discussing ethical problems and negotiations about employment contracts. (3) In the post merger integration phase, all previously discussed actions are set in motion. The focus of this research lies on the early preparation and planning phase of M&A, which is the pre-merger due diligence phase.

The post merger integration process is composed of multiple integration areas. Stahl and Voigt (2005) recognize several areas of M&A integration. Two important areas of integration in M&A are socio-cultural integration and task integration. Social-cultural integration is about the integration of employee attitudes, behavior and performance measures. Task integration is about knowledge and capability transfer between both companies and the extent of resource sharing (Stahl and Voigt, 2005). Part of the resource sharing is the physical resource sharing which includes the IT networks of both companies.

Mergers tend to be dominated by financial and managerial issues. An under investigated part of M&A is the growing importance of (information) technology to the operations of companies. M&A deals are becoming more complex. Technology and the people supporting it are becoming key factors in the merger and acquisition process (James et al., 1998). The planning of the integration of information technology and communication technology within the early stages of M&A is therefore important for the achievement of the expected benefits of the M&A (Mehta and Hirschheim, 2004; Holm-Larsen, 2005). Therefore, in the activity of M&A, potential gains are to be made by acquiring firms when paying attention to the integration of information technology as part of the merger. This may help to avoid high cost mistakes and lengthy integration processes, and results in a reduction of M&A failures. By also focusing on information technology integration in mergers and acquisitions, acquirers may obtain more value from synergies (James et al., 1998).

As stated before: many merging companies run into problems when integrating their information technology assets, which cause delays in the integration process of M&A (Harrell and Higgins, 2002). Therefore, it is important to make the distinction between the stages of the M&A process to be able to effectively prepare and plan for the integration of the IT networks. As applies to any activity, early preparation and planning usually increases the chances of success of that activity. Hence, the integration process of IT networks could follow the same stages of the M&A integration process. The preparation of IT network integration could be done in the pre-merger due diligence phase, before the deal will be closed. When the deal has been closed and the merger moves into the post-merger integration phase, this plan can be executed.

Now that is it clear what M&A is and how the M&A process works, it is important to know why companies pursue M&A activity and to understand that not all M&As are alike. Different mergers could lead to different integration strategies. M&As can be grouped into different categories, which are explained in the next paragraph.

2.1.2. Types of mergers and acquisitions

In general, there are four types of mergers. Each type of merger focuses on a different direction of integration in the value chain. The four types of mergers that will be discussed in this paragraph are: (1) horizontal integration, (2) vertical integration, (3) diversification and (4) divestment.

Figure 3 shows the different directions of integration of the different M&A types. (1) In a horizontal merger, competing firms in the same industry which are in the same part of the production process are integrated (Ghaury and Buckley, 2003). An example of a horizontal merger is a merger between banks. Horizontal mergers generally create value through cost-based synergies, such as cost-reduction, and revenue-based synergies (Capron, 1999). (2) In vertical integration, firms that handle subsequent parts of the production process (from raw material to finished end-product) are merged. Vertical integration occurs at the border between buyer-seller or supplier-client relations in the same value chain, which are then consolidated (Ghaury and Buckley, 2003). An example of a vertical merger is a merger between a

producer of sheet metal and a company that uses the sheet metal to build car parts. Vertical mergers create value through the elimination of transaction costs and supplier or buyer profit margins. (3) In diversification mergers, companies in unrelated businesses are consolidated (Ghaury and Buckley, 2003). An example of a diversification merger is when a company that produces telephones buys a company that is active in the audio equipment business. One last category of mergers is the divestment "merger". (4) In a divestment merger, parts of the company are split from the main company. This occurs when a part of a company is sold to another company, part of the production chain is separated into an uncoupled company, or when part of a company is sold that is no longer considered core business (Bergh, 1997). It should be clear that this type of merger leads to the division of a company, instead of integration. As this thesis is focused on (network) integration, divestment mergers are out of scope.

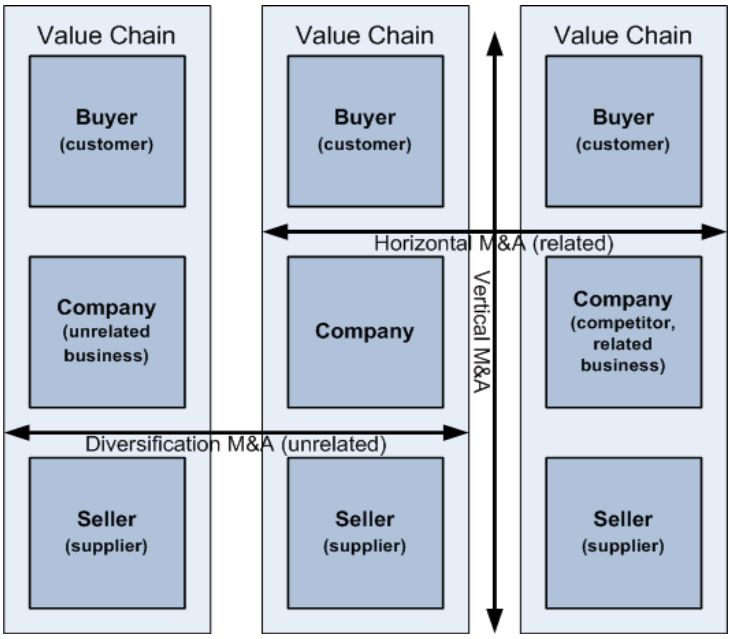

Figure 3: The direction of integration in different M&A types

To further understand why companies pursue M&A and to refine the focus of this research, the next paragraph will elaborate on the reasons why M&As occur.

2.1.3. M&A strategic objectives

One of the important reasons for companies to pursue M&A, is the creation of value through synergies, next to higher revenues and profits. Synergies are achieved when the sum of the output from the merged company exceeds the sum of the output of the separate companies. In theory, one plus one equals three. The literature about synergies for M&A is broad and specifies many sources of synergies. However, after analyzing the literature the sources of synergies can be narrowed down to a few important ones. According to Bower (2001) and Schweiger and Very (2003) common synergies that create value in M&A are: (1) economies of scale, (2) economies of scope, (3) revenue synergies, (4) cost reduction synergies and (5) operational synergies. It is important to understand these synergies, to be able to determine which synergies could be achieved with the integration of IT networks.

(1) Economies of scale provide synergies through a reduction of cost per unit of produced product, because as production increases, the cost of each additionally produced unit falls (Schweiger and Very, 2003). (2) Synergies from economies of scope are achieved by reducing the costs per unit through the production of a wider variety of products by using the same production facilities and technologies (Schweiger and Very, 2003). (3) Revenue synergies create value through the opportunity of the merged company to sell both companies' products to a greater (combined) customer base (Schweiger and Very, 2003). (4) Cost reduction synergies are created through the opportunity of a merged company to reduce or eliminate costs that are associated with running the business. This means removing duplicate entities from the merged company (Schweiger and Very, 2003). Cost reduction synergies are closely related to economies of scale, but differ from each other because economies of scale are obtained in the production process and cost reduction synergies are obtained in the process of running the business.

(5) Operational synergies are achieved through the collaboration of e.g. development teams that can benefit from each other's knowledge and skills (Schweiger and Very, 2003). Operational synergies are closely related to economies of scope, but differ from each other because economies of scope are related to the use of single assets for more than one product. Merging companies could also achieve synergies by merging their IT networks. By integrating two different IT networks into one, cost-reduction synergies could be realized by the removal of excess equipment or a reduction of the operating cost of running the network.

Different kinds of synergy are the result of different strategic objectives of M&A. To investigate on which type(s) of mergers the "to-be designed" tool should focus, it should be made clear in which types of M&A network integration could be beneficial. A brief overview of the strategic reasons of M&A is given below and can be grouped into: market consolidation (horizontal merger), consolidating inside the value chain (vertical merger), and consolidation into unrelated business (diversification merger). Merging companies can have varying reasons and objectives for pursuing M&A activity. A classification between mergers can be made based on their objectives and can be grouped into three different categories, as previously described, namely horizontal mergers, vertical mergers and diversification mergers respectively. It is important to see the different strategic reasons for M&A to get a firm understanding of the concept of why M&As occur. The most important strategic objectives and the potential synergies resulting from those objectives are explained below.

Market consolidation (horizontal merger)

When a certain market is confronted with overcapacity between many firms, one company may decide to buy another company in the same industry and remove less efficient production facilities. For instance, by closing underperforming facilities, removing excess management and rationalizing administrative processes. The acquiring company ends up with a larger market share while the total production capacity is reduced, pushing prices up. The main goal is to reduce costs and increase efficiency (cost reduction synergy and economies of scale) (Bower, 2001). Consolidation of the market within a certain geographical area is aimed at increasing a company's market share. The consolidation can take place within the geographical area of that market, e.g. a region of a country (Bower, 2001). However, this consolidation can also take place over borders, e.g. outside country borders (Schweiger and Very, 2003). Extending the business into geographic areas where the company was previously absent, by acquiring fragmented or liberalized industries, is utilized as a way to quickly increase market share. The goals of market consolidation are to obtain lower fixed costs through higher asset utilization (economies of scale) (Bower, 2001), economies of scope by sharing products and services, and cost reduction synergies by the removal of excess staff and assets (Schweiger and Very, 2003). One last important strategic objective of (market consolidation) M&A is the addition of products, services, skills, distribution channels and technologies to the company's portfolio. This increases the competitive capabilities of the company. The chances of success of this kind of M&A vary from deal to deal. Overall, a merger between a large company and a small company have a higher chance of success than two large merging firms (Bower, 2001). The potential synergies of this type of merger are diverse. Lower variable costs from increased buyer power, lower fixed costs through increased asset utilization, extended capabilities from acquired technologies, and lower fixed costs by removing excess staff and assets (Schweiger and Very, 2003). Together with overcapacity M&A, this type of M&A is the most common in large M&A's (Bower, 2001).

Consolidate inside the value chain (vertical merger)

This strategic objective is about consolidating suppliers or distribution channels. Companies try to increase the added value of their firms to the product or service of the value chain and gain more control over the business. To achieve vertical integration, only low levels of organizational integration and standardization are needed, but high levels of coordination. Potential sources of synergy are among others: lower overall costs from improved product development and manufacturing, lower fixed costs by removal of excess staff functions. Costs of managing the purchasing function are replaced by costs of managing the relation internally. Therefore, only cash management and financial statements are consolidated. Consolidation or standardization of operations is often not employed, because the operating processes of each firm differ (Schweiger and Very, 2003).

Consolidate into unrelated business (diversification merger)

Companies seeking to extend their business outside their current markets can choose to acquire unrelated business. By using these unrelated businesses, the acquiring company can create revenue synergies by e.g. combining products from the two companies and use them to create new product market combinations. Bower (2001) calls this “industry convergence”, which is about inventing an industry and a business model in which certain resources are removed from industries whose boundaries are changing. Potential synergies are usually aimed at revenue synergies, for instance by using the brand name of company A to create a strong selling position for the products of company B.

Synergies and IT network integration

Realizing cost-reduction synergies from network integration could be achieved by removing parts of the IT staff, excess network equipment and duplicate services. Economies of scale are also possible through the increased utilization of IT network assets and the use of a single asset type for a network function. Therefore the quest for synergies in M&A activity can trigger the integration of IT networks. However, not all M&A’s are alike, which is important for IT network integration. After analyzing the synergies achieved by each objective, it can be concluded that mostly horizontal and vertical mergers are possible M&A types in which IT network integration could lead to cost-reduction synergies. This is because both horizontal and vertical mergers are aimed at lowering costs through the removal of excess assets and staff. Diversification mergers are often aimed at revenue synergies and the business units are likely to be operating independently within the holding of a larger corporation after the deal has taken place. However, it is possible that business units in a diversification merger could benefit from e.g. economies of scale from IT network integration. Therefore, if a support tool is to be designed for IT network integration, it would be applicable to horizontal and vertical mergers and to some extent diversification mergers. This is due to the fact that those types of mergers are actually aimed at the integration of the business, while divestment mergers are not.

Before moving on to elaborating on the integration of IT networks in M&A, we should briefly look at how integration within an M&A is performed. It will become clear in the next paragraph that within an M&A, different integration approaches can be used. These approaches could help determine possible strategies for network integration in M&A.

2.1.4. M&A integration approaches

Within an acquisition there are four approaches to integrating companies. Schweiger and Goulet (2000) define the approaches inside an M&A as (1) combination, (2) standardization, (3) coordination and (4) intervention. (1) The combination approach is about the extent to which the different functions and activities of both bidder and target are physically integrated. (2) The standardization approach is about the extent to which the functions and activities of both companies are standardized and formalized, however not physically integrated. Separate operations may be active within the companies, but they are identical to each other. Typical for this type of approach is that the bidder transfers best practices across companies. (3) The coordination approach is about the extent to which functions and activities of the merging companies are coordinated, for instance either firm uses the other company's distribution channels. (4) The intervention approach to M&A is about the extent to which interventions are done in the acquired company to improve poor cash flows and operating profits, regardless of any sources of combination value (Schweiger and Goulet, 2000).

Parallels with these M&A integration approaches can be drawn for IT network integration. Depending on the situation of the specific M&A and its integration approach, different integration strategies can be used. A full network integration could be needed for situations in which two companies are combined or standardized, because these companies are physically integrated or will be using the same processes. Partial integrations could be applied for the coordination and standardization approach, depending on the level of network integration required for the specific merger. The differences in integration approaches within an M&A are important, because different M&A integration approaches could lead to different contexts for IT network integration. For example, this could be caused by differences in the strategic goals of the M&A.

2.2. IT networks and network integration

This section is about IT networks and the integration of those networks. The goal of this research is to design a tool that can help with the integration of IT networks. Before anything can be said about the integration of IT networks in M&A, first it must be clear what IT networks are and what they are used for. To be able to design a tool that aids with the preparation process of network integration, it is important to understand what the integration of IT networks comprises. After this, it is important to find out what problems are faced when integrating IT networks, because the to-be-designed tool should address those problems.

The keywords that have been used to search for relevant literature include: *network, information technology network, information technology infrastructure, network integration, network components, computer network* and *infrastructure integration*. The scientific literature did not provide the desired results. Therefore, the professional literature has also been used to construct this chapter. This includes network manuals, study material from IT studies, websites of commercial providers and professional magazines.

2.2.1. What is an IT network?

What is meant with an IT network? The IT network is an important asset of a modern company. The IT network allows the business to operate, by allowing people to collaborate and communicate whereby products can be produced and profits made. IT networks are part of the IT infrastructure (Ward and Peppard, 2002b). The physical infrastructure that the authors define is considered an IT network, which is commonly built by three main components. The components of an IT network as defined in this thesis are the Local Area Network (LAN), Wide Area Network (WAN) and Telephony network. Each component will be briefly explained in the following paragraphs to provide an understanding of the concepts. LANs, WANs and telephony networks have a close relation to each other. LANs connect the computers, servers and other IT related resources to each other within a single site. WANs are the interconnection of multiple LANs, and allow data to be transmitted between multiple office locations. Fixed telephony networks have been traditionally separated from the data network of the LAN and WAN. However, the technology development of voice over IP (VOIP) has caused an integration of these networks; both voice and data connections can use the same network. Therefore, telephony is gradually becoming a service on the data network (LAN & WAN).

As stated before, IT networks enable the modern business to operate on a daily basis. They are used to transfer information between entities in the network. These entities are the IT systems of the company and the employees using them. The type of information can be anything from documents to emails, video conferences and production control data. The hardware that enables the communication between all entities in an IT network is the backbone of the network, because it is the mechanism that transports the data from entity to entity. The scope of this research is the integration of IT networks, which in particular means the integration of the LAN, WAN and telephony equipment and services.

Now that the relation between LAN, WAN and telephony networks has been clarified, it is time to briefly look at the separate components to understand the basics of IT networks.

IT network component: Local Area Network

A local area network (LAN) consists of hardware equipment and special software that allows computers to send and receive data. LAN's typically cover small areas such as an office building and connects clients to servers, printers and other resources. Local area networks come in two types: wired or wireless. Wired LAN requires an Ethernet cable to physically connect all entities in the network through a data switching device. Wireless LAN uses radio waves to realize communication between computers, removing the need for wires. The LAN allows users on the network to share resources, resulting in a more efficient use of those resources. Figure 4 shows how different users can share resources. Network architecture defines one or more computers as servers and all the other computers as clients. The servers and clients are connected though a switch that passes data coming from a sender to the correct recipient. In order to do this, all computers in the network have a unique address, called IP address. When integrating networks of different companies into a single network, it is important to harmonize the IP address pool to be able to share resources over the combined company (Groth and Skandier, 2005).

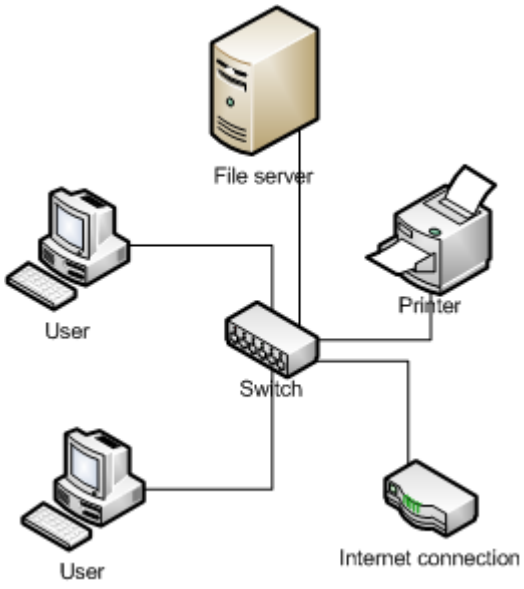

Figure 4: A LAN can be used to share resources between users

LAN networks operate by IEEE[1] standards to ensure interoperability between different equipment vendors. LAN belongs to the IEEE 802 standard. This research is limited to the most commonly used form of local area networks. The most often used LAN standard is the 802.3 standard, which is known as Ethernet (IEEE). Wired Ethernet connections vary in available bandwidth up to 1 Gbit for copper cable, up to 10Gbit over optic fiber connections. Wireless LAN belongs to the IEEE 802.11 standard and knows many extensions. Most commonly used wireless Ethernet networks are the 802.11a, 11b, 11g and 11n type of networks, increasing in available bandwidth and range (IEEE). As a rule, devices of a higher type are backwards compatible with previous types. (e.g. 802.1n capable wireless adapters are capable to connect to 802.11g and lower capable access points).

[1] Institute of Electrical and Electronics Engineers, a standardization organization for electrical related equipment

IT network component: Wide Area Network

A wide area network (WAN) is a network that covers a large geographical area, in contrast to LAN. The internet is a good example of a WAN. Basically a WAN is two or more LANs connected to each other through a special type of connection. For example: A company with offices in Amsterdam, Brussels and London has a LAN set up at each location. A simple way of connecting LANs is by using an internet connection and a virtual private network (VPN). Figure 5 illustrates the above example. Other WAN types are also possible and will be briefly explained later. A WAN is an excellent method for companies to run sites which are geographically remote and centralize productivity as it allows access to data 24 hours per day, seven days a week. A router on the edge of a LAN sends and receives data packets from and to other routers on the WAN and directs traffic to the correct machine on the LAN. Switches inside the LAN take care of delivering the packet to the right computer on the LAN (Groth and Skandier, 2005).

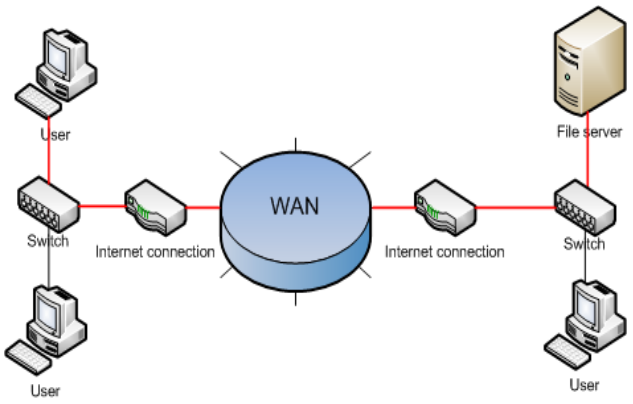

Figure 5: An example of a WAN over the internet that allows users to access remote resources

Wide area network technology generally functions on the lower three levels of the open systems interconnection model (OSI-model), providing transparent interconnections between local area connections. There is a difference between public and private WANs. Public WANs are implemented by creating a connection between two LANs over a public network such as the internet. Private WANs are generally delivered by special service providers who have large networks throughout a geographical region. These service providers deliver their services using different technological solutions. The most common WAN-technologies include Virtual Private Network (VPN), Asynchronous Transfer Mode (ATM), Frame Relay (FR), Ethernet (municipality oriented WANs) and Multiprotocol Label Switching (MPLS) and are used to provide transparent links between locations (Orange-Business, 2010). These technologies will be discussed briefly as they are important parts of networks.

Virtual Private Network

Leased lines can be expensive, and depending on the importance of the services used over the WAN, businesses can also create a WAN over the internet. To secure the connection between all sites of the WAN, a virtual private network (VPN) can be set up. By using VPN, all traffic that passes through the WAN remains encrypted from source to destination. This is referred to as tunneling, because the WAN is creating a secure route through a public network. A WAN via VPN over the internet is one of the most popular forms of wide area networking, because it is very cost-efficient. The drawback of using the internet for a WAN is that there is no guarantee about available bandwidth as the internet may become congested (Groth and Skandier, 2005).

Asynchronous Transfer Mode

ATM is a dedicated-connection switching technology that transfers digital data in small size cell units. Cells are transmitted asynchronously and queued before being multiplexed over the transmission path. The speed of an ATM connection can reach up to 10 Gbps. ATM is connection oriented, meaning that all switches on the path should be informed about the network service requirement and the parameters of traffic in order to establish communication. This legacy technology is still in place in some locations, but is slowly being replaced by newer technologies (Orange-Business, 2010).

Frame relay

Frame relay is a high-speed packet-switched data communications service. Frame relay is used for LAN-to-LAN connections and is able to handle burst-like demands of LANs. It operates at the physical and data link layer to provide an efficient method of transmitting data from a host to another host across multiple routers and switches. Frame relay does not guarantee data integrity and discards packets when the network becomes congested. However in practice frame relay delivers data with high reliability. Frame relay works by transmitting a frame to its destination through virtual circuits. These virtual circuits are logical paths from a defined origin to an endpoint and are bi-directional. Logical paths often share one physical medium through multiplexing. This feature reduces the equipment and network complexity that is needed to connect multiple devices. Within the frame relay technology there are permanent virtual circuits and switched virtual circuits. Permanent virtual circuits are set up by an administrator and are dedicated point-to-point connections. Switched virtual circuits are set up dynamically to provide flexible connections between endpoints. Frame relay offers a viable alternative to dedicated lines due to its bandwidth efficiency and high reliability (Orange-Business, 2010).

Ethernet

Recent advances in Ethernet technology have enabled it to exceed the borders of LAN and move towards creating WANs in municipal areas. Ethernet is being employed as the main backhaul network for mobile operators and is also being deployed as enterprise WAN. The technology has become popular as a WAN product, because the equipment is economical and flexible, allowing businesses to scale bandwidth to need. In addition its support for IP makes the integration of LANs through Ethernet WANs a viable option (Orange-Business, 2010).

Multiprotocol Label Switching

Multiprotocol Label Switching (MPLS) has been designed to eliminate the need for specific data link layer technology, such as ATM, frame relay or Ethernet and remove the dependence on multiple layer 2 networks to deal with different types of data traffic. MPLS is used in high-performance telecommunications networks and deals with the transportation of data from one point in a network to another. In an MPLS network, data packets are marked with labels; MPLS works by adding an MPLS header to packets, which contains one or more labels. The MPLS-labeled packets are switched using a label lookup instead of a lookup in the IP-table. Forwarding decisions are made only on the label, not the contents of the packet. This allows for the creation of end-to-end circuits through any type of transport medium, using any protocol. MPLS belongs to the packet-switching family of networks and is designed as a unified data-carrying service for both circuit-based and packet-switching networks. MPLS can be used to carry different kinds of traffic, such as ATM and IP packets, as well as Ethernet frames, thus making it an encapsulation protocol. MPLS has been developed based on the strengths and weaknesses of ATM and is currently replacing some of these technologies. It is possible that MPLS will replace all of these technologies in the future (IETF; Orange-Business, 2010).

IT network component: Telephony network

The telephony networks traditionally comprise the fixed handsets and the equipment that is needed to enable voice communications between these handsets. Telephony is a term for all types of voice communication which has been developed to provide interactive communication. The telephone provides a voice connection between two points, which is a heavily relied upon piece of technology during business hours. The telephony network is traditionally built upon exchanges, which deal with the processing of phone calls. In short, the basic flow of a phone call is that a point in the network signals the exchange that the subscriber wants to place a call. The exchange accepts the call, determines the endpoint of the connection and connects the caller and receiver. When the receiver is outside the coverage of the exchange of the caller, the call is routed through other exchanges until the connection has been established. Figure 6 illustrates this example.

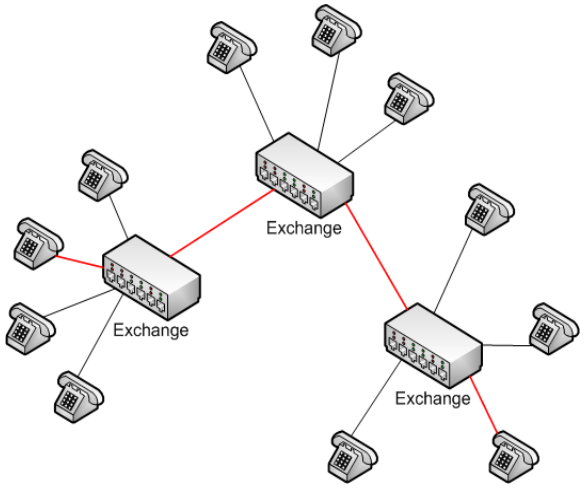

Figure 6: A call is routed through exchanges

Telecommunications technology has been continuously evolving and will keep adapting to future needs. Traditional telephony is based on time division multiplexing (TDM) which is a legacy technology in which different streams of voice data are taking turns in using the medium. Each communications sub-channel has a fixed bandwidth allocation even when the channel is not used and therefore is an inefficient system. Traditional telephony systems use separate cable networks which are installed next to the data networks. Traditional TDM systems are currently still in place in some companies, therefore when integrating telephony networks they could be upgraded to more cost-efficient systems, such as IP telephony. Upgrading to IP telephony removes the need for a separate telephony network because this type of telephony uses the LAN and WAN data network.

IP telephony is currently the most modern form of telephony, which uses the internet protocol (IP) to transmit voice data between senders and receivers. This allows for a more efficient use of the available bandwidth than traditional TDM systems and integration into local and wide area networks. The development of telephony integration into data networks opens many new possibilities for doing business. For instance, the integration of telephony services into a computer allows users to place calls with the click of a button without ever touching a dial pad. This is called computer telephony integration (CTI) and enables computers to interface with and control phone functions. CTI also allows services such as caller identification and other call processing functions on a computer. Computer Telephony Integration has opened the route to unified communication, which is the ongoing integration of telephony into applications (Bayer, 2001).

The typical components of an IT network are the Local Area Network equipment, Wide Area Network equipment and services, and telephony equipment and services. Now that the typical components of an IT network have been defined, it is time to look at the integration of these components. The next paragraph will elaborate on the integration process of IT networks.

2.2.2. Network integration

The previous paragraph provided an overview of the common components of an IT network. Now it is time to look at the integration of IT networks as this will provide the insight into the preparation process of network integration that is needed for the tool. What is meant with integration of IT networks? The dictionary definition of integration is: *"an act or instance of combining into an integral whole."* For IT networks this could simply involve the creation of a link between two previously unconnected networks, therefore making them part of an integral whole. This is network integration is its simplest form. However, most research considers the creation of synergies such as cost-reduction and economies of scale as important objectives of mergers and acquisitions. Therefore, the context of an M&A could apply a precondition to network integration: the goal of achieving synergies (Schweiger and Very, 2003) through the activity of network integration. This could mean that the IT network components can be harmonized to achieve i.e. cost reductions and economies of scale.

Therefore, for this research the definition of IT network integration is defined as follows: The process in which two previously independent IT networks are combined into an integral whole, while trying to achieve cost reductions by harmonizing IT network components.

The integration of IT networks is relevant for companies that merge different business units, but more importantly, companies that merge with other companies. How does one go about integrating IT networks? As discovered before, one of the goals of M&A is the creation of value through synergies. Cost-reduction synergies can be achieved by the removal of excess assets and personnel (Schweiger and Very, 2003). When two companies merge and no network integration is done, the merged company ends up maintaining two separate networks through two separate IT departments. Therefore, the goal of network integration could be the creation of a single network with one maintenance and support crew providing service to that network. For example, going for a single-vendor network setup and increasing the size of the existing networks to accommodate the assimilated company could lead to economies of scale from the improved utilization of IT network assets. Based on this insight and the fact that not all M&As are alike (Bower, 2001), it could be concluded that different mergers require different integration strategies. To be able to merge two previously independent networks, the person who is tasked with writing a plan to do this, is faced with making choices about harmonizing specific parts of the network and is challenged by time, budget and other resources.

Integrating networks is a complex task involving many factors. According to Gelman (2003) the process of designing a new or upgrading an existing IT network is about determining network needs, determining a budget, managing vendor relations, writing and awarding a request for proposal (RFP) and finally implementing the network. The author explains what is needed to make changes to a network, which is also the case when two merging companies integrate their networks. If the networks are to be integrated, at least one of the IT networks will be changed. The situation of network integration in M&A is slightly different from the situation described by Gelman (2003). The situation of integrating IT networks in M&A confronts the integration decision maker with two already existing networks. However, parallels with the work of Gelman (2003) can be made to the situation of integrating two networks in an M&A setting, which have been elaborated below.

The network integration process can be broken down into several steps. The first step is to create an accurate baseline of the inventory of the network. This is followed by the determination of the requirements for the network. After determining the requirements that the network should satisfy, it is important to look at the available budget for IT network integration, as this leads to the timing of the

network integration. The next step is the selection of vendors that will be the provider of LAN, WAN and telephony equipment and services and send them a request for proposal (Gelman, 2003). The different steps are described more precisely below.

Inventory phase

In M&A, the network integration process starts with knowing what is currently in place. This means that the process starts with making a detailed inventory of the installed network equipment and outsourced network services. The inventory should be as detailed as possible, including (among others) the installed network cables, routers, switches, wireless access points, WAN contracts, WAN equipment and telephony network equipment and handsets. This process is of vital importance and needs to be done accurately, because later steps in the integration process depend on it (Gelman, 2003). To create an accurate baseline of each network, Gelman (2003) states that in this phase it is important to analyze the entire network. Topics of analysis that may have an impact on the integration of networks in M&A include:

- Perform a bandwidth utilization analysis to determine the utilization of the current networks. If the business operates on any critical applications, the integrated network should accommodate for the required bandwidth to support those business critical applications.
- Making an inventory of all the installed routers, switches and wireless access points, WAN equipment and telephony equipment. Information such as the vendor, model, make, serial number, available bandwidth and other important specifications should be included. Gathering this information will help to make the decision as to which network equipment to keep and which to replace. Information about outsourced network services is also very important to note.
- Creating an overview of the IP address assignment method (static or dynamic) and the IP address pool. This ensures a conflict free communication between computers in the merged network.
- Listing and specifying the details of WAN services, such as the number of leased lines, internet access lines, VPN access points and the layout of the interconnections between offices.

Network requirements determination

Well-built networks start with a strong foundation which is based on the requirements that meet the expectations of the users it will support. The first step is finding out what the network will be used for. To analyze this, it is important to find out what applications will be used on the network. Each application will create an additional load on the network. Several questions can be asked to investigate the network requirements. These questions are important for the decision process and could be used as decision criteria for selecting network integration solutions (Gelman, 2003). Questions regarding the service the network should provide are:

- What type of traffic flows can be expected? Are these going to be burst-like in nature (such as file and printing services) or more of a streaming nature (such as voice and video services)?
- How many users will the network need to support? How many IP addresses are currently needed and how many will be necessary in the future? What is the impact on the IP-address plan? Is there sufficient room available for the expansion?
- Is IP telephony a requirement for the network and do we need simple services such as making and receiving calls, or should it support conference calling and unified messaging?
- Are there any new applications planned in the near future and are these burst-like (such as telecommuting) or streaming in nature (such as videoconferencing)? How does that impact the required bandwidth of the network?

- Will any of the applications on the network require quality of service (QoS) congestion management techniques? For example, the integration of IP telephony on the data network introduced the requirement of quality of service. Which applications should have priority over others on the network? To put this in perspective, think about receiving an email half a minute later versus a distorted video conference call when the network becomes congested.

It should be obvious that going back to the drawing board after new equipment has been purchased and installed will be a waste of resources. Therefore, asking the right questions should provide insight into the requirements of the network and will save time and money at a later stage (Gelman, 2003). Making decisions about network integration in M&A is therefore impacted by the requirements of both companies to the network.

Budgeting and planning

When the infrastructure analysis and requirements determination are completed, the next step is to look at the available budget and the timing of the steps of the integration. Important questions to ask are: "When are we going to migrate?" and "What approach should be used to migrate?" The migration could be done immediately after the decision has been made to do so. However, the cost of migration or possible penalties on running contracts with external suppliers could cause the decision maker to choose otherwise. As to the execution of the migration, it could be decided that all the to-be-migrated items will be changed at once, using a so called "flash cut". However, if there is insufficient budget to choose this approach, the work that needs to be done should be divided into accomplishable portions that fit the budget available for the task. Moreover, "big bang" approaches to network implementations are extremely risky and therefore companies often rely on incremental changes to migrate their networks (Ross and Rockart, 2003). This results in a staged process in which only portions of the network will be migrated at a time. Having insight into the budget at this stage of the process will help prevent problems at a later stage. When dealing with limited resources, breaking up the roll-out of the network into two or more budget cycles will better serve the users of the network (Gelman, 2003).

Preventing mistakes in this process can be done by looking early at potential network equipment vendors and the equipment that could be considered for the network implementation. By pre-selecting those vendors who supply products with the features that are required for the network, a lot of wasted resources can be saved. In addition to the vendor pre-selection, learning how vendors implement their equipment in a common scenario is worth investing time into. Knowing this information is important to make a well founded decision when vendors make an offer for a network implementation. A final way of preventing critical mistakes in the budgeting and planning of the network implementation is to decide how flexible the network should be in terms of capacity. To provide this flexibility in the network, either fixed-configuration or chassis-based switches can be used. In general, chassis-based switches have better performance and functionality and can be expanded with extra network ports, while fixed-configuration switches cannot be expanded but are more cost-effective. When designing a new or integrated network, the designer can apply the best of both worlds by putting chassis-based switches at the core of the network and use fixed configuration switches at the outer reaches (Gelman, 2003).

Vendor selection

According to Gelman (2003) the most difficult task in the process is vendor selection and management. Vendors come in different types and include manufacturers who sell directly to customers including installation assistance, or via resellers who take care of the installation process for the vendor. Selecting the right vendor is of critical importance to the implementation of the network. To determine which

vendors will be selected, evaluating vendors is required. Prior experience with vendors can be a good guide, because knowing how one vendor works gives great insights into how others work and provides a frame of reference. Vendor selection can be done on a number of factors (Gelman, 2003):

- Innovativeness in product design and functionality. Choosing a vendor that pushes the technology envelope to make the purchased products better in the future by adding features in the coming year might be a good selection criteria to maximize the benefit of the investment.
- Customer support. It should be one of the most important criteria of vendor selection and even more important than innovativeness, because no matter how innovative the product, if it fails and the vendor cannot fix the problem, the product is worthless (Gelman, 2003).

The next step is about deciding whether to use the best-of-breed approach (in which a different vendor for each network component is selected) or the single-vendor approach (in which one vendor supplies all network components). In other words, this is about the choice whether or not to harmonize network components throughout the entire network. Although many companies use the single-vendor approach, there are a few criteria to help deciding on the best solution:

- The cost of managing multiple vendor platforms (required staff);
- The cost of maintenance agreements from multiple vendors (required financial resources);
- The time that is required to learn the skills needed for administering multiple vendor platforms (required time).

If the analysis for these criteria concludes that the required resources are available, a best-of-breed solution can be chosen. However, if these criteria cannot be satisfied, going for a single-vendor approach will be the best option. A single-vendor solution will save staff by requiring fewer people to maintain a smaller collection of equipment, will save money by having one maintenance agreement for all of the components in the network, and save time by only having to train the staff on one equipment management system (Gelman, 2003). In conclusion, a single vendor solution will reduce the diversity in the network and leads to only a single system that needs to be maintained. This results in operational cost reductions for staff, maintenance agreements and training.

When selecting vendors, there is another important aspect to look at. It may not be possible to change the network in one night; therefore it must be possible for multiple vendor platforms to coexist in the network. Product interoperability is the key-word, when going for a staged process of going from one vendor to another. This can be caused by a limited budget, limited time, or the size of the network. Vendors that cannot deliver proof of interoperability should not be selected (Gelman, 2003).

Request for proposal

After completing all analysis and selecting a limited number of vendors, the last step of the process is writing a request for proposal (RFP). The request for proposal should address all the issues found in the previous stages. The RFP is a written plan of the to-be-implemented network configuration and can be used to ask vendors to submit an offer to implement the desired network. The preparation phase ends after sending the RFP to several vendors and awarding one or more vendors with the implementation contract (Gelman, 2003). The focus of this research is on the preparation phase of network integration, therefore the design of the tool should end at this step of the process.

Uncertainty and risk in network integration

Almost any project is executed in an environment of uncertainty and risk (Meredith and Mantel, 2006). This also applies to network integration projects. Uncertainty is the lack of complete certainty. This means that for a given problem, there are multiple solutions and the outcome is not known beforehand. For network integration, this is also the case. The effect of a solution cannot be entirely known before it is implemented and tested. As time progresses, more and more is known about the solution. This means that the uncertainties associated with that solution decrease as the integration project evolves. Risk originates from uncertainty, because if there is no uncertainty, there is no risk. A risk is defined as the probability of a negative effect occurring, multiplied by the magnitude of that effect (Meredith and Mantel, 2006). For instance, the risk of implementing equipment from a certain vendor that fails to deliver the promised functions is the probability of that failure multiplied by the financial resources involved in that choice. Adequate preparation research could mitigate the risks of network integration. Uncertainty and risk is a subject that intersects with all activities of preparing network integration. Performing a risk analysis is not part of this research. However, the following risks could be kept in mind during the preparation phase of network integration in M&A.

First, an important risk that can occur within a network originates from product interoperability. Products from different vendors might not be interoperable with each other, e.g. due to vendor proprietary software and protocols. One way of mitigating this risk is by aiming for a single vendor network setup. However, due to the fact that it is not always possible to replace network components with other components overnight, the different network components must be able to coexist in the network. For instance, a limited budget, servers or printers whose addresses cannot be changed easily, or the size of the network might prevent an overnight change. Therefore, the equipment within both networks must have a proven interoperability. For these components, vendors should supply statements of adherence to standards (Gelman, 2003). If either network component turns out to be incompatible with the other, one of them must be replaced or some form of creating an interface between the incompatible components should be implemented.

Second, network failure is a risk that could occur when integrating two networks. Making changes to a network could result in downtime of that network, rendering it inoperable. If the network fails, the business services that depend on the network fail. The reasons for network failure can be diverse, for instance due to interoperability issues between different vendors in the network. The impact of this risk can be quite high, because if the applications that support the business process are inoperable, the business can come to a halt. To mitigate this risk, a network migration plan could be prepared that allows for a seamless crossover to an integrated network.

Third, outsourced network services can pose risks to companies and network integration. Apart from the risks that could be involved with integrating outsourced network services (such as WAN connections), outsourcing brings some general risks that should be considered when integrating separate outsourced network services into a single contract. The results of outsourcing of IT activities seem to vary (Ward and Peppard, 2002a). Although outsourcing can provide cost benefits through the reduction of managing multiple vendors, platforms and support staff (Gelman, 2003), Ward and Peppard (2002a) argue that there are also risks involved with outsourcing strategies. Incomplete contracting, lack of active management of the supplier on contract and relationship dimensions, power asymmetries developing in favor of the vendor and hidden costs are among examples of possible outsourcing risks.

Finally, security is an important aspect of any modern network. There is a risk of unauthorized people entering the network and obtaining sensitive or competitive information. However, protecting the network at the border with the outside world is not enough, because attacks can also originate from compromised computers on the network. Therefore, to mitigate this risk several considerations should be taken into account when selecting the components for the integrated network. First, the equipment should have the ability to implement at least a minimum level of security at each point of entry or exit of the network. Second, the equipment should also have the ability to prevent misuse of the network from inside the company (Gelman, 2003). With regard to network integration in M&A, it is crucial to investigate whether the network components of both companies support the required security features. Similar to interoperability issues, vendor statements for adherence to standards should provide clarity to this question.

Network integration preparation process

Based on the information found in professional literature, the preparation process of IT network integration can be derived. The integration preparation process comes down to a few general steps:

- getting insight into the current situation;
- determining the relevant issues based on network requirements;
- determining a course of action for each relevant issue;
- and finally making a plan for IT network integration.

Insight into the preparation process of network integration has now been established. To be able to design the tool, which is the goal of this research, more components are needed. The next component that will be discussed is an overview of the common problems of IT network integration projects.

2.2.3. Common issues in IT network integration

Another building block that is needed for the design of the tool is an overview of possible IT network integration problems faced in M&A. What issues do integration decision makers meet when integrating the IT networks of two companies? The definition of IT network integration issues is as follows:

> IT network integration issues are defined as differences between the components of the two networks of merging companies. One company could be using a certain component for a specific network function, while the other could be using a different component. These components can be either hardware equipment, service contracts or configurations related to the IT network.

An issue could be that one company is using wired networks for their LAN connections, while the other company is using wireless LAN. If the first company is using high-bandwidth applications on their wired network, it may be possible that this application will have insufficient bandwidth on the wireless network of the other company. Another example could be a conflict in hardware vendor of the LAN equipment, where one company could be using equipment from vender A and the other is using vendor B. This can lead to problems when vendors use proprietary protocols to support and maintain their network devices. To be able to design a tool that helps with the integration, it is critical to understand which issues need attention. The literature has provided a limited list of possible integration issues. Therefore, an orientation interview has been conducted with a network expert at Accenture to supplement the list of integration issues. Table 2 shows the findings in literature and the orientation interviews. The sources of the integration issues have been listed in the "source" column.

Table 2: Overview of common IT network integration issues

Area	Issue	Source
Local Area Network	Different LAN technologies: Wired Ethernet versus Wireless Ethernet	(Groth and Skandier, 2005) (Orientation interviews)
	Different LAN equipment vendors	(Gelman, 2003) (Orientation interviews)
	Different wireless technology: (802.11a/b/g/n)	(Groth and Skandier, 2005)
	Different service strategy: Outsourced versus in-house	(Orientation interviews)
	Different and conflicting IP Plans	(Gelman, 2003; Groth and Skandier, 2005) (Orientation interviews)
	Different Quality of Service for applications/services	(Gelman, 2003)
Wide Area Network	Different WAN technology: Frame Relay, ATM, Ethernet, MPLS	(IETF; Orange-Business, 2010)
	Different WAN equipment vendors	(Gelman, 2003) (Orientation Interviews)
	Different WAN providers	(Gelman, 2003; Groth and Skandier, 2005)
	Different remote access services: Dial-in, VPN	(Gelman, 2003; Groth and Skandier, 2005) Orientation interviews
	Different service strategy: Outsourced versus in-house	(Orientation interviews)
	Different Quality of Service for applications/services	(Gelman, 2003)
Telephony	Different telephony technology: TDM, PABX, VOIP	(Bayer, 2001; Gelman, 2003)
	Different equipment vendors	(Gelman, 2003) (Orientation interviews)
	Different telephony approach: Traditional, Unified Communication	(Bayer, 2001; Gelman, 2003) (Orientation interviews)
	Different service strategy: Outsourced versus in-house	(Orientation interviews)

2.2.4. IT Network integration strategies in M&A

As stated in the introduction of this chapter, several components are needed for the design of the tool. One of these components deals with the possible integration strategies which decision makers can use to determine which network component to migrate. The literature for M&A states that there are different integration strategies within a merger (Schweiger and Goulet, 2000). As discovered in paragraph 2.1.4, depending on the situation of the specific M&A, different integration strategies could be applied to IT network integration. For instance, when the merger requires it, a full integration of the IT networks could be done. However, it might also be possible that only a partial integration is needed or none at all.

An integration strategy is defined as a possible scenario for a solution to a given integration issue. These strategies describe the approach of the integration that can be applied to an integration issue. Four integration strategies are defined in this thesis: full integration, partial integration, no integration, and new system.

The situation of an M&A confronts IT managers with two separated networks that have their own and unique configurations. Describing the integration approach for each combination of unique configurations could lead to a nearly infinite number of possibilities. Therefore, the integration of IT networks could be done by determining the strategy to a solution per integration issue. In this case, the integration of two previously separated networks can be done through a limited number of integration strategies.

The literature on IT network integration strategies is almost lacking. Therefore the integration strategies for IT networks have been defined by making parallels with integration in other areas, such as IT integration in M&A (Wirz and Lusti, 2004) and information system integration in M&A (Giacomazzi et al., 1997). These areas provide the basic ideas for the different integration alternatives in IT network integration. Wirz and Lusti (2004) argue that if two separate companies join together, they have four alternatives to unify their information technology. These are: Take-over, Best-of-Breed, Disconnection and New System. In the take-over alternative, the superior system persists and the inferior will be migrated. In the best-of-breed alternative, the integrated system will be built with the best components of the merging partners. In the disconnection alternative, both systems will persist without major modifications. The new system alternative is about building an entirely new system. On the other hand Giacomazzi et al. (1997) argue that there are three levels of integration. These levels are defined as: Total integration, Partial integration and No integration. The total integration alternative is the process in which all components are unified. Within the partial integration alternative, only some of the components are unified and the remaining components are operating side by side. The no integration alternative leaves both components untouched and in their current state. After analyzing these options, there are similarities between them. The take-over and best-of-breed alternatives are similar to the total integration alternative, because these alternatives aim for a single component solution. The disconnection alternative is similar to the no integration alternative, because both alternatives leave the network components in their current state.

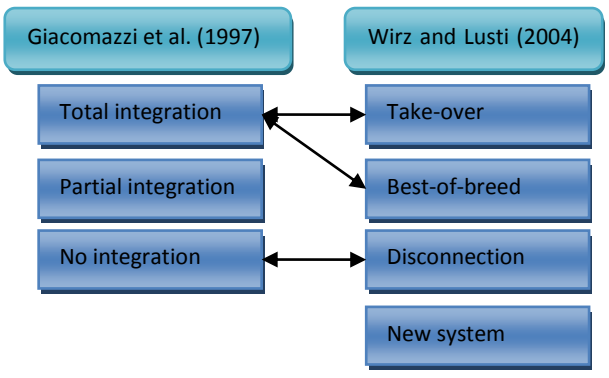

Figure 7: Possible integration strategies based on Giacomazzi et al. (1997) and Wirz and Lusti (2004)

The partial integration and new system alternatives provide unique integration strategies. Figure 7 illustrates the similarities between these strategies. Based on these alternatives, the integration strategies for IT networks have been defined. These are: Total Integration, Partial Integration, No Integration and New System. The names for these definitions were chosen because they have a more intuitive meaning in the context of network integration.

Total integration

In this alternative, one of IT the network components is migrated to the other or vice versa. For example: network A is built with equipment from vendor X, network B is built with equipment from vendor Y. When this alternative is chosen, the integrated network will be built using equipment of only one of these vendors. By using this strategy, cost-savings could be achieved by reducing the cost of managing multiple vendor platforms, maintenance agreements and vendor specific skills.

Partial integration

In this alternative, both IT network components are left in their current state but are connected through a bridge. For example, the telephony systems of company A are based on technology X and the telephony systems of company B are based on technology Y. In this case, both telephony systems will not be migrated to a single technology and will be connected through a bridge between the technologies. For instance due to a relatively large installed base, the cost of integration could be higher than the expected cost benefits of using a single technology.

No integration

In this alternative, the components of network A and network B will not be integrated into a single component or connected through a bridge. Both components will persist without any modification. For instance due to a relatively large installed base, the cost of integration could be higher than the expected cost benefits of using a single vendor and building a bridge between the systems is infeasible.

New system

In this alternative, the components of network A and network B will both be migrated to a new component. For instance, it could be the case that both merging companies' IT networks are largely outdated and both require an update. The activity of M&A can be a good opportunity to upgrade both companies' networks to a more future-proof IT network.

These strategies will be used in the design of tool, to provide the user with options for integration. The relevant topics of IT networks and network integration have been discussed. Insight into some of the building blocks of the tool have been defined and elaborated. The next step in this research is the application of this knowledge in a tool. This step will be elaborated in the next section.

2.3. Network integration support tool

In the previous sections, the basic concepts of mergers and acquisitions have been explained (see section 2.1). After that, a basic understanding of IT networks and the integration of these networks has been provided (see section 2.2). Next, it is time to find or develop a suitable tool to support the network experts in the preparation phase of IT network integration in M&A. If a tool for the preparation of network integration in M&A is to be designed, what would it look like and how should it work? The purpose of this section is to explore these questions. Before moving on to do this, it is essential to make a clear definition for "the tool", of which the design is the end product of this research.

The definition of "the tool" is derived from the main question of this research and is defined as: A tool that assists network experts in the preparation process of IT network integration in a merger. For the purpose of clarity, the tool has been named Network Integration Support Tool (NIST).

As discovered in section 2.2, the preparation of the integration of networks is about thorough situation analysis: what is currently in place? This is followed by analyzing the requirements that need to be satisfied by the network and analyzing which parts of the network need to be integrated. The network expert can apply several integration strategies for each part of the network. The preparation process is then ended with the development of a plan, which is used to integrate the IT networks after the M&A deal has been closed.

The aim of this section is answering the second research sub question:

> *Can the concept of decision support systems be used to design a tool that can be used to support the preparation of the integration of IT networks in M&A?*

This research sub-question is aimed at finding a suitable tool to be used for the design of the tool. This could mean that either an existing tool will be used, or a new tool will be designed. Before going into this, it is important to understand what decision support systems are and how they work, because it provides essential information on how our tool can be designed. After exploring the concept of decision support systems, the design of the tool will be clarified by elaborating on how the process of the tool should work. Confronted with the task of finding a suitable decision support tool for the design of the tool, it proved difficult to find literature that directly fits into the context of this research. Therefore it was decided to start with a general method for developing decision support systems and use it to design a decision support tool specifically for the preparation of integration of IT networks in M&A. This has been done by looking at the decision support system process at a high level and applying it to the process of network integration as described earlier.

2.3.1. Decision support systems

Decision support systems (DSS) have been in development since as early as 1970 (Sprague, 1980) and have evolved from supporting individual decision makers into group decision tools for teams of decision makers. Decision support systems provide decision makers with a guided decision making process (Shim et al., 2002). In literature, the term decision support systems and decision support tools (DST) are used interchangeably; however a distinction can be made between them. DSS is the general term for systems that aid decision makers in their work and the tools that enable sub processes of the system are DST. In short: a DSS can contain many DST's (Shim et al., 2002). DSSs are characterized as interactive computer based systems or applications, which help decision makers, utilize models and data to solve problems. Some authors extended the definition to have it include any system that contributes to decision making,

therefore not limiting them to computer systems. *[The words have a certain "intuitive validity"; any system that supports a decision, in any way, is a "Decision Support System."]* (Sprague, 1980).

Decision support systems own certain characteristics, which specifically focus on features that allow problem solving to be done in an interactive way and are flexible and adaptive to allow changes in the environment and decision making approach (Sprague, 1980). These characteristics are ideal for the varying environment of IT network integration in M&A, as they allow the decision maker to stay flexible while still being able to decide on a solution for the problem he is facing (Shim et al., 2002). Therefore, decision support systems could be used for the design of a tool that helps network experts in the preparation phase of network integration in M&A.

Decision support systems provide a means to guide a decision making process in an interactive digital environment. To do this, a DSS works with predefined process steps. In their paper on the evolution of decision support systems, Shim et al. (2002) provide a common framework that applies to decision support systems in general. The process follows a common "flow" that is the basis for many DSS. Figure 8 shows the common framework on which decision support systems are built. Once the problem is recognized, it can be defined in terms that facilitate the creation of alternative solutions. Models are then developed and used to analyze the various alternatives. The results of the alternative analysis are the foundation on which the best alternative is selected and implemented. Obviously, no decision process is as clear-cut as the described process. Phases typically overlap and blend together. Phases will also be looping back to earlier stages as more is learned about the problem, as certain solutions prove to be undesirable, and so forth (Shim et al., 2002).

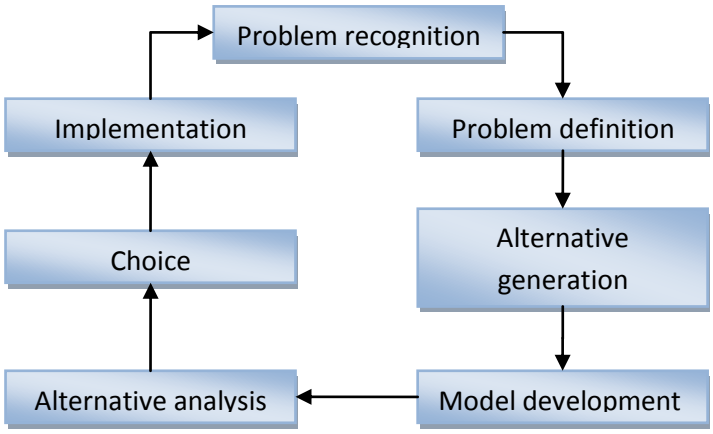

Figure 8: The DSS decision-making process. From Shim et al. (2002)

Next, the general process flow for DSS could be applied to the situation of the problem situation; the preparation of IT network integration in M&A. How the general process flow of a DSS translates into a support tool for network integration is explained in the next paragraph.

2.3.2. IT Network integration support tool design

The goal of this research is the design of a tool that helps network experts with the preparation of IT network integration in M&A. As clarified in chapter one, the tool should be designed as a support tool. This tool helps network experts with the preparation for IT network integration in M&A, by providing an integration strategy for integration issues. What would a tool look like, that assists network experts in the preparation phase of network integration? What steps should it take to achieve this goal? By applying the knowledge of the preparation process of network integration from Gelman (2003) to the DSS framework from Shim et al. (2002), it is possible to create a tailor-made process model for this tool. Figure 9 shows a proposed model for the process model of the tool. Each step of the DSS process as described by Shim et al. (2002) will briefly be discussed and how the steps translate into a possible process model for the tool.

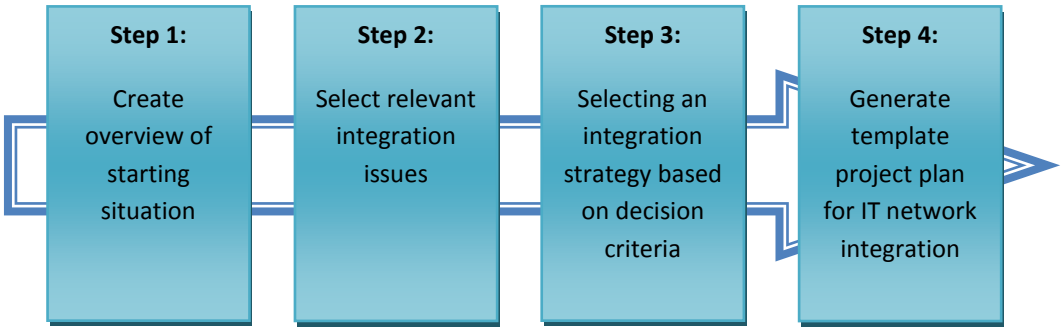

Figure 9: Proposed decision support process flow

Problem recognition: The problem recognition in network integration in M&A should start at making an inventory of the currently installed LAN, WAN and telephony equipment in both companies. As stated by Gelman (2003), this inventory should include detailed information about the number, type, and other specifications of all LAN, WAN and telephony equipment. Additional information could include information on possible outsourced network services, such as network maintenance and WAN connections. The problem recognition also includes environmental factors, such as a dominant party in the merger who could dictate the solution for the merged network. By creating this overview, possible conflicts between components of the IT networks of the two companies become visible. This is step 1 of the tool.

Problem definition: In the case of network integration in M&A, not all detected integration issues might need to be addressed. In the problem definition phase, the relevant integration issues could be defined by the user of the tool. In other words, the user can select relevant items from a list of common integration issues in IT network integration (see paragraph 2.2.3). For example, there might be a difference in applied LAN technology, but the situation of the M&A might not require those technologies to be harmonized and therefore not be relevant. For the design of the tool, this means that the user of the tool is provided with options to include or exclude certain integration issues. This is the problem definition part of the tool and is done in step 2 of the tool.

Alternative generation: Shim et al. (2002) argue that alternative solutions can be created after the problem has been defined. The alternative solutions can be applied to the common problems of IT network integration. For this purpose, four pre-defined alternative solutions have been made (see paragraph 2.2.4). These are: total integration, partial integration, no integration and new system. These alternatives are part of step 3 of the tool; selecting a solution for a given integration issue.

Model development: According to Shim et al. (2002), the next step in the process is to use a model to analyze and select one of the alternatives. The model should facilitate the selection of an alternative for a given integration issue. If there are multiple possible alternatives for each integration issue, there are multiple end points for one starting point. Therefore, a model that facilitates arriving at different end-points from one starting point is needed. Giacomazzi et al. (1997) suggest that a decision tree could be used for selecting different alternatives for a single starting point. For the purpose of the tool, a decision tree could be used as a model to analyze and select one of the integration strategies (the concept of the decision tree is further elaborated in paragraph 2.3.3). The decision tree is part of step 3 of the tool and facilitates selecting a solution for different integration issues.

Alternative analysis: The user of the tool should be able to select an optimal solution for each integration issue. To do this, the tool should have information on different decision criteria. Examples of possible decision criteria are: the dominant M&A party's choice, technical functionality or cost of ownership. The decision criteria are used in the branches of the decision tree that facilitates the selection of an integration strategy. The decision tree that will be used to select integration strategies for different integration issues will be explained in the next paragraph. The decision criteria are needed in step 3 of the tool.

Choice: Making a choice between alternative solutions is ultimately up to the user of the tool. Therefore, after evaluating different decision criteria for each of the relevant integration issues, the user can make a choice of which strategy to apply to a given integration issue. This is part of step 3 of the tool.

Implementation: After the M&A deal has been closed, the integration of networks could start. This means that the preparation for this activity should have been done and a plan for the integration of IT networks should be ready. This helps the network expert in the preparation phase of an M&A. After the user is done reviewing all issues and respective alternatives, the tool could create a template integration plan that can be used in the post-merger integration phase. This is part of step 4 of the tool.

Functional requirements

The process steps as stated above are a preliminary procedure that the tool could follow. This proposed process is the starting point of the process flow of the tool and will be validated at a later stage in the research process. Based on this process model, the basic functional requirements for the design of the tool can be established. The functional requirements of the design describe how the tool helps the user in the preparation process of network integration. Table 3 shows the functional requirements for the design of the tool.

Table 3: Overview of basic functional requirements for the design of the tool

Nr	Functional requirement	Comments
0	The tool should work according to a staged process, that takes the user through the decision making process. The steps in the process are: (1) creating insight into the starting situation, (2) Selecting relevant integration issues, (3) analyzing and selecting alternative integration solutions and (4) generating a template of a project plan for network integration.	These are the four steps in the process model that help the user in the preparation process of network integration.
1	The tool should provide the user with functionality to define the starting situation. This can be done by entering detailed information about each merging company's network configuration.	
2	The tool should provide the user with functionality to choose the integration issues that are relevant for the M&A situation.	
3a	The tool should guide the user through the decision process of selecting an integration solution by providing a decision tree that leads the user to an integration strategy for each integration issue.	The decision making process can be done through a decision tree that asks the user a series of questions that leads towards an integration strategy. The questions are based on a list of decision criteria.
3b	The tool should provide the user with functionality to override the strategy choice and select a different strategy.	If the tool leads the user towards a solution that the user deems unsatisfactory, the user should be able to override this choice.
4	The tool should generate a template for a network integration plan after the user is done reviewing all integration issues.	What to integrate, when to integrate, how to integrate

Now that the process flow of the tool has been defined and the basic functional requirements have been established, it is time to take a look at the core of the tool: the decision making process that results in the selection of integration strategies for integration issues.

2.3.3. Alternative selection decision tree

One of the goals in M&A is the creation of value through synergies, such as cost-reduction and economies of scale (Schweiger and Very, 2003). The integration of IT networks in an M&A could also be aimed at creating cost reduction synergies and economies of scale. To achieve these synergies, the IT network components of both companies could be harmonized. How does a decision maker decide which component of the IT network to integrate and which to leave in their current state? And how does the decision maker decide which integration strategy to choose? The answer is seemingly simple: by asking the right questions (Gelman, 2003). The next question is: how does the tool help the decision maker select the right integration alternative? Giacomazzi et al. (1997) suggest that a decision tree could be used for selecting different integration strategies. This idea can be applied to the decision making in the integration of IT networks, because it allows a variety of decision criteria to be evaluated in a structured manner to determine the integration strategy. The strategies are selected through a series of questions, which take the decision maker through the strategy selection process. Some of the decision criteria to arrive at a certain end-point have already been identified in the previous section on network integration. Figure 10 shows the decision tree from Giacomazzi et al. (1997) and visualizes the decision tree which is part of the tool (NIST) that helps the user make a decision. By going top-down through the tree, the user

is asked a series of questions that take him to a certain end-point. This decision tree will be used for each of the integration issues that had been selected in the previous step of the process of the tool. However, the decision tree may vary between different integration issues, because some decision criteria may be irrelevant for some integration issues. In other words, the tool contains multiple decision trees. To create the decision trees for the tool, three things are needed. (1) At the top of a decision tree is an integration issue (see paragraph 2.2.3). (2) At the bottom of the tree, there are several integration strategies (see paragraph 2.2.4). (3) Next, the decision criteria that can be used to select an integration strategy for an integration issue are needed. Based on the literature review in chapter two, a preliminary overview of possible decision criteria that can be used to guide the decision maker towards an integration strategy is listed below:

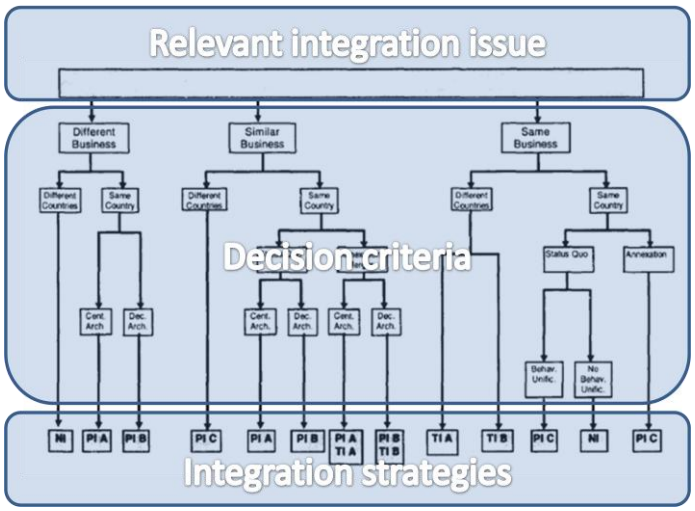

Figure 10: Network integration decision tree. Adapted from Giacomazzi et al. (1997)

- Dominant M&A party decision maker; (Mehta and Hirschheim, 2004)
  The dominant party in a merger can and often will determine the integration strategy. The dominant party is often the acquiring company.
- Cost of migration (Gelman, 2003);
  The cost involved in the migration project: the cost of migrating all instances of a network component to another. Can include purchasing of new equipment, penalties for breaking contracts for outsourced services, and consultancy fees.
- Technical functionality (Gelman, 2003; Groth and Skandier, 2005);
  Certain business applications can pose (technical) functionality requirements to the network. These are the properties that the network should provide to support the services on that network. For instance, if a company wishes to implement IP telephony, the network must support traffic shaping features that allow issue-free telephone conversations over the network.
- Vendor customer support (Gelman, 2003);
  Selecting a vendor can be done based on their customer support. Comparing customer support between vendors can be done on several aspects: industry recognition for customer support, after-hours support, first-call closure rates, one point of entry for support and local engineering support.
- Future proof (Gelman, 2003);
  Selecting network components for the integrated network can be done by evaluating the extent to which these components are future proof. For instance, does the component allow for future growth or does it support features that will be important to the business? Components that can be upgraded through software updates can be future proof.
- Bandwidth requirements (Gelman, 2003; Groth and Skandier, 2005);
  The integrated network should provide sufficient bandwidth for all applications that use the network.

- Product innovation (Gelman, 2003).
  Selecting products and services from different vendors can be done based on innovativeness in product design and functionality. Ease of use and implementation due to innovations, are examples of reasons to choose for innovative vendors and products. Investigating product innovativeness can be done by looking at several factors: the amount of financial resources the vendor spends on research and development, whether the vendor is a member of IEEE or other standards organizations, or whether the vendor has won awards in the industry for their products.

These preliminary decision criteria are based on the literature and will be validated and complemented through interviews with network integration experts.

2.4. Conclusion

This chapter was aimed at achieving several goals. The first goal was to provide the conceptual framework that contains the relevant theories for this thesis. The second goal was to provide the definitions that are used in this thesis. The third goal was to answer the first and second research questions. The final goal was the discovery of the building blocks of a tool that helps networks experts prepare for network integration in M&A.

To achieve these goals a literature study has been performed. First, scientific literature was consulted. Next to scientific literature, professional literature has been consulted. This was done because the scientific literature was lacking in the area of IT networks and network integration. Several sources of professional literature were used. These sources are educational study material, handbooks which are used by network experts, and professional websites of renowned networking companies. The literature provided a limited list of possible contextual requirements. Therefore an orientation interview with a network expert at Accenture has been conducted to obtain a more complete overview of the relevant context.

The conceptual framework is built around three core subjects. These are mergers and acquisitions, IT networks and network integration, and decision support systems. The reason to deal with these subjects is to obtain an up-to-date overview of the research theme and identify relevant concepts for the design of the tool. The conceptual framework provided the answers to the first and second research question.

> The first research question states: *"What is the current scientific knowledge about mergers and acquisitions, IT network integration and the relation between them?"*

The current scientific knowledge of M&A is abundant (Cartwright and Schoenberg, 2006). Many sources have been found that deal with aspects of M&A, such as cultural aspects (Cartwright and Cooper, 1993) and organizational aspects (Datta, 1991). Scientific literature about IT networks and IT network integration is lacking, however professional literature provided information on IT networks and the process of integrating two previously separated networks (Gelman, 2003; Groth and Skandier, 2005). Scientific literature about the relation between IT network integration and M&A is also lacking, providing an opportunity for this research to contribute to this field of knowledge. The relation between M&A and network integration seems to be twofold. First, it is aimed at enabling the combined business process and achieving the synergies from integrating the production facilities, workforce, etc. Second, synergies can be achieved from the integration of the IT network itself by harmonizing the networks of both companies. This results in synergies from cost-reductions and economies of scale (Bower, 2001; Schweiger and Very, 2003). Therefore, these goals could be the trigger for network integration in M&A.

The goal of achieving cost-reduction synergies and economies of scale by harmonizing the networks of both companies is the focus of this study. In addition, the context of M&A adds criteria to the decision making process in network integration. To support this claim, it has been discovered that companies are becoming more and more dependent on IT and their networks for their operation. Having this in mind, it can be concluded that the success of a merger is at least partially dependent on the integration of the IT networks. Companies have many strategic objectives for M&A activity, but the main goal of any M&A boils down to the same thing: the creation of value through synergies. The literature on mergers and acquisitions consider this the most important aspect of M&A. This helps narrowing down the context of the requirements and assumptions that have to be determined for the to-be-designed network integration preparation tool.

> The second research question states: "*Can the concept of decision support systems be used to design a tool that can be used to support the preparation of the integration of IT networks in M&A?*"

It turned out to be difficult to find a tool for this specific situation. However, the literature on decision support systems provided indications on how to design a support tool (Shim et al., 2002) for the preparation of IT network integration in M&A. The concept of decision support systems can be used to design a tool for the preparation process of network integration. The preparation process of network integration contains multiple steps that can be applied to the process steps of a decision support system. Therefore, a tool has been designed by combining the knowledge of network integration with the general process of decision support systems. The decision support system is powered by a decision support tool. This decision support tool is based on a decision tree that allows to evaluate several decision criteria in a structured approach, to select integration strategies for integration issues (Giacomazzi et al., 1997). The result is the proposed network integration preparation process and describes the steps that the tool takes to aid the user in the preparation process. This process has been depicted in Figure 9, see paragraph 2.3.2. From this design it can be concluded that to be able to design a tool for aiding the preparation of integration of IT networks in the context of M&A, insight into several areas is needed. These are called the building blocks of the design. They form the functional, contextual and user requirements for the design.

The functional requirements describe the functions that the tool should have if it would be implemented in software. Even though the implementation of the tool in software is not part of the scope of this research, the functional requirements are important for the design because they are needed for the implementation phase of the design process as defined by Verschuren and Hartog (2005). The literature study resulted in a preliminary overview of functional requirements, which are derived from the process model of the tool (As defined in section 2.3). The process model of the tool contains several functions which are: (1) defining the starting situation, (2) selecting the relevant integration issues, (3) guided decision making to select a solution for an integration issue, (4) and generating a template project plan. These requirements will be validated and supplemented in the next chapter.

The contextual requirements describe the content of the tool. In other words, what is the phenomenon that the tool provides support for? In this case it is the preparation of network integration in M&A. The contextual requirements are broken down into categories that have been defined as integration issues, decision criteria and integration strategies.

- The integration issues are defined as the possible problems that are faced in network integration in M&A. Dealing with the relevant integration issues is a requirement for the design of the tool. A number of possible integration issues have been found in literature. These have been supplemented through orientation interviews with network experts, because the literature provided a limited number of issues.
- The decision criteria are defined as the criteria on which the decision maker can make his decision to select a solution for a given integration issue. The literature provided a number of possible decision criteria that can be used in the decision making process.
- The integration strategies are defined as the possible solutions for a given integration issue. These integration strategies have been derived from integration strategies of related integration practices in mergers and acquisitions. There are four integration strategies defined in this thesis: total integration (all components of an integration issue are migrated to a single component), partial integration (the components of each network are left intact, operating side by side and a bridge between the components is built), no integration (the components are left in their current state) and new system (all components of each network are migrated to a new system).

  These contextual requirements are used in a decision tree (per integration issue) that is part of the tool. The decision trees are the core of the tool and will be further specified in chapter four.

The user requirements describe who the user is and when and how he uses it. In this case the user of the tool is defined as a person that is specifically tasked with the integration of the IT networks of both companies. This can be someone from the buying or acquiring company's IT department, but also an external consultant. This person could use this tool in the preparation phase of an M&A, preferably before the deal has been closed. In this way, the least amount of time between deal closure and integration will be needed and activities that take a long time to complete can be planned ahead.

The concepts that have been described in this chapter and summarized in this section will be the input for chapter three. In that chapter, the concepts will be used to prepare and conduct interviews with network integration experts to validate and supplement the requirements for the design of the tool.

3. Gathering requirements for the design

The purpose of this chapter is to answer the third research question.

> The third research question states: "*What are the requirements for the design of a support tool for the preparation of IT network integration in M&A?*"

This chapter will elaborate on validating and supplementing the building blocks of the tool and the requirements for the design. Therefore, this chapter will start with an overview of the requirements for the design of the tool that were found in the literature study and orientation interviews (see chapter 2). The next step in the research is to validate and supplement these requirements through a first round of interviews with network integration experts. The methodology for these interviews is discussed next. This is followed by the presentation of the results. The third goal of this chapter is to provide an overview of the "complete" list of requirements which answers the third research question.

3.1. Overview of requirements found in literature

The literature study in the previous chapter has provided an overview of the relevant topics for this research. As elaborated in the introduction of chapter 2, to be able to design a tool that assists network experts in the preparation phase of network integration in M&A, a number of building blocks are needed. The building blocks of the tool have been discussed in the previous chapter. The literature review was primarily aimed at finding requirements for the design of this tool, which have direct links with these building blocks. The literature provided a preliminary overview of these building blocks which are separated into functional, contextual and user requirements.

3.1.1. Functional requirements

The functional requirements of the tool define how the tool should work. In other words: what is the desired functionality of the tool when it is implemented? To discover the functional requirements of the tool, a process model has been designed. This process model describes the steps that could be taken to prepare for network integration. From this process model, the basic functional requirements are derived. The process model for the tool is given in Figure 9 and a list of basic functional requirements is given in Table 3 (see paragraph 2.3.2 for both).

The basic functional requirements are:

1. **Defining the starting situation by creating an overview of the existing IT networks**: This requirement is aimed at creating insight into the starting situation. This involves tasks such as making an inventory of the existing network equipment, relevant network configurations and contracts with service providers;
2. **Selecting the relevant integration issues that need to be solved for the specific merger**: This requirement ensures that only those integration issues that are relevant for the specific merger will be dealt with. It also helps the user not to overlook any issues that might be relevant for the specific merger, by providing a list of possible integration issues;
3. **Guiding the decision maker towards an integration strategy for each integration issue, through a decision tree**: This requirement is aimed at selecting a solution for a given problem in network integration. This is achieved with the help of a decision tree that allows the user to evaluate different decision criteria in a structured way. This is the core functionality of the NIST, because it helps the user to make decisions in the preparation phase of network integration;
4. **Generating a template project plan that can be used for the integration of IT networks in M&A**: This requirement is aimed at providing a means to manage the integration process of IT

networks. To this end, the NIST generates a template for a project plan that contains all the integration issues that will be integrated and how this is done.

3.1.2. Contextual requirements

The contextual requirements define the content of the tool. In other words: what does the tool help the user with? The tool helps the user with the preparation of IT network integration in M&A. To this end, three things are needed. First, an overview of the common problems which are faced in IT network integration in M&A is needed. Second, a set of possible integration strategies that can provide a solution to a given integration issue is also needed. Third, a set of decision criteria that allow the user to evaluate the situation and select an integration strategy for an integration issue.

A full overview of the possible integration issues is given in Table 2 (see paragraph 2.2.3). Examples of possible integration issues in IT network integration in M&A are:

- Different hardware vendors (one network component could be built with equipment from vendor A, the other network with vendor B);
- Different service strategies (in/outsourcing of services such as maintenance or network management);
- Different technologies (different office sites could use different LAN technologies, or could be connected to each other by different WAN technologies);
- Different service providers (merging companies could have contracts with different service providers, such as WAN services).

Next to the possible integration issues, possible solution strategies are needed. These strategies describe the approach that can be used to solve an integration issue. The strategies are given in Table 4.

Table 4: Integration strategies for IT network integration

Strategy	Description
Total integration	All instances of a specific integration issue are migrated to instances of the same type. For instance, LAN equipment will be migrated to a single vendor. This strategy focuses on cost reduction and enables communication between IT network components by using components of the same type.
Partial integration	All instances of a specific integration issue are left in their current state. A bridge between the instances is built to enable the combined IT network. This strategy focuses on enabling communication between different IT network components.
No integration	All instances of a specific integration issue are left in their current state. No connection between the instances is made. This strategy does not provide cost-reduction benefits or communication enabling features.
New system	All instances of a specific integration issue are migrated to a new system. This strategy focuses on creating a new system for an IT network component. This means that both companies' IT network components are migrated to a new system.

For a more elaborated explanation of these strategies, see paragraph 2.2.4.

Finally, a set of decision criteria is needed to select a solution for a given integration issue. The decision criteria can be used in a decision tree that is part of the tool that aids the user in choosing a solution for a given integration issue. These decision criteria are given in Table 5.

Table 5: Overview of possible decision criteria to select a integration strategy for a given integration issue

Decision criterion	Source
Dominant M&A party decision maker;	(Mehta and Hirschheim, 2004)
Cost of migration;	(Gelman, 2003)
Technical functionality;	(Gelman, 2003; Groth and Skandier, 2005)
Vendor customer support	(Gelman, 2003)
Future proof	(Gelman, 2003)
Bandwidth requirements	(Gelman, 2003; Groth and Skandier, 2005)
Product innovation.	(Gelman, 2003)

For more elaborated information about these decision criteria, see paragraph 2.3.3.

3.1.3. User requirements

The user requirements define the requirements set by and to the user. Who is the intended user of this tool? The intended user of the tool is a person that is specifically tasked with the integration of the IT networks of both companies. This can be someone from the acquiring or acquired company's IT department, but also an external consultant. This person could use the tool in the preparation phase of an M&A or just after the deal has been closed. These user requirements have been used to select possible candidates for validation interviews.

3.2. Methodology for validating and supplementing requirements

In order to obtain data from the field to validate and supplement the requirements for the design of the tool, several interviews have been conducted. Developing an interview protocol is an effective way to ensure the reliability of the interviews. The measurement must be systematic, not coincidental. The reliability of an instrument is virtually always defined in terms of repeatability; if you repeat a measurement on the same object, you should get the same results (Velde et al., 2004). Therefore, the measurement instrument (interviews) will be elaborated in this section.

First, the reason to choose for interviews is discussed. This is followed by presenting the interview protocol which shows how the interview questions were formulated, based on the concepts found in literature. For each question, the relation to the research questions is given. The selection process of the interview candidates is explained next and shows how and why these candidates have been selected. An overview of the interviewees that have participated is given. This section is concluded with an explanation of how the gathered data will be analyzed.

3.2.1. Data gathering method: interviews

The goal of the research is to design a tool that assists network experts in the preparation phase of network integration in the context of M&A. To be able to design the tool, the researcher needs to investigate the functional, contextual and user requirements (Verschuren and Hartog, 2005). To this end, a literature study was performed to find these requirements which resulted in a preliminary overview. The literature provided a limited number of requirements for the design of the tool. Therefore, it is essential to validate these requirements in practice and to supplement them. Supplementing the requirements is achieved by gathering data from experts in the field.

To complete the knowledge on the requirements, experience in the field of IT network integration is needed. Since it involves supplementation of the current knowledge, it is essential to use a method of data gathering that allows several themes to be explored, while leaving room for extra information from the experts. According to Van der Velde et al. (2004) the semi-structured interview is suited best for this task, because it allows the researcher to use a previously formulated set of questions but also have the flexibility to go more deeply into subjects as they arise. This method is primarily used with explorative research (Velde et al., 2004). Therefore the semi-structured individual interview has been chosen as the data gathering method for this research. The advantage of interviews is that they generally yield a large amount of information in a short period of time. Moreover, there is a smaller risk in interviews of questions being skipped, compared to e.g. questionnaires, because the interviewer can actively monitor this. However, interviews require much more time to process, analyze and generalize. In addition the interviewer needs to have skills in active listening, because the interviewer must pay attention to the content and the intention behind the words. The information that the interviewee presents, can take a whole different meaning by the tone on which it is said and the gestures the interviewee makes (Velde et

al., 2004). The interviewer also has the opportunity to ask follow-up questions based on responses from the interviewee.

3.2.2. Formulating interview questions

The focus of the interview is to verify existing and identify new relevant functional and contextual requirements for the design of the tool. Verifying and identifying new requirements has been done by dividing the interview in parts. Each part deals with a building block of the tool. The interview is supported by a PowerPoint presentation, in which each building block of the tool is placed on a slide. Questions regarding the functional and contextual requirements of a specific building block are placed on each respective slide. For the interview slides, see appendix A. The interviewee is given an explanation of the contents of each slide, before asking the interview questions. This helps the interviewee to better understand the topic at hand, which should increase the quality of the answers.

The first concept that needs to be validated is the proposed integration preparation process, because this is the supporting structure of the tool. It describes the flow of the preparation process. Therefore, the interviewee is shown a figure of the process model, accompanied by two questions. The figure is the operationalization of the process model. The questions are aimed at verifying this model. The first question is formulated as "*This is the proposed process model for the tool. Do you think the steps of the process model are correct?*" In case the interviewee would indicate that the process model is not correct, we need to find out what could be improved. Therefore, the second (follow-up) question is formulated as: "*Do you think there are any steps missing?*" These questions are aimed at verifying and improving the process model for the tool. This question is related to the second research question, which is aimed at finding a suitable tool for the preparation of IT network integration in M&A.

The process model for the tool has delivered a set of basic functional requirements. Each requirement describes the basic functionality of each step in the proposed integration preparation process. These functional requirements need to be validated. Therefore, the interviewee is presented a list with these requirements, accompanied by two questions. The list is the operationalization of the functional requirements. The questions are aimed at verifying and supplementing the functional requirements. The first question is formulated as: "*Given this list of requirements, do you think the functional requirements on this list are needed for the design of the tool?*" To find any additional functionality that the experts would like to have, if the tool is to be implemented, the next question is formulated as: "*Do you think there are any functional requirements missing in this list?*" The answers to these questions provide the supplements of the functional requirements. This question is related to the third research question, which is aimed at finding the (functional) requirements for the design the tool.

Next, we are interested in verifying and supplementing the contextual requirements of the tool. The contextual requirements define what content is needed for the tool, to be able to provide decision support. First, we focus on the common problems of IT network integration. Second, we focus on the decision criteria involved in the decision making process of IT network integration. Third, we focus on the possible integration strategies to provide a solution to the common integration problems.

The task of designing the tool includes gaining an insight into common problems of network integration. Therefore, the interviewee is presented with a list of common problems faced when integrating networks. This list is the operationalization of a part of the contextual requirements for the tool. The next question is formulated as: "*Given this list of possible network integration issues, do you recognize these problems in practice and can you provide examples of these integration problems?*" This question is

aimed at verifying the list of common integration problems that were found in the literature research. To find any additional integration problems, a follow-up question is formulated as: "*Do you think there are any important IT network integration issues missing in this list?*" The answers to this question provide integration problems that were not found in the literature, but are encountered in practice. This question is related to the third research question, which is aimed at finding the (contextual) requirements for the design the tool.

Next, the decision criteria that are involved in the decision making process of IT network integration are needed. To verify the decision criteria that have been found in the literature, the interviewee is presented with a list of decision criteria, which is the operationalization of the concept of network integration decision criteria. The first question is aimed at verifying the decision criteria that were found in the literature and is formulated as: "*Given these decision criteria, do you recognize them in practice?*" To supplement the list of decision criteria, a follow-up question is formulated as: "*What other decision criteria are used to select different integration strategies?*" These questions are also related to the third research question, which is aimed at finding the (contextual) requirements for the design of the tool.

Last, the concept of the integration strategies needs to be verified. The integration strategies define the approach of the integration for a specific integration issue. Based on literature, four integration strategies have been constructed. These strategies are explained to the interviewee, followed by two questions to verify and supplement the strategies. The interview question is formulated as: "*Given these integration strategies, do you recognize them in practice?*" To find additional strategies for network integration, a follow-up question is formulated as: "What other strategies could be used for network integration?" The answers to these questions provide the integration strategies that can be applied to integration issues. The relation with the third research question is that these strategies are part of the (contextual) requirements for the design of the tool.

Pilot interviews

The interview has been subjected to two pilot interviews, to find any problems in the questions. These pilot interviews have been conducted with experts at Accenture. Appendix A contains the final interview questions, in which the feedback from the pilots has been processed.

3.2.3. Selecting interviewees and making contact

Van der Velde et al. (2004) argue that when conducting interviews as part of this kind of explorative study, it is important to interview a varying range of people. Therefore, the interviewees were selected based on their function and background within the IT networking business, their experience and specific field of occupation. To obtain a good variety in the interview candidates, experts from within and outside Accenture have been selected. The experts were first selected within Accenture, based on their role in IT network related projects. To increase the number of possible interview candidates, the snowball technique was used. The snowball technique is a method in which existing study subjects recruit future study subjects from their acquaintances. For this research experts outside Accenture were found through the business networks of the experts within Accenture. This increases the variety of knowledge, therefore increasing the external validity of the results.

Experts within Accenture were contacted directly. Experts outside Accenture were contacted through the network of an expert at Accenture. The expert at Accenture sent a brief introduction to the external expert. After this, direct contact was established between the researcher and the expert via email. In the first email to the expert, a short introduction to the research was given to clarify the objective and

context of the interview and to inform the interviewee about their role in the research. After making an appointment, the interviewee received the full set of questions a few days before the actual interview. This allowed the interviewee to prepare the answers to improve the quality of the gathered data.

According to Van der Velde et al. (2004), a sufficient number of interviews is achieved when a good representation of the population is used in the research. For this round of interviews, roughly half of the available population of network experts at Accenture was used. Therefore, it is considered to be a good representation of the population within Accenture. This does not necessarily mean that the results provide an accurate reflection of the population outside Accenture.

A profile for the selection of the interviewees has been defined, to ensure that the expert will be able to provide the relevant information. This has been done based on the user requirements of the tool, because these people are the intended user of the tool. In this case, it means that they are either directly involved in network integration projects or have the required knowledge to do these projects. Therefore, the (network integration) experts are able to validate the requirements, because they work or have worked in network integration projects. Therefore the information they provide is considered relevant. The profile has been specified as follows. The interviewee:

- has experience with the creation, development and execution of network integration projects;
- has been working in the network (integration) business for at least two years;
- has knowledge on the problems that are faced when integrating two previously independent IT networks;
- has knowledge on the decision criteria that are used to make decisions on IT network integration issues.

Table 6 lists the candidates that have participated in the first round of interviews. For more detailed information about the experts, see appendix D.

Table 6: Overview of interviewees in the first round

Participant	Role	Company	Experience
Expert 1	Project leader of ICT projects	A Dutch Higher Education institution	± 20 years
Expert 2	Technical sales engineer	International WAN services provider	± 20 years
Expert 3	Technical design consultant	International WAN services provider	± 20 years
Expert 4	Senior Manager network infrastructure	Accenture	± 20 years
Expert 5	Manager IT infrastructure	Accenture	± 15 years
Expert 6	Manager IT infrastructure	Accenture	± 15 years

3.2.4. Data analysis

At the start of the interview, the interviewee was asked for permission to record the conversation. Notes were taken on a printed set of the interview slides. This allowed the researcher to quickly make remarks on a specific subject, reducing the need for elaborate note taking and speeding up the interview. These notes and recordings were used to analyze the interviews and compare answers between interviewees.

The answers from the experts were collected into tables. In these tables, the answers were grouped per interview question to allow comparison between the answers of individual experts. The notes that were taken during the interview were used to create a primary overview of the answers of the experts. The recordings were used as a secondary check to ensure all important data was collected. The recordings were also used to make partial transcriptions of the responses of the experts on specific questions. The transcriptions provide an overview of the subjects that the experts deemed important. These subjects have been mentioned multiple times. In addition, subjects that received less attention or have been

mentioned by only a few experts have been added to provide a complete picture. These partial transcriptions are shown in tables in the next section, and list the most important information of the experts regarding a question.

When processing the feedback of the experts and choosing whether to implement it in the tool, this was done by determining whether the suggestion did not cause conflicts with other requirements. If this was the case, the suggested functionality would be taken into account.

3.3. Interview results

The interviews provided input for the design of the tool. Next to the information that was specifically needed for the design of the tool, the interviews also provided additional information that is relevant for this research. The opinions of the experts will be discussed in this section and are divided by the functional and contextual requirements of the tool design. The functional and contextual requirements of the tool are discussed separately. The overall opinion of the experts about a requirement is given in its respective paragraph. Any comments from the experts that fall outside the boundaries of the interview, but are deemed important for the context of the research, have been summarized in the last part of this section.

3.3.1. Functional requirements per building block

The design of the tool is made according to the requirements that it needs to be fulfill. The functional requirements describe the desired functionality of the building blocks of the tool. The functional are needed for the implementation phase of the design process (Verschuren and Hartog, 2005). During the interviews, the experts were asked to give their opinion about the functional requirements and whether they could identify missing functions that they would need in such a tool. In other words, what additional functionality would they be looking for? The interviews resulted in a refinement of the existing functional requirements and delivered additional functional requirements. For the reason of overview, all functional requirements that have been discovered after processing the feedback from the interviews are listed in Table 9, see section 3.4. This table contains the modifications and additions to the requirements, based on expert feedback.

Main building block: The process model of the tool

The main building block of the tool is the process model that describes the steps of the tool guiding the user from start to finish. The interviewees were presented with a picture of this process, accompanied by an explanation of the four process steps. Each step represents a (sub) building block. The functional requirement corresponding to the process model was defined as: “The tool should work according to a staged process, to guide the user through the decision making process. The steps in the process are: (1) creating insight into the starting situation, (2) Selecting relevant integration issues, (3) analyzing and selecting alternative integration solutions and (4) generating a template of a project plan for network integration.”

Expert	Response
1	*Yes, I think this process is self-evident. This process describes the steps that we take in our own integration projects.*
2	*Yes, I think this is complete. The process model is good, the requirements are correct. I don't think you are missing any important steps.*
3	*I think this process is correct, but of a high-level. (…) However, this process is good for the preparation of network integration.*
4	*The approach to the problem is correct. I do have a note about the phases of the tool. (1) The first note is about the intake process. (…) the number of sites, but also the number of employees has a strong impact on the scale, but also the nature of the solutions. (2) (…) you must make a decision about the basic strategy of integration. This is an important guiding decision that has to be made early in the process.*
5	*Yes, the steps are correct. This is how we approach these kinds of projects. A footnote to this process would be that step 1 and 2 could be merged. The conclusions that can be drawn in step 1 could be used to automatically select the relevant integration issues in step 2. Or a selection of relevant problems leads to a number of required situational inputs. For instance, the user selects some integration issues from the list, and the tool then shows him input fields for the required information.*
6	*I like the idea of a tool, however the reality in network integration is often too complex to do this through automated tools. If you want to do this, you will have to generalize. (…)*

From the above statements it can be concluded that the majority of interviewees agreed to the proposed process model for the tool. However, the process of integration projects can be very different between mergers. It is confirmed that the most important step in the preparation of a network integration project is to make a decision about the direction and nature of the solution. Therefore, the tool should help the user making that decision, by providing certain integration strategies that describe the approach of integration.

Building block 1 (stage 1 of the process model): Gaining insight into the starting situation

The functional requirements of the first building block of the process model are defined as: “The tool should provide the user with functionality to define the starting situation. This can be done by entering detailed information about each merging company's network configuration.” This describes the functionality that allows the user to create an overview of both merging companies’ networks. Some of the experts provided feedback on this requirement, allowing for a refinement in its description and an addition to its functionality.

Expert	Response
3	*The tool should provide functionality to enter information from both sides of the situation. Both company A's and company B's network configuration should be in the tool. (…)*
4	*(1) The user should be provided with examples to help him enter the required information. (2) I think that it should also provide input for non-technical matters such as company size. (3) Large organizations work from policies and turn to technical integration with those policies in mind. Your tool should take those policies into account, as inputs (decision criteria).*
5	*The user should be able to enter what vendors are used, what the relevant policies are, what are the details of service contracts. (…)*
6	*The user should be able to specify contract details such as contract duration and termination penalties. Later on in the process, this information can be used to determine whether integration is worth it.*

Based on these answers, it can be concluded that besides technical information, also non-technical information is of importance. Non-technical information involves policies, service contract details, and company size. This information is important for the decision making process, because it is part of the decision criteria that are needed in step 3 of the tool. Therefore, the tool should allow for this information to be entered, so that it can be used in a later stage of the tool. The functional requirements that were the result of the expert feedback are added in Table 9, referenced by 1.x.

Building block 2 (stage 2 of the process model): Selecting relevant network integration issues

The functional requirements of the second building block of the tool have been defined as: "The tool should provide the users with functionality to choose the integration issues that are relevant for the M&A situation." This describes the functionality that allows the user to select the integration issues that need to be dealt with and to provide the user with suggestions not to overlook any relevant issues. The experts believed that this could be a good approach to assist the user in the decision making process. Some additional functionality was suggested.

Expert	Response
1	*<agrees to requirement>*
2	*Good requirement. Not all parts of the network will always have to be integrated in an M&A. This allows the user to only select those issues that are needed.*
3	*<agrees to requirement>*
4	*<agrees to requirement>*
5	*The tool could also make a suggestion about relevant issues, based on the information that has been specified in the first step.*
6	*The user should be able to assign priorities to certain integration issues. Issues that should be dealt with first should get a high priority in the tool, so they appear near the start of the network integration activities list. (…)*

Based on these answers, it can be concluded that the majority of the experts agree with this requirement. Two experts were able to provide some additional functionality. Based on information that has been entered in the first step, the tool could automatically suggest relevant issues. In addition, one expert adds functionality that allows assigning a ranking to integration issues. This ranking could be used in the output of the tool (project plan template, created in step 4), to specify the order in which the integration issues should be dealt with during the actual network integration process. The functional requirements that were the result of the expert feedback are added in Table 9, referenced by 2.x.

Building block 3 (stage 3 of the process model): Alternative selection through a decision tree

The functional requirement of the third building block of the tool is defined as: "The tool should guide the user through the decision process of selecting an integration solution by providing a decision tree that leads the user to an integration strategy for each integration issue." This describes the functionality that assists the user to reach a decision about the strategy that will be used to solve an integration issue.

Expert	Response
1	*Using a decision tree is a good way to approach an integration issue. The decision tree should contain a set of criteria that help the user make his decision. However, different decision criteria apply to different integration issues. In other words, not all criteria are relevant for each integration problem. This leads to a different decision tree for each integration problem.*
3	*(1) I recognize this in practice, because we use this approach to decide what needs to be done. Note that for different integration issues, different trees should be made. (2) When going through the decision tree, the user should be able to compare relevant information that has been gathered in the first step of the process. The decision tree should contain short questions and could ask new questions based on previous answers. (…) To make this decision tree, take note that there is a certain ranking between decision criteria. Some criteria are more important than others.*
4	*A tool that works completely autonomous is not possible in my opinion. The user will always be needed to evaluate the different decision criteria.*
5	*The decision tree should be transparent. This means that each step of the tree should be visible and the user can see the result of a choice on a given criterion. Another feature that could aid the user, is to provide examples about best practices used for a given integration issue. E.g. what is the recommended course of action for this issue based on practical examples?*

Based on the feedback from the experts, it can be concluded that they believe that using a decision tree to assist the user in the decision making process is a good approach. The branches of the tree should contain questions that allow different decision criteria to be evaluated. Using a decision tree per integration issue also seems to be essential, because not all decision criteria are relevant for every

integration issue. Another important aspect of the decision trees is that different decision criteria have a certain ranking. Some criteria should be evaluated before others (e.g. the cost of migration should be evaluated before a decision is made based on technical functionality). Additional functionality that could help the user in the decision making process was suggested by the experts, such as showing information that is relevant to the choice at hand and showing information about best practices. These suggestions will be taken into account for the design of the tool, because they are considered beneficial. The functional requirements that were the result of the expert feedback are added in Table 9, referenced by 3.x.

Another requirement of this building block was defined as: "The tool should provide the user with functionality to override the strategy choice and select a different integration strategy." This requirement has been developed to allow for making changes manually, if the user finds the reality and the tool are in conflict. Only two out of six experts made a comment about this requirement, but it is important to look at it critically. Expert 1 states: *"(…) The user could just take a different route through the decision tree to end up at the desired solution."* Expert 2 asks: *"(…) I don't think the tool should have this option. Instead, the user could just go back and go through the decision tree again."* The similarity in their statements is that the decision tree should be built in such a way that the user can go back in the decision tree and make a different choice. The suggestions from the experts actually achieve the same goal as the original requirement: allow the user to make changes manually. However the implementation is different. These suggestions will be evaluated during the prototype phase of the design process.

Building block 4 (stage 4 of the process model): Generating a template project plan for network integration

The functional requirement of the final building block was defined as: "The tool should generate a template for a project plan for a network integration plan after the user is done reviewing all integration issues." The output of the tool should be a plan for network integration that could be used in the post-merger integration phase of an M&A. Three out of six experts provided feedback on this requirement, suggesting a refinement to improve the output of the tool.

Expert	Response
4	*The final step of this tool looks like some sort of document generator. This is a smart way of composing a report or plan. (…) Make sure that you specify the classification of the report/template and specify per section and per domain what the (integration) approach will be."*
5	*"(…) I think the template should specify the decision criteria that have been used to choose a certain solution (for an integration issue). The plan should also give an overview of the priorities of the different integration issues, to create a certain order in the integration tasks. (…)The template project plan should contain a list of activities that have to be performed to integrate the network. You should not go into too much detail, you should provide a checklist of activities. (…)*
6	*To create this template, we need two things. First, determine the direction of integration and second, make a list of tasks for technical integration. (…) Each integration issue should have its own paragraph in the template and it should indicate the priority of integration issues. In addition, there are standard tasks that will appear in any merger which these need to be listed in every template."*

The experts provided four refinements to the requirements of this building block. First, the template project plan should contain a prioritized overview of integration issues. Second, in this overview the decision criteria that are used to select the integration strategy should be specified for each integration issue. Third, there should be a checklist of technical activities that need to be performed during integration. And fourth, there should be a checklist of tasks that need to be performed in any network integration project. The functional requirements that were the result of the expert feedback are added in Table 9, referenced by 4.x.

3.3.2. Contextual requirements

The contextual requirements provide the necessary content for the tool that is needed to allow the NIST to help network experts in the preparation of IT network integration in M&A. The conceptual framework provided three areas of contextual requirements; integration issues, decision criteria and integration strategies. These contextual requirements are needed for the construction of the decision trees that allow the tool to assist the user in the decision making process. The decision trees are also needed for the implementation phase of the design process (Verschuren and Hartog, 2005).

Integration issues

Part of the contextual requirements for the design of the tool is a list of common network integration issues. The user can use this list to select relevant issues for the integration project that he is currently facing (in stage 2 of the NIST). A list of possible integration issues has been constructed based on findings in the literature and orientation interviews (see paragraph 2.2.3). The interviewees were asked to specify whether they recognize these problems in practice and to provide any missing integration issues.

The majority of the experts recognized the integration issues in practice and confirmed that they should be incorporated into the NIST. For a full overview of responses to the integration issues, see Table 11, Appendix B.

The experts also provided additional integration issues that could be incorporated in the tool. For a full overview of the additional integration issues, see Table 12, Appendix B. Integration issues that were mentioned multiple times by different experts were taken into consideration to ensure that the integration issues are not based on a single individual opinion.

The integration issues that were found in the literature and orientation interviews were combined with the additional integration issues provided by the experts. Table 7 shows this combination[2]. Newly found integration issues that will be incorporated in the NIST have been indicated by a green color.

[2] Network integration issues that were mentioned, but are outside the scope of this research are:

- Different network support teams. The people of the two teams that deal with network management and maintenance need to be integrated into a single team
- Network policies. Policies such as the vendor policy, security policy and sourcing policy need to be integrated. However, in the design of the tool, these policies will be treated as input variables for the decision making process and not as an issue in itself.
- Datacenter integration. Data centers are part of the IT infrastructure, however not part of the IT network as defined in this thesis and are therefore out of scope.
- Application integration. Some applications, such as email and other office applications, can be part of the IT infrastructure. However they are not part of the IT network

Future research into network integration in M&A could include these issues. These subjects will be further discussed in chapter five.

Table 7: Common integration issues in mergers from literature and interviews

Nr	Integration issue	
1	LAN: Different LAN technologies: Wired Ethernet versus Wireless Ethernet	
2	LAN: Different LAN equipment vendors	
3	LAN: Different wireless technology: (802.11a/b/g/n)	
4	LAN: Different service strategy: Outsourced versus in-house	
5	LAN: Different and conflicting IP Plans	
6	LAN: Different Quality of Service for applications/services	
7	WAN: Different WAN technology: Frame Relay, ATM, Ethernet, MPLS	
8	WAN: Different WAN equipment vendors	
9	WAN: Different WAN providers	
10	WAN: Different remote access services: Dial-in, IPSec, SSL VPN	
11	WAN: Different service strategy: Outsourced versus in-house	
12	WAN: Different Quality of Service for applications/services	
13	TEL: Different telephony technology: TDM PBX, VOIP/IPTEL PBX	
14	TEL: Different equipment vendors	
15	TEL: Different telephony approach: Traditional, Voice over IP (VOIP), IP Telephony, Unified Communication	
16	TEL: Different service strategy: Outsourced versus in-house	
17	Network management tools	Four out of six experts raised this issue. Even though network management tools are applications, the experts indicated that they are at the core of the IT network, because they are used to monitor and control the network. Therefore it is considered in scope and will be incorporated into the design.
18	TEL: Different and conflicting number plans	Even though only one expert mentioned this issue, number (or IP) plans are also part of the LAN and WAN. Therefore it is incorporated into the design.
19	TEL: Mobile telephony contracts	Two out of six experts mentioned this. According to the experts, this is part of the telephony part of the IT network, similar to a contract with an external WAN provider. Therefore, it will be incorporated into the design.
20	WAN: Internet access contracts	Internet access services are often used to support remote access services such as VPN. Therefore, it can be considered part of the IT network and will be incorporated into the design.
Black – Existing integration issues based on literature and orientation interviews, confirmed by the experts Green – New integration issues, within the scope of this research		

Decision criteria

Decision making about integration issues is done through the evaluation of different decision criteria. These criteria are evaluated per integration issue and used to select an integration scenario. For the design of the NIST, the construction of decision trees is needed. To construct the decision trees that are part of the tool, a mapping of decision criteria to integration issues is needed. The experts made general remarks about the decision criteria. It should be noted that not all criteria are relevant to every integration issue and that some criteria are more important than other criteria. The interview recordings contain information about the relation between decision criteria and integration issues, which will be used to construct the first versions of the decision trees. However, the first versions of the decision trees that will be used in the tool will also be based on assumptions and logical reasoning about the applicability of a criterion on an integration issue. These decision trees will be validated in the next chapter. Table 8 presents the final set of decision criteria that can be used for the construction of the decision trees. This table contains the criteria obtained in literature and from the interviews. Only criteria that were mentioned by multiple experts are listed to ensure that a decision criterion is not based on a single expert opinion.

Table 8: Decision criteria for selecting different integration strategies

Nr.	Decision criterion
1	Dominant M&A party decision maker
The dominant party in a merger can and often will determine the integration strategy. The dominant party is mostly the acquiring company. Many experts confirmed that in most cases, the buying party makes all the decisions.	
2	(Technical) functionality (e.g. application requirements)
Certain business applications can pose (technical) functionality requirements to the network. These are the properties that the network should provide to support the services on that network. For instance, if a company wishes to implement IP telephony, the network must support traffic shaping features that allow issue-free telephone conversations over the network. The experts indicated that technical aspects are evaluated only if all other criteria have resulted in equal outcomes. Required functionality (for applications) is a criterion that is more important to evaluate than technical functionality, according to the experts.	
3	Future proof (in terms of room for growth)
Selecting network components for the integrated network can be done by evaluating the extent to which these components are future proof. For instance, does the component allow for future growth or does it support features that will be important to the business? Components that can be upgraded through software updates can be future proof. The experts indicated that this criterion only applies to very few integration issues and applies only to special cases.	
4	Cost of migration (project cost)
The cost involved in the migration project: the cost of migrating all instances of a network component to another. Can include purchasing of new equipment, penalties for breaking contracts for outsourced services, and consultancy fees. According to the experts, this is one of the most important criteria to evaluate. For any integration issue, they mostly evaluate costs versus benefits and make a selection based on that calculation.	
5	Cost of ownership (operational cost)
The costs that is associated with ownership. E.g. cost of maintenance contracts or the need to hire people with specific skills, Operational cost reduction can be achieved from lower cost of managing multiple vendor platforms (required staff), lower cost of maintenance agreements from multiple vendors (required financial resources) and through economies of scale by using the same network assets for more purposes. According to the experts, this is an important criterion to evaluate against the migration cost.	
6	Vendor customer support (e.g. customer support or product support)
Selecting a vendor can be done based on their customer support. Comparing customer support between vendors can be done on several aspects: industry recognition for customer support, after-hours support, first-call closure rates, one point of entry for support and local engineering support. According to the experts, this criterion applies to outsourced network services such as network maintenance and management. This criterion could also apply to the selection of a WAN provider in case the merged company spans multiple countries and it is looking for e.g. a provider that has local support teams.	
7	Innovative products (e.g. easy to use or implement)
Selecting products and services from different vendors can be done based on innovativeness in product design and functionality. According to the experts, this criterion is hardly ever evaluated in the decision making about network integration. A special case could occur when a company would like to be the frontrunner of new technology, or believes they can obtain a competitive advantage by using innovative network products.	
8	Bandwidth requirements (e.g. from applications)
The integrated network should provide sufficient bandwidth for all applications that use the network. According to the experts, this is no longer an issue for the wired LAN because its bandwidth is abundant. This can apply to wireless LAN, because some older technologies cannot provide the required bandwidth that is required in some cases.	
9	Company size (e.g. number and size of sites)
The number and size of the office sites of the merging companies heavily impact the nature and scale of the solutions. For instance, the decision making of network integration between a large and a small company often results in the adoption of all network components by the smaller company.	
10	Vendor policy (e.g. single/dual vendor)
The vendor policy could dictate the use of a single vendor for reasons of interoperability, economies of scale, or cost considerations such as fewer support staff required or legislation. Policies, especially in large companies and mergers are often leading in the decision making process of network integration. According to the experts one of the most important decision making factors is the dominant party's vendor policy.	
11	Sourcing policy (e.g. in/outsource)
The sourcing policy could state that all network maintenance and management should be done in-house or be out-sourced. This can be for reasons of economies of scale, the IT networks not being core business, fewer internal staff required, etc. According to the experts one of the most important decision making factors is the dominant party's sourcing policy.	
12	Network management policy (Identity, Access and Security)
Network management policies can be of importance to technical integration. These policies dictate how the network is managed in terms of the identity of users on the network, who is allowed access to which parts of the network and how security is enforced. According to the experts, this criterion is only important as soon as the actual integration starts.	
13	Service level requirements (e.g. uptime and bandwidth)
This decision criterion specifically applies to outsourced network services under contracts, such as wide area networking, maintenance and network management.	

14	Legislation (e.g. legal requirements)
For some industries, legislation can be a decision making factor for network integration. For example, companies that deal with privacy sensitive data could be obliged to manage and maintain their wide area networks themselves. The experts indicated that this decision criterion applies to a select group of mergers.	

Green – Obtained from literature
Red – Obtained from interviews
Black – Both

Integration strategies

The literature provided four different integration strategies that could be used to approach integration issues. The integration strategies are selected through the evaluation of decision criteria. Table 13 (see Appendix B) shows an overview of the opinions of the experts regarding the integration strategies. The majority of the experts confirmed that these strategies cover the most common strategies used in network integration projects. No new integration strategies were discovered.

Total integration

The high level of integration in this strategy was recognized as a viable option for IT network integration. In this case, all instances of an IT network component are harmonized. This strategy is often chosen, to obtain cost-reductions in the long term, or when vendor proprietary protocols prevent two different components from working together. Moreover, the harmonization can occur in two directions: either the components of company A could be migrated to those of company B, or vice versa.

Partial integration

If for whatever reason it is not possible or desired to harmonize the components of the network, the partial integration strategy could be chosen. Partial integration is an option when companies employ dual vendor strategies. This can be done to reduce risks, due to redundant networking functions. Obviously, the benefits from a single vendor strategy cannot be obtained in these cases. However, this is considered an exception to the rule, because the trend seems to be for companies to aim for single-vendor strategies. One expert noted that a partial integration is often the intermediate solution when aiming for a total integration strategy. The networks are simply connected at first and at a later stage the components of the combined network are harmonized.

No integration

It can be an option not to integrate certain parts of the network and keep them separate. This results in hybrid network configurations. Not integrating certain components of the IT network was recognized by the experts as one of the possible options.

New system

According to the experts, creating a new system is sometimes a good option. Instead of migrating one network component to the other, it might be beneficial to migrate both components to a new vendor or technology. The merger between two companies might provide a good opportunity to re-evaluate their technology, vendor and network functionality choice.

3.3.3. Additional considerations

The interviews provided additional outcomes that were not direct answers to the interview questions, but are considered important in the context of this research.

Part of the interview was aimed at finding any missing requirements for the design of the tool. Most experts found the given requirements sufficient for the design of a prototype of the tool. However, some experts were able to specify some additional requirements that could improve the applicability of the tool. As expert 4 states: *"What is the user base of your tool? If your user base is not more than 10.000 people worldwide, it would be illogical to distribute it via a CD. Even a platform based implementation (e.g. windows) would be inadvisable. Instead, implement it in a web-based tool."* This suggestion is considered useful for the implementation phase of the design process (Verschuren and Hartog, 2005).

The scope of this research is limited to the integration of LAN, WAN and Telephony networks. However, these components are part of a larger entity that is called an IT infrastructure (see chapter 1). To allow for future expansion of the tool into other areas of IT infrastructure integration, the experts suggested that the tool should be expandable with other integration issues. Expert 4 states: *"Examples, decision trees, templates and integration issues should be available in a maintainable library, which allows the user (or admin) to add new or update components."* This is confirmed by expert 6, who states: *"The tool should be expandable and have the possibility to add components. For example, datacenter integration. This will allow your tool to be modified to accommodate for situation specific integration issues."* Since this requirement is not in conflict with any other requirements, it could be incorporated into the design of the tool.

A critical note about the design project itself is that some experts believe that the reality of network integration is too complex to be captured in a tool. For instance, expert 6 states: *"I like the idea of an 'automated' tool. However the reality in network integration is often too complex to do this through automated tools. If you want to do this, you have to generalize. (…) I am interested to see if it is possible."* This is partially confirmed by expert 3, who states: *"(…) I must say that real world cases can contain many relevant elements to the integration challenge. This leads to very complex and circumstance dependent situations. (…)"* The conclusion that can be drawn from these comments is that care should be taken when making claims about the general applicability of the tool to real world examples, because the tool is likely to provide a simplified view on the network integration problem.

Some experts made comments about the point in time during the M&A process at which the tool should be used. Expert 6 argues: *"When will this tool be used? (…)In the most ideal case, before the deal has been closed. In practice however, preparation starts after M&A deal closure."* Expert 1 confirms this and argues: *"It is important to make sure that the IT network is integrated before the merger takes place. Early in the M&A process there should be some sort of pre-decision to allow for the necessary preparation time. (…)"*. These statements argue for the application of this tool during the early stages of an M&A, because integration activities require preparation time. These comments are taken into account in the conclusions and recommendations in chapter 5.

Some experts asked questions about the user of the tool. As stated in paragraph 3.1.3, the intended user is a network expert that is given the task of integrating two networks. This can either be an independent consultant or someone especially appointed for the integration project. This user requirement is confirmed by the experts. Expert 3 states: *"(…) an independent IT manager who is specifically appointed for the task. The good thing about using such a tool by an independent person is that you can remove the*

emotion from the integration process." Expert 4 states*: "(…) The user of this tool should be a consultant or other independent manager that deals with network integration in their work."* Expert 6 confirms this and adds: *"Who will be using this tool? (…) a consultant from outside the merging companies or someone who is appointed for the task? A normal IT manager should be able to use this tool. (…)"*

A final observation from the interviews is about the network teams, the people at the IT department of each of the merging companies. In a merger between two companies, it is obvious that these departments can and probably will be merged. This creates uncertainty for the people working at those departments, because it puts them at risk of losing their job. Integrating the IT departments in an M&A might be an even bigger challenge than anything else. Expert 2 says: *"Two networks generally have two teams of network people supporting them. How do you integrate those? This can be quite the challenge."* This is confirmed by expert 4 that says: *"(…) I was involved in a project to integrate two networks in a merger. The IT departments both struggled to keep their system in place, resulting in conflicts between them. In the end, it was not much of a technical decision, but more of a personnel-related decision, that solved the integration problem."* Expert 6 suggests that to improve the process of network integration, it is crucial that the network teams should start communicating with each other in an early stage. *"Another problem that is faced in network integration is that the network teams don't know each other. These people will take a defensive stance which causes delays. They should be getting in contact with each other as soon as possible. The sooner they do that, the sooner the starting situation will become clear. This information is needed to start integrating the networks and will improve the process."*

The interview results were presented in this section and the impact on the functional and contextual requirements was discussed. Additional considerations were also found that are of importance to the research. These will be discussed in the conclusions and recommendations. Continuing, this chapter was aimed at answering the third research question. This will be done in the next section.

3.4. Conclusion

The experts provided feedback on the requirements for the design of the tool. The interviews also provided insight into the problems faced in network integration projects and an understanding of the decision criteria involved in decision making about integration issues. The discussions about the problems involved in network integration in M&A illustrated that there is a need for a well performed preparation process for network integration. The to-be designed tool could provide this preparation process. In this paragraph, the conclusions that can be drawn from the interviews will be summarized.

This chapter was aimed at answering the third research question of this research:

> *"What are the requirements for the design of a support tool for the preparation of IT network integration in M&A?"*

To answer this question, it is important to understand that there are multiple aspects to this question. This question can be answered by providing a list of functional requirements and contextual requirements for the design of the tool.

The functional requirements per building block of the tool are grouped into a single list. Table 9 provides the overview of the functional requirements for the design of the tool. This list is constructed by combining the requirements from the literature with the requirements found in interviews with network integration experts.

Table 9: Overview of functional requirements for the design of the tool

Req. nr.	Specification of requirement	Comments
0	The tool should work according to a staged process that takes the user through the preparation process. The steps in the process are: (1) creating insight into the starting situation, (2) Selecting relevant integration issues, (3) analyzing and selecting alternative integration solutions and (4) generating a template of a project plan for network integration.	Main building block of the tool that describes the process model.
1	The tool should provide the user with functionality to define the starting situation. This can be done by entering information about the merging companies' networks.	Building block 1 allows the user to create an overview of the merging networks.
1.1	The tool should provide the user with functionality to specify the network configuration. This includes the number, type, function, and vendor of the installed equipment/outsourced services.	
1.2	The tool should provide the user with functionality to specify non-technical information, such as company size and the dominant party.	
1.3	The tool should provide the user with functionality to specify network related policies, such as vendor, sourcing and network management policies.	
1.4	The tool should provide the user with functionality to specify contract details of outsourced components, such as monthly cost, service level, contract end date and the penalty for breaking the contract.	
1.5	The tool should provide the user with examples to aid with entering the required information.	
2	The tool should provide the users with functionality to select the integration issues that are relevant for the M&A situation.	
2.1	Based on the information specified in the first step of the process, the tool automatically selects relevant integration issues. The user can select additional integration issues to be taken into account.	
2.2	The tool should provide the user with functionality to apply a priority/ranking to integration issues by assigning a value between 0 and 10.	This information is used in the template project plan to specify the order of tasks.
2.3	The tool checks if all required information for each integration issue has been specified and presents the user with functionality to specify missing information.	If the tool finds that no information has been specified for a given issue, it asks for this information.
3	The tool should guide the user through the decision process of selecting an integration solution by providing a decision tree that leads the user to an integration strategy for each integration issue.	This is the main functionality that helps the user reach a decision.
3.1	The tool provides the user with a decision tree for each integration issue that contains decision criteria that are relevant to the issue.	Not all decision criteria apply to all integration issues.
3.2.	The tool should provide the user with relevant information on the integration issue that is being analyzed.	The user should be able to compare relevant information about the integration issue being analyzed.
3.3	The decision tree should be transparent and shows the user the entire path of the decision tree.	The entire decision tree should be visible to allow the user to see where a choice on a given criteria will take him.
3.4	The tool should provide the user with information on best practices for the integration issue being analyzed.	The tool can provide the user with best practices to help

		making a choice on a given issue.
3.5	The user should be able to go take a step back in the decision tree and select a different choice.	This requirement replaces the override function.
4	The tool should provide functionality to generate a template project plan for network integration after the user has finished reviewing all integration issues.	
4.1	The generated project plan should contain a section per integration issue that describes the integration strategy and the decision criteria that have been used to select it.	Each issue should have its own paragraph in the template.
4.2	The generated project plan should contain a prioritized overview of the relevant integration issues.	The project plan should indicate the priority of integration issues.
4.3	The generated project plan should contain a checklist of technical steps that have to be taken when solving an issue.	The project plan should provide a guide for technical integration.
4.4	The generated project plan should contain a checklist of activities that have to be taken in any network integration project.	
	Additional requirements	Comment
Add1	The tool should be implemented as a web-based application.	The user base of this tool will be rather small. Distribution
Add2	The tool should contain a maintainable database, which contains a list of integration issues, decision trees, decision criteria, and templates. This allows the user to add and update components.	The tool should be expandable with other integration issues.
Red – Functional requirement based on literature Black – Functional requirement based on expert interviews		

Based on these functional requirements, it is possible to create a functional design for the tool. This design describes how the tool functions. To be able to complete the design for this support tool, the contextual requirements are also needed.

The contextual requirements are divided into three areas, namely integration issues, decision criteria and integration strategies. The list of relevant integration issues is shown in Table 7. The list of relevant decision criteria for the selection of an integration strategy for an integration issue is shown in Table 8. The integration scenarios that can be applied to integration issues are “total integration”, “partial integration”, “no integration” and “new system”. (See section 3.3 for these tables). However, at this point in the research the conclusion can be drawn that not all decision criteria apply to every integration issue. This implies a certain mapping between integration issues and decision criteria. Mapping decision criteria to integration issues in decision trees is part of the next stage of this research and is elaborated in the next chapter. The initial design of the decision trees is done by making assumptions about the relevance of a given criteria on a given integration issue. However, the interviews provide information about this mapping and these are taken into account.

Now that the third research question is answered, the requirements for the design of the tool are known. These requirements are used to design a tool that could assist network experts to prepare and manage the integration of IT networks in M&A. The next research question is aimed at this design and is discussed in the next chapter.

4. Network integration support tool design

Briefly returning to the research approach (Verschuren and Hartog, 2005), the first hunch (and reason for this research) is that there is a need for a tool that helps network experts prepare for IT network integration in the setting of mergers and acquisitions. This need originates from the discovery that the integration of IT networks is often overlooked in the preparation phase of a merger. The literature review and first round of interviews provided the requirements for a first design of the Network Integration Support Tool (NIST). The next step in the design process is the prototype phase which contains the realization of the design. The "prototype" is used as a means to make discussions about the requirements less abstract. Therefore, a prototype is a mostly an incomplete mock-up (Verschuren and Hartog, 2005). The "prototype" of the tool will be created in the form of a design, which will be elaborated in this chapter. In parallel with the presentation and verification of the design, this chapter is aimed at answering research question four:

"What support tool can be designed for the preparation of IT network integration in M&A?"

The tool (NIST) will have the functional requirements that have been found in the literature and interviews. Based on the literature review, the NIST will have the following general functional requirements: (1) the tool should provide functionality to define the starting situation, (2) the tool should provide functionality to select the integration issues that are relevant for the given M&A situation, (3) the tool guides the decision making process to select integration strategy for each integration issue, by making use of decision trees, (4) the tool should provide functionality to generate a template project plan for network integration. The information from the interviews resulted in a refinement of, and an addition to, these functional requirements. An overview of all functional requirements is given in Table 9, see section 3.4.

The NIST will have the contextual requirements that were found in the literature and interviews. The contextual requirements define prerequisites set by the environment (Verschuren and Hartog, 2005), in this case: IT network integration in M&A. For the tool this comprises: (1) a set of possible integration issues that can be found in a network integration in a merger, (2) a set of decision criteria that can be evaluated and used to select a solution for a given integration issue, (3) a set of integration strategies that can be applied to the possible integration issues between the merging companies.

The user requirements of the NIST are that it will be used by network experts. These network experts have been defined as the people that are tasked with the integration of IT networks in a merger. This can be someone from the acquiring or acquired company's IT department, but also an external consultant. This person could use the tool in the preparation phase of an M&A.

4.1. IT Network integration preparation tool for mergers and acquisitions

The NIST should assist network experts with the preparation and management of IT network integration in the context of mergers. Mergers create a dynamic environment for network integration, because in this situation the integration of the networks can go further than merely connecting office sites to each other. First, connecting the networks of companies enables the integrated network to transmit data between entities in the merged network and enables the business process to function. Second, the M&A goals of cost-reduction and economies of scale can also be applied to network integration. Achieving those goals can be done by harmonizing IT network components. The tool should be able to serve both needs.

Therefore, a tool is designed based on a network integration process that is applicable to any network integration. This ensures that the tool can function complementary to existing network integration processes and is easily understood by network experts. Next, features have been added to the process to allow network components to be harmonized and achieve the intended M&A synergies.

First, the main process of the tool with its sub stages is explained. Next, the sub stages are elaborated. In the following paragraphs, the description of the process and its stages is specified, and which functional requirement it satisfies. For an overview of these requirements see Table 9, section 3.4.

4.1.1. Main process

The main process of the tool follows four basic stages. Each stage is explained briefly.

1. Identify the current IT network configurations of the acquiring and acquired company.
2. Identify the IT network components that need to be integrated in the merger.
3. Determine the desired integration strategy for each IT network component.
4. Create a project plan that can be used to support and manage the integration process.

By identifying the current IT network configurations of the acquiring and acquired company, the differences between the networks will become visible. This allows identifying possible differences between network components of the two networks. Next to technical information, also non-technical information can be specified such as the dominant party and the size of both companies as well as applicable policies. This information can be used as decision criteria (at a later stage in the process) to determine the integration strategy.

The next stage of the process is to select those IT network components that need to be integrated in the merger. The network components that need to be integrated can vary between mergers. The information about the network configurations of the merging companies already points to possible components that could be integrated. In addition, the tool supports the user by providing a list of possible differences between network components. This is to prevent the user from overlooking important integration tasks, but also to prevent executing unnecessary integration tasks. It's up to the user to decide whether or not to include components in the integration plan, which is the output of the tool.

In the third stage, the integration strategy for each network component is selected by evaluating different decision criteria. The different decision criteria have been placed in a decision tree, to evaluate them in a structured fashion. For each possible conflict between IT network components (integration issues) a decision tree is presented to the user. For each network component, different integration strategies can be followed that can be selected by going through the decision tree. The integration strategies are: total integration, partial integration, no integration and new system.

- The total integration strategy is aimed at both enabling the integrated network and creating cost-reduction synergies and economies of scale, by harmonizing the components of the network. For instance, to reduce cost from maintenance contracts, support staff or required expertise for different vendors of network equipment, this strategy defines that a single vendor will be used for all equipment.
- The partial integration strategy is aimed at creating a connection (or bridge) between the different components of the network, but leaving both in their current state. For instance, the cost of harmonizing the components of the IT network could be higher than the benefits from expected cost-reductions. To enable the communication between the two components, a connection between them is established in the form of a bridge or conversion interface.

- The no integration strategy leaves both components in their current state, neither is a connection between them established. This strategy could be selected when no benefits of harmonization or interconnection can be expected, therefore making resource spending on the integration of the components unnecessary.
- The new system strategy is aimed at migrating the components of both IT networks to a new system. For instance, the components of both IT networks could be outdated or could be unable to support the combined organization.

The fourth stage does not require any action from the user. The tool has gathered the required information to generate a template of a project plan. This template contains the network components that will be integrated, the integration strategy that has been chosen for that component, and the decision criteria that have been used to select the integration strategy. In addition, the template contains a planning that deals with the order and timing of the integration tasks. Moreover, the template contains general integration tasks that would have to be executed in any network integration, regardless of any network component or strategy.

The above description of the general process stages satisfies requirement 0 (main process) of the tool. The separate stages of the NIST are depicted in Figure 11 and will be further elaborated in the following paragraphs.

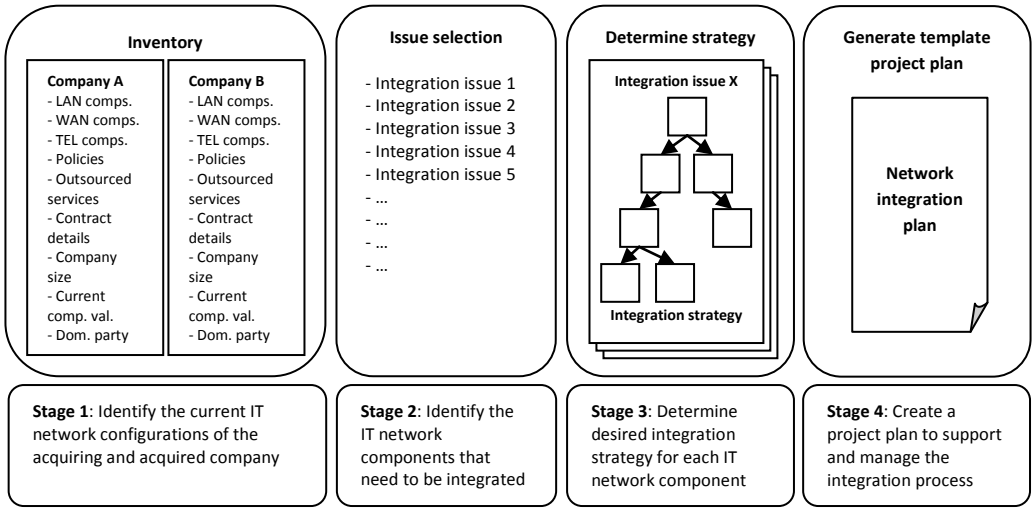

Figure 11: The four stages of the network integration support tool

4.1.2. Stage 1

The first stage of the tool assists the user in defining the starting situation. It helps the user with identifying the current IT network configurations of the acquiring and acquired company and allows for recognizing the differences between components of the two networks. The information that is gathered in this stage can be used in a later stage to determine whether the expected benefits from a certain strategy outweigh the cost of pursuing that strategy.

Part of this stage involves creating an overview of the installed equipment in both networks, including the number, type, function and vendor of each network component for each company. In addition, the current financial value and depreciation value can be entered for each component. This information could be used in a later stage, to determine whether the expected cost reductions outweigh the cost of replacing or harmonizing certain components. This functionality satisfies requirement 1.1.

The user can also enter non-technical information in this stage. This information includes the size of the company in terms of people (network users) and the current value of the networks of both companies. This information can be used to quickly determine the direction of harmonization. Obviously, it makes sense to change the network components of the smaller company to those of the larger company, because fewer resources are involved in this activity. Moreover, the user can enter which of the two companies is considered the dominant party, to determine the decision maker on the strategy for each integration issue. This functionality satisfies requirement 1.2.

Decision making towards a specific integration strategy for each network component is often based on policies. These policies are a definite course of action adopted to guarantee unity of the components within the network. This is especially the case in large companies. Therefore, the user can enter information about the vendor policy, sourcing policy and network management policy. The vendor policy specifies the desired vendor for a specific component of the network. For instance, the vendor policy could state that a single vendor is used for all instances of a certain network component and that the supplier is defined as vendor X. This policy could also include exceptions, for instance when the vendor does not have a product for a specific IT network component. The sourcing policy specifies whether a third party is used to perform certain tasks for the company. For example a company can do the maintenance and management of their IT networks by using their own IT department, or they can outsource this activity to external companies. The sourcing policy states these preferences, which are needed in a later stage. The network management policy defines the management strategies for network devices, network access control systems and network management tools. The user can enter this information into the tool, to aid the decision making process in the third stage of the tool. This functionality satisfies requirement 1.3.

For outsourced services, the user can specify the contract details of these services. This information includes the function of the service, its monthly or yearly cost, the service level, the contract expiration date and any penalties for breaking the contract. This functionality satisfies requirement 1.4.

While entering the above information, the user is supported with examples of the data that needs to be entered, to assist him to find the right information within the merging organizations. This functionality satisfies requirement 1.5.

The combined functions as described above satisfy the main requirement for the first stage of the process of the tool, requirement 1.

4.1.3. Stage 2

The network components that need to be integrated can vary between different mergers. Therefore, the second stage of the process is to select those IT network components that need to be integrated in the merger. To achieve this, the user is presented with a list of common IT network integration issues that can be encountered in a merger. (For this list, see Table 7, paragraph 3.3.2).

Based on the information that has been specified in the first stage, the tool will automatically select integration issues that can be relevant for the given situation. The user can change this selection and add additional integration issues. This functionality satisfies requirement 2.1.

Some integration issues are more important than others. Moreover, some integration issues need to be dealt with before others. This information is needed in the project plan that is the output of stage four. Therefore, the user can assign a ranking between 0 and 10 to each integration issue. This ranking is used

in the template project plan to determine the order of integration tasks. This functionality satisfies requirement 2.2.

When the user decides to add additional integration issues, but no information about these issues has been entered in the first stage, the tool will automatically ask the user to specify this information. This functionality ensures that the tool can provide all the required information for the decision making process in stage 3, and provide this information for the project plan template. This functionality is complementary to the previous functions and satisfies requirement 2.3.

The combined functions as described above satisfy the main requirement for the second stage of the process of the tool, requirement 2.

4.1.4. Stage 3

In the third stage, the integration strategy for each IT network component is selected by evaluating different decision criteria. There is a difference between technical integration issues, which are aimed at enabling the combined network, and integration issues that can be the source of synergy creation. For instance: IP plans, QoS settings or wireless/non-wireless implementations are part of technical integration. Merging contracts with WAN providers, network maintenance and management services and harmonizing equipment can be the source of synergy creation such as cost-reductions and economies of scale, which are common goals in mergers that can also be achieved from network integration.

The decision criteria have been placed in a decision tree, to evaluate them in a structured fashion. For each IT network component that was selected in stage 2 (integration issues) a decision tree is presented to the user. These decision trees are unique for each integration issue and contain the decision criteria that are relevant to the issue at hand. In this way, a different integration strategy can be selected for each integration issue, which satisfies requirement 3.1.

When the user is reviewing a specific decision tree, the tool shows relevant information about the integration issue that is analyzed. For instance, the user has to decide about an integration strategy for different equipment vendors (assuming the merging companies used different vendors for their equipment). The user needs information on policies he needs to comply with to make choices about this issue. If the policy states that all equipment (of a specific IT network component) should be from a single vendor, a total integration strategy is selected. If there is no policy, or no preference, the next question is to calculate the cost benefit from a single vendor strategy and compare it against the expected project cost of migrating to this situation. To make these calculations, the user needs to know the number, type and functions of the equipment. This information was entered in stage one. This functionality provides the user with the required information to make a decision, which satisfies requirement 3.2.

The decision tree is fully visible to the user, so he can see the direction a certain choice will take him. This makes the entire decision making process transparent to the user and satisfies requirement 3.3. In addition, the user can return to a previous decision criterion and re-evaluate it. This functionality allows the user to select another integration strategy that might be a better solution for the given situation. This functionality satisfies requirement 3.5.

Additional user support is provided by the tool, by showing information on best practices for the integration issue analyzed. These best practices inform the user about how the specific integration issues were solved in other cases. This information assists the user in making a choice for an integration strategy for an integration issue and satisfies requirement 3.4.

The combined functions as described above satisfy the main requirement for the third stage of the process of the tool, requirement 3.

Decision trees

The decision trees are considered the decision making core of the tool, because they assist the user in the decision making process. For all 20 integration issues that have been identified in this research (see Table 7, paragraph 3.3.2), a decision tree has been constructed. Explaining every possible decision tree would result in an unnecessary repetition and bulky thesis. Therefore, to provide insight into how the decision trees work, this paragraph explains three decision trees in detail. Since the decision trees partly overlap between the domains of the IT network, three decision trees that deal with a unique decision making process are selected. The other 17 decision trees can be found in appendix C. Rectangular boxes represent questions that were based on different decision criteria. Diamond shaped boxes represent the different outcomes of the decision trees.

Wide Area Network service strategy: In-house or out-sourced WAN

An important strategic decision for network integration between two companies is whether the integrated wide area network is to be maintained and managed by the internal staff or by an external provider. By harmonizing the service strategies of the merging companies, synergies could be achieved. Figure 12 shows decision tree 11, which helps the user make this decision. Total integration outcomes have been noted with “TI”. The decision trees for the service strategies for LAN and Telephony maintenance and management are similar to decision tree 11.

At the start of the tree, the user selects if the merging companies have different sourcing strategies for their WAN maintenance and management. If this is not the case, the user selects the no-branch. With regard to the integration of the service strategy, no action needs to be taken. Then the user specifies whether the WAN is managed and maintained by internal company staff. If this is the case, he selects the yes-branch reaching an end-point of the tree. The user is redirected to another decision tree that analyzes the WAN technologies and equipment vendors. In the other case, he selects the no-branch. In this case, both companies have contracts with external WAN providers. The user is redirected to a decision tree that further analyzes that situation.

Going back to the start of the tree, the user can also select the yes-branch, which indicates that one company has an out-sourcing strategy, the other an in-house strategy. The next important decision criterion is the presence of a sourcing policy. In most cases, the dominant party’s sourcing policy is leading. If there is no sourcing policy or the policy does not dictate a preference, all options are open. In this case, advantages of either strategy should be analyzed for the specific situation and the best option should be chosen. If there is an outsourcing policy, a total integration strategy is selected. The user is redirected to a decision tree that helps him analyze that situation. If there is an in-sourcing policy, it has to be determined whether the benefits of transferring out-sourced WAN services to the internal staff outweighs the cost of migration directly after the merger has taken place. If this is the case, the total integration strategy is selected. If this is not the case, the outsourced WAN services must be migrated to in-sourcing after the contract expires. This minimizes the migration cost and satisfies the policy requirements.

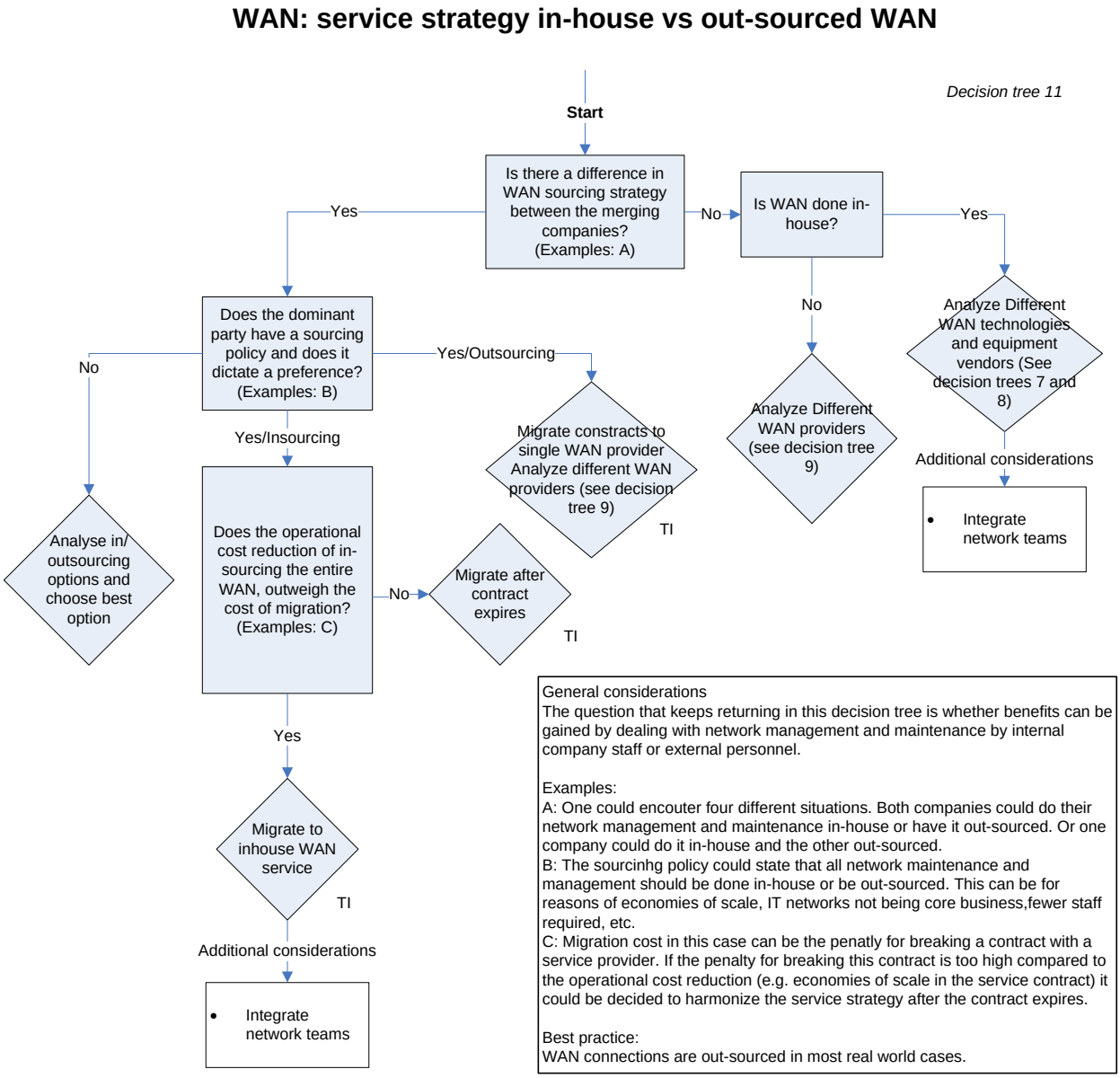

Figure 12: Decision tree 11

Local area network equipment vendors

Another important decision for the integration of two networks is to determine whether network components that fulfill the same function should be from the same vendor. A single vendor approach results in lower operational costs (synergies): a reduction in the cost of managing multiple vendor platforms, lower costs for maintenance agreements with multiple vendors and economies of scale. Figure 13 shows decision tree 2, which helps the user make this decision. Total integration outcomes are noted with “TI”, no integration outcomes with “NI”. The decision trees for vendor selection of WAN and telephony equipment are similar to decision tree 2.

At the start of the tree, the user selects whether the merging companies use the same vendor for the components of the local area network. If this is the case, no integration strategy for this integration issue is needed. However, there are some additional considerations. Sometimes, different types of equipment from the same vendor are not fully compatible. If this is the case, non-compatible equipment should be replaced with compatible equipment from the same vendor.

If there is a difference between the vendors of the LAN equipment, the user must determine if there is a vendor policy and if that policy dictates a certain vendor. If this is the case, the user selects the yes-branch. The next step is to determine whether the benefits of migrating all equipment to a single vendor outweigh the cost of migration. Based on a cost calculation by the user, he decides whether to migrate the equipment directly after the merger has taken place or at equipment end-of-life. To make this calculation, the user can use the data that has been gathered in previous stages of the tool.

If there is no vendor policy or it doesn’t dictate a preference, the user should calculate if operational cost savings can be achieved in this case by going for a single vendor strategy. If this is not the case, a “no integration” strategy is selected which leaves the components of the LAN in their current state. It should be noted that this outcome has additional considerations that need to be solved.

The final step is to determine whether the benefits of migrating all equipment to a single vendor outweigh the cost of migration. Based on a cost calculation by the user, he decides whether to migrate the equipment directly after the merger has taken place or at equipment end-of-life. To make this calculation, the user can use the data that has been gathered in previous stages of the tool.

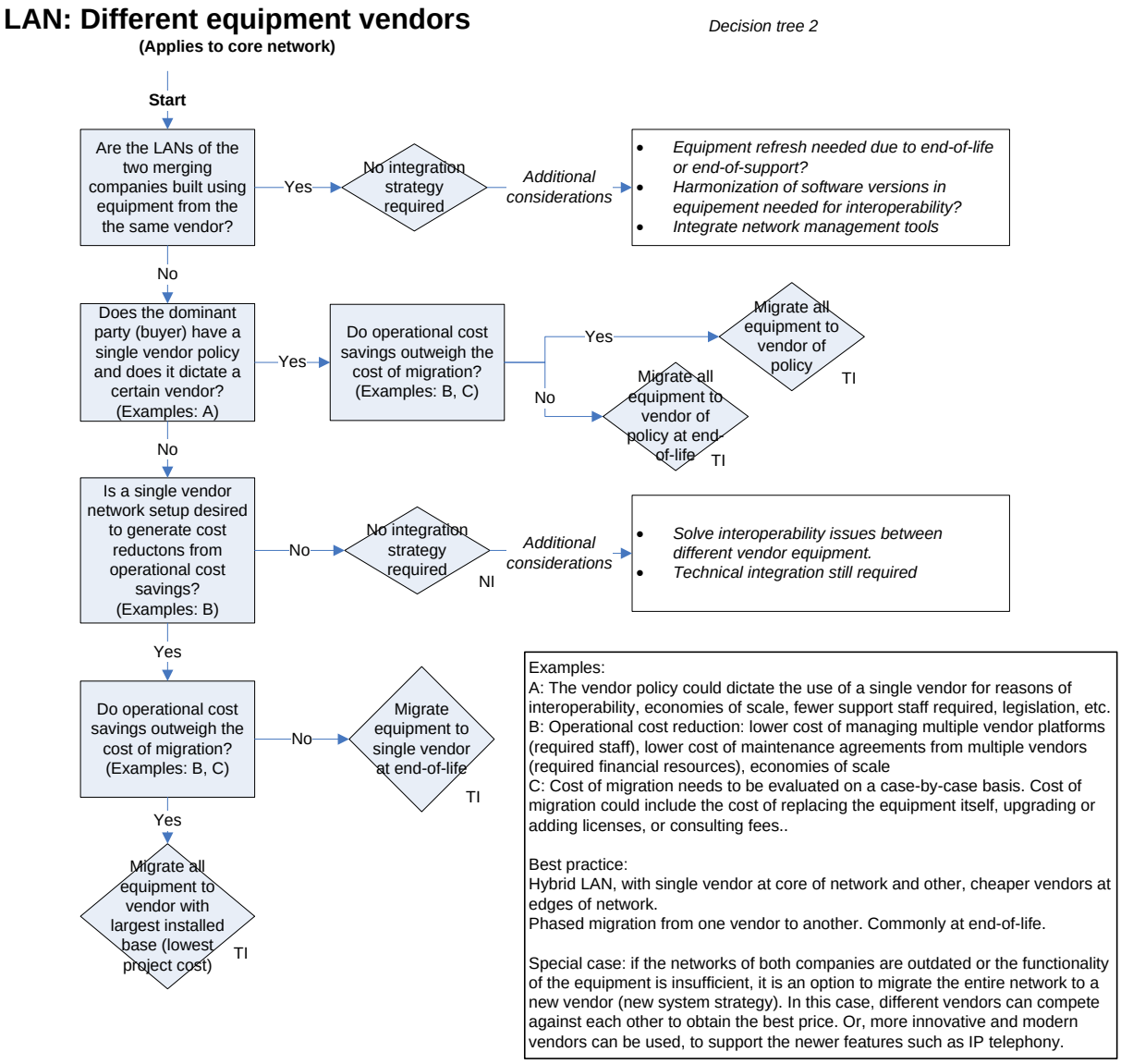

Figure 13: Decision tree 2

Local area network functionality: wired versus wireless LAN

The network should be able to support the combined business process of a merged company. The network should provide the functions that the business requires. One of those functions is a wireless networking environment. Figure 14 shows the decision tree that allows the user to determine whether wired and/or wireless LAN should be installed at a specific office location. This tree is mostly aimed at enabling the business rather than generating synergies from cost reductions.

At the start of the tree, the user specifies whether a wired network is present at a specific office site. For example, a new office building (or a so called “green field” location) for the merged company does not have any network infrastructure yet. If there is a wired network present, the user selects the yes-branch. Next, the user has to determine whether wireless LAN is required for functionality reasons. For instance, the company could be looking to implement flexible working places for employees that will be working at different offices. The company could also want to provide guests with internet access, but does not want to allow external personnel on the wired network. A separate wireless network for this purpose serves this requirement.

If there is no wired LAN at the site, the user selects the no-branch at the start of the tree. The next question determines whether wireless functions are needed, similar to what has been described above. If this is not the case, the LAN of that specific site should be built with wireless technology. Wired LAN seems to hold preference over wireless LAN, for reasons of bandwidth, maintenance, security and stability. If wireless functionality is required, the user needs to determine whether a wired network is needed as well. A wired network is needed when there will be high bandwidth applications going over the network, such as high definition video conferencing streams or large files are being transferred often. If this is the case, a hybrid LAN with wired and wireless functionality should be installed. Otherwise, a wireless network will satisfy the requirements for that specific site.

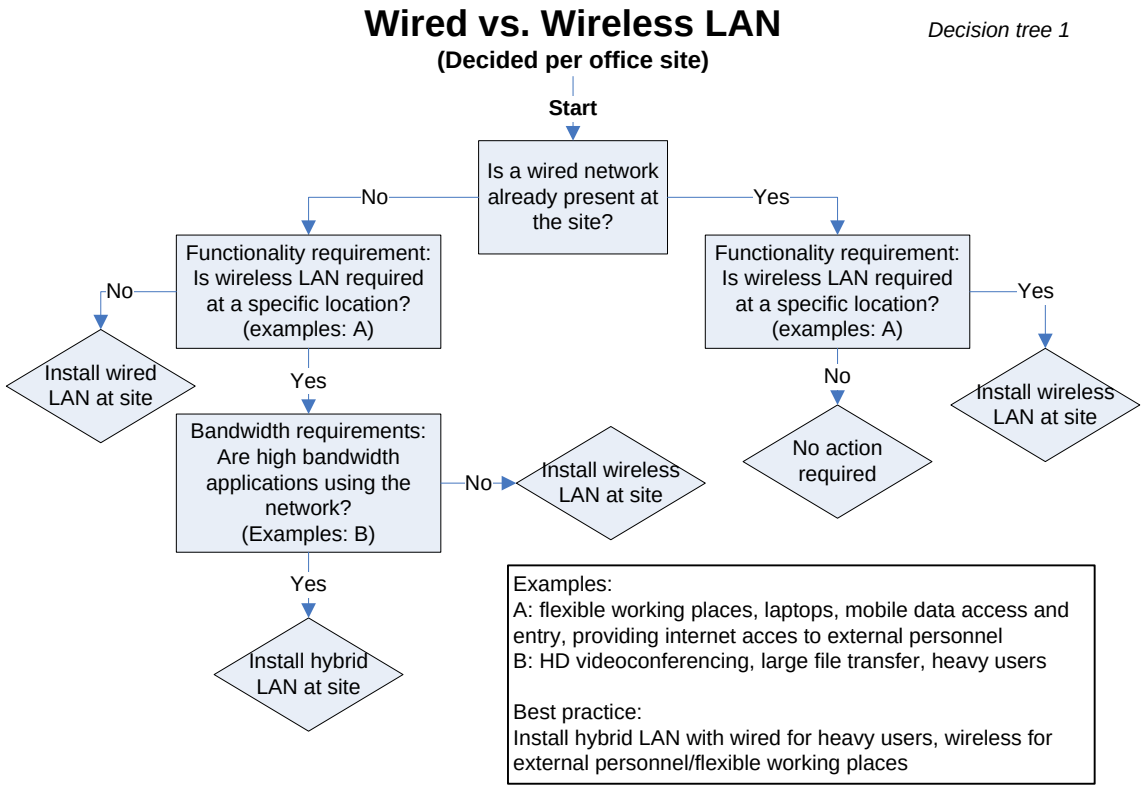

Figure 14: Decision tree 1

4.1.5. Stage 4

In the fourth stage of the process, the tool generates a template for a project plan. The project plan describes the intended project result and how it is obtained. The template project plan that the tool generates contains:

- The project description;
- Phasing and activities;
- Project management.

The tool generates this information automatically for which it has the required information. It also generates standard texts that the expert can manually edit after the template project plan is generated.

Project description

The first chapter of the project plan template contains the project description and elaborates on the goals of the project, its results, and the starting conditions.

The project goal describes the problem statement, the motivation and background of the project and its goals (Meredith and Mantel, 2006). In addition, the underlying goals supporting the main goal, as well as the nature of the project are specified. Since this template is aimed at network integration in M&A, this information could be automatically generated by the tool. The problem statement elaborates on the fact that two companies intend to merge and need to integrate their networks. The goal of the project could be the enablement of the combined network, to support the applications the business needs to function. Another goal of the project could be the creation of synergies such as cost-reductions and economies of scale by harmonizing several components of the network.

The result of the project specifies the deliverables and the scope of the project (Meredith and Mantel, 2006). The deliverables of a network integration project are the integrated components of the IT network. The deliverables are part of the scope of the project, which is defined as the set of integration issues that were selected in stage 2. The tool generates the description of the project scope based on this information.

The starting conditions define the expectations and requirements set by the principal of the project. Since this information is unique for every integration project, the network expert will have to add this information to the project plan. Therefore, the template contains a formatted section for this purpose. For the integration project itself, the template contains the starting situation of the to-be-merged networks. This information includes all items that have been gathered in stage one and describes the current IT network configurations of the two networks that will be integrated.

Phasing and activities

The second chapter of the template describes the phasing of the project and activities to be executed in each phase.

The project plan template contains a section per domain. These are the LAN, the WAN and telephony parts of the IT network. Within each domain, a paragraph for each selected integration issue is created. Each paragraph contains a short description of the conflict between the components of the networks and the integration strategy that has been selected for that specific integration issue. In addition, the decision criteria that have been evaluated to select that strategy will be listed and explained. This information satisfies requirement 4.1.

The next part of this chapter contains the phasing of the activities and describes the planning of the different activities in the execution phase of the project. Therefore, the project plan template contains a prioritized overview of the integration issues, specifying the order in which tasks need to be executed. In addition, the project plan template contains a pre-made planning in with the relevant integration issues filled in. Since every merger is different, it is difficult to automatically generate a planning for the tasks. Therefore, the expert can add planning data in the pre-made planning chart to suit the specific merger. This function of the tool satisfies requirement 4.2.

The execution of a network integration project involves a number of technical steps to be executed to deal with a given integration issue. The project plan could provide a guide for the network experts with the integration to support them. Therefore, the project plan also contains a checklist of activities to be taken when solving an integration issue. This part of the template satisfies requirement 4.3.

The last part of this chapter describes general activities to be taken in any network integration project. Therefore, the template contains a checklist of these activities. For instance, the first action within a network integration project is to create connectivity between the networks of both companies. This allows the transmission of data across the different locations in the network, enabling the people in the company to communicate and work together. This part of the project plan satisfies requirement 4.4.

Project management

Part of any project plan, is a chapter about how the project is managed in terms of time, money, quality, information, organization and risk management (Meredith and Mantel, 2006). The template project plan contains a section for each of these subjects where further specifications can be added for the project. Since much of this information can be rather unique for each network integration project, the tool does not automatically generate the information of this section. Instead, it provides section and paragraph headers. These headers contain questions that can be used to add this information to the project plan. Examples of such information are given below.

The section about time deals with questions such as how the project is decomposed in a work breakdown structure and how the activities are planned (Meredith and Mantel, 2006). This section also contains information about milestones, the critical path and how progress is managed. The network expert should determine the work breakdown structure and the milestones of the project.

The section about money contains information about the budgeting of the integration project and how individual integration activities fit into the total budget (Meredith and Mantel, 2006). The network expert should specify in this section how the integration tasks fit into the available budget for the integration project.

Quality is discussed in a separate section that specifies how the process quality and technical quality is guaranteed. In addition this section contains information on how change management is organized and how quality is measured and reported (Meredith and Mantel, 2006).

The section on information contains agreements on consultation structures, how the project files are organized and reporting agreements (Meredith and Mantel, 2006). This mandatory subject should be filled in by the network expert.

The organization of the project is discussed in a separate section. This section contains information on the principal and project leader of the project, and specifies their mandates. It also specifies the number of people working on the project and their responsibilities.

Almost any project is executed in an environment of uncertainty and risk (Meredith and Mantel, 2006). Therefore, the section on risk management contains information about the risks of the project. For each integration issue that was selected in stage two, a paragraph is added to this section. Each section contains a list of possible risks associated with the integration issue, and how that risk could be mitigated. The network expert should perform a risk assessment for the specific situation and add the results to this section.

The design of the tool currently has no functionality that assists the user with these subjects in an interactive way, because the main focus of this research is on the selection of an integration strategy for possible integration issues. This could be the focus of a future study.

4.2. Design validation

In order to obtain data from the field that can be used to validate the decision trees that are the core of the design of the NIST, several interviews have been conducted. To ensure the reliability of the interviews, an interview protocol has been developed. This makes the measurement systematic and not coincidental. The reliability of the measurement instrument is defined in terms of repeatability; if you repeat a measurement on the same object, you should get the same results (Velde et al., 2004). Therefore, the measurement instrument (interviews) will be elaborated in this section.

First, the reason to choose for interviews is discussed. This is followed by presenting the interview protocol which shows how the interview questions were formulated, based on the concepts that need to be validated. For each question, the reason to ask that question is given. The selection process of the interview candidates is explained next and shows how and why these candidates have been selected. An overview of the interviewees that have participated in the second round of interviews is given. This section is concluded with an explanation of how the gathered data will be analyzed.

4.2.1. Data gathering method: interviews

The literature review and the interviews of the first round provided a set of contextual requirements that have been the basis for the construction of the decision trees. The decision trees have been constructed based on the information that has been provided by the experts in the first round of interviews. In addition, some assumptions had to be made to create a first design of the decision trees. Therefore, it is essential to validate these decision trees in practice. This process also allows to improve the decision trees to more accurately represent the reality, therefore improving the validity of the tool.

To improve the decision trees, experience in the field of IT network integration is needed. It is essential to use a method of data gathering that allows several themes to be explored, while leaving room for extra information from the experts. According to Van der Velde et al. (2004) the semi-structured interview is best suited for this task, because it allows the researcher to have a previously formulated set of questions and have the flexibility to go more deeply into subjects as they arise. This method is primarily used with explorative research (Velde et al., 2004). The advantages of doing interviews are that they generally yield a large amount of information in a short period of time. In addition, there is a smaller risk of questions being skipped, compared to e.g. questionnaires (Velde et al., 2004). Therefore the semi-structured individual interview has been chosen as the data gathering method for this research.

4.2.2. Formulating interview questions

The focus of the interview is to verify and refine the design of the decision trees that form the core of the tool. Verifying the decision trees has been done by dividing the interview in parts. The first part of the interview is aimed at (re)introducing the interviewee with the research. An introduction is given, explaining the goal, approach and context of the interview. In addition, their role is clarified. The second part is aimed at explaining the concepts that will be discussed in the interview. This is aimed at introducing the decision trees and presenting the key questions that will be asked for each decision tree. A short explanation of the functional design of the tool is given, to help the interviewee understand the place of the decision trees in the total design. The third part of the interview contains the decision tree designs, which are the main focus of the interview. This approach helps the interviewee to better understand the concepts being discussed and should increase the quality of the answers.

The concept that needs to be validated in this round of interviews is the contextual design, which is the design of the decision trees. Each decision tree captures the decision making process that facilitates the selection of an integration strategy for a network component of an IT network. Therefore, the interviewee is shown a figure of a decision tree accompanied by five questions. These questions are aimed at the objective of the second round of interviews; the refinement of the design of the tool.

The decision trees have been constructed based on information provided by network experts in the first round of interviews and by making assumptions and logical reasoning. Therefore, it needs to be verified whether this has been done correctly. The first question is formulated as: "*Do you recognize the given decision making process, as described in the decision tree, in practice?*" The answers to this question indicate to what extent the design represents reality.

Next, we need to verify that the most important decision criteria (relevant for the integration issue at hand) have been used in the decision tree. Therefore, the second question is formulated as: "*Are the most important decision criteria being evaluated in the tree?*" If this is not the case according to the expert, we need to find out what other criteria should be evaluated and how they could be placed in the decision tree. Therefore, the follow-up question is formulated as: "*If not, which other decision criteria should be evaluated and how could they be placed in the decision tree?*"

The decision criteria that have been found in literature and the first round of interviews have been used to formulate questions. These questions have been placed in the decision tree. To resolve issues with the formulation of these questions, the third question has been formulated as: "*Is the formulation of the questions in the decision tree clear to you?*" If this is not the case, the follow-up question is formulated as: "*If not, how could this be improved?* "

The experts in the first round of interviews indicated that some decision criteria are more important than others and should be evaluated in order of importance. Therefore, the fourth question is formulated as: "*Are the decision criteria being evaluated in the right order within the decision tree?*" This question is aimed at obtaining the correct sequence of questions in the decision tree.

Each decision tree has several outcomes that indicate a certain integration strategy for the given integration issue. The integration strategy is selected after evaluating several decision criteria. It is essential that the tool selects the right integration strategy, therefore the fifth question is formulated as: "*Is the right integration strategy selected after evaluating the different decision criteria?*"

4.2.3. Selecting interviewees and making contact

Van der Velde et al. (2004) argue that when conducting interviews as part of this kind of explorative study, it is important to interview a varying range of people. Similar to the first round of interviews, the interviewees were selected based on their function and background within the IT networking business, their experience and specific field of occupation. To obtain a good variety in the interview candidates, experts from within and outside Accenture have been selected. For this round of interviews, the same interviewee candidates have been selected as the first round of interviews. These experts have been selected because they are already familiar with the research and have the required expertise. In addition, the population of network experts within Accenture is around eight people and some of them do not have the experience that is required by the profile for the candidates. These people have been selected to check their thoughts on, and achieve a general insight into, the decision making process. Moreover, in the second round of interviews, an opportunity arose to speak with two additional experts. These experts were unavailable for the first round of interviews, due to time limitations. The new experts provided an opportunity to check whether the first round of interviews resulted in a "complete" overview of the requirements for the design. When the feedback from these experts does not provide new and important information, more certainty is achieved about the completeness of the results.

Contact with all experts had been previously established, during the first round of interviews. The experts were contacted by email for the second round of interviews. In this email, a short reintroduction of the research was given. This was done to clarify the objective and context of the interview, and to inform the interviewee about their role in the second round of interviews. After making an appointment, the interviewee received the full set of interview questions and decision trees a few days before the interview. This allowed the interviewee to prepare the answers, therefore improving the quality of the gathered data. Due to the number of decision trees (20) and the limit on the available time (one hour), the interviewee could make a selection of decision trees to discuss in detail. The expert was allowed to choose the decision trees that he considered most important to network integration in M&A. Or the expert could choose the decision trees that he found incomprehensible, disagreed with or have a different opinion about. However, most experts chose to increase the duration of the interview, to be able to discuss all decision trees.

According to Van der Velde et al. (2004), a sufficient number of interviews is achieved when a good representation of the population is used in the research. For this round of interviews, roughly half of the available population of network experts at Accenture was used. Therefore, it is considered to be a good representation of the population. One extra expert from outside Accenture was used, to maintain the same balance between experts inside and outside Accenture.

The profile for the selection of the interviewees has already been established in the previous chapter and has been re-used. See paragraph 3.2.3. This profile guarantees that the experts have sufficient knowledge about network integration and are able to provide the researcher with relevant information. Table 10 lists the candidates that have participated in the second round of interviews. Expert 1 to 6 have been given the same number as in the first round of interviews. Expert 7 and 8 are new and unique interviewees. For more detailed information about the experts, see appendix D.

Table 10: Overview of interviewees in the second round of interviews

Participant	Role	Company	Experience
Expert 1	Project leader of ICT projects	A Dutch Higher Education institution	± 20 years
Expert 2	Technical sales engineer	International WAN services provider	± 20 years
Expert 3	Technical design consultant	International WAN services provider	± 20 years
Expert 4	Senior Manager network infrastructure	Accenture	± 20 years
Expert 5	Manager IT infrastructure	Accenture	± 15 years
Expert 6	Manager IT infrastructure	Accenture	± 15 years
Expert 7	Network Services Consultant	International Pharmaceutical Company	± 10 years
Expert 8	Consultant IT infrastructure	Accenture	± 5 years

4.2.4. Data analysis

At the start of the interview, the interviewee was asked for permission to record the conversation. Notes were taken on a printed set of the decision trees. This allowed the researcher and expert to discuss the decision trees and add comments to specific parts of the decision trees. In addition, this approach allowed both expert and interviewer to draw additional branches in the decision trees. The recordings were used to capture specific comments of the experts on a given subject. If an expert provided elaborate feedback on a subject, the researcher wrote down the specific time within the recording, reducing the time needed to make extensive notes.

When processing the feedback of the experts and choosing whether to implement it in the decision tree, only the feedback that represented the majority of the opinions of the experts were taken into account. This was done to prevent basing a decision tree design on a single expert opinion. Processing the data from the interviews was done in two stages. In the first stage, all the notes that were taken on each set of decision trees were compared between the experts. In the second stage, all the recordings were played back, to ensure no important data was missed in the first stage.

4.3. Results

The focus of this round of interviews was on the contextual requirements of the tool. These contextual requirements were used to construct decision trees that form the core of the NIST. Therefore, the decision trees were the focus of the interviews. Due to the number of decision trees and time limitations of each interview, the interviewee received the interview material a few days before the interview. This included all decision trees of which the interviewee was allowed to make a selection. However, most experts chose to increase the duration of the interview, to be able to discuss all decision trees. On average, each interview lasted for 1,5 hours.

The interviews provided feedback on the design of the decision trees. The feedback of the experts will be discussed in this section and has been broken down into the general response and the responses per decision tree. Besides information that was directly applicable to the design of the decision trees, the interviews also provided additional information that is indirectly relevant for this research. These additional considerations have been discussed in the last paragraph of this section.

4.3.1. General response

This paragraph contains the general responses of the experts that did not fit with a specific decision tree. These responses give an indication of the degree to which the proposed decision trees capture the reality of decision making in network integration in M&A.

The goal of the second round of interviews was to determine if the decision making process for varying integration problems has been correctly captured in the decision trees. As stated before, the construction of these decision trees had been done based on information provided in the first round of interviews. The interviewees were asked whether they could recognize the decision making process (that has been described in the decision trees) in practice. To support this question, the interviewees were asked to indicate whether:

- the most important criteria had been used in each respective tree;
- the questions in the decision tree were clear and self supporting;
- the criteria were being evaluated in the right order;
- and if the outcome (integration strategy) at the end of each branch was correct.

Recognition in practice

Regarding the practical applicability of the decision tree, the majority of the interviewees indicated that the decision making process of the decision trees could be recognized in a practice. Therefore, the initial design of the decision trees proved to be mostly correct. For example, expert 3 says: "*I think these decision trees capture the general decision making about these kinds of challenges. The approach to the problem is good. You only need to do the finishing touch.*"

The decision trees are partly similar between specific components of the IT network areas (LAN, WAN or Telephony). Some experts detected this overlap between the decision trees and confirmed that the decision making for similar components in different areas is roughly the same. For example, expert 1 indicates: "*I see some overlap in these decision trees. For some components, the decision making is roughly the same over the different areas.*"

In general the decision trees fit with the decision making process in practice. However, the experts commented that in reality a lot of exceptions can exist, reducing the applicability of the designed decision trees. This implies that the tool provides a solution for general cases, rendering it a one-size-fits-few solution, instead of a one-size-fits-all solution.

Important criteria per tree

When the decision trees were constructed, not all decision criteria were used for every tree. Some criteria are only relevant to specific integration issues. Moreover, some criteria were deemed more important than others. The second round of interviews provided an opportunity to verify whether the most important decision criteria were used in each tree. The majority of the interviewees indicated that this was indeed the case. Expert 2 says: "*Your focus on cost reductions in the decision making process is good. As I've seen in many of my projects, a big question in any merger is: what can I save on IT?*" Other experts provided similar statements, which supports the conclusion that the creation of synergies (e.g. cost-reductions and economies of scale) is one of the main goals of network integration. In addition, the literature indicated that a merger quite often has a dominant party who dictates the integration decisions. Therefore, this criterion was incorporated in many decision trees. The experts confirmed the importance of this criterion in the entire process. For example, expert 1 says: "*I like the fact that the dominant party is often present in the decision making. The dominant party is in 9 out of 10 cases the*

decisive factor in network integration in M&A." In some cases however, the merging partners are equal. However, this is only a small portion of mergers and acquisitions. Based on feedback from the majority of the experts, a few criteria were added to a number of decision trees.

One expert mentioned that he was missing the "innovative" criterion in the decision trees. As he explained, in some cases companies want to have the most state of the art networks that support the newest functions. However, this is considered to be an exception because this criterion applies to only a small group of mergers. If it is important in a specific merger, this criterion could be evaluated separately.

Another expert stated that the "legislation" criterion was missing in the trees. In some cases, companies are bound by law that sets certain requirements to the network. For instance, legislation could dictate that the network of a bank should contain certain security measures, or that the WAN may not be outsourced for customer privacy reasons. As with the "innovative" criterion, this is considered to be an exception. Expert 8 adds: "However, in practice this is only a criterion when they run into it in a specific merger."

Clear formulation

To construct the decision trees, the criteria were used to formulate questions. The clarity of the formulation of these questions was verified in the interviews. With some exceptions, the interviewees were satisfied with the comprehensibility of the questions in the decision trees. Suggestions for improvement have been processed in the decision trees. To improve the clarity between different trees, the formulation of the questions was done as uniformly as possible. The recurring structure of the decision making process was found to be very clear. It was suggested to add examples in the decision trees to improve their comprehensibility. However, many experts indicated that the questions in each of the trees are very recognizable in practice.

Correct order of questions

As discovered before, some decision criteria are more important than others (see paragraph 3.3.2). This implies that the questions about these criteria should be asked in a certain order, where the most important questions are asked first. In most cases, the order of the questions was found to be correct. In some cases, the order of questions was changed, based on feedback from multiple experts.

A special case was found related to the order of the questions. However, this was not within a tree, but between trees. About half the interviewees detected that some decision trees could be used as input for questions in other decision trees. As expert 6 says: "*Some decision trees can be used to answer questions in other trees. An example is decision tree 15, which provides input for the functionality question in decision tree 13.*" This special case points to a larger issue regarding an interconnection between the decision trees, which will be discussed in the "additional considerations" paragraph.

Outcomes of decision trees

The last important thing to verify is whether the right integration strategy is selected at the end of every end-point of the decision trees. Some experts noticed that the total integration strategy is selected quite often. They confirmed that in many cases of network integration in mergers, a harmonization of components is performed (total integration). In addition, the reason to choose for a total integration strategy not only depends on cost and policies, but also on functionality requirements. Expert 6 says this most accurately: "*Not only cost reductions are a reason to harmonize the networks. Other reasons can be user friendliness or specific functionality that is needed by the business. For example, the people of a company with flexible working places could easily work at other office locations, if these have wireless*

functions, but also the same login credentials." These reasons explain why often a decision tree can result in a total integration strategy.

Regarding the service strategy for LAN and WAN, the experts note that in most cases the WAN function of the network is outsourced, managed by an external party. On the other hand the LAN is managed and maintained in-house in most cases, for example to be able to more quickly respond to problems with the network as they occur. An exception to this general rule applies to small companies or smaller office locations. In these cases it is often not feasible to maintain an in-house support crew for the LAN. One expert claimed that in a merger between two companies, the WAN service strategy and the contracts with WAN providers should always be harmonized. This means that a total integration strategy would be selected in any case. This would defeat the idea of using a decision tree for these integration issues. However, it supports the high number of total integration outcomes in those trees.

Some of the experts indicated that the decision trees could show a checklist of actions that need to be performed when a certain strategy has been selected. This actually corresponds with one of the functional requirements that was found in the first round of interviews. In other words after an integration strategy has been chosen for an integration issue, there are still some actions to be performed. In practice, the current situation is firstly evaluated and compared to the desired functions that the network component should provide. An analysis of the possible options is then executed, after which the best option is chosen. For example, even when the vendors for the LAN equipment are the same between the merging partners, this does not mean that the networks can be connected without an effort. Quite often, there are different pieces of hardware that are incompatible with each other even if they are from the same vendor. This is often caused by software versions installed on the equipment. If the networks are to be integrated, these software versions need to be harmonized.

Two experts also mentioned that one of the important actions after selecting an integration strategy is to document that choice in a company policy. By doing this, the decision can be enforced on the current and future network. Expert 6 explains this clearly with an example: "*As soon as the decision for a certain strategy has been made, it has to be documented. For instance, if the outcome of the equipment vendor tree states that a single vendor is used, it needs to be documented which vendor it is. After that, it has to be enforced.*"

4.3.2. Decision trees

The experts provided feedback per decision tree. This was collected on printed sets of the decision trees. The feedback has been evaluated and has been processed in the decision trees that can be found in Appendix C and paragraph 4.1.4. Only feedback that has been presented by multiple experts has been taken into account, to prevent the design being based on a single expert opinion. To ensure that the refined designs are not the sole opinion of the researcher, the final designs were sent to the experts for a final check. This prevents the designs from being biased by the opinion of the researcher, who can choose which feedback to process and which to leave out.

4.3.3. Additional considerations

The interviews also provided additional outcomes that were not direct answers to the interview questions, but are considered important in the context of this research.

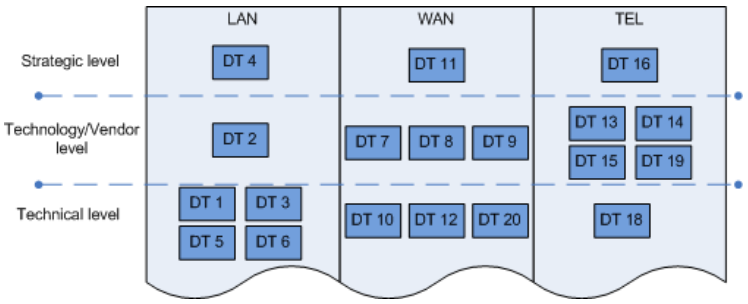

Figure 15: Hierarchy between decision trees

After analyzing the decision trees, several experts indicated that there are certain dependencies between the trees. According to them, there are several layers of decision making processes. The general opinion about the dependencies between the trees is best explained by expert 5, who claims: "*A general note to these decision trees is that there is a certain hierarchy between them. There are three layers of decision trees. You start by looking at the strategy for each of the domains. Second, you look at vendor or technology choices. And last you look at technical integration decision making.*" This would mean there are three levels of decision making, going from a high strategic level to a low technical level. For example, if one has to make a decision about which WAN provider to use, the WAN service strategy must be evaluated first. For the design of the tool, this would mean that if the user selects a lower level integration issue, the tool should automatically select the superseding integration issue as well. Figure 15 shows the hierarchy between the decision trees.

When the first versions of the decision trees were created, it became apparent that this method has its limitations. The decision tree method is based on work from (Giacomazzi et al., 1997), because it allowed to evaluate several decision criteria in a structured way and ultimately select an integration strategy for integration. What seemed a promising method at first, might have its limitations if the number of decision criteria increases to a large number. A small number of experts also detected this, which is best explained by expert 8, who claims: "*I have one consideration about the used method (decision tree). To what extent is this usable to evaluate many decision criteria? I can see these trees becoming quite large and complex when a lot of criteria are evaluated in one tree. An option to solve this problem is to use a method with weighed factors*." This could mean that if the design of this tool is refined in the future, a different decision making method could also be used.

A similar topic was raised by expert 2, who says: "*The presented overview of the different decision criteria is very useful. One could use this list to write a decision document, in which each of the decision criteria is evaluated. I also believe this list rather complete, you won't find much more really important decision criteria*" This implies that if the decision tree method would be less useful for evaluating a large number of decision criteria in a single tree, one could evaluate all relevant criteria separately and then determine the appropriate course of action based on that analysis.

The functionality of the fourth stage of the tool, as described in section 4.1 states that the tool generates a template for a project plan. This project plan contains information about the starting situation of the network integration project and describes both companies' IT networks. It also contains the integration issues that have been selected, what strategy for integration has been selected and on which criteria this has been done. The name "project plan" might suggest that an entire project plan is generated, however this is not the case. The template contains several sections and paragraphs that the user has to fill in manually after it has been generated. This is seen as a limitation of the design and could be the source of

future research. This limitation was also brought up by expert 6, who says: "*The functionality of your tool indicates that it generates a project plan. I would be careful to call it a project plan. This document would contain a high level activities plan. It should describe the course of action for an integration issue. In addition, it could show the most important activities that should be done in the integration itself. You could call it a roadmap instead of a project plan.*"

There can be differences between a model and reality. In reality, not only hard evidence is used to make a decision. This is explained by expert 3, who mentions: "*This tool helps companies to look at these challenges in an unbiased way, free from emotions. For example, in practice the choice for a certain vendor is not always made based on the question if the vendor can supply the best solution for the best price. Quite often, the relation between the decision maker and the account manager of a vendor is leading in the decision.*" This suggests that by using a tool such as this one, companies could improve the decision making by making less biased decisions.

4.4. Conclusion

This chapter was aimed at achieving three goals. The first goal was to present the design of the Network Integration Support Tool (NIST). The second goal was to verify and refine this design, with the help of experts in the field. The final goal of this chapter was to answer the fourth research question.

To achieve these goals, several activities were performed. The functional design of the NIST has been created based on the functional requirement as found in chapter three. The contextual requirements found in literature and interviews provided the necessary input to design the decision making core of the NIST. This resulted in a set of 20 decision trees that provide assistance to the user of the tool in making decisions about various network integration issues.

The next activity was aimed at verifying the validity of these designs in a practical setting. Therefore, several interviews with network integration experts have been conducted. These interviews focused on the validation of the decision trees. The experts provided feedback on the designs of the decision trees, which facilitated a refinement of the designs and resulted in a more accurate modeling of the decision making process of network integration in reality. The interviews also provided additional considerations that are not directly applicable to the design of the NIST, but are relevant to the research and the applicability of the NIST in practice.

The fourth research questions states: "*What support tool can be designed for the preparation of IT network integration in M&A?*"

The answer to this question has been presented in this chapter with the description of the functional and contextual design. The functional design describes the various functions of the NIST, which assist the user in the different stages of the preparation process. The NIST is powered by a decision making core, which consists of several decision trees. These decision trees contain the various contextual requirements that allow the tool to be used in the appropriate context: the preparation of network integration in mergers and acquisitions.

5. Conclusions & recommendations

The situation of two companies in a merger presents unique challenges to network integration, because both companies have an existing IT network. These networks might not be compatible and would need to be changed to be able to support the combined business process after the merger has taken place. Research on mergers and acquisitions has been mainly focused on organizational and cultural aspects and many mergers seem to fail to achieve their expected goals. Moreover, no systematic research has been performed into the role of IT networks in M&A. As modern companies seem to be dependent on their IT assets, failure to integrate those assets can lead to M&A failure. The literature suggests that proper preparation of IT integration could decrease the chance of M&A failure. Therefore, the focus of this research has been to determine how to support the preparation process of IT network integration in a merger.

The main research question in this thesis was:

How can companies prepare and manage the integration of IT networks in M&A to enable the combined business process and achieve the expected M&A goals?

Supported by four sub questions:

1) *What is the current scientific knowledge about mergers and acquisitions, IT networks and network integration, and the relation between them?*
2) *Can the concept of decision support systems be used to design a tool that can be used to support the preparation of the integration of IT networks in M&A?*
3) *What are the requirements for the design of a support tool for the preparation of IT network integration in M&A?*
4) *What support tool can be designed for the preparation of IT network integration in M&A?*

By using the design cycle as described by Verschuren & Hartog (2005), a design for a support tool has been created. This tool could help companies with the preparation of network integration when they decide to merge into a single company.

5.1. Conclusions

Mergers and acquisitions are processes in which two companies are integrated into a single company. The integration into one company involves cultural and organizational integration, as well as IT integration. An under investigated part of IT integration is the IT network integration. Generally, the goal of mergers and acquisitions is the creation of synergies. Common synergies are cost-reductions and economies of scale.

The relation between M&A and network integration seems to be twofold. The first reason for merging companies to integrate their networks is to enable the combined business process. If the networks of two merging companies are not integrated, the employees of that company are severely hindered in collaborating with each other. The second reason for network integration in M&A, is that synergies can be achieved in the network itself. Reductions in operational cost can be achieved by harmonizing the components of an IT network. This could lead to lower costs of managing multiple types and brands of network components, multiple maintenance agreements and a reduction of the different skills needed for support staff. Economies of scale could be achieved by improving the utilization of existing network resources. In other words, using the network resources of either company to support the merged firm.

The scientific literature on IT networks and their integration is limited. Professional literature (Gelman, 2003) served as the foundation for a four stage preparation process for IT network integration in M&A. The process of network integration in M&A confronts companies with two unique networks, with their respective configurations. Conflicts between the components of these networks are defined as integration issues. Common IT network integration issues are differences in vendors, technologies, service contracts and service strategies (Gelman, 2003; Groth and Skandier, 2005). To solve these issues, four different integration strategies have been found that can be applied to the different integration issues. These integration strategies have been defined as: total integration, partial integration, no integration and new system (Giacomazzi et al., 1997; Wirz and Lusti, 2004). The strategies set the extent to which the components of the networks are harmonized or integrated. Selecting different integration strategies for integration issues is a decision making process. In this process several decision criteria need to be evaluated. The most important decision criteria for network integration in M&A are: the dominant party, network related policies, required network functionality and cost (migrating and ownership cost).

For the decision making process in IT network integration a support tool has been designed, based on the concept of decision support systems. The process model for the decision support system is based on four stages, each consisting of specific functions that assist the user of the tool in the preparation process. Decision support systems contain decision support tools to facilitate the decision making process (Shim et al., 2002). Literature on decision support tools provided a model for the decision making core of the support tool. The decision making core is based on the concept of a decision tree (Giacomazzi et al., 1997). This method allows analyzing the situation based on several decision criteria and facilitates the selection of an integration strategy for integration issues.

To design a support tool for the preparation of IT network integration in M&A, the requirements for this design have been specified. The requirements have been divided into functional, contextual and user requirements, based on the knowledge from literature and interviews with network experts (see paragraph 3.3.1 and 3.3.2).

The functional requirements for the design of the tool coincide with the four stages of the preparation process. The first functional requirement of the tool is that it should assist the user in gathering the relevant information for the network integration process. The second requirement is that the tool should allow the user to select the integration issues that are relevant to the merger at hand. The third requirement of the tool is that it should help network experts selecting an integration strategy for common problems of network integration in M&A, through the use of a decision tree. The last requirement of the tool is that it should generate a template project plan that can be used to prepare the integration of IT networks.

Besides the functional requirements, the contextual requirements are also needed for the design. The contextual requirements are used to construct the decision trees that provide the means to select integration strategies for integration issues. The contextual requirements are broken down into three areas, namely integration issues, decision criteria and integration strategies. It was discovered that different decision criteria apply to different integration issues. In other words, not all decision criteria apply to all integration issues.

The user requirements define the intended user of the tool. In this thesis, the user of the support tool is defined as a person that is specifically tasked with the integration of the IT networks of both companies. This could be someone from the acquiring or acquired company, but also an external consultant.

The steps that have been found in the literature review and interviews were used to create the design of the process model that is part of the support tool. The support tool follows four stages:

1. Identify the current IT network configurations of the acquiring and acquired company.
2. Identify the IT network components that need to be integrated in the merger.
3. Determine the desired integration strategy for each IT network component.
4. Create a project plan that can be used to support and manage the integration process.

These four stages assist network experts to perform a set of activities to prepare for network integration. In the first stage, all relevant network configuration information is gathered. This ranges from technical information such as numbers and types of network equipment and services, to non-technical information such as company size, dominant party and network related policies. This information is used in later stages to aid the user in the decision making process. In the second stage, the user of the tool can select the relevant components of the network that need to be integrated in the specific merger. The third stage of the tool contains the decision making core. For each integration issue that was selected in stage two, the user is presented a decision tree that helps him determine the appropriate integration strategy. For this purpose, the decision tree method as proposed by Giacomazzi et al. (1997) has been used. Each decision tree contains several decision criteria that need to be evaluated for a given integration issue, which consequently lead to the selection of an integration strategy. In the final stage, the tool generates a template for a project plan that can be used to manage the integration of two IT networks of merging companies. In this project plan, information about the selected integration issues, the selected integration strategies and how these strategies were selected is provided.

In conclusion, merging companies can prepare for the integration of their networks by following several steps. It begins with thoroughly analyzing the starting configuration of the networks. From this analysis, it will become clear which parts of those networks are in conflict and need to be combined into an integrated whole. The next step is to determine the integration strategy for each of those conflicts. Determining the integration strategy is supported by a model in the form of decision trees that provide insight in the decision making process. The final step is the creation of an integration plan, which can be used to execute the network integration in M&A. The network expert can be assisted in these tasks, by using the designed tool.

5.2. Discussion

In this thesis, a tool has been designed based on several concepts and ideas from the literature. The applied concepts and theories will be discussed for their applicability in this section. With the knowledge that was gained during the research project, the used theories will be reflected.

Process model and support tool design

The process model for the tool has been derived from the process of designing new - and upgrading existing - enterprise networks by Gelman (2003). This knowledge has been used to create a four stage preparation process for the integration of two networks in M&A and acts as a framework for the tool. The experts that were consulted during the interviews agreed that this process is applicable to the preparation of network integration in M&A. Therefore, based on the findings in this research, it seems that Gelman's process is also applicable for the preparation process of the integration of networks in M&A.

Our designed support tool contains four stages that define the preparation process of network integration in M&A. However, a general design of a decision support system contains seven stages (Shim et al., 2002). Some of the seven stages could be merged, resulting in our four staged process which is in accordance with the proposed process model based on Gelman (2003). Shim's stages of *alternative generation, model development, alternative analysis* and *choice* have been merged into one stage. In this stage, several decision trees (developed model) contain integration strategies (alternatives), decision criteria (alternative analysis) and choice.

Design cycle

To approach the design, a design process from scientific literature was used. The design cycle methodology from Verschuren & Hartog (2005), provided a suitable approach for the design of the network integration support tool. The structured steps of this design process provided grip on the design of a tool, of which the requirements were not fully clear beforehand. Each subsequent step of the design process provided more clarity about the final tool, but also resulted in feedback loops to previous stages of the process. This led to a reconsideration of parts of the design as the project progressed. Gradually, the requirements for components of the design became clear, further shaping the design. The design that is provided in this thesis can help future discussions about the requirements for the support tool become less abstract. Due to time limitations, the last two stages of the design cycle were not executed. Therefore, the implementation and evaluation phase are still untested for this project, but it is likely that the last two steps of this design cycle are also applicable to complete the tool.

Integration strategies

Four integration strategies have been proposed to provide possible solutions to integration issues in M&A. These strategies have been validated by the interviewees in this research. According to the experts, the integration strategies cover the different possibilities to solve integration issues. The strategies have been derived from integration strategies for information systems in M&A (Giacomazzi et al., 1997) and from information technology strategies in M&A (Wirz and Lusti, 2004). The integration strategies that both authors present partially overlap and have been combined into a set of four unique integration strategies for network integration in M&A. Therefore, it could be concluded that the integration strategies for information systems in M&A and the IT strategies in M&A can be applied to network integration in M&A.

Decision trees

The decision making core of the tool has been based on decision trees. Using decision trees as a method for decision making in network integration has been validated by network experts. The experts confirmed the applicability of this method for the purpose of decision making in network integration. The concept of decision trees has been based on Giacomazzi et al. (1997). The authors propose a model to make decisions about the integration strategies of information systems in mergers and acquisitions at a strategic level. In this decision tree, various decision criteria are evaluated in the branches of the tree which lead to different integration strategies. For the decision making on integration strategies in IT network integration, no such model existed. The applicability of Giacomazzi's model to this research originates from the fact that Giacomazzi uses this model to determine the integration approach at a strategic level, similar to this research. Therefore, this method has also been used for the core of the tool. However, the model of Giacomazzi et al. (1997) evaluates only six different decision criteria, while the number of different decision criteria for network integration in M&A can be much higher (up to 14 found in this research, see paragraph 3.3.2). Even though not all decision criteria are applicable to all integration issues, an increasing number of decision criteria in one tree results in large and complex structures. Moreover, the designed decision trees present a certain order of importance between the decision criteria within a tree. This order has been verified by the experts in the interviews to be applicable in practice. However, the importance of specific decision criteria could differ between mergers. This would imply a different order of the questions in the decision trees and therefore result in different decision trees for different mergers. Besides the number of decision criteria and their respective order, the tool provides a *general* set of decision trees for the purpose of selecting an integration strategy for integration issues. In other words, the tool is not applicable to *all* possible merger situations, but can provide a good first impression of the preparation for IT network integration in M&A. To our knowledge, this tool presents a notable contribution to the current knowledge of IT network integration.

The decision trees which were created to provide insight into the decision making process are rather rigid. Moreover, this method is less useful for evaluating multiple decision criteria simultaneously. However, the sequence and importance of decision criteria could vary per merger. This could result in a requirement to assign a weight factor to decision criteria, adding flexibility to the evaluation. This could also allow for simultaneous evaluation of criteria, through multi criteria analysis. On the other hand, multiple criteria analysis could be less useful for evaluating decision criteria that exclude other decision criteria. For example, if legislation dictates a certain choice that the network integration must comply with, this removes the need to evaluate other decision criteria. However, future research could provide a definitive answer to this question.

Network integration and M&A

This research was focused on the integration of network assets, while trying to achieve synergies through this integration. Based on the results of this research, it can be concluded that companies integrating their networks can achieve those synergies. Schweiger and Very (2003) demonstrate a link between value creation and the integration process itself. There seems to be a variety of ways in which people and assets can be combined in a merger to create value. Therefore, this research confirms this link. The experts in this research also indicated that one of the parties in network integration is the primary decision maker. This is in accordance to previous findings in literature that in mergers and acquisitions, often one of the parties is dominating the other (Mehta and Hirschheim, 2004).

We now know that it is difficult to design a tool that provides a definitive answer about the detailed steps that have to be taken to integrate networks in a merger, because every merger provides unique properties and requirements to the network integration process. However, we can provide a general strategy that indicates the direction and degree of integration, which can be elaborated towards a specific merger. The designed tool provides the aforementioned direction, however it does not provide a detailed plan for the actual network integration process. The network expert should create this plan for the specific merger.

5.3. Recommendations for network integration in M&A

Based on the research findings several recommendations for network integration in mergers and acquisitions can be made.

This research was aimed at designing a tool that assists with the preparation of IT network integration in M&A. Companies could prepare for IT network integration in M&A by having and using this tool. The tool assists companies in the preparation for IT network integration by providing help in the decision making process of determining the integration strategy for several IT network integration problems. The person using the tool could be a person who is specifically appointed with the task of integrating the IT networks of the companies in the merger. This could be someone from the acquiring or acquired company, but also a consultant from outside the merging companies. An advantage of this tool is that a manager can use the designed tool to quickly obtain the information that is needed in the preparation process of network integration in M&A. Subsequently the tool can assist him in the decision making process to determine the appropriate integration strategy for each component of the IT network. Moreover, the generated template for the project plan can be used as a document to support the discussion about network integration choices with the stakeholders in the merger. However, the generated project plan does not provide an *entire project* plan, including a *detailed* project planning, budget overview and risk analysis. Instead, it provides templates for these subjects, which can be used to create a tailor made project plan for the network integration project in the merger. This could save preparation time, which could result in faster integration of the IT networks. In turn, it could reduce the chance of failure of the merger, because the IT network is not a fail-factor anymore. Another advantage of the tool is that it can help making integration choices in an unbiased way and select an optimal solution, regardless of personal relations with equipment and service vendors.

One of the first things that was discovered is that even though the IT network is an important asset of a company, IT network integration is an often overlooked area in mergers and acquisitions. As research indicates, most mergers tend to forget to evaluate the integration of their IT systems before the deal has been closed (Toet, 2008). This finding was confirmed by the experts that have participated in this research. Therefore, it is recommended that the preparation of integration of IT and in particular IT networks is started early, preferably before the deal has been closed. This is confirmed by some of the experts who claim that somewhere in the pre-merger due diligence phase, there should be some sort of pre-decision for IT network integration. This could provide the necessary time for preparation.

Another aspect that is important for IT network integration in a merger is the integration of the teams of people who support them. These people are important in the preparation process, because they can provide the integration manager with the required information. Obviously, a merger presents a stressful situation to the people in the teams, because they could potentially lose their job. Therefore, integrating the IT departments in an M&A might be a bigger challenge than the network integration itself. The additional findings of this research suggest that it is crucial to set up communication between the IT departments of the merging companies at an early stage. This will facilitate the process of information gathering that is needed for this tool and for the integration of IT networks in M&A.

5.4. Limitations

The research as presented in this thesis is bound with several limitations.

It is important to understand that the designed tool is a prototype. It is a mock-up of the final product, designed to make discussions about the requirements of the tool less abstract (Verschuren and Hartog, 2005). Although every effort has been invested to be as complete as possible, there could still be components missing. The current tool generates a template for a project plan that contains the selected integration strategy for each integration issue in a specific merger. However, this plan does not contain a detailed planning of activities, a risk analysis and a budget overview. Instead, the generated project plan contains general templates for these subjects that support the network expert to perform the planning, budgeting and risk analysis activities. The results of this study provide the basis on which the implementation (in software) and evaluation of the design can be performed. Any missing properties that surface in the implementation and evaluation phase can be supplemented by additional research.

The network integration support tool has been designed to assist network experts in the preparation of network integration in M&A. The tool should provide a solution to general cases of network integration in M&A. Moreover, it could also provide a solution for more specific cases, by providing guidance to integration decisions at a generic level which can be tailored towards these specific cases. It is tempting to claim that this tool works for all network integrations in all mergers and acquisitions. However, based on the findings in this research, it is essential to understand that each merger presents unique properties for the integration of the IT networks. Even though this research focused on the most important factors in network integration decision making, a merger could contain exceptions that would have an impact on the decision making. In this case, the tool can provide guidance to the integration decision making process.

The list of integration issues that can be encountered in a merger provides an indication of common integration problems. This list could be expanded with more specific issues to provide a more complete and accurate overview for the user of the tool to choose from. The same applies to the list of possible decision criteria. The network experts in this research indicated that the most important decision criteria have been found, but also indicated that there could be more decision criteria. The most important decision criteria should be evaluated, because additional criteria would be less common and would apply to very specific cases of IT network integration in M&A. Additional integration issues and decision criteria found in future studies could supplement the designed tool.

As mentioned in the discussion, the decision tree method could have its limitations with regard to the application in the tool. Based on the responses from the interviewees, the decision tree is a viable method to evaluate a certain number of decision criteria. However, as the number of decision criteria could expand in future designs of the tool, the branches of the trees expand exponentially. In addition,

the order and relevance of the different decision criteria could vary between mergers, leading to situational dependent decision trees. In other words, a decision tree for each integration issue for each merger. This is consistent with the researcher's own opinion, when looking back at the research with the current knowledge in mind. If a tool that should be applicable to *all* situations of network integration in M&A had to be designed, perhaps a different method of decision making support could be used.

Half of the interviews were performed with network experts from Accenture. This could mean that the results of this research are biased towards the vision of Accenture, not explicitly the general view. In an attempt to remedy this possible bias in the results, the other half of the interviews was conducted with experts from outside Accenture. The feedback from the experts within and outside Accenture showed great similarities, implying that the view presented in this research matches the general view. However, the possible bias of the results must be kept in mind when interpreting the research findings. Moreover, the total number of experts that was interviewed in comparison to the entire population of network experts is rather small. All interviewees in this research are employees of companies in The Netherlands. The entire population of network experts obviously exceeds country borders. However, this study is a pilot study providing a preliminary overview of the problems and solutions involved in IT network integration in M&A.

5.5. Recommendations for future research

Based on the findings in this research, possibilities for future research can be suggested.

The scope of this research was limited to IT networks. IT networks were defined as the physical infrastructure of the IT infrastructure and included the Local Area Network, Wide Area Network and Telephony network of companies. The scope of this research was defined in cooperation with Accenture. In a future research the scope could be expanded to include other parts of the IT infrastructure, such as network architecture integration, policy and standards integration and network management process integration (Ward and Peppard, 2002b). Another area of research could be the integration of network enabled services in mergers and acquisitions. These are services that operate on top of the IT network such as email, web portals, and other collaboration tools which need to be integrated as well in a merger.

This research used the design cycle from Verschuren & Hartog (2005) to design the tool. The first four stages of this design cycle were executed to provide a prototype of the design of the tool. However, the last two stages were not. Future research could focus on the last two stages of this design cycle, which involves the implementation of the design and subsequently evaluating it in practice. Implementing the tool could be done in e.g. a web-based environment. Moreover, the components that have been used in the design could be further evaluated within a larger population of network experts. These components include the common integration issues, the decision criteria and the decision tree method. In addition, the integration strategies proposed in this thesis could be further evaluated to find out if these strategies really cover all the possibilities for network integration in M&A.

This research is based on a relatively small sample of network experts. For a more supported result, a larger sample size should be used. This can include among others international IT network experts, companies of varying sizes and different types of companies.

Finally, it might be possible that a different decision making core could provide different decision making support in the context of network integration in M&A. This means that instead of using a decision tree, a different decision making method could be used. Therefore, more research focusing on different decision making tools for the core of this tool could be useful. However, this should be done after the method presented in this thesis has been implemented and evaluated. The functional design of the tool has been made in such a way that the decision making core can be replaced by another model. The first two stages provide the necessary input for the decision making process in stage three. Even if the decision making core would be replaced by another method; the rest of the tool could remain the same.

In any case, the literature on network integration in mergers and acquisitions seems to be limited. Therefore, more research in this area could be beneficial towards understanding the aspects that contribute to the success and failure of mergers and acquisitions.

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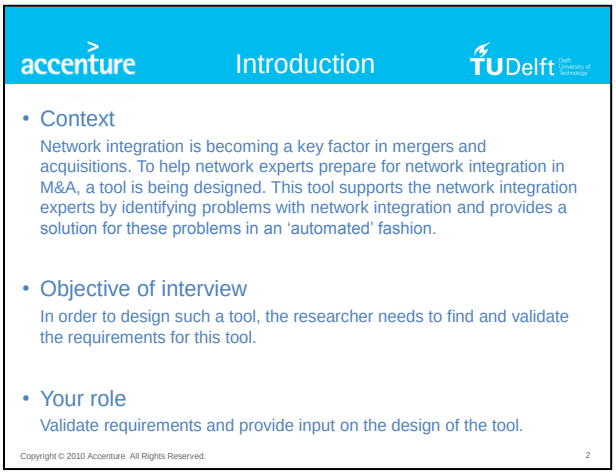
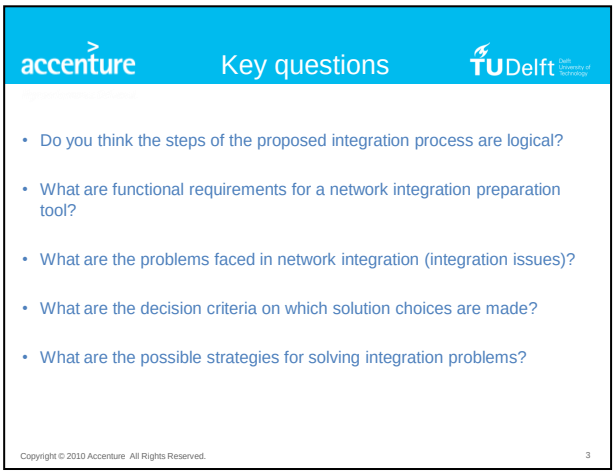
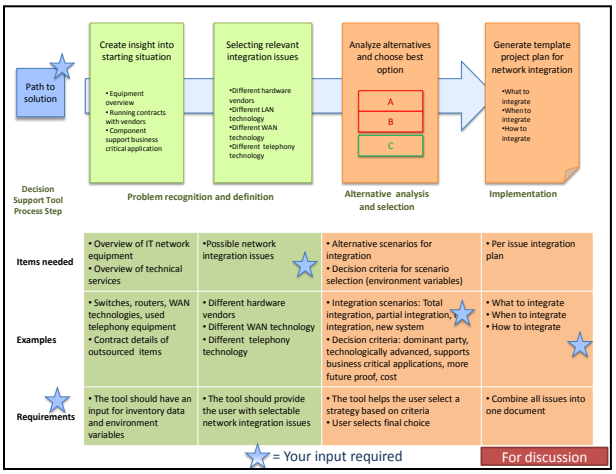
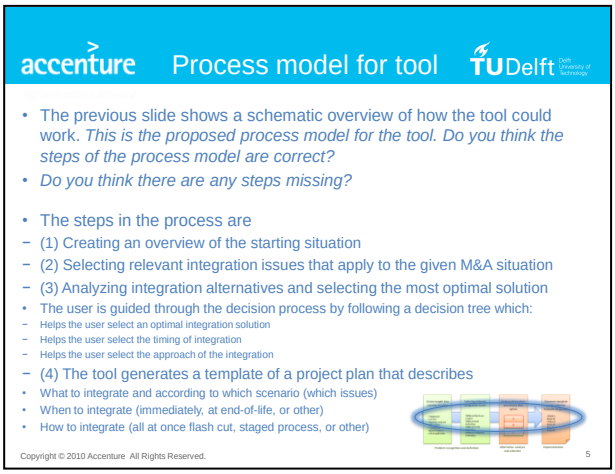
Appendix A: Interview slides of the first round of interviews

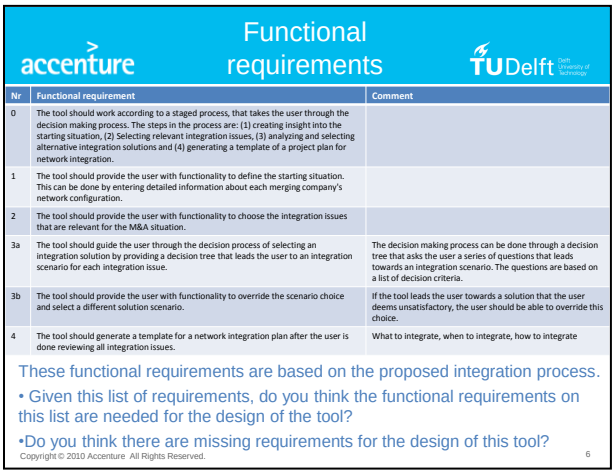
The following PowerPoint presentation has been used to guide the first round of interviews.











Integration issues

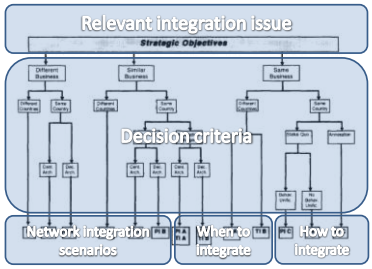
- Given this list of possible network integration issues, do you recognize these problems in practice and can you provide examples of these integration problems?

LAN	WAN	Telephony
•Different LAN technologies: Wired Ethernet versus Wireless Ethernet	•Different WAN technology: Frame Relay, ATM, Ethernet, MPLS	•Different telephony technology: TDM, PBX, VOIP
•Different LAN equipment vendors	•Different WAN equipment vendors	•Different equipment vendors
•Different wireless technology: (802.11a/b/g/n)	•Different WAN providers	•Different telephony approach: Traditional, Unified Communication
•Different service strategy: Outsourced versus in-house maintenance	•Different remote access services: Dial-in, VPN	•Different service strategy: Outsourced versus in-house
•Different and conflicting IP Plans	•Different service strategy: Outsourced versus in-house	
•Different Quality of Service for applications/services	•Different Quality of Service for applications/services	

- Do you think there are any important IT network integration issues missing in this list?

Decision tree

The tool uses a decision tree to guide the user towards a solution



Decision criteria

Possible integration scenarios

- Total integration
- Partial integration
- No integration
- New system

Use decision criteria in a decision tree to select integration scenario:

- Dominant M&A party decision maker
- Technical functionality
- Future proof
- Cost of migration
- Vendor customer support
- Innovative products

- Given these integration strategies, do you recognize them in practice?
- What other strategies could be used for network integration?
- Given these decision criteria, do you recognize them in practice?
- What other decision criteria are used to select different integration strategies?

Project execution

When to integrate?

- Immediately
- At end of life/current contract
- Other?

How to integrate?

- All at once
- Staged process
- Other?

- With respect to the planning (when) and the approach (how), do you think these options are applicable to IT network integration?

Appendix B: Expert responses for the first round of interviews

Table 11 presents a list of integration issues (based on literature and orientation interviews) and shows the responses of the experts to the given integration issue. Expert 4 and 6 did not provide feedback on each individual issue, but provided a general response to the list of issues.

Table 11: Overview of network integration issues and expert responses

Nr.	Integration issue
1	LAN: Different LAN technologies: Wired Ethernet versus Wireless Ethernet
(1) This can be an issue in an integration project. To choose between wired or wireless solutions, we look at the bandwidth requirements of the applications that will be going over the network. (2) This is a common technology and works according to standards. In network integration this is of less importance, because LAN technology is transparent and has little interconnection issues. (3) This is usually decided at each specific location. (5) These can exist next to each other without problems. The components are even complementary to each other. Even at our office, where every employee uses the wireless network, there is a wired equivalent available.	
2	LAN: Different LAN equipment vendors
(1) In many integration projects we run into this problem. Problems in this area are caused by vendor proprietary protocols, for instance in managing and controlling the network (2) This is somewhat of an issue. For large companies, there is only a small number of vendors. In these cases, interoperability issues are few. Only vendor proprietary protocols are an issue. (3) The LAN is usually a diverse field of installed equipment. For each office location of a company, a different equipment vendor can be used. For example, an office location is using Cisco switches and routers, while another locations using HP equipment. (5) This is important for network integration.	
3	LAN: Different wireless technology: (802.11a/b/g/n)
(1) As said before, to choose between wireless technology, we look at the bandwidth requirements of the applications that will be going over the network. An extra problem is encountered when installing wireless networks of more than 50-60 access points. To configure these access points, wireless lan controllers are needed. These wireless lan controllers allow the network manager to configure all access points in one go. However, these wireless lan controllers use vendor proprietary protocols and are not interoperable between vendors. (2) This is only an issue in small and medium business. The differences in technology are caused by the available bandwidth of each technology. All vendors support these technologies. The final choice about what to migrate is made based on application requirements and cost. (3) The integration of LAN equipment and technologies is often done on a per-site basis. (5) This is important for network integration.	
4	LAN: Different service strategy: Outsourced versus in-house
(1) This is important. It depends on who is doing the network maintenance and management. At our company it is common to do this in-house. When we merge with another company that outsourced these activities, we have to look at the future approach. Commonly the approach of the buyer will be selected, but the other way around is also possible. (2) This is very important. The company policy dictates certain choices for network configuration. For instance, the policy could state that all network maintenance should be outsourced, because it is not considered core business. For this issue it is important to check the company policy and strategy. (3) This is very important, but also network management. Who is doing the maintenance and management of the network? Or the maintenance outsourced and the management in sourced? (5) This is one of the most important aspects of your LAN. Conflicts between companies in this area require a lot of attention to solve.	
5	LAN: Different and conflicting IP Plans
(1) This is a problem of technical integration. IP number plans are dependent on the available address space. For example, IPv4 addresses are very scarce and requests for extra IPv4 addresses are commonly declined. If necessary, IPv6 can be adopted but this has a lot of technical consequences. (2) This is a technical problem which is dealt with as soon as the deal has been closed. It does not pose a real technical problem as it can easily be solved with gateways. (3) This is a matter of technical integration. For instance, ten different office locations could be using the same IP address pools. This can be easily solved by building gateways between those networks. In the wide area network there are always unique address pools to avoid communication problems. This could be part of a technical integration checklist that the tool could provide. (5) This is important for the technical integration.	
6	LAN: Different Quality of Service for applications/services
(1) This is a problem of technical integration. Quality of service is usually applied for Voice over IP implementations over the network. Voice over IP is commonly transmitted through a voice VLAN that has a higher priority on the network, so the voice transmissions don't suffer directly from mild network congestion.	

(3) This issue has a link to IP based telephony. QoS is applied to ensure issue-free telephone conversations. This is part of the technical integration. (5) This is also important to look at during technical integration.
7 WAN: Different WAN technology: Frame Relay, ATM, Ethernet, MPLS
(1) At some point, the data going over one local area network must be transmitted to another LAN. There is a difference between companies when it comes to wide area networks. Commercial providers offer transparent WAN connections to companies and are generally more expensive, but can be used without worrying too much about technical details. Educational institutions, such as ours, are using more technically oriented solutions and have only one WAN provider to choose from, namely Surfnet. In this case one has to think about how the data on your LAN needs to be offered to the Surfnet WAN. (2) The technology choice for a certain WAN implementation is not relevant for the integration manager. All implementations support IP and the choice for a new network or one of the current networks is technology independent. The choice for a certain implementation of WAN technology is only dependent on the guarantees the provider can give on the connection (service level agreements) and cost. (3) The most up-to-date technology is MPLS (global) and Ethernet (local). Frame relay and ATM are only being employed in the last few kilometers as technology to gain access to a global MPLS network. Ethernet is being used in domestic networks; building a high-speed network in a country based on Ethernet. Ethernet is traditionally used for LANs, but has become an official WAN technology and has its own specification in the IEEE802 standard. The reason to employ Ethernet in WANs is that the switching equipment for Ethernet is much cheaper than ATM and frame relay equipment. Going from most expensive to cheapest: ATM, Frame Relay, MPLS, Ethernet, IPSec VPN over DSL. (5) This is of lesser importance, because almost no company manages their own WAN. WAN connections are supplied by external vendors such as KPN, BT or Orange. Of this technology list, Frame Relay and ATM are of lesser relevance and a missing technology is dark fiber. Dark fiber is a "dead" fiber, without any service. The customer can use this fiber to create his own WAN connection. Dark fiber can be considered a layer 1 connection, ATM and Frame Relay are layer 2 connections and MPLS is a layer 3 connection. Choosing between technologies depends on the application that it should support. For example, two datacenters are connected through the Ethernet and automatic teller machines at bank use frame relay.
8 WAN: Different WAN equipment vendors
(1) Same as previous (3) WAN equipment is not very diverse. WAN equipment is usually dealt with on a global level and is standard technology. Customer side WAN equipment is usually leased from the provider and is part of the contract. Therefore the different WAN equipment is not really a problem. (5) As said before, there are very few companies who own their own WAN equipment. Obviously, telecom provider have them. Exceptions to this rule are contracts with WAN providers which specifically state that the WAN routers (edge of WAN) are owned and managed by the customer. (6) This is not so important because there are very few companies who own their WAN equipment. WAN equipment is usually part of a WAN contract (leased).
9 WAN: Different WAN providers
(1) Same as previous (2) Again, for large companies there is a small number of WAN providers. The selection for a WAN provider is made based on cost and vendor support. (3) This is an issue, because of different contracts with different providers. When integrating two WAN provider contracts in an M&A, we run into problems that one contract might expire earlier than the other. The choice of migrating to a single WAN provider depends on the remaining contract duration and penalties that might be included in the contract. (5) For WAN this is very important. Especially different contracts with different providers. This leads to the question of which one to terminate. (6) Integrating the WAN is the most important part of network integration. If this fails, the internal business communication fails. For instance, if the WAN at our company fails, we are unable to book meeting rooms through our portal, even though we are in our own building! Company LANs can be connected to each other through a WAN without changing anything to the LANs. The integrated network will be able to transport data from anywhere to anywhere. However, to achieve cost-reductions, it is important to start harmonizing your networks.
10 WAN: Different remote access services: Dial-in, IPSec, SSL VPN
(1) Same as previous. (2) This is a problem that is dealt with during the technical network integration in a merger. Current remote access services usually work over the internet via IPSec or SSL VPN. Whatever the company decides to use is based on cost. (3) This is of importance to technical integration. VPN is used over an access technology. For instance the internet. This is an open public network which is made secure by applying encryption to the data going over the VPN.
11 WAN: Different service strategy: Outsourced versus in-house
(1) Same as previous. (2) Most companies have their WAN outsourced. Only in a few specific cases, a company may decide to do their WAN implementation in-house. (3) This is very important! Choosing either often depends on the policy of the dominant party. (5) This is important to network integration. (6) This is very important. Conflicts in contracts are often expensive to solve.
12 WAN: Different Quality of Service for applications/services

(1) Same as previous (2) Quality of service is a matter of technical integration. Differences between quality of service settings in two companies can easily be solved by using qos-translation at the border between two networks. (3) This issue has a link to IP based telephony. QoS is applied to ensure issue-free telephone conversations. Part of the technical integration.
13 TEL: Different telephony technology: TDM, PBX, VOIP
(1) In the world of telephony, many problems are caused by problems with vendor proprietary protocols. Traditional telephony has been around for many years and interoperability issues are not so common. In the VOIP and IPTEL domain however, vendor proprietary problems arise again, just as they did with the first traditional telephony systems. (2) A PBX is either TDM oriented or based on VOIP. Both are exchanges, but the difference between them is that traditional PBX systems are hardware based systems and IP based telephony can also be a software package running on a server in the network. Each vendor provides features to connect to traditional PBX systems and to other vendor's systems, but at a cost. (3) The telephony systems within one company can be very diverse. You can find many different devices and different vendors. Integrating telephony is one of the big challenges of any integration, because of the great diversity in vendors and devices. (4) I was wondering why you chose telephony, but not email or unified communication? Telephony used to be based on a separate voice network, but this is moving into the software domain. (5) There is a difference between VOIP and IP telephony. VOIP is an unmanaged service without any service level agreements. IP telephony is a managed service which does have service level agreements. Home users often have VOIP. Businesses on the other hand have IP telephony services, that are guaranteed by the provider. (6) Important to network integration. Problems in telephony are very visible to the end user. If this does not work, the user is directly impacted.
14 TEL: Different equipment vendors
(1) When integrating two companies with different (fixed) telephony equipment vendors, there will be a large portion of the integration budget being spent on desktop handsets. Placing calls between handsets of different vendors is possible, if both use SIP. However, extended functionality such as presence information and other enhancing features will not work between different vendor handsets. (2) There are many interoperability issues between telephony equipment of different vendors. For traditional telephony systems, these interoperability issues have been solved over the past years. However, with the adoption of IP-based telephony and the lack of a standard, it seems that a new interoperability issues occur. This is caused by special features that vendors implement in their equipment, such as presence information. Each vendor implements this in a different way in their proprietary protocols and these cause interoperability issues. (3) Same as previous. (4) We see a lot of interoperability issues between different telephony vendors. Especially with deep integration into applications, this causes problems. For example, when using an IP telephony system from Microsoft, you can get presence information of a certain person by typing his name in word and putting your mouse cursor over it. Another brand does not support this feature. (5) This is an important aspect of network integration. There are many interoperability issues between different telephony equipment vendors. Features such as presence information is not compatible between vendors.
15 TEL: Different telephony approach: Traditional, Voice over IP (VOIP), IP Telephony, Unified Communication
(1) Differences in telephony approach between merging companies usually result in costly migration projects. As said before, buying new handsets for one of the merging entities is costly. (2) Going from old to new: Traditional TDM, VOIP, unified communication. (3) Same as previous. (4) This is a relevant issue. Traditional telephony is the oldest form. VOIP should be called VOIP telephony. Then there is IP telephony. The most advanced and modern form of telephony is unified communication. (5) Important to note (from old to new): Traditional telephony, VOIP, IP Telephony and Unified Communication. Unified communication is the integration of voice, mail, video and other ways of communication. Integrating traditional telephony networks into the data network can lower costs. (6) Telephony is moving towards being a service on the data network (LAN/WAN). There still are currently separate telephony networks in place within companies, but in the future the trend will be to move towards IP based telephony services. If you look at the integration of networks, integration of telephony networks is an issue. In the future however, these networks will no longer be separated.
16 TEL: Different service strategy: Outsourced versus in-house
(2) Fixed telephony is usually serviced by the same team that deals with network management. If LAN and WAN management is outsourced, this is usually also outsourced. Mobile telephony is always outsourced. One important thing to note is that before (IP) telephony systems are integrated, LAN and WAN should be already integrated. (3) Same as previous. (4) Be careful about weighing telephony too heavily in network integration. Traditional telephony is no longer a standalone technology as it has been heavily integrated into applications, making it a service on the network. (5) Very important to network integration. (6) Very important for integration, because much cost-reduction can be achieved here.

The experts provided a number of integration issues that were – according to them – missing in this list. Table 12 shows the individual responses from the experts to the question if they thought there were any missing integration issues.

Table 12: Additional integration issues provided by the experts

Ex.	Integration issue
1	A) Network management tooling. Managing networks is done with software tools that give a user insight in network load, congestion, status and other important network control information. Vendor proprietary network management tool are often incompatible. Standalone (e.g. open source) network management tools are expensive. B) Different and (possibly) conflicting number plans for telephony. Is the available number space sufficient for the migration? P C) The people in the network teams. Two networks have two teams of network people supporting them. How do you integrate those? This can be quite the challenge. D) Access security. Who has access to the network and who doesn't? E) Legacy systems in either LAN, WAN or telephony cause much integration problems. They are usually replaced first.
2	A) I am missing the network management tools that are used to control the network. These are important tools that need to be integrated, because using different tools to manage different areas of the network is impractical. B) Different security policies. C) Datacenter integration. This can be data storage, data processing and application hosting datacenters. The merging companies could have conflicting implementations which need to be harmonized.
3	A) Part of your IT infrastructure are also the datacenters. Consolidation of datacenters is an important part of IT infrastructure integration. B) Application integration such as ERP, E-mail and others.
4	A) Data center integration. These are independent centers usually outside the company site or hosted at a specific company site. B) Network management tooling, that monitors the network and provides insight into its performance. C) Identity and access management, which is the management of users on the network. D) Security. However, some experts group these things (B, C, D) in one category named network management tools. (FCAPS)
5	A) I am missing the mobile telephony contracts. B) LAN and WAN management tooling (software). These are vendor dependent software applications. These applications are used to create reports about the network load, uptime, availability, etc. Even though applications are out of scope, you should consider this in your tool. C) Different internet providers. By terminating one contract and enlarge an existing contract, cost-benefits can be achieved.
6	A) You are missing mobile telephony contracts. If you add this to your issues list, you are complete on the area of telephony. Integrating mobile telephony between companies is one of the simplest things to do, and can lead to great cost reductions.

The experts provided feedback on the four different integration strategies. Table 13 shows the individual responses to the integration strategies for integration issues.

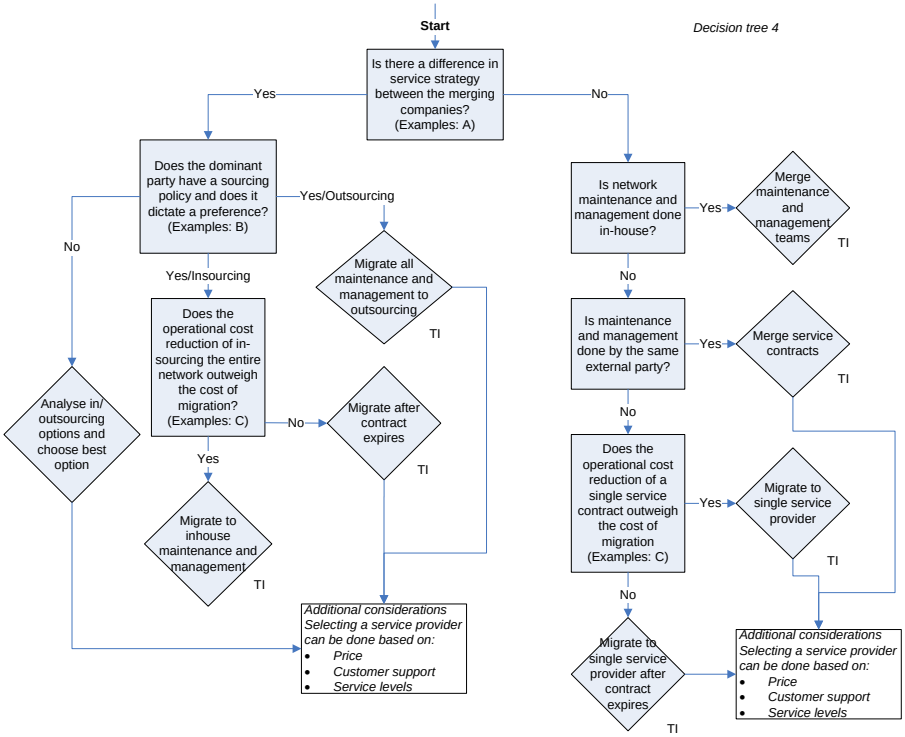
Table 13: Expert responses to integration strategies

Integration scenario - Responses
Total integration -
(1) There are a couple of options for integration. Either you migrate A to B or vice versa (…) (2) This integration scenario applies to the situation in which a single-vendor approach is desired from a cost-reduction standpoint. However, a dual vendor strategy could also be possible, for reasons of redundancy or supplier (in)dependency. If one company is using a dual vendor strategy for a certain network component, and the other is using a single-vendor approach, this poses a challenge for integration. (3) This is a possibility. For instance, from a maintenance and management point of view, a merged company could go for a single vendor strategy. (4) Good possibilities for integration. The decision about the direction of integration should be made per domain, or even better, per issue. Also, before any technical integration can be done, the strategic direction must be determined. (5) These integration scenarios cover the possibilities in network integration. This specifies the direction of integration, which is used later on in the technical integration. (6) You follow this scenario to obtain cost reductions on the long run. But first you just build a bridge between the networks to enable the business to function.
Partial integration -
(1) (…) Or you could leave both systems as they are and build a bridge between them (…) (2) If two parts of the network will remain in their current state, building a bridge between them to enable communication is a viable option. (3) A single-vendor strategy, but also a dual vendor strategy is possible. Dual vendor strategies are aimed at the reduction of risk. These risks can be e.g. vendor bankruptcy, or underperformance. The single or dual vendor strategy is often chosen per site. However, the trend I've seen in the last few years is that companies stop using dual-vendor strategies, because they believe that the cost-benefit from a single vendor outweighs the risk. Currently, I can think of only a few customers that have a dual vendor strategy. Suggestion: Partial integration in which you make decision for each site. (4) Same as previous (5) Same as previous (6) Building a bridge between two systems is always the case. This needs to be done first. Then it can be decided to leave the network in this state or go for a harmonization of other parts of the network.
No integration -
(2) For some parts of the network, it could indeed be decided not to integrate them. (3) Another option is not to integrate certain parts of the network and keep both previous networks in their current state. In principle, this is going for a dual-vendor strategy, however the reason is different. In practice I see many hybrid configurations, especially when comparing between sites. (4) Same as previous (5) Same as previous (6) It is an option to leave both networks in their current state. Suppose that two companies merge, both having over a 100 sites. There is network A and network B. Suppose that some of these sites have been newly installed. Then you could decide that you won't migrate these sites to a single-vendor (yet).
New system -
(1) Creating something entirely new is also an option in some cases. (2) A new system is sometimes a good option. For instance when integrating two telephony systems which are both outdated or have insufficient capacity to accommodate the merged network. Partial integration is also possible, for instance only WAN and LAN will be integrated and telephony will be left in the current situation. (4) Creating a new system is not an odd option at all. Jointly choosing a solution is often a good way to find an implementation that suits both parties. For the integration, they agree to one solution. For example, both companies have their own set of business applications. Both companies change to an integrated set of business applications through a SaaS solution. (Software as a service) (5) Creating a new system is a good option in some cases. (6) The previously mentioned scenarios are good possibilities for network integration. These scenarios should be selected per issue, because it can be beneficial to choose different scenarios for different integration issues. A new system is also a good option.

Appendix C: Decision trees for common integration issues in M&A

This appendix provides the remaining decision trees that were not discussed in chapter four.

LAN: service strategy in-house vs out-sourced maintenance and management



General considerations
The question that keeps returning in this decision tree is whether benefits can be gained by dealing with network management and maintenance by internal company staff or external personnel.

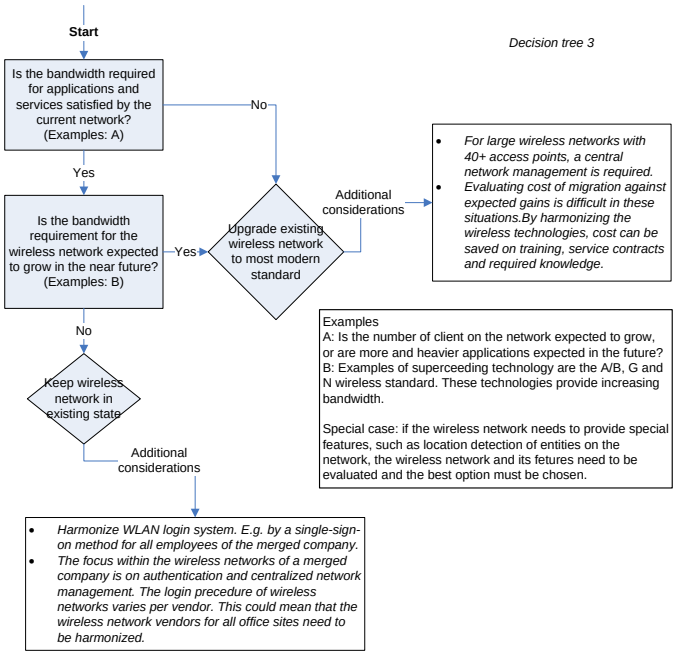
Examples:
A: One could encouter four different situations. Both companies could do their network management and maintenance in-house or have it out-sourced. Or one company could do it in-house and the other out-sourced.
B: The sourcinhg policy could state that all network maintenance and management should be done in-house or be out-sourced. This can be for reasons of economies of scale, IT networks not being core business,fewer staff required, etc.
C: Migration cost In this case can be the penalty for breaking a contract with a service provider. If the penalty for breaking this contract is too high compared to the operational cost reduction (e.g. economies of scale in the service contract) it could be decided to harmonize the service strategy after the contract expires.

Best practice:
LAN service outsourcing works well for small offices to save cost on staff

LAN: Different wireless technologies (802.11 a/b/g/n)

(Decided per office site, assumed a wireless network is already present)

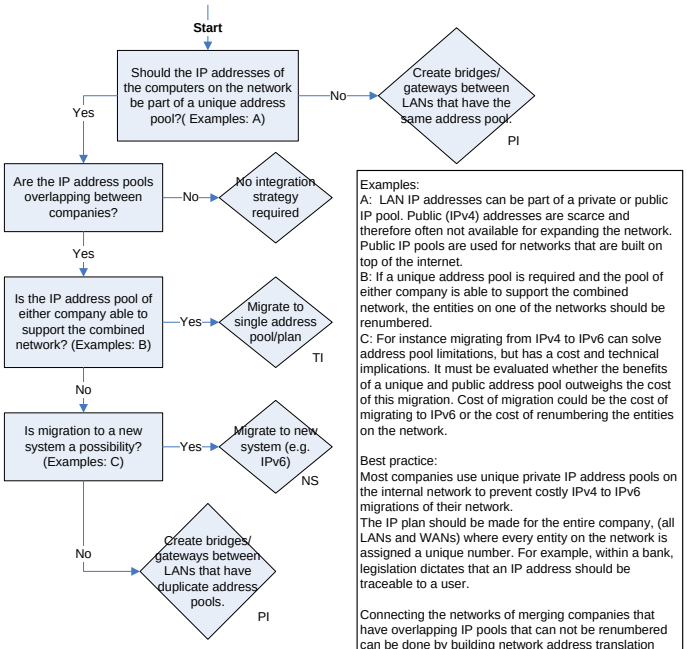
Decision tree 3



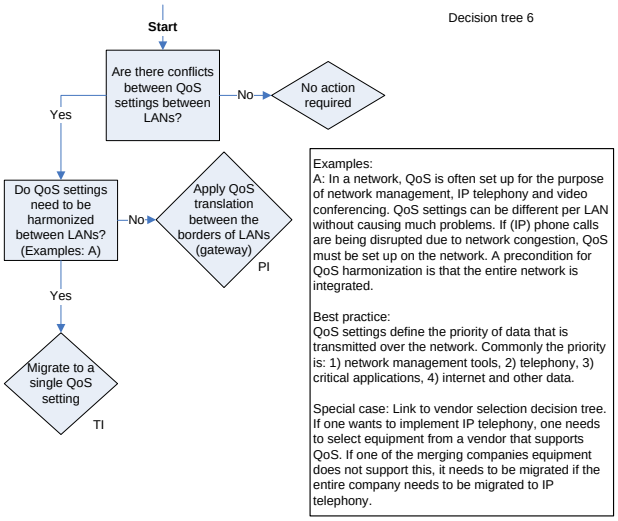
LAN: IP PLAN

(Enabling connectivity)

Decision tree 5

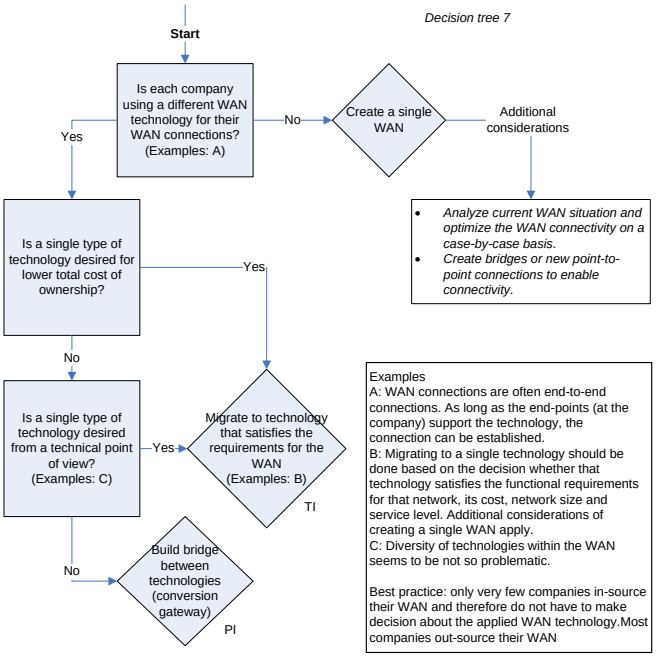


LAN: Quality of service settings (QoS)



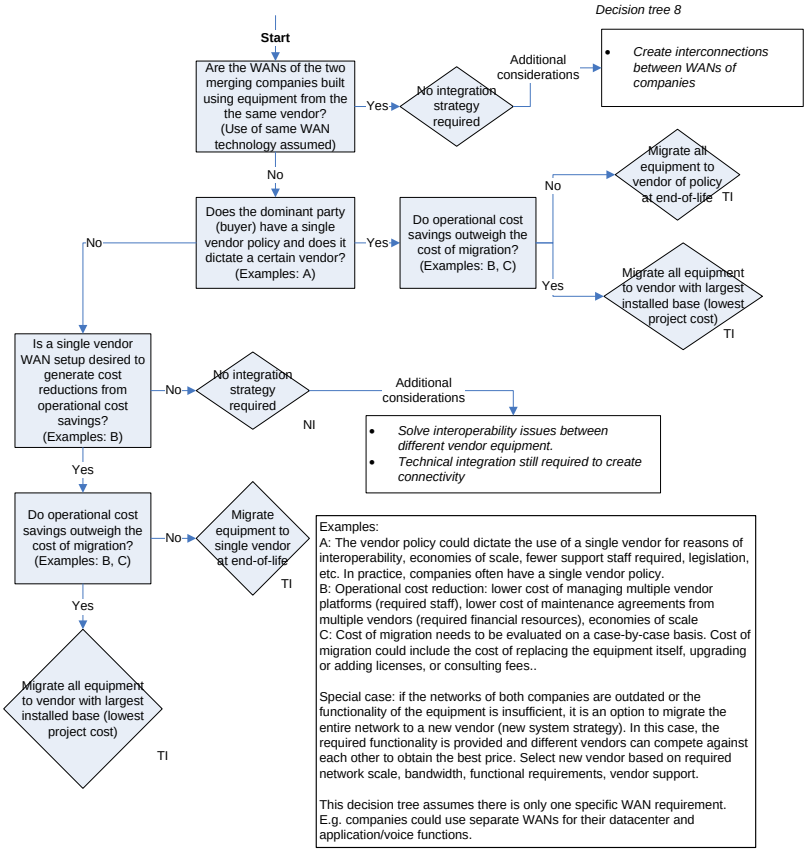
WAN: different technologies

(only applies to companies that deal with WAN in-house)



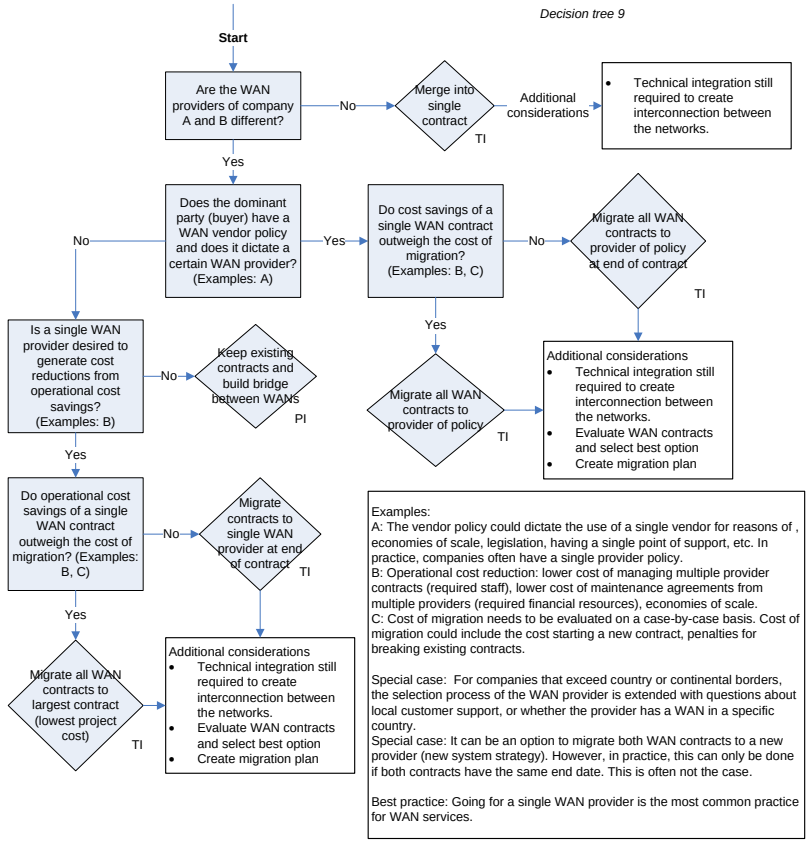
WAN: different equipment vendors

(only applies to companies that deal with WAN in-house)



WAN: different WAN providers

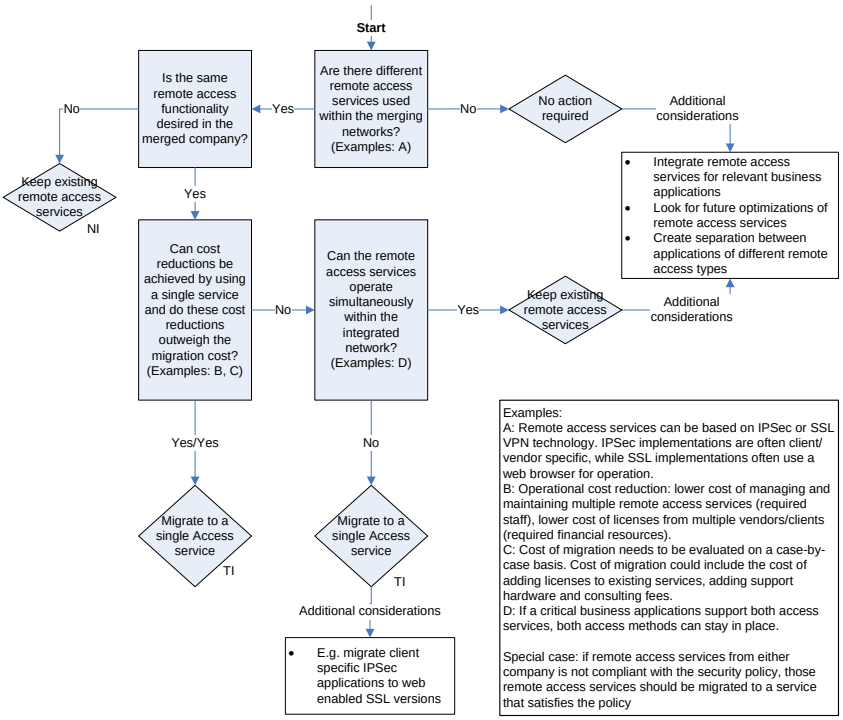
(only applies to companies that out-source their WAN)



WAN: Remote access services

(Services that can be used by employees to access business applications from remote locations)

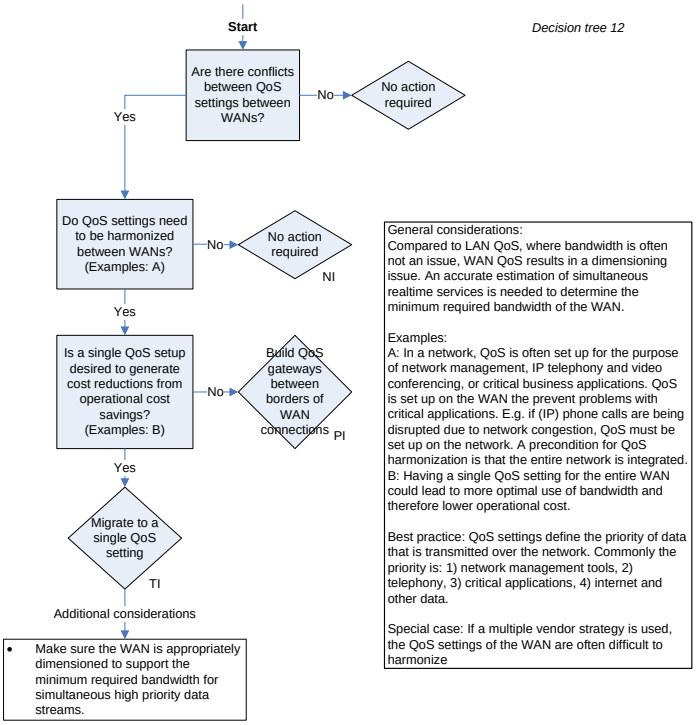
Decision tree 10



WAN: Quality of service settings (QoS)

(Single WAN provider assumed or in-house management)

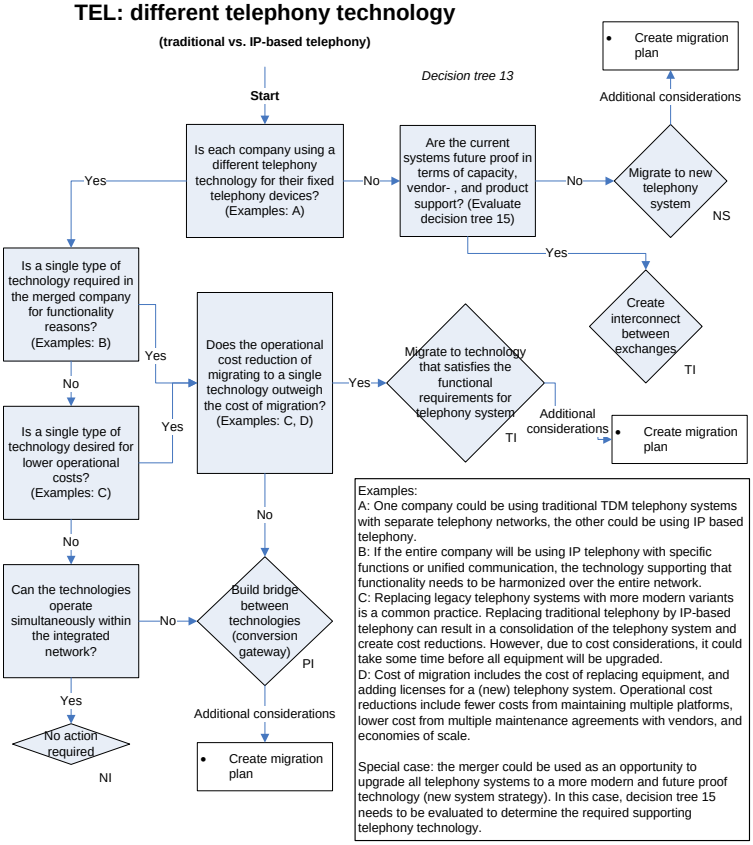
Decision tree 12



TEL: different telephony technology

(traditional vs. IP-based telephony)

Decision tree 13

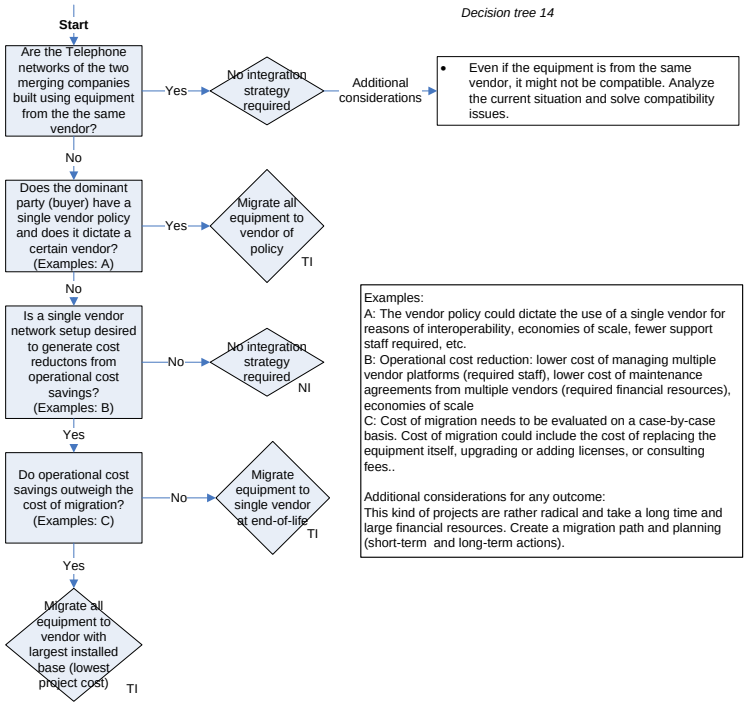


Examples:
A: One company could be using traditional TDM telephony systems with separate telephony networks, the other could be using IP based telephony.
B: If the entire company will be using IP telephony with specific functions or unified communication, the technology supporting that functionality needs to be harmonized over the entire network.
C: Replacing legacy telephony systems with more modern variants is a common practice. Replacing traditional telephony by IP-based telephony can result in a consolidation of the telephony system and create cost reductions. However, due to cost considerations, it could take some time before all equipment will be upgraded.
D: Cost of migration includes the cost of replacing equipment, and adding licenses for a (new) telephony system. Operational cost reductions include fewer costs from maintaining multiple platforms, lower cost from multiple maintenance agreements with vendors, and economies of scale.

Special case: the merger could be used as an opportunity to upgrade all telephony systems to a more modern and future proof technology (new system strategy). In this case, decision tree 15 needs to be evaluated to determine the required supporting telephony technology.

TEL: Different equipment vendors

Decision tree 14



Examples:
A: The vendor policy could dictate the use of a single vendor for reasons of interoperability, economies of scale, fewer support staff required, etc.
B: Operational cost reduction: lower cost of managing multiple vendor platforms (required staff), lower cost of maintenance agreements from multiple vendors (required financial resources), economies of scale
C: Cost of migration needs to be evaluated on a case-by-case basis. Cost of migration could include the cost of replacing the equipment itself, upgrading or adding licenses, or consulting fees..

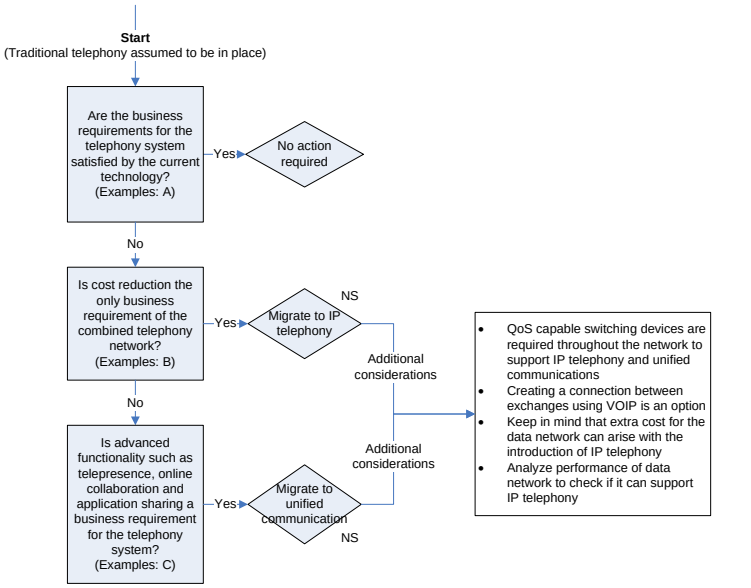
Additional considerations for any outcome:
This kind of projects are rather radical and take a long time and large financial resources. Create a migration path and planning (short-term and long-term actions).

TEL: different telephony Approach

(Traditional, Voice over IP (VOIP)/ IP Telephony, Unified Communication)

Decision tree 15

(This tree is used to evaluate the required telephony technology in decision tree 13)

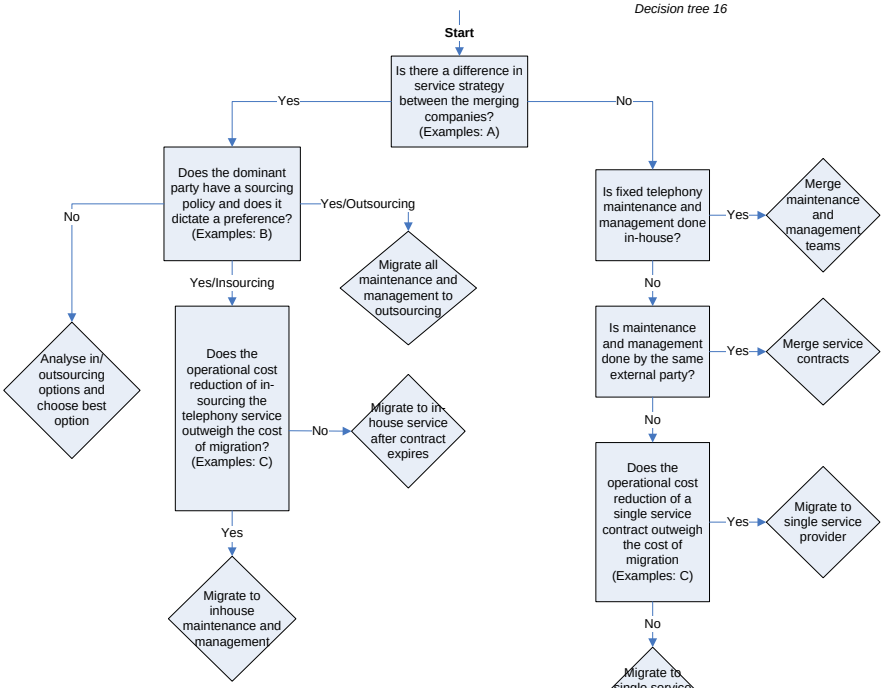


General considerations
Due to the responses of the experts consulted in this research, it is very likely that this decision tree provides a simplistic and incomplete view of the reality. Determining the required telephony functions in a merger seems to be one of the more difficult challenges, compared to other integration challenges.
A merger does provide a company with an opportunity to reconsider their telephony technology choices.

Examples:
A: If only simple telephony functions are needed, such as placing and receiving calls are needed and no other benefits over the current system can be achieved, upgrading the telephony approach is not needed.
B: By migrating to IP-based telephony, cost reductions can be achieved from lower cost per call and economies of scale through the improved utilisation of the network assets.
C: Unified Communication is the integration of telephony, email, applications and other ways of communications into one platform. This provides new possibilities to the employees to do their job in a more effective way. Unified Communication is more future proof and innovative than other telephony systems. IP telephony is a requirement before a migration to UC is possible.

TEL (fixed): service strategy in-house vs out-sourced maintenance and management

Decision tree 16



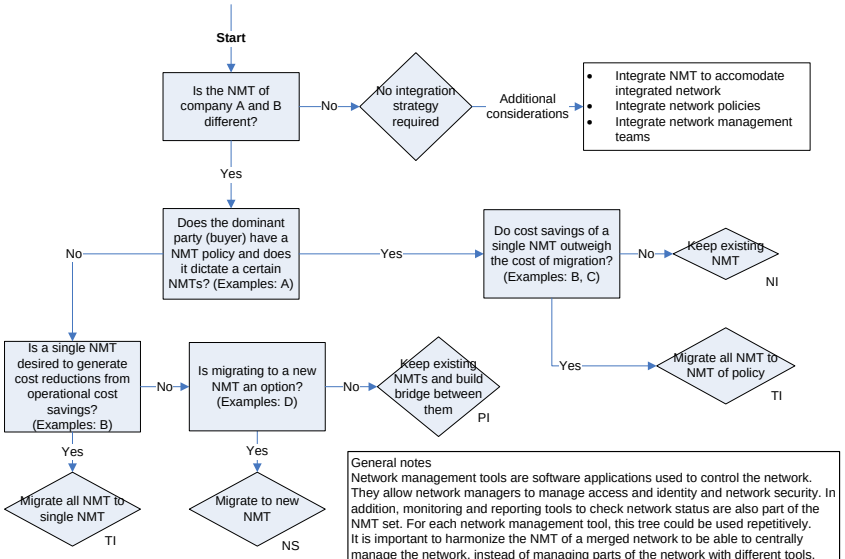
General considerations
The question that keeps returning in this decision tree is whether benefits can be gained by dealing with telephony network management and maintenance by internal company staff or external personnel.

Examples:
A: One could encouter four different situations. Both companies could do their telephony management and maintenance in-house or have it out-sourced. Or one company could do it in-house and the other out-sourced.
B: The sourcinhg policy could state that all telephony maintenance and management should be done in-house or be out-sourced. This can be for reasons of economies of scale, IT networks not being core business,fewer staff required, etc.
C: Migration cost In this case can be the penatly for breaking a contract with a service provider. If the penalty for breaking this contract is too high compared to the operational cost reduction (e.g. economies of scale in the service contract) it could be decided to harmonize the service strategy after the contract expires.

Network management tools (NMT)

(evaluated per management/monitoring tool)

Decision tree 17



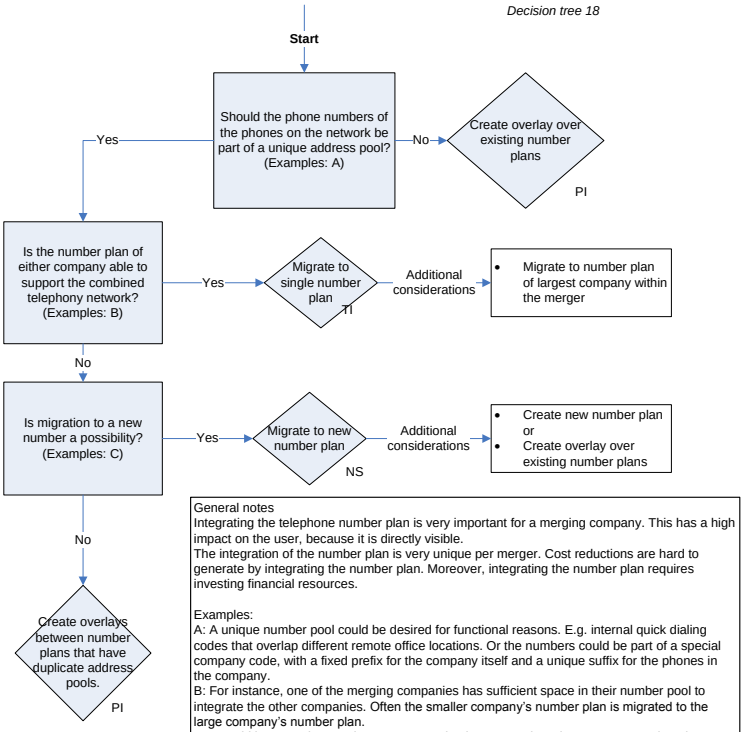
General notes
Network management tools are software applications used to control the network. They allow network managers to manage access and identity and network security. In addition, monitoring and reporting tools to check network status are also part of the NMT set. For each network management tool, this tree could be used repetitively. It is important to harmonize the NMT of a merged network to be able to centrally manage the network, instead of managing parts of the network with different tools. This decision tree is dependent on the service strategy for LAN/WAN. If the management of LAN/WAN is out-sourced, NMT are usually outsourced too.

Examples:
A: The vendor policy could dictate the use of a single NMT of a specific vendor for reasons of interoperability, economies of scale, fewer support staff required, etc.
B: Operational cost reduction: lower cost of managing multiple NMT platforms (required staff), lower cost of license agreements from multiple vendors (required financial resources), economies of scale by improved utilisation of NMT assets.
C: Cost of migration needs to be evaluated on a case-by-case basis. Cost of migration could include the cost of replacing the equipment itself, upgrading or adding licenses, or consulting fees.
D: To select a new NMT, evaluate migration cost, operational support for NMT, contract details, etc.

TEL: Different number plans

(Internal/external numbers)

Decision tree 18

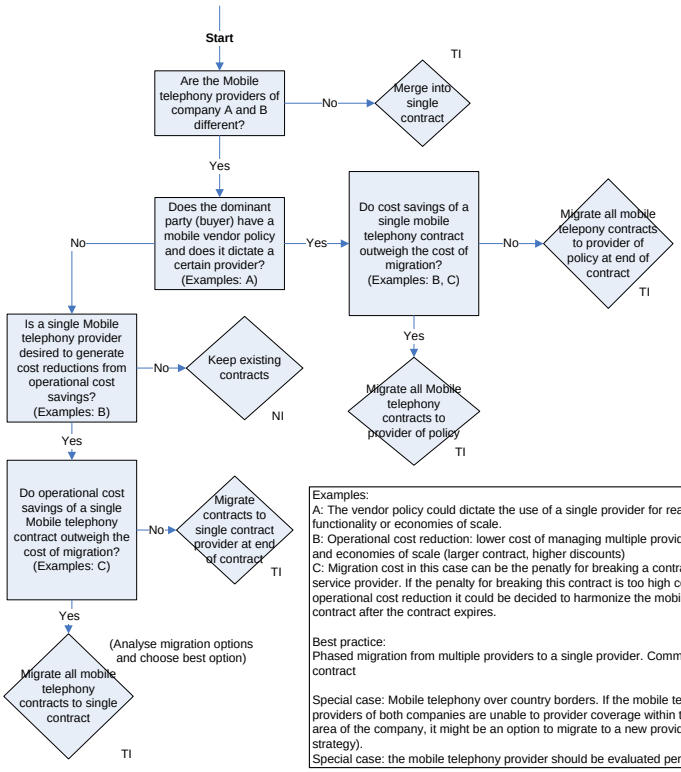


General notes
Integrating the telephone number plan is very important for a merging company. This has a high impact on the user, because it is directly visible.
The integration of the number plan is very unique per merger. Cost reductions are hard to generate by integrating the number plan. Moreover, integrating the number plan requires investing financial resources.

Examples:
A: A unique number pool could be desired for functional reasons. E.g. internal quick dialing codes that overlap different remote office locations. Or the numbers could be part of a special company code, with a fixed prefix for the company itself and a unique suffix for the phones in the company.
B: For instance, one of the merging companies has sufficient space in their number pool to integrate the other companies. Often the smaller company's number plan is migrated to the large company's number plan.
C: It could be an option to migrate to a completely new number plan, to accommodate the merged company in a unique number plan.

TEL: different Mobile telephony providers

Decision tree 19



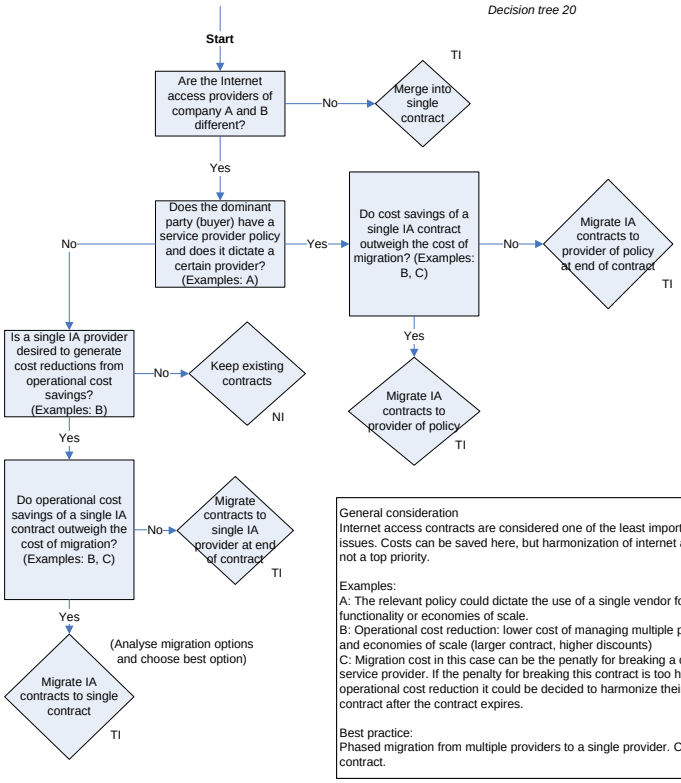
Examples:
A: The vendor policy could dictate the use of a single provider for reasons of functionality or economies of scale.
B: Operational cost reduction: lower cost of managing multiple provider contracts, and economies of scale (larger contract, higher discounts)
C: Migration cost in this case can be the penalty for breaking a contract with a service provider. If the penalty for breaking this contract is too high compared to the operational cost reduction it could be decided to harmonize the mobile telephony contract after the contract expires.

Best practice:
Phased migration from multiple providers to a single provider. Commonly at end of contract

Special case: Mobile telephony over country borders. If the mobile telephony providers of both companies are unable to provider coverage within the working area of the company, it might be an option to migrate to a new provider (new system strategy).
Special case: the mobile telephony provider should be evaluated per country.

WAN: different Internet access contracts

Decision tree 20



General consideration
Internet access contracts are considered one of the least important integration issues. Costs can be saved here, but harmonization of internet access contracts is not a top priority.

Examples:
A: The relevant policy could dictate the use of a single vendor for reasons of functionality or economies of scale.
B: Operational cost reduction: lower cost of managing multiple provider contracts, and economies of scale (larger contract, higher discounts)
C: Migration cost in this case can be the penalty for breaking a contract with a service provider. If the penalty for breaking this contract is too high compared to the operational cost reduction it could be decided to harmonize theinternet access contract after the contract expires.

Best practice:
Phased migration from multiple providers to a single provider. Commonly at end of contract.

Appendix D: Background information on the interviewees

To ensure the interviewees in this research are able to provide relevant information on the topics of the interview, a profile was established. This profile is described in paragraph 3.2.3, and ensures that the experts are working on network integration projects, or have done this in the past. Moreover This appendix provides additional information about the interviewees, to guarantee that they have sufficient knowledge about network integration to provide relevant information for this research.

Expert 1 – Role: Project Leader of ICT Projects

This expert has been involved in the management and extension of the company's data and telephony network since the early 90's, and is responsible for the operation of the current network. Over the past years, this company has merged with a number of other educational institutions. This expert managed and executed several projects to merge the IT network with the merging partners, including integration projects that were aimed at the integration of older (legacy) systems into the integrated IT network.

Expert 2 – Role: Technical Sales Engineer

The technical sales engineer is the "design authority" for the network architecture of a customer and determines the choices and guidelines for subjects as technology choices and network architecture. This expert is responsible for creating and executing integration projects for IT networks between companies. These projects take place on a regular basis, when one of the customers buys other companies in a merger. This expert is consulted when two companies intend to integrate their IT networks. The technical sales engineer proposes solutions for network integration challenges and is directly involved in the development of the project. Activities include writing business cases, formulating solutions and managing the integration projects. This expert held similar jobs at different companies over the past years.

Expert 3 – Role: Technical Design Consultant

This expert is currently responsible for problem solving for IT network integration projects between companies and assist in the development of new network services. The technical design consultant acts as an external expert towards companies that want to integrate their IT networks. The expertise of the technical design consultant includes network LAN & WAN, IP telephony, network security and 'business everywhere' (working from remote locations). Regular activities of this expert include network integration projects at existing customers as well as new customers, which involve the creation of high-level plans for network integration and migration.

Expert 4 – Role: Senior Manager Network Infrastructure

This expert is a senior manager at Accenture. The expert is responsible for developing network infrastructure related projects, including network integration projects and the accompanying decision making process of network integration. This experts has extensive expertise and experience in telephony technology, but also holds expertise on data networks and the integration of those networks.

Expert 5 & 6 – Role: Manager IT Infrastructure

These experts are working at Accenture and are responsible for creating and managing network related projects, including the integration of networks. These experts were both involved in the decision making process of network integration between companies in past projects. Expert 5 has specific expertise on data networks and the configuration that is needed to integrate these networks. Expert 5 Expert 6 is currently working on a project for network separation at a financial institution, but managed several network integration projects in the past.

Expert 7 – Role: Network Services Consultant

This expert is responsible for network related projects. The employer of this expert, a pharmaceutical company, has acquired several other pharmaceutical companies over the past years. This expert has been involved in projects to integrate the data and telephony networks between the merging companies and the decision making process that is complementary for these projects.

Expert 8 – Role: Consultant IT Infrastructure

This expert is a consultant at Accenture. This expert is responsible for managing and executing sub-projects of IT infrastructure projects, including network related integration projects. The consultant is also involved in the decision making process of network integration.