Management report

STRATEGIC CONDITIONS TO BE CONSIDERED BY TELKOM BEFORE INVESTING IN VOICE OVER INTERNET PROTOCOL EQUIPMENT FOR THEIR NATIONAL NETWORK

by

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Declaration

I, Andre Vlotman, herewith declare that the language of this research report has been edited by TM Bron

A. Vlotman

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List of abbreviations

ATM	-	Asynchronous Transfer Mode
BRAS	-	Broadband Remote Access Server
BSS	-	Billing Support System
Co-ps	-	Connection-oriented packet-switched networks
CSG	-	Content Selection Gateway
ETSI	-	European Telecommunications Standards Institute
FCAPS	-	Fault, configuration, accounting, performance and security
FR	-	Frame Relay
IETF	-	Internet Engineering Task Force
IP	-	Internet Protocol
ISC	-	International Softswitch Consortium
IT	-	Information Technology
ITU	-	International Telecommunications Union
LAN	-	Local Area Network
MSF	-	Multiservice Switching Forum
MPLS	-	Multi Protocol Label Switching
NGN	-	Next Generation Network as defined by the MSF
OSS	-	Operation Support System
PABX	-	Private Automatic Branch Exchange
PMA	-	Packet Mode Architecture
PTN	-	Private Telecommunication Network
QoS	-	Quality of service
TDM	-	Time Division Multiplexing
VoATM	-	Voice over ATM
VoIP	-	Voice over Internet Protocol

EXECUTIVE SUMMARY

Voice-data convergence has the potential to create a technology revolution in the telecommunication environment. One technology that will enable the convergence of voice and data onto one network is the IP protocol.

Over the past 3 years much of the 'hype' has quieted down about the merits of VoIP. Vendors and operators have toned down their commercial expectations, equipment suppliers have evolved their products: more mature and realistic decisions can now be made.

In a mature market such as the voice telecommunication market, price is a source of competitive advantage that an operator can offer its end customers. No operator wants to erode the biggest income generator, voice, to create a low cost competitive advantage. Operators delivering voice would rather focus on reducing costs of delivering the voice service. Converging voice and data networks is one option to reduce operational and capital expenditure.

Innovation is another possible source of ensuring a competitive advantage. IP offers the operator the opportunity to use one network offering voice with many other new innovative applications such as video conferencing and computer telephony integration.

This report provides insight into the strategic conditions that Telkom needs to consider when making a decision to invest in Voice over Internet Protocol (VoIP) equipment for their national network. If a vendor has insight in the conditions and the strategy that Telkom wants to follow to address this market the vendor would be able to shape his/her organisation and would know how to convince Telkom to implement a VoIP network.

The Strategic Management Model as described by Pearce and Robinson (2003) was used to do a theoretical survey of possible conditions that should be considered by Telkom during the decision-making process. The Strategic Management Model was enhanced with the product-market and the resource-based normative views. If Telkom wants to implement a VoIP network, they would need to ensure that the business portfolio and technology portfolios match. Telkom also needs to determine where on the technology adoption life cycle they want to implement a VoIP network. They also need to determine how they want to introduce this technology into the market and what the expected acceptance would be.

None of the conditions identified during the theoretical survey or the analysis of the long-term objectives and generic and grand strategies of Telkom excludes the use of VoIP by Telkom. VoIP could actually assist Telkom to achieve their long term objectives and assist it in implementing generic and grand strategies if implemented in the right situation.

The identified conditions from the theoretical survey are broad areas that need to be refined and condensed to a few important strategic conditions. For the qualitative research the survey method was selected based on the key informant interview technique. Judgement sampling was used to select the interviewee. The results of the theoretical survey were used as a framework during the interviews with Telkom employees to identify the more specific and strategic conditions. The Telkom employees' responses were used to determine their views on the strategic conditions that would influence the decision-making of the Telkom executives.

Findings:
Telkom is interested in deploying a VoIP network. ATM will be applied to support existing services and could be used in the access environment only to deliver QoS-managed transport. VoATM will therefore be a competing technology in the access network.

Telkom has determined the markets that are relevant for VoIP as well as the markets that are the most important for their future success. These markets are the international, national and corporate market segments. Telkom has been reviewing the deployment of a national VoIP network since 2000. At the time, ITU, ETSI and IETF standards were considered 'sufficiently mature' to deploy VoIP technology to replace the TDM interconnect topology in the core network. The technology was implemented and has proven itself for international interconnection. The next step would be to deploy VoIP in the national network. Telkom also defined the network solutions required to address the introduction of VoIP in the national and corporate market segments. They are already using leased lines to connect corporate that want to use VoIP between various corporate locations. Telkom intends to deploy a net to off-net international VoIP connections soon. This would require the deployment of a national VoIP network that requires a QoS enabled IP network and a gatekeeper or softswitch.

Twenty-eight major conditions were identified during the interviews of Telkom employees. Some of them will enable and other will inhibit the implementation of a national VoIP network. For example:

- Legislation in South Africa prevents Telkom from deploying VoIP other than in virtual private network scenarios.
- Concerns still exist about the maturity of VoIP technology.
- Operational and business processes need to be adapted to cater for VoIP.

By addressing the niche markets segments some of the inhibiting conditions could be eliminated. Telkom is also proactively taking steps to remove inhibitors that are internal to Telkom.

Recommendations:
The vendor can assist Telkom with network equipment and services that can neutralize inhibiting and strengthen enabling conditions. Keeping the twenty-eight major conditions in mind the vendor will be able to refocus its organisation to address the potential VoIP network equipment and services market.

Continuous monitoring of the state of the various conditions is required because new conditions may arise from the environment or some may change depending on the progress made by Telkom to address the enabling and inhibiting conditions.

Telkom is interested in deploying a VoIP network and stated that they would start implementing a network soon (as early as the beginning of 2004).

CHAPTER 1: INTRODUCTION AND STATEMENT OF PROBLEM

1.1 Introduction

Telecommunication operators are currently confronted by various major changes in the markets they are operating in. A few of these changes are:

- Fixed-mobile convergence
- Voice-data convergence
- Deregulation
- Globalisation.

Each of these changes creates it own challenges and opportunities, and one change affects others.

The telecommunication environment has not experienced so many diverse and important changes for a long period of time. Operators have to decide whether these changes will affect their business and how it will affect it. The way an operator reacts to these changes will determine how successful the operator will be in the future.

Voice-data convergence makes a technology revolution possible and is of particular interest in this management report.

1.2 Problem background

1.2.1 Description of voice-data convergence

Telecommunication operators currently make use of Time Division Multiplexing (TDM) technology as the basis for connecting voice calls. Operators also make use of separate packet-based networks to transfer data e.g. Internet Protocol (IP), A-synchronous transfer mode (ATM), Frame relay and X.25.

The percentage of traffic generated by voice calls seems to be rapidly overtaken by data. Voice traffic though is still responsible for the largest part of the operator's revenue. For Telkom Revenues from their data business grew 18% to R3,9 billion in 2002 from R3,3 billion in 2001(Telkom SA Limited, 2002a).

The increased demand for data network products has spurred on the development of packet-based technology. The development of packet-based technology now allows the transport of both voice and data across a packet-based network. This network is called a "voice-data converged network". Voice-data convergence offers the operator the opportunity to use one network instead of several separate networks to run all the telecommunication traffic across.

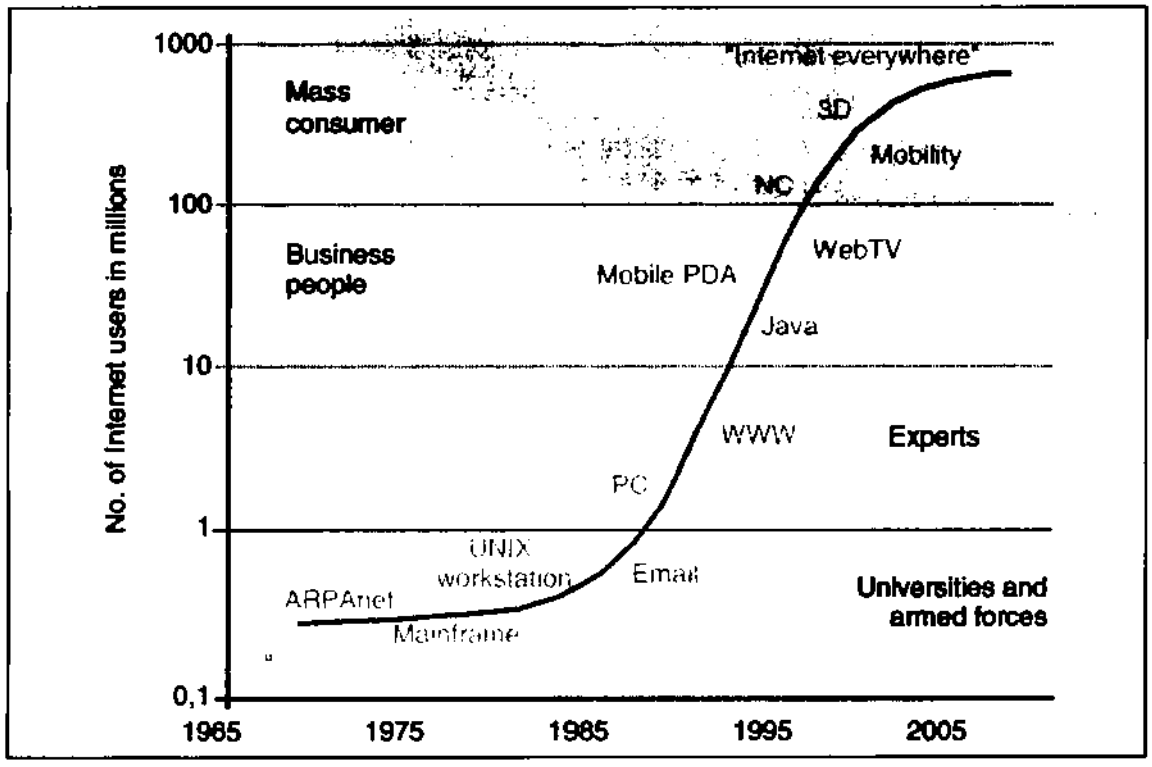
This allows an operator a reduction in the amount of capital expenditure to deploy a network and reduces the amount of operational expenditure to operate and maintain the various networks.

1.2.2 Description of Voice over Internet Protocol (VoIP)

There is an array of competing protocols that can be used to implement a packet-based network. The most important packet based standards are the Internet Protocol (IP), A-synchronous transfer mode (ATM), Frame relay and X.25.

IP is the leading protocol used for data communication between computers e.g. LAN's and the Internet. Telecommunication operators and vendors of telecommunication equipment agree that IP will be the dominating data protocol in the future. This is a result of the number of users that support IP and that most applications use the IP protocol to communicate. See Figure 1.1 below for details on the number of Internet users and the applications IP is used for.

Figure 1.1 - The number of Internet users and applications using IP



Source: ITU, 2003.

The use of IP to transfer and control voice calls is called the Voice over Internet Protocol (VoIP).

Since 1995 the development of VoIP was enabled by a set of standards and recommendations developed by the International Telecommunications Union (ITU), the European Telecommunications Standards Institute (ETSI) and the Internet Engineering Task Force (IETF). These have been supported by cross industry bodies such as the International Softswitch Consortium (ISC) and the Multiservice Switching Forum (MSF). They developed service architectures such as the Next Generation Networks (NGN) for use in connection-oriented packet-switched networks (co-ps).

IP is well established as a data network protocol and is reaching maturity to carry real time traffic, which includes voice. VoIP technology is approaching the same reliability and quality of service standards, which telecommunication operators are used to with Time Division Multiplexing (TDM) technology. Currently VoIP technology is proving itself as a viable technology alternative to TDM in enterprise networks. Telecommunication operators require a higher level of reliability, quality of services and highly flexible billing options. Due to the number of subscribers to be supported the operator also requires management systems that will enable the effective and efficient delivery of service. As a result VoIP is an alternative technology to TDM for carrier scale networks that still has to prove itself beyond doubt and has to reach general acceptance in the operator market.

1.2.3 Conflict within telecommunication operators

Today's telecommunication environment is very competitive. The survival of telecommunication operators depends on analysing all areas in this environment and the making of decisions that would keep them as competitive as possible. In the long term operators have to create strategic competitive advantages that no competitor would be able to equal.

In the world market the voice-data convergence variable still has to prove itself beyond any doubt for telecommunication operators. This leads to uncertainty in the mind of the operator whether voice-data convergence solutions should be used in the operator's strategy to deliver service to the end customer.

There are multiple technical solutions that can be used to implement a voice-data converged solution. For example, the underlying technology could be based on IP, or ATM, or even IP

over ATM. Differences in opinion on where these various technologies should be used (access, edge and core) also exist. How the operator can migrate its current voice and data networks to a converged voice-data network should also be considered.

The use of voice-data convergence network equipment and specifically VoIP equipment can result in an array of advantages for the operator when applied in the right situation. Telkom has to decide whether it will implement a national VoIP network.

1.2.4 The importance of VoIP

Voice generates the largest part of most operators' income, including Telkom. R23,3 billion of the R28 billion operating revenue of Telkom was generated by fixed voice calls in 2002. In 2003 R24,2 billion of the R29,6 billion operating revenue was generated by fixed voice calls (Telkom SA Limited, 2002a and Telkom SA Limited, 2003). Fixed voice must therefore be of strategic importance to Telkom.

Telkom is currently using TDM switches to deliver voice services to their end customer. VoIP will require Telkom to migrate from the TDM based voice network to an IP based network. Voice can also be transported across other protocols e.g. ATM and FR. Why are IP based networks then so important?

The ITU sees ATM and IP as the two dominating technologies. They made the following statement:

> "ITU-T says it is leading a more pragmatic approach to networking by providing standards that link disparate technologies such as Asynchronous Transfer Mode (ATM) and Multiprotocol Label Switching Standard (MPLS)." MPLS is a protocol that forms part of the IP protocol.
> "In this case, the approach championed by ITU provides interworking between two dominant technologies in the connection-oriented packet-switched network (co-ps) mode" (*EngineeringNews*, 19 August 2003).

In Figure 1.1 below a summarised comparison of VoIP versus VoATM is made. The strengths of VoIP are explained in this table and why VoIP is seen as a long term technology of strategic importance.

Table 1.1 - Comparison of VoATM versus VoIP

Criteria	VoATM	VoIP
Support of converged value added services such as application sharing, multimedia messaging...	No	Yes
LAN PBX systems are based on	No	Yes
Inter-working to LAN-PBX systems supported	No	Yes (IP-PBX)
Support of IP Centrex	No	Yes
User Terminals are based on	No	Yes (H.323, SIP)
Data traffic growth is driven by this technology	No	Yes
Support of time critical applications	Yes	Yes (Via MPLS)
Speed of innovation and development	Low	High
Quality of Service (QoS) compliance	Yes	Yes (Via DiffServ)
Economy of self-routing, self-managing network capabilities.	Low	High

Source: Siemens, 2002.

Price could be a source of competitive advantage. No operator wants to erode the biggest income generator, namely voice by reducing the income it generates. The focus of operators delivering voice is on reducing the costs. This can be achieved by IP, by converging the voice and data networks into one network. Using only one network reduces the operational expenditure. To deploy the VoIP network requires capital expenditure and as a result a stepwise migration is required.

Innovation is another possible source of competitive advantage. IP offers the operator the opportunity to use one network offering voice with many other new innovative applications such as video conferencing and computer telephony integration.

Both British Telecom (BT) and Telecom Italia want to achieve operational cost savings and allow for the introduction of new services by implementing NGN's:

> "British Telecom and Telecom Italia both are implementing NGN networks. BT is implementing a Voice over ATM solution and will consider migrating if IP technology develops sufficiently. Telecom Italia is moving straight to VoIP. Both these operators' two main goals are: Reduce operational costs and allow the introduction of new services."
> (*Ovum*, 2003)

Migrating all the different networks of Telkom to an IP based network has far-reaching effects on every part of the organisation and would require several years of investment to migrate. For these reasons IP and VoIP are strategic long-term technologies.

1.2.5 Reasons for addressing this problem

As an employee of a vendor of telecommunication equipment, the researcher is responsible as Technical Sales Manager to promote voice solutions to Telkom. Before this research it was only known that VoIP is a technology that was monitored by Telkom for possible deployment in the future. It was uncertain if Telkom is interested or even if they were seriously considering deploying a VoIP network. It is important to understand which conditions would influence the operator's decision to invest in VoIP equipment.

The operator, for example has to decide if it is the right time from a market and a technology maturity point of view to implement a VoIP network. As a result, for a vendor of VoIP equipment, it is very difficult to judge whether the operator will see VoIP as a business opportunity.

If the vendor has insight in the conditions and the strategy that Telkom wants to follow to address this market, the vendor will be able to refocus its marketing strategy for VoIP.

1.3 Statement of the problem

The problem is that the vendor does not know which strategic conditions Telkom will consider when making a decision to invest in VoIP equipment for deployment in their national network.

1.4 Aim

The aim of this research is to determine which strategic conditions the operator should consider when making the decision to implement a national VoIP network.

This will result in the vendor knowing how to convince Telkom to implement a VoIP network.

1.5 Goals

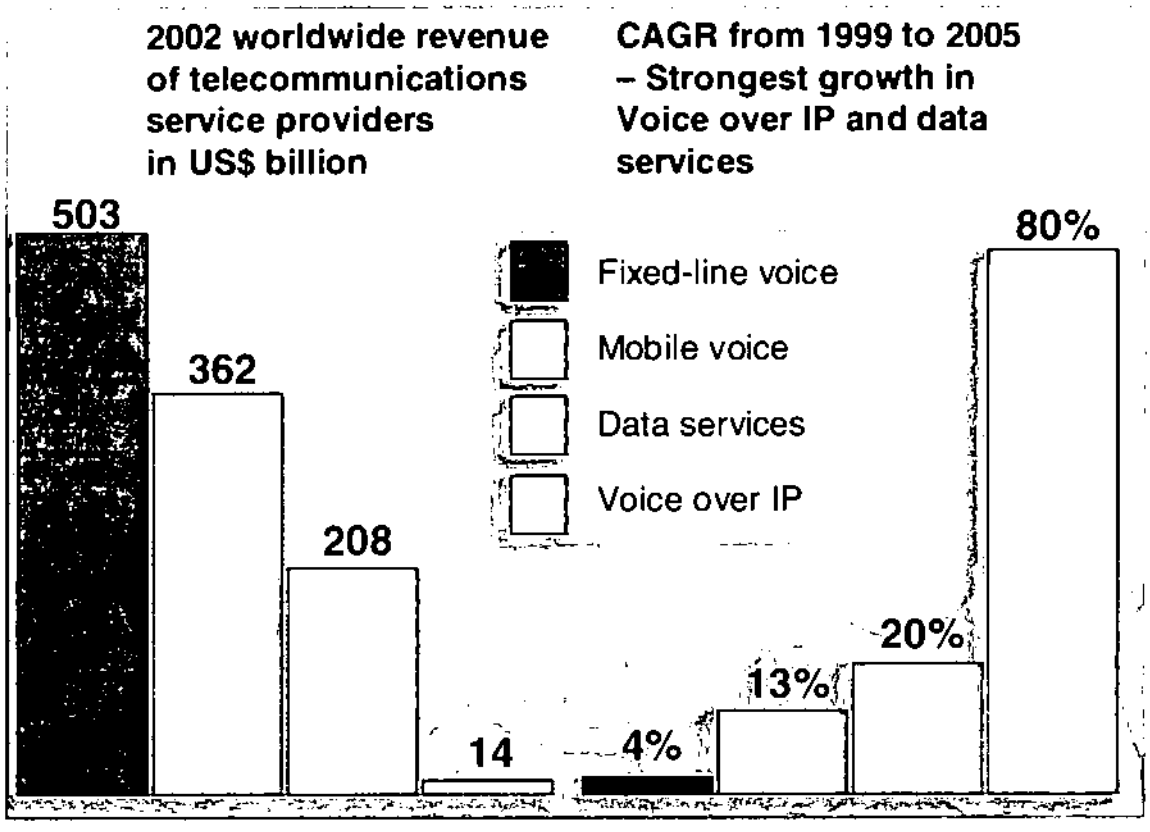
The goals are to:

- Review the theory that applies when making a decision to implement a VoIP network.
- Use the survey research method using qualitative research by means of the key informant interview technique to determine Telkom employee's views on the strategic conditions that would influence the decision-making of the Telkom executives.
- Conclude whether Telkom might be willing to invest in a national VoIP network.
- Provide recommendations to refocus the vendor's attention to the potential market for its VoIP equipment.

1.6 Importance of problem

VoIP is the strongest growing market in the telecommunication industry. Gartner Dataquest (2002) projects an industry average of 9% compound annual growth rate (CAGR) in the telecommunication industry and 80% for VoIP over the period 1999 to 2005.

Figure 1.2 - Worldwide telecommunication revenue and growth



Source: Gartner Dataquest, 2003.

VoIP technology creates opportunities and threats for Telkom. VoIP allows and requires the operator to change its business model. An operator entering the market first with the right kind of service offerings could capture the market. It would be difficult for any other to compete once they have fallen behind. By implementing VoIP at the right time and for the right reasons an operator will be able to create a sustainable competitive advantage. The capital expenditure and operational expenditure to deploy, operate and maintain a telecommunications network is considerable and once selected could determine the future success of the operator.

By ensuring that the operator is currently seriously considering implementing a VoIP network based on strategic conditions, the vendor could right size and enable its organisation and which arguments to use in its proposals to the customer. This will ensure that no market opportunities are missed and that internal enabling costs to the vendor are minimized.

1.7 Research methodology

The report reviews the theory applicable to the strategic management process. It also addresses market management theory relevant in a technology environment that can be used when making a strategic decision.

The theory is used as a framework to extract the relevant strategic conditions. Pareto's principle (20/80) is applied throughout this report to reduce the number of conditions to the important few.

The survey method of research was selected. Qualitative research was done by means of the key informant interview technique. The interview technique was selected to allow a high level of lateral thinking and it ensures that all the strategic conditions are captured. The only way a vendor would know if the operator intends to implement a certain technology is by talking to them or by observing the action the operator is taking. The interview will also allow the interviewer to request more detailed information on a specific identified strategic condition. The framework of relevant theoretical strategic conditions was used to structure the interview.

Interviewing employees from the various functional units ensured that all the relevant conditions as seen by the operator are identified and correctly interpreted. The focus was on the functional units that would be the key role players in the decision-making processes of whether VoIP should be implemented or not. The interviewed employees selected are at senior management level. Senior managers were selected because they provide the recommendations to the decision-makers, the executives of Telkom.

The results will be organised and presented systematically.

Based on the above interviews' results a conclusion is made whether the operator will implement a VoIP network and which implementation strategy the operator will follow.

Finally the report provides recommendations on a possible sales strategy. The recommendations consider the current conditions and attitude of Telkom towards the viability of a successful implementation of VoIP.

1.8 Limitations of study

The following limitations apply to this study:

- This study is limited to the market environment of South Africa and the national operator Telkom South Africa. The study will be limited to the incumbent, fixed telecommunication network operator. The analysis only considers solutions of a carrier's scale. Solutions relevant to the corporate environment are not considered because operators require a higher level of reliability, a larger scale network solution and a solution that requires less operational effort.
- Solutions that are not chargeable from an operator's perspective are not considered. Solutions such as those provided by IP clients that do not register for charging of the connection as a voice call but rather as a data connection would not be considered e.g. NetMeeting.
- The study focuses only on the local and national traffic of the incumbent operator because a point-to-point transmission solution as required for international traffic has many more competing technologies and requires a lot less features. Telkom has already implemented an international VoIP solution using the Clarent product range.
- The report only analyses the selection of VoIP as a technology and does not analyse the selection of a vendor.

Although the scope of this study is limited, most of the results of this study are transferable to the excluded business areas.

1.9 Assumptions

The report is based on the following assumptions:

- Telkom does not have a deployed national VoIP network.
- The interviewees answered the questions honestly and have no reason to be deceitful. Sensitive information was not disclosed due to the pending deregulation of the telecommunication industry. In these cases respondents provided generic and personal views.
- Executives would make a decision based on a few strategic conditions. The Pareto principle is applied throughout this report to focus on these important few strategic conditions.

1.10 Conclusion

VoIP technology creates new opportunities and threats of strategic importance for Telkom.

The problem is that the vendor does not know which strategic conditions Telkom will consider when making a decision to invest in VoIP equipment for deployment in their national network.

The aim of this research is to determine which strategic conditions the operator should consider when making the decision to implement a national VoIP network.

A review of the applicable theory regarding the strategic management process, strategic technology management and technology market management theory will be dealt with in Chapter 2. The theory will assist in designing the research instrument.

CHAPTER 2: THEORETICAL SURVEY

2.1 Introduction

There are many reference theories on strategic management. The textbook *Formulation, Implementation and Control of Competitive Strategy* by Pearce and Robinson, 2003 was selected as the source of reference as this book is a recognised authority in strategic management.

Telkom needs to manage technology and innovation, as technology is required to deliver telecommunication services to the customer. A review of the strategic management and technology strategy theory follows. The Pareto principle was applied to identify the applicable and important parts of the theory.

2.2 Definition and tasks of strategic management

Pearce and Robinson (2003, p. 3) state: "Strategic management is defined as the set of decisions and actions that result in the formulation and implementation of plans designed to achieve a company's objectives. It comprises of nine critical tasks:

1. Formulate the company's mission, including broad statements about its purpose, philosophy and goals.
2. Conduct an analysis that reflects the company's internal conditions and capabilities.
3. Assess the company's external environment, including both the competitive and general contextual factors.
4. Analyse the company's options by matching its resources with the external environment.
5. Identify the most desirable options by evaluating each option in light of the company's mission.
6. Select a set of long-term objectives and grand strategies that will achieve the most desirable options.
7. Develop annual objectives and short-term strategies that are compatible with the selected set of long-term objectives and grand strategies.
8. Implement the strategic choices by means of budgeted resource allocations in which the matching of tasks, people, structures, technologies and reward systems is emphasized.
9. Evaluate the success of the strategic process as input for future decision making."

Modern executives have to manage activities internal to the organisation and have to respond to the challenges posed by immediate and remote external environments.

The immediate external environment includes competitors, suppliers, increasingly scarce resources, government agencies and their ever-increasing regulations and customers whose preferences often shift inexplicably.

The remote external environment comprises economic and social conditions, political priorities (especially prevalent in the recent history of South Africa) and technological development, all of which must be anticipated, monitored, assessed and incorporated into the executive's decision-making.

However, the executive is often compelled to subordinate the demands of the organisation's internal activities and external environment to the multiple and often inconsistent requirements of its stakeholders (owners, top managers, employees, communities, customers and country). To deal effectively with all factors that affect the growth and profitability of a firm, executives employ management processes to position it optimally in its competitive environment.

Increased emphasis is placed on environmental forecasting and external considerations in formulating and implementing plans. This all-encompassing approach is known as strategic management.

Corporate strategy means the strategy of an entire corporate entity, which may contain any number of business units and a fair number of functional areas (Tomer, 1995). This report focuses on the strategy for the fixed line business and on the business strategy of Telkom. Telkom owns various companies of which Vodacom is one. Vodacom has an influence on Telkom's strategy regarding the fixed line VoIP solutions. Both Telkom's corporate and business strategy will influence and will be influenced by the strategic conditions identified.

2.3 A business strategy formulation model

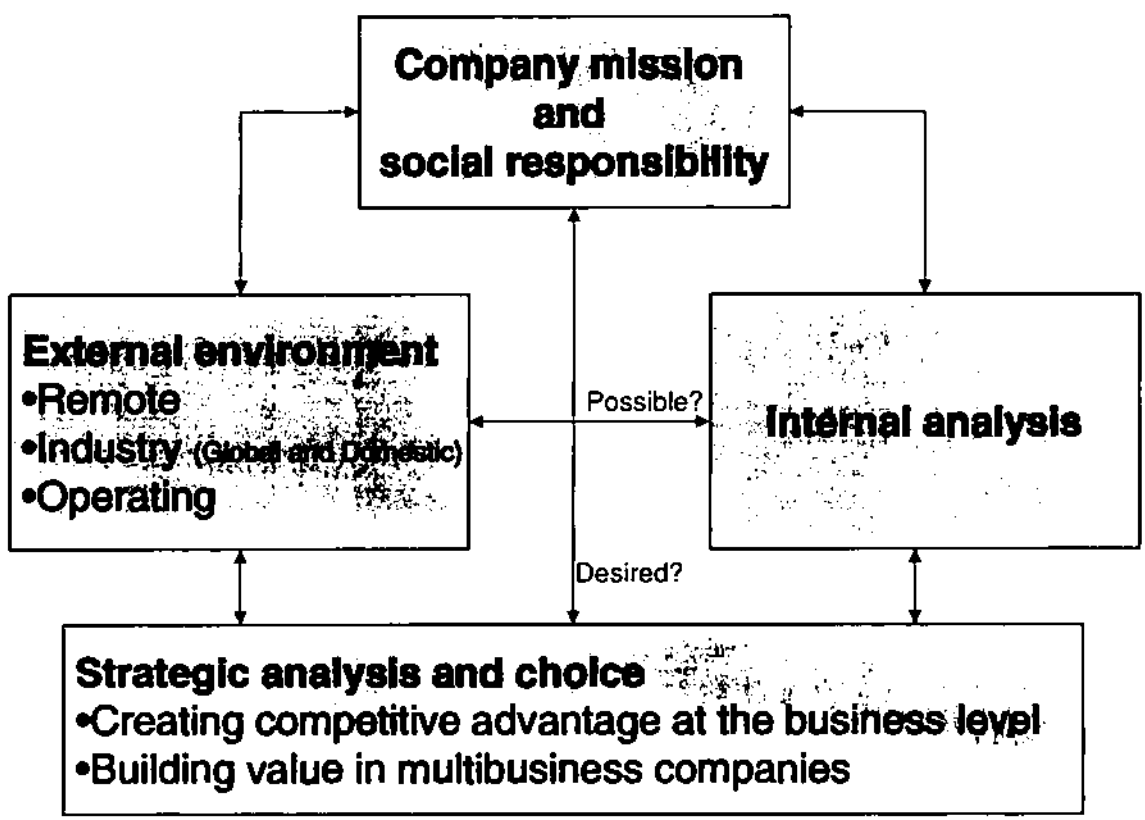
Pearce and Robinson (2003) describe a Strategic Management Model. Only the formulation part of this model is described here, as the implementation and control part is not relevant for this report.

- The model offers an approach to analyse the operator's strategy and serves as a theoretical base.
- Theoretical areas described in the model will be used to identify the various strategic conditions.

- It depicts the sequence and relationships of the major components of the strategic management process up to strategic analysis and choice.

Figure 2.1 provides a view of the formulation part of the Strategic Management Model.

Figure 2.1 - The Strategic Management Model



Source: Adapted from Pearce & Robinson, 2003.

2.3.1 Company mission and social responsibility

2.3.1.1 Company mission

"The mission of a company is the unique purpose that sets it apart from other companies of similar type and identifies the scope of its operations. In short, the mission describes the company's products, markets and technological areas of emphasis in a way that reflects the values and priorities of the strategic decision-makers" (Pearce & Robinson, 2003, pp. 12-13).

Telkom has included their mission in their vision statement:

"**Telkom's vision**

Our vision is to be a world-class communications company.

- We are a communications company that offers total communication solutions to our customers.
- We will be world-class when our customers say we are.
- We are more than just a "phone company".
- Our area of business includes a full spectrum of digital communications, including voice, data, video, and latest Internet and E-Commerce enabling technologies" (Telkom SA Ltd, 2002c).

VoIP enhances the capability of an operator to provide a total communication solution and is a digital communication technology. IP, the underlying technology used by VoIP enables the communication of voice, data, video and the latest Internet and E-Commerce. VoIP could therefore be used by Telkom to fulfil their vision.

2.3.1.2 Social responsibility

"Social responsibility is a critical consideration for a company's strategic decision-makers since the mission statement must express how the company intends to contribute to the societies that sustain it. A firm needs to set social responsibility aspirations for it, just as it does in other areas of corporate performance" (Pearce & Robinson, 2003, p. 13).

Telkom has created a separate legal entity namely the Telkom foundation. The vision and mission of the foundation is:

"**Vision**

To position Telkom SA Limited as the leading model corporate citizen.

Mission

The Telkom Foundation's mission is to identify, develop and implement community development initiatives geared towards sustainable development" (Telkom SA Ltd, 2002d).

VoIP will not prevent the Telkom foundation to embrace and achieve their vision and mission. VoIP could actually assist the Telkom foundation in reaching their vision and mission.

2.3.1.3 Stakeholders

Stakeholder demands on Telkom are considered in the formulation of the vision and mission of Telkom and also when considering the social responsibility of Telkom.

The internal stakeholders are executive officers, board of directors, shareholders and employees and the external stakeholders are customers, suppliers, creditors, governments, competitors and the general public (Pearce & Robinson, 2003).

The influence of **shareholders** on Telkom is becoming more predominant especially in light of the Thintana shareholders (Consisting of SBC Communications Inc. and Telekom Malaysia Berhad) that have management right and the recently completed initial public listing.

The **executive officers and board of directors** are influenced by strategic conditions and also by behavioural considerations affecting strategic choice. These include the current strategy, degree of external dependence, attitude towards risk, managerial priorities different from shareholders interest, internal political considerations and competitive reaction (Pearce & Robinson, 2003).

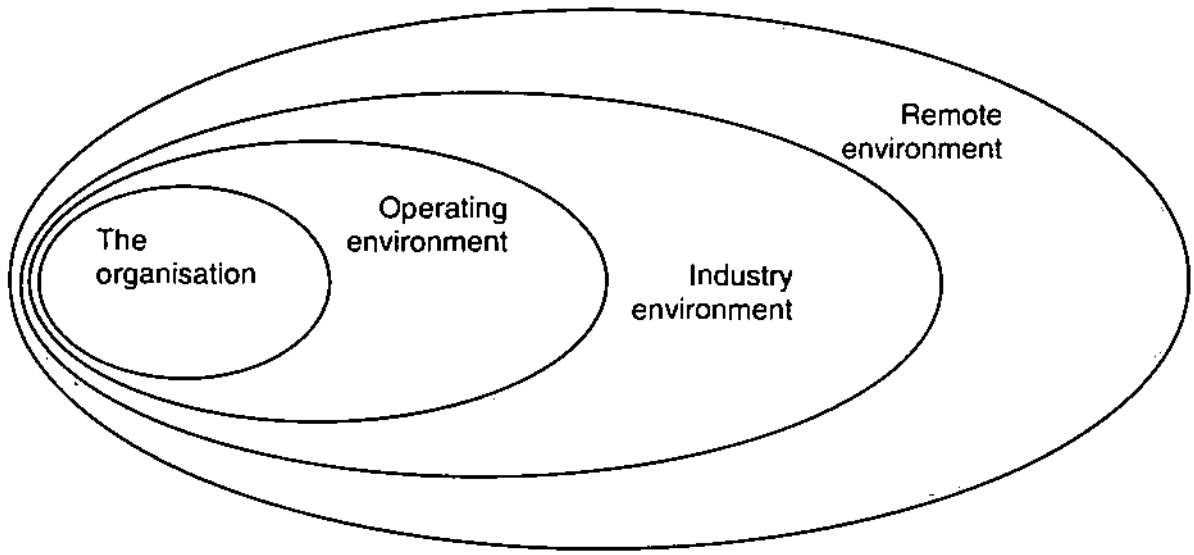
These stakeholders would play a major roll in the decision-making process. The other stakeholders mentioned above will be considered as part of the external or internal environment.

2.3.2 External Environment

"A firm's external environment consists of all the conditions and forces that affect its strategic options and defines its competitive situation. The Strategic Management Model shows the external environment as three interactive segments: the remote, industry and operating environment" (Pearce & Robinson, 2003, p. 13).

The opportunities and threats that Telkom has to face from the external environment caused by VoIP are of specific interest.

Figure 2.2 - External environment of the organisation (global and domestic)



Source: Adapted from Pearce & Robinson, 2003.

2.3.2.1 The remote environment

The remote environment includes factors that originate beyond the control of the organisation or any one specific originations operating situation e.g. economic, social, political, technological and ecological factors (Pearce & Robinson, 2003).

2.3.2.1.1 The economic environment

Economic environment is the nature and direction of the economy in which the firm operates (Pearce & Robinson, 2003).

The major economic conditions are the cost to Telkom to buy the VoIP network equipment and potential revenue that can be generated. Examples are:

- Exchange rate influence on the cost of network equipment.
- Telkom can increase its tariffs to the maximum of the RSA inflation rate as enforce by their licenses conditions as a monopoly of the fixed telecommunication network of RSA.
- The telecommunications market has recently been going through a slump with many of the operators experiencing financial problems. As a result the cost of capital has increased.
- GDP growth that leads to an increase in disposable income that can be spent on telecommunication services.

Consumer confidence and economic stability were also considered but is not seen as a major influence on the decision under current market conditions.

The economic environment can be summarised in the business cases used to evaluate the feasibility to implement a VoIP network. Sentiment of investors toward telecommunication projects is also important in the decision-making process.

2.3.2.1.2 Social environment

Social conditions that influence an organisation "involve the beliefs, values, attitudes, opinions and lifestyles of persons in the organisations external environment as developed from cultural, ecological, demographic, religious, educational and ethnic conditions" (Pearce & Robinson, 2003, p. 58).

Examples are:

- Impact of AIDS on the economically active population will reduce the potential market size in the future.
- VoIP delivered to high population density areas would be the most viable solution. To provide telecommunication services to low subscriber dense areas is more costly. In many cases the population in rural areas is sparsely concentrated and is poor. These potential subscribers cannot afford to pay for telecommunication services.
- The advantage of VoIP compared to traditional TDM voice communication is that the more advanced services can be bundled together with the voice services making it more attractive for the operator as well as the end subscriber. People with low literacy levels would require only basic telecommunication services and will also spend relatively little on telecommunication services. People that are highly educated will use advanced telecommunication services and will be prepared to spend more on telecommunication services.

Ecological, religious and ethnic conditions do not play a major role especially when comparing the use of VoIP to the current TDM based network.

These conditions have a direct and strategic impact on the decision and are discussed as part of the customers or more specifically the market for this opportunity. Refer to paragraph 2.3.2.3.3 for details.

2.3.2.1.3 Political environment

Political conditions define the legal and regulatory environment in which the organisation has to operate. Legal and regulatory conditions serve the interest of the community e.g. the consumer, employees and general public and the environment. Conditions can be incentives to promote activity or restrictive and can include the following: fair trade, antitrust, minimum wage, pollution, price policies, tax etc. Government also plays a role in the supplier and customer function. As supplier it provides access to the resources controlled by government e.g. natural resources, infrastructure and access to servitudes. As a customer function the government requires telecommunications services and can create, sustain, enhance or eliminate market opportunities (Pearce & Robinson, 2003).

The following listed conditions are very important:

- License conditions and Telecommunication regulations – Government's main goal of regulating the telecommunication environment is to ensure that the people of RSA have access to telecommunication service at the cheapest possible price.
- Economic upliftment - It is a well-accepted fact that where there is infrastructure economic growth takes place. The infrastructure normally included is transport, power and telecommunication. The Government is striving to increase the tele-density in RSA. Any proposals to achieve this will be welcomed and even supported by the government.

Telkom has to meet many requirements to keep within the prescribed boundaries of the law. To implement VoIP would require an in-depth analysis of the political environment.

2.3.2.1.4 Technological environment

"To avoid obsolence and promote innovation, a firm must be aware of technological changes that might influence its industry. Creative technological adaptations can suggest possibilities for new products, for improvements in existing products, or in manufacturing and marketing techniques" (Pearce & Robinson, 2003, p. 60).

Technology forecasting would be of critical importance before the selection of VoIP for deployment. It attempts to foresee advancements and estimate their impact on the organisation.

Examples of technology forecasting for VoIP are:

- Convergence of voice and data onto a packet based network infrastructure instead of the current separate voice and data networks.
- The use of VoIP instead of other packet related technologies such as VoATM or VoFR.
- VoIP technology hype created by the industry

- Fixed mobile convergence and the impact on the fixed network equipment because the mobile networks are also considering the voice and data convergence. The fixed line operator also has to transport the traffic of the mobile network operators.

Clearly the technology environment is of strategic importance for VoIP and would require further in-depth analysis in this report. Refer to paragraph 2.3.3.2.3 and 2.8 for details.

2.3.2.1.5 Ecological environment

Ecological conditions are the conditions that refer to the relationships of human beings and the impact of their activities on other living things and the air, water and soil that support them (Pearce & Robinson, 2003).

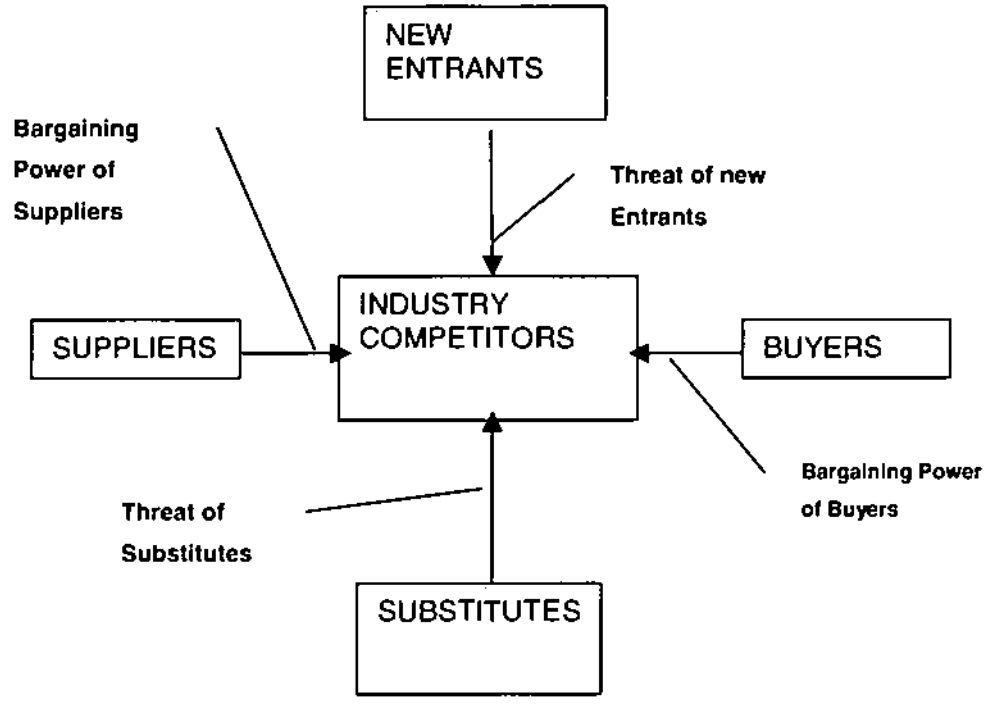
Conditions that were considered include electromagnetic radiation and an increase in number of street cabinets required due to limited transmission distance of higher frequency signals. VoIP technology does not add any important or new environmental conditions compared to other telecommunication technologies.

2.3.2.2 Industry environment

Pearce and Robinson refer to the work of Micheal E. Porter when providing an analytical framework of the industry environment with five forces driving industry competition.

According to them the degree of competition in an industry hinges on five forces: the threat of new entrants, the bargaining power of customers, the bargaining power of suppliers, the threat of substitute products or services and the jockeying among current contestants. The collective strength of these forces determines the ultimate profit potential of the industry.

Figure 2.3 - Forces driving industry competition



Source: Adapted from Pearce & Robinson, 2003.

2.3.2.2.1 Threat of entry

The seriousness of the threat of entry depends on the barriers present and on the reaction from existing competitors that the entrant can expect (Pearce & Robinson, 2003).
The six major barriers to entry are:

- Government policy
- Economies of scale
- Product differentiation
- Capital requirements
- Cost disadvantage independent of size
- Access to distribution channels

Telkom is currently operating in a monopolistic national voice network environment. The threat of a new entrant is real with the pending Second Network Operator (SNO) license that the government wants to issue. Not having a telecommunication license is an entry barrier. The SNO will have to deploy a substantial network to start offering services countrywide. The SNO will require substantial financial resources to capture an economical viable market size.

The SNO will deploy a NGN from the start and will be able to create unique brand identification with unique services. With the currently separated TDM voice network and packet based data network Telkom will be at an operational cost disadvantage to deploy the same service.

The threat of new entrant is real and would have to be seriously considered by Telkom.

2.3.2.2.2 Supplier power

"Suppliers can exert bargaining power on participants in an industry by raising prices or reducing the quality of purchased goods and services. Powerful suppliers, thereby, can squeeze profitability out of an industry unable to recover cost increases in its own prices" (Pearce & Robinson, 2003).

Major suppliers such as Siemens, Lucent, NEC, Alcatel and Nortel dominated the carrier scale TDM voice network equipment market. Only a limited amount of supplier existed because the large amount of development effort required to development carrier scale network equipment. With the introduction of VoIP the market required solutions for niche markets and as a result required less complex solutions. As a result many smaller vendors e.g. Clarent and Sonus have been able develop solutions and capture markets traditional to the carrier scale vendors e.g. the international voice traffic market. Due to the increase in suppliers the supplier power in the telecommunication industry has reduced and does not play a major role.

2.3.2.2.3 Buyer power

Powerful customers can force down prices, demand higher quality or more service and play competitors off against each other (Pearce & Robinson, 2003).

Corporate customers are responsible for a big proportion of any fixed line operators profit. The demands of these corporate customers need to be addressed especially in the light of the potential competitor entering the market place. The top corporate customers of Telkom have substantial buying power but have no legal means of wielding this power in the current monopolistic environment.

It is unknown whether the corporate customers are demanding VoIP as a service from Telkom.

2.3.2.2.4 Substitute availability

Substitute products place a ceiling on the price that can be charged for the product (Pearce & Robinson, 2003).

VoIP and voice data converged network services can be a substitute for the previously deployed TDM voice network and packet based data networks of Telkom. Vendors as a result can not ask high prices to sell their network equipment and Telkom can not charge excessive prices for the converged voice data service. The current networks deployed by Telkom act as a strong substitute to the deployment of a VoIP network and will be considered during the decision-making process.

Mobile networks using GSM and GPRS technology are possible alternatives. These technologies offer the mobility service additionally and are relatively higher priced. Telkom as fixed line operator is not allowed to deploy a Mobile network.

2.3.2.2.5 Competitive rivalry

"Rivalry among existing competitors takes the familiar form of jockeying for position – using tactics like price competition, product introduction, and advertising slugfests" (Pearce & Robinson, 2003, p. 75).

Currently there is no legal competitor to Telkom for the national fixed voice network. Threat of entry is currently of concern to Telkom.

2.3.2.3 Operating environment

The operating environment consists of conditions " in the competitive situation that affect a firm's success in acquiring needed resources or in profitably marketing its goods and services" (Pearce & Robinson, 2003, p. 82).

2.3.2.3.1 Competitors

Telkom needs to assess its competitive position that it can improve the chances of designing strategies that optimize its environmental opportunities (Pearce & Robinson, 2003).
Many criteria needs to be used to evaluate the competitive position e.g. market share, experience, advertising and promotion effectiveness.

Telkom currently has no competitor but is preparing for competition. The following criteria are of special interest when evaluating VoIP compared to the potential competitor: breadth of

product line, price competitive, age of network, productivity, experience, raw material cost, relative product quality and technological position.

2.3.2.3.2 Creditors

If Telkom wants to borrow money they will be able to sources the necessary funds (Pearce & Robinson, 2003). Will the creditors see VoIP as a good business opportunity and will they be prepared to fund such a project.

To migrate Telkom's total network to a VoIP network would require many years of capital investment. Although Telkom has a high net debt to equity ratio of 109,5%, Telkom's cash and cash equivalents increased from R299 million to R461 million in 2003 and Interest bearing debt decreasing from R21 660 million to R15 961Million (Telkom SA Limited group annual report 2003, 2003). Telkom is in a position to source the necessary funds to exploit a VoIP market opportunity.

Creditors will be a minor concern if Telkom decided to deploy a VoIP network.

2.3.2.3.3 Customers

Developing a profile of a firm's present and prospective customers improves the ability of its managers to plan strategic operations to anticipate changes in the size of the markets, and to reallocate resources to support forecast shifts in demand patterns (Pearce & Robinson, 2003).

To select the market segment for the introduction of VoIP geographic, demographic, psychographic and behavioural variables are all applicable on Telkom's consumer market. For Telkom's industrial market the operating variables such as technology, volume of usage and service requirements of these markets apply.

Customers and the various markets are of major importance because the service that VoIP offers should satisfy these markets.

2.3.2.3.4 Labour

"A firm's ability to attract and hold capable employees is essential to its success" (Pearce & Robinson, 2003, p. 87).

Telkom has a very good position regarding labour. They have highly skilled employees and are able to attract capable labour. Due to the inexperience of the telecommunication markets regarding VoIP on a carrier scale, the availability of experienced personnel is only available at a premium. The current installation, maintenance and operation personnel will require training on the new technology

Labour needs to be considered during the decision-making process due to the number of personnel that needs to be trained and time and cost required to create a skilled work force.

2.3.2.3.5 Suppliers

"Dependable relationships between a firm and its suppliers are essential to the firm's long term survival and growth" (Pearce & Robinson, 2003, p. 86).

Telkom has access to many vendors that have the necessary credentials. This ensures the abilities and services are competitive. Due to the potential volume of business most suppliers are prepared to provide equipment to Telkom. Most telecommunication vendors supply equipment in the world market, which ensures the long-term survival of the vendor. Telkom is a dominant buyer in the market place. They can dictate their requirements on suppliers.

Due to the highly specialised nature of telecommunication network equipment the selection of the right supplier for the required solution is of critical importance. The features of the equipment can influence the marketable services that Telkom could offer and influences its operational effectiveness and efficiency.

2.3.2.4 The global environment

In the international environment all the environments need to be considered for the various national markets. The one additional complication is the interplay among these various markets (Pearce & Robinson, 2003).

Telkom features in the global market and forms part of the larger global telecommunication community. The factors attributable from the global environment are included in the various other conditions such as economic environment, creditors and technological development. This report is limited to the national network of Telkom.

An example of where the global environment is relevant is where other operators are trialling or deploying VoIP networks. Some of these operators form part of the multinational firm SBC Communications Inc., one of Telkom's major shareholders. Information and experience is shared within the multinational firm and could play a major role in the strategy of Telkom towards VoIP.

Telkom will have to consider the influence of the international environment.

2.3.3 Internal Analysis

"The company analyzes the quantity of the company's financial, human and physical resources. It also assesses the strengths and weaknesses of the company's management and organisational structure. Finally, it contrasts the company's past successes and traditional concerns with the company's current capabilities in an attempt to identify the company's future capabilities" (Pearce & Robinson, 2003, p. 13).

By considering the value chain of Telkom many of the strengths and weakness may be identified. The focus is specifically on the strategic conditions and those that relate to VoIP. The value chain is divided into primary activities and supporting activities (Pearce & Robinson, 2003).

2.3.3.1 Primary value chain activities

2.3.3.1.1 Inbound logistics

Inbound logistics consist of the activities, costs and assets associated with obtaining material from vendors, receiving, storing, inspection and inventory management. Introducing VoIP would not have a major affect on this part of Telkom's value chain.

2.3.3.1.2 Operations

Operations consist of the activities, costs and assets associated with converting inputs into final product form. The VoIP network needs to be implemented and integrated into the existing network. Introducing VoIP will have a major impact on the operations of Telkom with many business processes and procedures that need to be redefined and implemented.

2.3.3.1.3 Outbound logistics

Outbound logistics consist of the activities, costs and assets dealing with physically distributing the product to buyers. Outbound logistics would be influenced in a minor way and

would mostly function as with any other technology. Introducing VoIP would have a minor effect on this part of Telkom's value chain.

2.3.3.1.4 Marketing and Sales

Marketing and Sales consist of the activities, costs and assets related to sales force efforts. These include advertising and promotion, market research and planning and dealer/distributor support.

VoIP will have a major impact on the marketing and sales activities because VoIP along with IP will require re-formulation of the market segments due to the convergence of the voice and data market segments. VoIP with IP allows the redefinition of charging customers for services rendered. Voice allowed duration and distance based charging and data allowed for volume, distance and/or bandwidth based charging. VoIP with IP allows for the combination of duration, distance, volume, bandwidth and content. As a result of a redefinition of market segments and charging, all other activities in the organisation could potentially be affected.

2.3.3.1.5 Service

Service consist of the activities, costs and assets associated with providing assistance to buyers, such as installation, maintenance and repair, technical assistance, buyer inquiries and complaints. VoIP will have a major impact on the service activities because VoIP will require the adaptation of all processes and methods to deliver the various services to the end customer.

2.3.3.2 Supporting value chain activities

2.3.3.2.1 General administration

General administration consists of the activities, costs and assets relating to general management, accounting and finance, legal and regulatory affairs, safety and security, management information systems and other overheads. Although VoIP would have an influence on these activities the fundamental functions that need to be executed will not change.

2.3.3.2.2 Human resource management

Human resource management consist of the activities, costs and assets associated with the recruitment, hiring, training, development and remuneration of all types of personnel, labour relations activities and development of knowledge-based skills. VoIP will require the re-

training of the operational and service personnel who are currently enabled to operate TDM based voice networks.

2.3.3.2.3 Research, technology and system development

Research, technology and system development involves the activities, costs and assets relating to product development, process development, equipment design and development of computerized support systems. Telkom would normally buy the relevant systems but would act as an integrator of the total network solution. This activity requires defining the total network solution from access to the core network and from element management to business process management. Due to the inexperience with VoIP this activity will be of major importance.

Refer to paragraph 2.8 for more details on the "Integration of an organisation's technology and business strategy"

2.3.3.2.4 Procurement.

Procurement consist of the activities, costs and assets associated with purchasing and providing raw materials, supplies, services and outsourcing necessary to support the organisation and its activities. This function functions as with any other technology to select the vendor and negotiate the best terms for Telkom. The selection of the vendor is not part of the scope of this report. Introducing VoIP would not have a major affect on this part of Telkom's value chain.

2.4 Strategic Analysis and Choice

"Simultaneous assessment of the external environment and the company profile enables a firm to identify a range of possible avenues for investment. However, they must be screened through the criterion of the company mission to generate a set of possible and desired opportunities. This screening process is meant to provide the combination of long-term objectives and generic and grand strategies that optimally position the firm in its external environment to achieve the company mission" (Pearce & Robinson, 2003, p. 13).

"Strategic analysis and choice in single or dominant product/service businesses centres around identifying strategies that are most effective at building sustainable competitive advantage based on key value chain activities and capabilities – core competencies of the firm. Multi-business companies find their managers focused on the question of which

combination of businesses maximises shareholder value as the guiding theme during their strategic analysis and choice" (Pearce & Robinson, 2003, p. 13).

In essence, strategic analysis and choice refer to the point at which the strategic decision-makers attempt to strike a balance between the internal and external environment as well as the company mission and social responsibility. As a result of the strategic analysis and choice, the long-term objectives as well as generic and grand strategies are defined.

2.4.1 Telkom's long-term objectives

"The result that an organisation seeks over a multi-year period is its long-term objectives. Such objectives typically involve some or all of the following areas: profitability, return on investment, competitive position, technology leadership, productivity, employee relations, public responsibility and employee development" (Pearce & Robinson, 2003, p. 13).

Telkom states: "Our group strategic goals are to increase shareholder value by increasing profitability and cash flows, while maintaining our market leadership in the South African fixed-line and mobile communications markets. We also intend to support Vodacom's strategy of establishing and maintaining leading positions in other sub-Saharan African mobile markets. In addition, we will seek to increase the synergies between our fixed-line business and Vodacom" (Telkom SA Limited, 2002e).

2.4.2 Telkom's generic and grand strategies

"Many businesses explicitly and all implicitly adopt one or more generic strategies characterising their competitive orientation in the market place. Low cost, differentiation or focus strategies define the three fundamental options. Enlightened managers seek to create ways for their firms to possess both low cost and competitive differentiation advantages as part of their overall generic strategy. They usually combine these capabilities with a comprehensive, general plan of major actions through which their firm intends to achieve its long-term objectives in a dynamic environment. Called the grand strategy, this statement of means indicates how the objectives are to be achieved" (Pearce & Robinson, 2003, p. 14).

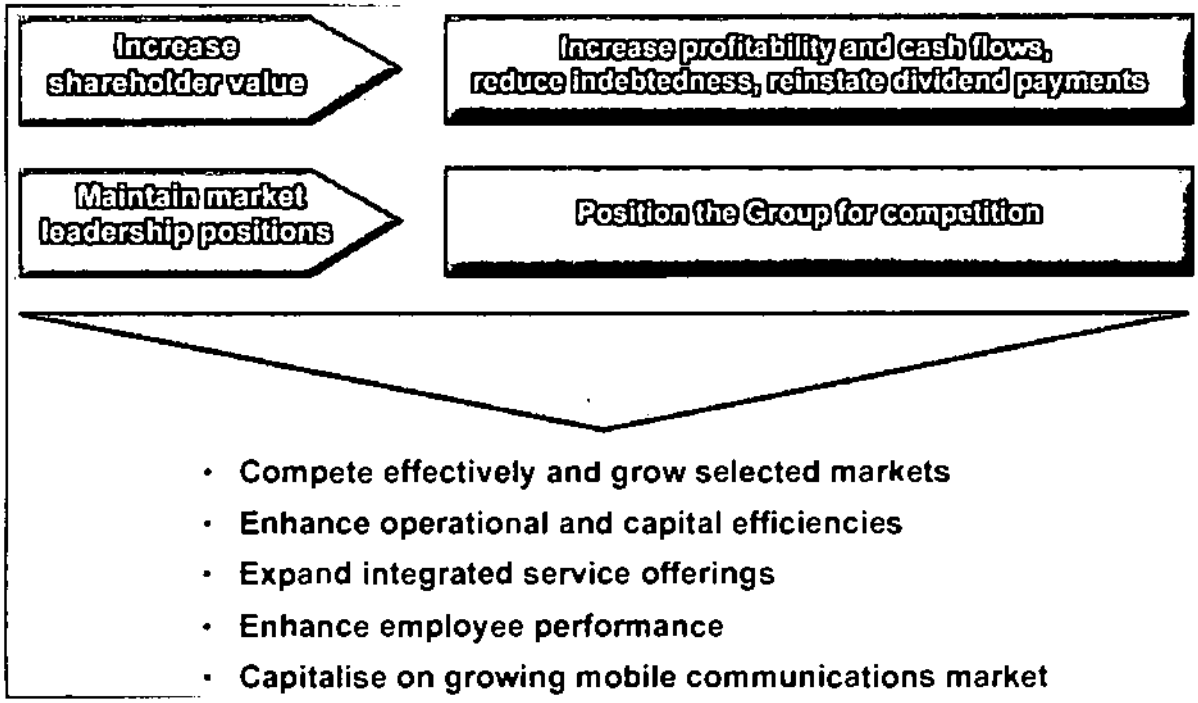
Although every grand strategy is, in fact, a unique package of long-term strategies, fourteen basic approaches can be identifies: concentration, market development, product development, innovation, horizontal integration, vertical integration, joint venture, strategic alliances, consortiums, concentric (focused) diversification, conglomerate diversification, turnaround, divestiture and liquidation (Pearce & Robinson, 2003).

Grand strategies provide basic direction for strategic actions and are the basis of coordinated and sustained effort directed towards achieving long-term business objectives (Pearce & Robinson, 2003).

Telkom states: "In order to achieve our goals, we intend to pursue the following strategies:

- compete effectively in our core fixed-line markets and grow selected markets;
- continue to reduce operating expenses and enhance capital investment efficiencies;
- expand our integrated service offerings;
- continue to invest in employees to foster a highly competitive corporate culture; and
- capitalise on the growing mobile communications market through Vodacom " (Telkom SA Limited, 2002e).

Figure 2.4 - Telkom's objectives, and grand and generic strategies



Source: Telkom SA Limited group annual report 2003, 2003.

2.4.3 Impact of long-term objectives, and generic and grand strategies on VoIP

If applied in the right situation VoIP could assist Telkom achieving its long term objectives, and generic and grand strategies. For example, VoIP can increase profitability and cash flows while maintaining their market leadership in the South African fixed-line market. VoIP can be deployed to ensure that Telkom can compete effectively in core fixed-line markets and grow selected markets. VoIP can allow the reduction in operating expenses and

enhance capital investment efficiencies. VoIP could also expand Telkom's **integrated** service offerings.

2.5 A definition of strategy

Strategy is a plan at the highest organisational level. It usually is a goal based executive guideline in the form of dynamic synoptic information. It has to do with how corporate actions will achieve corporate goals, with goals used to define objectives. It is a primary executive input and must be rolled down, up or across the organisation (Dimension Data, 2001).

2.6 Dimensions of a strategic decision

Pearce & Robinson (2003) state that strategic decisions have the following dimensions:"

1. Strategic issues require top-management decisions.
2. Strategic issues require large amounts of the firm's resources.
3. Strategic issues often affect the firm's long-term prosperity.
4. Strategic issues are future orientated.
5. Strategic issues usually have multi-functional or multi-business consequences.
6. Strategic issues require considering the firm's external environment"

It is apparent that for Telkom the decision to deploy a VoIP network would require a strategic decision as it meets all the above dimensions.

2.7 Product markets and resource-based normative influence on strategy

"Current normative work in strategy is oriented towards better integrating the product-market and the resource-based views" (Burgelman, Maidique & Wheelwright, 2001, p. 4).

"Product market view of strategy is primarily concerned with how the firm competes with its products and services. The resource based view of strategy is concerned primarily how the firm can secure the factors needed to create the core competencies and capabilities that form the basis for establishing and sustaining competitive advantage" (Burgelman, Maidique & Wheelwright, 2001, pp. 3-4).

According to Hamel and Prahalad (1990) the basis of ensuring that a business excels is to define and use their core competencies to build core products/services that customers need but have not yet even imagined. In their view core competencies are the nourishment, sustenance, and stability of any business that enables it to produce superior products and to

exploit the market to the company's full advantage. This indicated the growing prominence of the product market and resource based view of strategy.

2.8 Integration of an organisation's technology and business strategy

Burgelman, Maidique and Wheelwright refer to the model of JM Harris, RW Shaw and WP Somers to match business and technology portfolios. The business portfolio is represented by the product or service that is plotted on a matrix of competitive position versus market/industry attractiveness. This matrix is called the directional policy matrix and is discussed in detail by MacDonald (2000). The relevant technologies are plotted on a similar matrix with relative technology position versus technology importance.

A comparison of these two matrixes would indicate matching or mismatching business and technology portfolios and resulting investment priorities (Burgelman, Maidique & Wheelwright 2001).

2.9 Technology market management

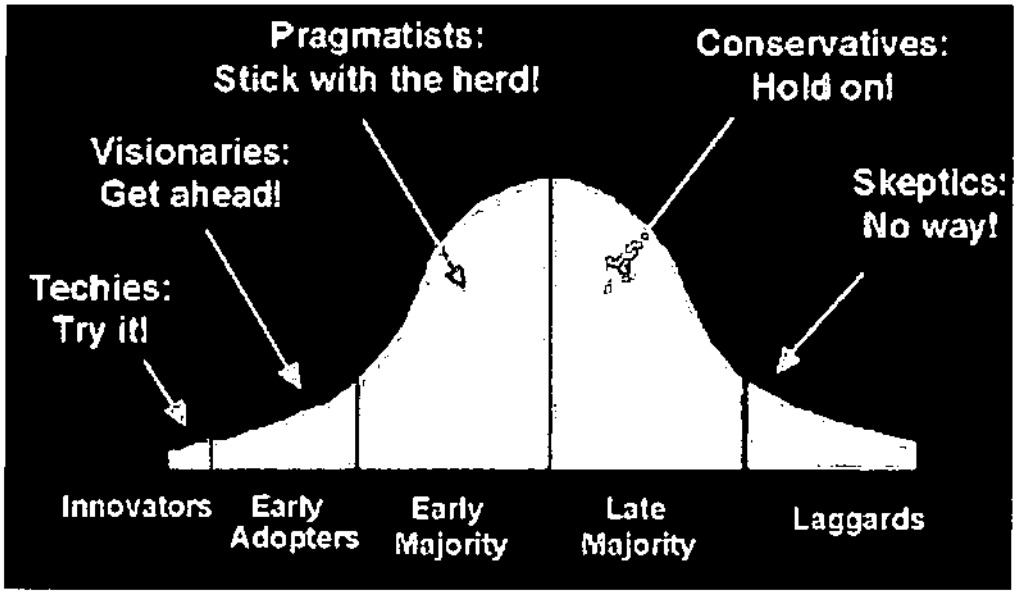
Understanding the market in which organisations operate is crucial to the success of the organisation. If they do not understand the market, the needs of the market cannot be met. By understanding the market the management of an organisation could steer the organisation to meet the needs of the market. Before even attempting to formulate a strategy it is crucial to know the needs of the market in which the firm operates. The Technology Adoption Life Cycle and Market Development Model assist in providing insight in the market.

2.9.1 Technology Adoption Life Cycle

The Technology Adoption Life Cycle can be used in all technology based industries e.g. Medical, Insurance, Pharmaceutical and the Information Technology (IT) industries. It makes a very successful attempt to explain the radical changes in the market in which technology companies operate. These changes place huge and changing demands on the organisation that operates in these markets (Moore, 1999a).

If organisations respond correctly and positively to these demands the benefits that could be reaped are huge and is worth the "pain" an organisation has to go through to meet these changes in the market demands.

Figure 2.5 - The Technology Adoption Life Cycle



Source: Moore, 1999a.

The Technology Adoption Life Cycle curve shown above represents a normal distribution curve with the boundary between the visionaries and the pragmatist and the border between the conservatives and the sceptics around one standard deviation from the norm.

- The **innovators** are not the inventors of the solution. They are the technical wizards that experiment with technology and enjoy the thrill thereof. They do not use the solution in a commercial application in an official way. The reason they are important is because they are the gatekeepers to the rest of the life cycle. Only with their endorsement will other people give the product another glance. Time and money should be used to ensure that the innovation gets their approval.
- **Early adopters** are the visionaries in the industry that identify early on that a solution has advantages. They want to break with the past and start with the discontinuity of an innovation. They are the first group to bring real money to the market (although limited). They will put considerable energy into the solution to make it a complete, commercially useable solution, but this requires considerable customisation to meet their demands. Sooner or later this customisation forces companies to search for customers that want the functionality that everybody else requires - the pragmatist.
- **The Early Majority** are the pragmatists that make the bulk of the purchases of technology infrastructure. They want to be in control of all the company's mission critical systems. They prefer to buy from market leaders because their products are the most stable. The market leader attracts many third party companies, which will respond to

customer request if the market leader does not. They require a total solution that is fully functional.

Table 2.1 - Characteristics of visionaries versus pragmatists

Visionaries	Pragmatists
Intuitive	Analytic
Support evolution	Support revolution
Loner/Contrarians	Stay with herd/Conformist
Take risks	Manages risks
Explore opportunities	Exploit capabilities
Motivated by opportunities	Motivated by present problems
Require good conceptual service/product	Require financial statements, organization and references
80% solution – build together other 20%	100% Standard solution required – solve my problems

Source: Moore, 1999a.

- **Late Majority** or conservatives are pessimistic about the ability of technology to give them any advantage. They are price sensitive, highly sceptical and very demanding. The market is none the less big and presents deep challenges to the vendor. The key to success and profitability is to simplify and commoditise the product to the point where it just works. For example conservatives will buy dozens of advanced microprocessors as long as they are deeply embedded inside a BMW.
- **Laggards or** sceptics are the ever-present critics and the goal is not to sell to them but to sell around them.

The Technology Adoption Life Cycle has the idea of developing the market by working from one profile of customers to the next.

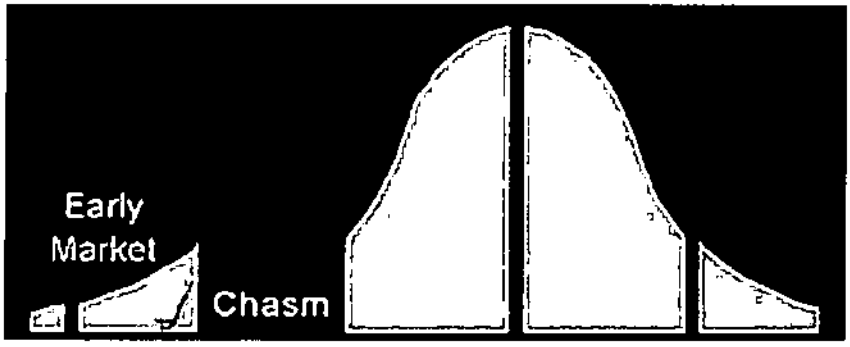
2.9.2 Market Development Model

Along with the Technology Adoption Life Cycle the Market Development Model is used by many technologies oriented companies as a basis of creating wealth and addressing and understanding the market the firm operates in.

The Market Development Model (Moore, 1995) is applicable to technology that allows for a paradigm shift or discontinuous innovation.

- The **early market** is a time of great excitement when customers are technology enthusiasts and visionaries are looking to be first on board with the new paradigm.
- The **chasm** is a time of great despair, when the early market interest wanes but the mainstream market is still not comfortable with the immaturity of the solution available.

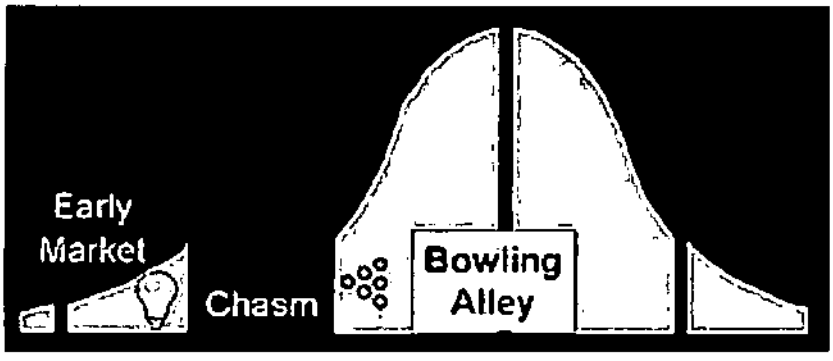
Figure 2.6 - The Chasm



Source: Adapted from Moore, 1995.

- The **bowling alley** is a period of niche-based adoption in advance of the general market place driven by compelling customer needs and the willingness of vendors to craft niche specific whole products.

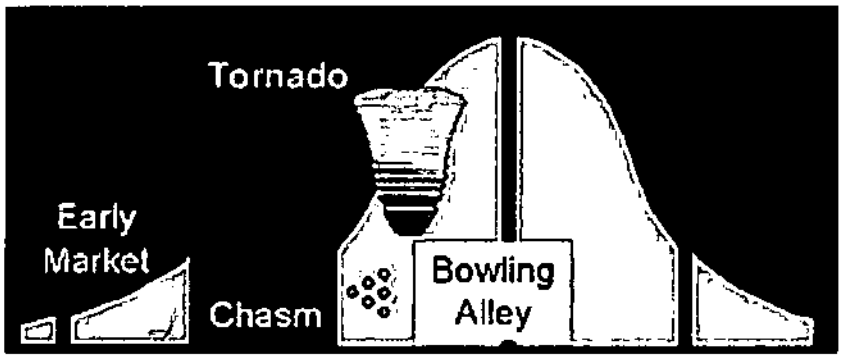
Figure 2.7 - The Bowling Alley



Source: Adapted from Moore, 1995.

- The **tornado** is a period of mass-market penetration when the general marketplace switches over to the new infrastructure paradigm.

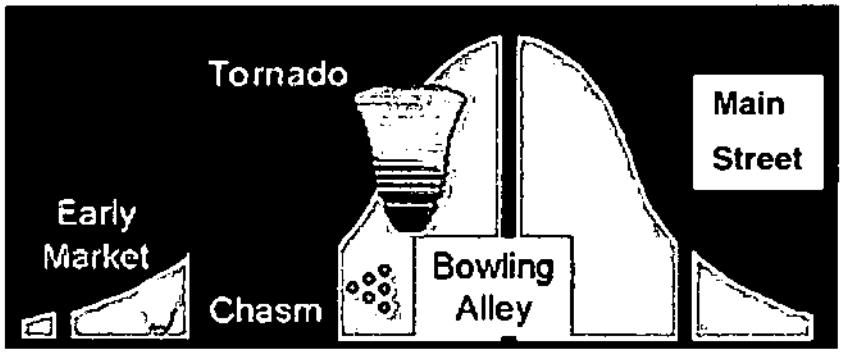
Figure 2.8 - The Tornado



Source: Adapted from Moore, 1995.

- **Main street** is a period of aftermarket development, when the base infrastructure has been developed and the goal now is to milk the cash cow to its full potential.

Figure 2.9 - Main Street



Source: Moore, 1995, p.19.

- **End of life** can come all too soon in the high tech industry e.g. semiconductor markets are striving for higher performance and lower price. In this period continuous change and new paradigms of technology enter the market, thereby replacing the market leaders.

Both these theories serve as a framework to identify the conditions that an operator needs to consider when making a decision to implement a VoIP network.

2.10 Summary of potential conditions identified during the theoretical survey.

A summary of the potential conditions identified during the theoretical survey is provided in Table 2.2. The table indicates whether the conditions will have a major or a minor influence during the decision-making process.

Table 2.2 - Potential conditions applicable when making a decision to implement a VoIP network

Refer to paragraph	Potential condition	Major influence on/by VoIP	Minor influence on/by VoIP
2.3.1	**Company mission and social responsibility**		
2.3.1.1	Company mission		√
2.3.1.2	Social responsibility		√
2.3.1.3	Stakeholders	√	
2.3.2	**External Environment**		
2.3.2.1	The remote environment		
2.3.2.1.1	The economic environment	√	
2.3.2.1.2	Social environment	√	
2.3.2.1.3	Political environment	√	
2.3.2.1.4	Technological environment	√	
2.3.2.1.5	Ecological environment		√
2.3.2.2	Industry environment		
2.3.2.2.1	Threat of entry	√	
2.3.2.2.2	Supplier power		√
2.3.2.2.3	Buyer power	√	
2.3.2.2.4	Substitute availability	√	
2.3.2.2.5	Competitive rivalry		√
2.3.2.3	Operating environment		
2.3.2.3.1	Competitors	√	
2.3.2.3.2	Creditors		√
2.3.2.3.3	Customers	√	
2.3.2.3.4	Labour	√	
2.3.2.3.5	Suppliers	√	
2.3.2.4	The global environment	√	
2.3.3	**Internal Analysis**		
2.3.3.1	Primary value chain activities		
2.3.3.1.1	Inbound logistics		√
2.3.3.1.2	Operations	√	
2.3.3.1.3	Outbound logistics		√
2.3.3.1.4	Marketing and Sales	√	

and 2.9	Where on the technology adoption life cycle model would Telkom want to introduce VoIP and where is the VoIP market currently?		
2.3.3.1.5	Service	√	
2.3.3.2	Supporting value chain activities		
2.3.3.2.1	General administration		√
2.3.3.2.2	Human resource management	√	
2.3.3.2.3 and 2.8	Research, technology and system development How will Telkom ensure that your technology and business strategy for VoIP are integrated?	√	
2.3.3.2.4	Procurement.		√

2.11 Conclusion

The design of business strategies is based on the conviction that if a firm is able to anticipate future business conditions, a firm will be able to improve its performance and profitability. Despite the uncertainty and dynamic nature of the business environment, an assessment process that narrows, even if it does not precisely define, future expectations are of substantial value to strategic managers (Pearce & Robinson, 2003).

The Strategic Management Model as described by Pearce and Robinson (2003) was used to do a theoretical analysis of possible conditions that should be considered by Telkom during the decision-making process. The Strategic Management Model was enhanced with the product-market and the resource-based normative views.

If Telkom wants to implement a VoIP network they would need to ensure that the business portfolio and technology portfolios match. They also need to determine where on the technology adoption life cycle they want to be as a customer using VoIP network equipment. They also need to determine how they want to introduce this technology into the market and what the acceptance of this technology would be.

A summary of the potential strategic conditions that were identified during the theoretical survey is provided in paragraph 2.10. The conditions that will have a major or a minor influence during the decision-making process is indicated there.

None of these conditions or the long-term objectives, and generic or grand strategies of Telkom excludes the use of VoIP by Telkom. VoIP could actually assist Telkom achieve their long term objectives and assist them to implement generic and grand strategies if implemented in the right situation.

The identified conditions from the theoretical survey are broad areas that need to be further refined and need to be condensed to the few most important strategic conditions. Based on the theoretical framework, the research methodology will be discussed in Chapter 3.

CHAPTER 3: RESEARCH METHODOLOGY

3.1 Introduction

This chapter will describe the research method used, the sample selection, the guideline questions and preparation to the interview and hints on how to collect the data and the method of analysing the gathered data.

3.2 The research method

The main methods of research are archival, case study, field experiment and survey.

The archival method is used when events in the past is used to predict the future (Jankowicz, 2000). The voice market has changed since the previous introduction of a new technology (TDM). Only a few number of the conditions will be identified if this method is used. The field experiment method is used where the relative importance of one or more variables are investigated. The focus is on the variables rather than issues (Jankowicz, 2000). This report aims to determine the issues. Thus the field experiment is not suitable. The case study explores issues both in the present and the past. The recommendations you make look towards the future (Jankowicz, 2000). The survey method directs questions at people to explore issues largely in the present (Jankowicz, 2000). The survey method was selected because issues largely in the present need to be identified.

During the theoretical analysis Telkom's website was extensively used as a reference to eliminate conditions that are not important for the decision of implementing a VoIP network by applying the Pareto principle. The website is the only source of information that can be used to find official information as required for this report. Telkom normally only publishes statements in newspapers about new services or it provides comments on certain topical issues of the day. The planned technology or network deployments are usually not discussed in the media and if it is discussed it is too generic to be meaningful. This is due to the pending de-regulation.

The key informant interview technique was selected because it allows the "particular perspective arising from different expertise bases contribute to a picture" (Jankowicz, 2000, p. 222). This technique is especially useful in the following situations:

- The essential characteristics of some issue need to be defined by drawing on the experience and understanding of the person involved.
- The boundaries, constraints and extremes within which these definitions apply need to be identified.

- The knowledge of the issue itself needs to increase (Jankowicz, 2000).

The key informant interview was selected because it is particularly suited to explore complex issues. It is also used to gain a detailed picture of the participant's perceptions or accounts of the topic. Because the research is of a qualitative nature open-ended questions requiring a descriptive type of response were used. An interview with open-ended questions allows the maximum amount of lateral thinking and ensures that all the strategic conditions are captured. It also allows the use of on the spot questions to gain more in-depth understanding of the respondent's beliefs, attitude and situation thus allowing the interviewer to request more detailed information on a specific identified strategic condition.

To understand a firm's strategy requires not only top management statements and assertion about the firm's strategy but also observations of what the firm actually does (Burgelman, Maidique & Wheelwright, 2001). To understand what a firm is going to requires discussions with various employees. For this reason the interview technique was selected.

Qualitative research is concerned with non-statistical methods of inquiry and analysis of social phenomena. It draws on an inductive process in which themes and categories emerge through analysis of data collected by such techniques as interviews (McRoy, 2003). Qualitative research was selected because it allows the understanding of how and why the implementation of VoIP will take place and not only on the outcome. The question of whether it will take place, is a characteristic of quantitative research.

The survey method of research was selected. The qualitative research was done by means of the key informant interview technique.

3.3 Sample

Judgement sampling is a common non-probability sampling method. The researcher selects the sample based on judgement of some apparent characteristic (Zikmund, 2000).

The key informant interview was selected because respondents are chosen on the basis of specialised knowledge rather than randomly (Jankowicz, 2000).

Buying centres are normally used when a business interacts with other businesses during the buying process. Various parties play a role during the process. The possible roles are the initiator, gatekeeper, influencer, decider, user and buyer. The three of interest are the

influencer that establishes the actual requirements of the product or service, the decider that makes the final buying decision and the user that needs to use the product (Mahin, 1991).

The Telkom funding council is the decision-making forum that will decide whether VoIP will be implemented in the Telkom network. The role players at this decision-making forum are the executive managers of Telkom. The main parties that have to agree are the Chief Sales and Marketing Officer and the Chief Technical Officer. Interviewing employees from the various functional units reporting to these officers will ensure the identification of various perspectives from the functions in Telkom. Employees from the following functional units need to be interviewed: Marketing and Sales; Operations and Services; Research, Technology and System Development. The other functional units provide support to enable the decision e.g. Legal, Financial, General Administration, Human Resources Management and Procurement Services. The management of the selected functional units will also consider the impact on these support functions and will be able to mention any major impact these functions have on the decision.

The interviewed employees selected are at senior management level. Senior managers were selected because they provide the recommendations to the decision-makers, namely the executives of Telkom.

As a result, interviews were held with various people in the selected functional units.
Technology Network Services (TNS)

- Technology and Direction and Integration (TDI) - Paul Ingelsby (Technology strategy), Henry Paul, Albert van Zyl and Albert van Schalkwyk (Proof of concept, Technology integration)
- Integrated Network Planning (INP) - Billy Fick (Business models)

Core Network operations (CNO)

- NNOC Tier 2 operations - Andrew Hadley (Operation)
- Technical Product Development (TPD) - John Davis (Solutioning)

Marketing and Sales - Steven White

Two Siemens Key Account Managers, Bruce Atherton and Rolf Spaeth responsible for sales to Telkom were also interviewed to determine if they could see any major oversights.

In total 8 Telkom employees were interviewed and 2 Siemens employees.

3.4 Research instrument

The research is of a qualitative nature and open-ended questions were used. A guideline introductory statement was created. Pre-prepared questions were created to provide guidance to the researcher during the interview. The aim was to provide the minimum of guidance to the interviewed person in an attempt to allow the maximum amount of lateral thinking.

Refer to Appendix B for the guideline and the questions used during the interview.

3.4.1 Guideline used during the interview

As an introduction during the conversation it was indicated that the reporter was in the process of completing an MBA and to achieve the MBA degree had to complete a management report.

The subject of discussion was introduced to the interviewee by stating the title of this business report: '**Strategic** conditions to be considered by Telkom before investing in voice over Internet protocol equipment for their national network'.

It was explained that the focus is on strategic issues as explained in the Strategic Management Model and that the focus was on the formulation part of the model. Reference was made to Figure 2.1 - The Strategic Management Model.

The interviewee was then encouraged to answer the question and to speak from his personal perspective.

3.4.2 Questions asked during the interview

The first asked question was to ensure that Telkom is interested in deploying VoIP and that they are not interested in deploying another technology or that they will continue deploying TDM technology. The question was 1. Is Telkom interested in deploying a national VoIP network or would Telkom rather deploy another technology (e.g. TDM, ATM)?

The identified conditions from the theoretical survey are broad areas that need to be further refined and condensed to the important few strategic conditions. If suggestions are provided to the interviewee of possible conditions then unimportant conditions might be confirmed as relevant and thus important. If the interviewee has to think what the conditions are, the conditions of major importance would be mentioned.

As a result the following two open ended questions were asked to establish the current enabling and inhibiting conditions for Telkom to implement a VoIP national network. The questions are: 2. Why will Telkom invest in VoIP technology? and 3. Why has Telkom not yet implemented VoIP technology for their national network?

In support of these two guideline questions the framework of relevant theoretical strategic conditions that was created during the theoretical survey was also used as a reference during the interview. Refer to paragraph 2.10 for detail on the framework. This framework was only used if the interviewee did not respond to question 2 and 3 in a satisfactory manner or to initiate further thoughts of other strategic conditions that were left out during the interview. For example the following question was used: Is the political environment an area of strategic importance?

On-the-spot questions were used to gain more in-depth understanding of the respondent's beliefs, attitude and situation. This allows the gathering of more detailed information on a specific identified strategic condition. For example, to reach a deeper understanding of any of the identified areas the following question was used: Can you please clarify why you think this condition is of strategic importance?

Using open ended questions, the theoretical survey framework and on-the-spot questions ensured that all the relevant conditions were identified and correctly understood as seen by the operator.

To establish whether the interviewee thinks that a national VoIP network will be implemented soon, the question, 4. When will Telkom implement a national VoIP network? was asked.

To ensure that no strategic conditions were left out, the interviewee is asked: 5. Do you have anything to add that was not addressed by my questions or that was not mentioned already?

3.5 Data collection

A request to discuss the topic was sent to the various selected interviewees. A meeting was scheduled with each of the interviewees using the topic of this report as the subject to discuss during the meeting. The meetings were scheduled for a duration of an hour.

The research instrument was used during the interview.

Notes were taken during the interviews to record the answers of the interviewees. Some interviewees made drawings to explain concepts and were provided to the researcher.

Seven of the interviewees were open and receptive and enthusiastic to share information. One of the interviewees seemed to be guarded. Due to the passion of the interviewees on this topic the meetings normally lasted for an hour and a half.

A summary of all the interviews are provided in Appendix C

3.6 Data analysis and interpretation

The results were organised and presented in a systematic way into various categories. Reference will be made who or how many respondents mentioned the strategic conditions. The result of the analysis and interpretation is provided in Chapter 4.

3.7 Conclusion

The survey method of research was selected. The qualitative research was done by means of the key informant interview technique. Judgement sampling was used to select the interviewee.

The research is of a qualitative nature and thus open-ended questions were used for the guideline questions during the interview.

The identified conditions for the theoretical survey are broad areas that need to be further refined and condensed to the important few strategic conditions. These results were used as a framework to interview Telkom employees to identify the more specific and strategic conditions. This framework was only used to initiate further thoughts of other strategic condition that were overseen during the interview.

The following chapters will provide an overview of the information that was gathered during the interviews and is presented in categories. It will then be interpreted. This will provide insight in the strategic conditions that will influence Telkom's decision regarding the implementation of a VoIP network.

CHAPTER 4: PROCESSING AND INTERPRETATION OF RESULTS

4.1 Introduction

The chapter presents the gathered information during the key informant interviews. The results are organised and presented in a systematic way.

The decision making process used by Telkom to analyse the potential of a new service is described. The strategic conditions that Telkom will consider during the decision-making process and the influence on the decision is described. Reference is made of how many respondents mentioned the strategic conditions. Telkom's strategy regarding the implementation of VoIP is then described and indications are given of when the implementation of a National VoIP network could take place.

4.2 The decision-making process of Telkom

In his interview, Andrew Hadley mentioned that Telkom has defined a process that evaluates possible market opportunities (Appendix C.5). During this decision-making process the following questions need to be answered:

- What are the needs of the market?
  E.g. corporate customers using IP PABX's want to interconnect corporate sites via IP and want to connect to Telkom via IP connections for their voice traffic at varying quality of service and price.
- What is the cost of deploying the service?
  E.g. would the network equipment plus the internal cost to Telkom (OPEX and CAPEX) together result in a positive business case?
- Will the equipment do what you want it to do in the market?
- Does it make business sense?

This will result in a decision to start the introduction of a new service.

This process is in effect similar to the Strategic Management Model as described by Pearce and Robinson (2003). The needs of the market refer to the external environment. The cost to deploy the service refers to the internal analysis. The equipment meeting the requirements of the market refers to what is actually possible. Whether it make business sense refers to what is desirable and the integration of the mission, external environment and internal analysis into a final decision.

Telkom would start the product development process, which includes vendor selection and the creation of detailed operational and marketing plans. The product is only then introduced to the market place.

During the decision-making process employees from the various functional units in Telkom would contribute conditions that would have an influence on the ultimate decision. It is assumed that Telkom has not taken the final decision whether they want to implement a national VoIP network and some employees may not be fully informed of all the conditions. No importance can be attached to the number of persons that have mentioned a certain condition. It could however be assumed that if it was not mentioned, the condition will have little or no influence on the decision.

4.3 Telkom's interest in deploying a national VoIP network

Telkom has been reviewing the deployment of a national VoIP network over the past few years. Over the past 3 years, much of the 'hype' has settled down about the merits of VoIP. Vendors and operators have toned down their commercial expectations, equipment suppliers have evolved their products: more mature and realistic decisions can now be made. The status quo remains: there is merit in deploying a national VoIP network, with TDM remaining in place as long as this is economically and commercially feasible. ATM will be applied to support existing services and could be used in the access environment only to deliver QoS-managed transport.

Seven interviewees provided this response with one actually stating that ATM is seen as a legacy technology. It can therefore be concluded that Telkom is interested in deploying a national VoIP network.

4.4 Strategic conditions that need to be considered

Livingstone (1999) states that using multiple perspectives during the decision-making process improves the final decision. The three perspectives used are the technical, organisational and personal perspectives. These three perspectives were used to create the three main categories for the conditions that were mentioned during the interviews. The various conditions are described below.

4.4.1 Technical perspective

The technical perspective is the most dominant perspective and uses rationality and scientific logic. The conditions identified during the interviews are grouped according to items that can be associated with the various functional units of Telkom.

4.4.1.1 Marketing and Sales

4.4.1.1.1 The needs of the market

An important strategic condition is the customer's communications needs. All eight interviewees stressed this condition.

To provide voice services any technology can be used as long as the needs of the customer are addressed. From a marketing point of view the technology used is irrelevant except if the customer demands a certain technology because of the advantages it has (White, 2003).

Customers of Telkom have many telecommunication needs that need to be addressed. They require Telkom to provide telecommunication services as cheaply as possible and at certain reliability and quality levels.

For example VoIP along with IP allow for voice data convergence. One network addresses both voice and the data service needs of the customer. By utilising one network the customer and Telkom is aiming to reduce costs to address their telecommunication needs. Reliability and quality of the VoIP services was mentioned as a concern by six interviewees.

The needs of the market will have a major influence on the decision and can have an enabling or inhibiting influence on the implementation of a VoIP network.

4.4.1.1.2 Potential VoIP revenue generating market segments

Eight interviewees mentioned that market segments that need to be addressed by Telkom are those that can generate revenue for Telkom. Details of these revenue-generating markets were provided by four of the interviewees.

With the Packet Mode Architecture (PMA) tender Telkom attempted to define how to evolve their total network to a NGN in one step. This resulted in a too complex and uncontrollable scenario to analyse and impractical to implement. At the same time the world economy and the telecommunication economy started to decline. As a result Telkom decided to look at selected market segments and identified the most important market segments for Telkom.

The table below provides an overview of the high-level markets segments. These segments are not unique to Telkom. Most fixed line operators use them.

Table 4.1 - Market segments for telecommunication traffic

Market segments*	Importance for Telkom's future success/ revenue
International traffic	Important
National traffic	Important
Corporate traffic	Important
Public consumer traffic	Lesser importance

* The special market segments as defined by Telkom are included in this segmentation

Keeping this segmentation in mind Telkom needed to find network solutions to address the various needs that existed for the important market segments and had to formulate a strategy for each.

There is currently a demand in the market for VoIP services especially for international and national traffic from the corporate market. These are also the most important markets (Ingelsby, 2003). For a detailed discussion of the various VoIP market segments and the technical VoIP network solutions refer to paragraph 4.5

Many customers, especially in the public consumer market require only basic voice connections. Due to the cost of deploying a VoIP network and the limited potential revenue that can be made from the public consumer market, Telkom is not interested in deploying a VoIP network for the current public consumer market. Telkom will continue using the very reliable TDM voice network that already exists for these customers (White, 2003).

A niche market deployment of VoIP can be the short-term solution to address the important international, national and corporate market segments. These markets use data networks to by-pass Telkom's ability to charge for the voice calls. Operators cannot afford to lose important sources of revenue, and with growing consumer comfort and confidence in using VoIP, operators have no choice but to reciprocate and meet consumer demands. "Telkom accordingly has no choice" (van Zyl, 2003).

There is a correlation between the various market segments that require VoIP as service and the markets that Telkom has to address. This condition will have a major influence on the

decision. The specific market segments will have an enabling influence on the implementation of a VoIP network.

4.4.1.1.3 Competition and market liberalisation

Four interviewees mentioned this condition as being potentially important in the future.

Telkom currently is experiencing competition from the GSM operators, multi-national conglomerates and VAN's e.g. ISP's. The companies are not allowed to compete in the fixed voice market with Telkom due to their licence conditions, but do compete in the total voice market.

Multi-national conglomerates us leased lines or managed data connections to make voice connections via VoIP. They are allowed to make net-to-net connections but not off-net connections. Telkom now has to offer solutions that prevent the loss of revenue in this fashion.

Telkom is aware that the SNO will be allowed to compete in all areas of Telkom's markets but it will take at least 6 months after being awarded a licence, to start operating. Telkom is yet under no direct competitive pressure to introduce the latest available features or services to their end customers. They have a market window to introduce VoIP, before a competitor enters the market.

Competition from the GSM operators and multi-national conglomerates has and in future will have an even stronger influence on the decision of whether Telkom needs to implement a VoIP and in which market segments.

Competition currently has a minor influence but has the potential in future to have a major influence on the decision. If in future a competitor to Telkom offers a VoIP solution, the competition will be an enabler or will force Telkom to implement a similar solution.

4.4.1.1.4 Cost to the customer

Three interviewees mentioned this condition. They motivated their answer by the following three arguments.

An IP handset currently costs about R1500 versus a POTS phone of R50. Alternatively a PC can be used. The difference in cost limits the amount of end users that can afford the use of

VoIP. As technology matures and reaches acceptability in the mass market, prices of equipment would decline.

There are a number of hidden costs when implementing an IP PABX's e.g. replacement of LAN cables, improvement of LAN switches and routers to allow real-time traffic. These costs need to be compared to the advantages of converged networks and improved call charges that Telkom may offer for compressed VoIP call connections.

The international market has indicated how sensitive the customer is towards the price that is charged for a VoIP call. Customers expect VoIP calls to be cheaper that TDM based voice calls or that the compressed VoIP calls should be cheaper than using a leased line to make voice calls.

The cost to the customer will have a major influence on the decision and can inhibit the decision because the cost of the solution may make it unattractive for many customers requiring the service.

4.4.1.1.5 Perceptions

The perception in the market is that VoIP provides services at low quality and at low cost. This perception is caused by the use of VoIP via the Internet or LAN/WAN that is not QoS enabled or by compressing the bandwidth used for a conversation. This allows the use of less network resources and as a result can be delivered at a lower price. The low quality creates the perception with many operators and consumers that VoIP is not a mature technology. VoIP over a managed data network could equal the quality offer by TDM based networks.

As an operator no compromise on reliability can be made, but quality can be reduced as long as there is an incentive (normally price) to accept the lower quality. Telkom is considering VoIP for their national network by using carrier pre-select for a lower quality service.

The perception in the market needs to be managed when introducing VoIP. No clear statement can be made on the influence and if it will enable or inhibit the implementation.

4.4.1.1.6 Risk of customer satisfaction

Six interviewees expressed concerns that VoIP is not a mature technology yet e.g. QoS, reliability and manageability of current VoIP solutions by.

Telkom would be required to deliver reliable solutions immediately when deploying a VoIP solution. This is especially true when delivering service to the corporate customers. To expect any newly deployed system to be reliable and especially with a new technology is unrealistic. The risk of creating dissatisfied customers is high especially with initial deployments.

The risk of customer dissatisfaction will have a major influence on the decision and could inhibit the implementation.

4.4.1.1.7 Pro-active or reactive market strategy

If Telkom adopts a reactive market strategy, the VoIP PABX market and competition would force/demand service from Telkom to support VoIP. This has already happened to the international traffic market segment.

A pro-active market strategy where services are deployed before or as they are required may be the alternative. This requires that Telkom becomes more risk-oriented and also requires Telkom to do market education on new services. Strong leadership would be required in the pro-active case. The pro-active market strategy would see the introduction of VoIP into the market sooner.

The market strategy will have a major influence on the decision and can enable or inhibit the implementation.

4.4.1.1.8 New tariff models for telecommunications services

The pricing of telecommunication services is bound to change. Currently TDM based voice connections are charged based on duration and distance. Data networks are charged on bandwidth. With IP, content and volume based charging and combinations of the above are possible.

It is virtually impossible to distinguish between low quality voice and data traffic and as a result a new pricing strategy needs to be determined. Telkom currently has no pricing strategy for VoIP except to protect their current revenue streams for international voice connections. Cannibalization of current revenue streams especially of leased lines and rental fees of the various access types is of great concern.

This indicates that the business models used by operators currently worldwide are due to change. Telkom has started initiatives in this regard but no clear marketing strategy exists.

The tariff models will have a major influence on the decision and can enable or inhibit the implementation depending on the outcome of the new tariff models.

4.4.1.1.9 VoIP PABX/LAN equipment

The migration of PABX's to **VoIP PABX/LAN equipment** is seen to be the main driver for the migration to VoIP. Four interviewees confirmed this.

Some of the reasons why VoIP PABX/LAN equipment will force Telkom to offer this kind of a service are:

- The requirements of corporate customers that want to use IP PABX type devices and want to connect the various sites need to be addressed and would be the main driver. The corporate market is the main revenue earner of Telkom and has to be kept satisfied.
- Historically in the development of the telephone industry, PABX manufactures stopped producing analogue PABX's and only produced ISDN PABX's. This forced Telkom to introduce ISDN based access to the PABX users. A similar situation may arise with IP PABX's.

By answering the following questions it may become clearer when the migration would take place. When are many of the current ISDN PABX's due for replacement? Does Enterprise VoIP add to productivity increases and is it more economical to implement an enterprise VoIP solution than a TDM PABX?

VoIP PABX/LAN equipment will enable the implementation of a VoIP national network.

4.4.1.1.10 New services

Using IP technology offers the possibility to address new and current markets by using technology and solutions not available before. IP allows different services across the same network e.g. voice, data and video. Examples of new services are video on demand, on-line gaming and video games.

Two interviewees stated that voice alone would not be the only motivator to evolve the current Telkom networks to IP. Steven White feels that there are not enough customers that

require and are prepared to pay for some of the benefits of VoIP such as computer telephony integration.

New services will be an enabler for the implementation of VoIP but it depends on the size of the market for the new service, which will determine whether it will have a major or minor influence on the decision.

4.4.1.2 Technology and system development

4.4.1.2.1 State and evolution of technology

Any new technology takes time to mature. Telkom has to make a decision where on the Technology Adoption Life Cycle (Moore, 1999a) they want to operate on.

Previously, Telkom was the pilot for new technologies and experienced the leading edge of technology development. This nearly led to serious degradation of service to the end-user. Reference was made to the introduction of TDM systems relative to electromechanical exchanges about 20 years ago. Alternatively Telkom can benefit from the mistakes and experience other operators have with VoIP technology before they invest in this technology.

This benefit of VoIP has to be weighed up against the risks of introducing a new technology. This will determine if the implementation of VoIP should be delayed to:

- enable further evolution of standards / solutions to prevent abortive costs,
- enable VoIP technology costs to 'settle' (i.e. become more reasonable and cost-based), and
- learn from the mistakes of other operators that are more pro-active in the deployment of VoIP and can afford high costs and unscheduled expenditures.

Technology continuously improves and will always indicate that in the future a better solution will be come available. The state of technology and evolution will only inhibit the implementation of the VoIP network. An operator needs to decide if technology is mature enough and whether technology will play a major or minor influence on the decision.

4.4.1.2.2 Convergence of access and core network

For each service Telkom currently has a different network e.g. Voice, leased lines, X.25, GE (Gigabyte Ethernet), ATM. This is valid for the core and the access side of the network.

Telkom can deploy one technology i.e. IP for all technology types to be transported across (X.25, ATM and Frame relay and obviously IP traffic). This eliminates the need for multiple networks and will inhibit cost of maintenance. Four interviewees mentioned this.

This is one of the main reasons to implement a VoIP network. Depending on the short or long term view of the decision-maker the importance of this condition will be adapted because most of the benefit of converging the access and the core network is only realised when a large part of the exiting network is converged.

4.4.1.2.3 Network resources

Overselling of bandwidth can be used where data and voice can be sent across the same network. Bandwidth is not continuously used by data applications and can then be sold to another user. The compression of voice and silent suppression are examples of where the bandwidth used by voice calls can be reduced. VoIP gateways have codec's that offer these features and are about 3 times cheaper that DCME equipment that is the TDM based equivalent. Telkom though has a large supply of bandwidth.

The operator can then define services according to classes of quality of a connection and ensure that it is priced according to the amount of resources used by the connection. An example on a data network service that Telkom offers with varying quality is called VPN supreme. VPN supreme has 4 classes of data connects of varying bandwidth and quality.

The network resource condition will have a major or minor enabling influence on the decision to implement VoIP depending on Telkom's view on the savings related to the bandwidth optimisation.

4.4.1.2.4 Reliability of services

The reliability and stability of the new technology is a concern when implementing a VoIP network solution. Technically the IP network will be able to provide the quality of services required with Diffserv and MPLS. Degradation of quality of service is allowed but only to a point when it would be seen as being unreliable. Concerns were expressed about the unproven capabilities of IP to deliver voice, data and video reliably across the same network. This is probably the most important factor in the acceptance of IP for use of IP equipment on a carrier scale.

The reliability of service conditions will have major influence because an operator cannot compromise on the defined levels of quality of service or provide an unreliable service. Unreliable service delivery will inhibit the implementation.

4.4.1.2.5 Features and cost per connection of current voice and data networks

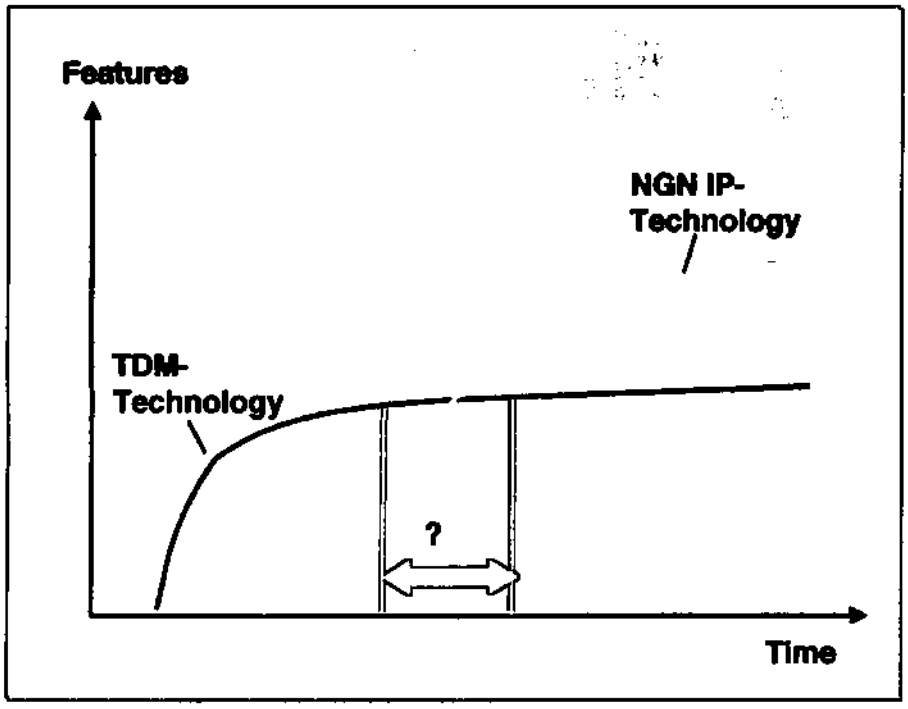
Telkom already has voice and data networks that serve the voice and data network markets.

In this case the following questions have to be asked:

- With a stagnant PSTN subscriber base and an over-supply of TDM bandwidth, does it make any economic sense to even pursue VoIP for a pure transport application?
- Are the required features already available in the NGN IP based network technology?
- Is IP based network equipment reasonably priced compared to the advantages that it may offer?

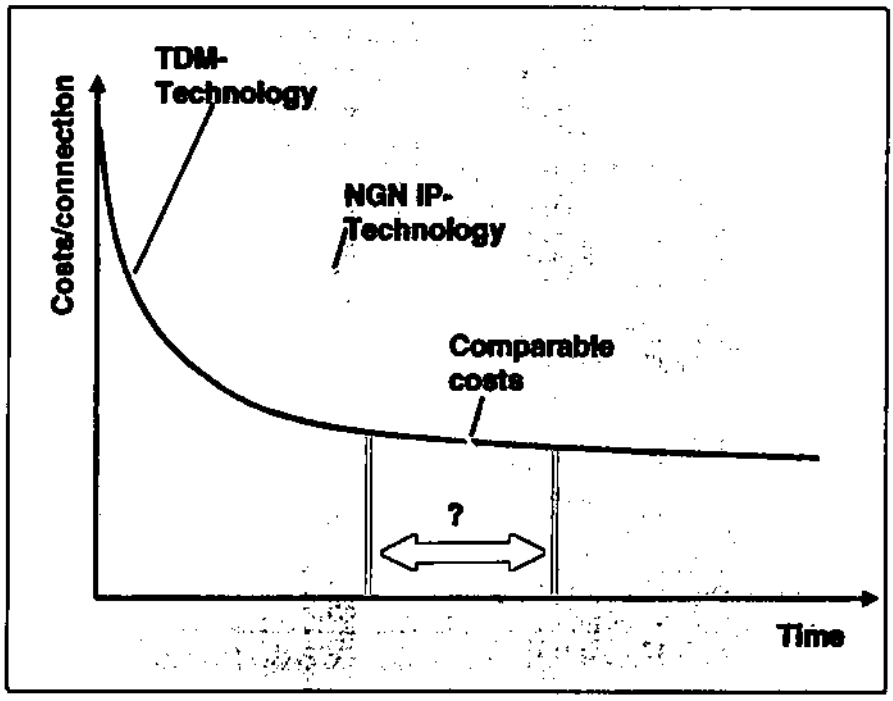
Refer to the two figures below for graphical explanation.

Figure 4.1 - Number of features available in TDM versus NGN technology over time



Source: Hadley, 2003.

Figure 4.2 - Cost per connection for TDM versus NGN technology over time



Source: Hadley, 2003.

With the SIP and H.323 signalling methods and the transport and application of the IP protocol, there is still continuous momentum within the ITU, ETSI and IETF to evolve the maturity of VoIP solutions.

Comparing the current voice and data network solutions with the potential VoIP solution will have a major impact on the decision and could only inhibit the implementation.

4.4.1.2.6 Competing technologies

There are various competing technologies that aim to provide a converged voice data network. This kind of a network is commonly referred to as a Next Generation Network (NGN).

In the short term the alternate technologies that Telkom is considering deploying are VoATM and VoDSL (ATM based) in the access network because:

- ATM currently is still cheaper than IP especially for bandwidths bigger than 2 Mbits.

- ATM provides the possibility to provide connections on the link layer e.g. leased lines and to transport network layer connections e.g. IP over ATM.

VoATM can be used for corporate customers with have ATM networks and that demand this kind of a service. VoDSL can be used in the access network for those customers with DSL connections. Currently in Telkom there is conflict on how to migrate the access network based on ATM or IP to an ultimately foreseen IP network.

The plan is to base the core network on one technology, namely IP. The current IP network that is not quality of services enabled. Telkom intends utilising the partially deployed ATM network to assist the IP network to deliver quality of service enabled services.

The conflict within the telecommunication operators about the possible alternative technologies that can be employed and why IP and specifically VoIP are seen as the technologies of choice to ensure the long-term success of Telkom was discussed earlier in the report.

The competing technologies will have a major or minor influence on the decision depending on Telkom's view on the use of VoIP compared to the other technologies and will inhibit the implementation of the VoIP network.

4.4.1.3 Operational

4.4.1.3.1 Business processes required

Telkom is striving to be more service oriented. Offering VoIP services requires a total redefinition of the business processes and even the business models, which the operator uses. A re-analysis of all assumptions and processes needs to take place. According to Andrew Hadley, Telkom is currently in the process of resolving many of these issues.

Examples of processes that need to be redefined are provisioning, fault finding and clearance, and charging.

The business processes condition will have a major influence because if the processes are not in place when introducing VoIP, VoIP will not even be considered by Telkom and will inhibit its implementation.

4.4.1.3.2 Manageability of the VoIP solution

Internal to Telkom VoIP and IP will have a big impact on the OSS/BSS systems that are required. They need to be adapted to meet the newly defined business process and to cater for the way the new technology functions. This will have an impact on virtually all the OSS/BSS systems.

The solution needs to ensure that the total network solution is manageable. The full FCAPS should be covered i.e. fault, configuration, accounting, performance and security.

For example the charging methods and tariffs need to be re-designed to cater for the new business models. IP allows for many different kinds of billing e.g. duration, content, distance and quality that could lead Telkom to exploit new market opportunities. If the network is not designed properly, end customers will be able to by-pass the billing systems of Telkom and receive the services without paying for them. VoIP introduces many new and unknown risks because of the limited experience operators have had to date in the support of VoIP networks. The way the market will react towards the changing tariff structures is also of concern.

The manageability of the VoIP solution will have a major influence because if the management systems are not in place when introducing VoIP, VoIP will not be considered an option. Manageability could also be an enabler for new business opportunities.

4.4.1.3.3 Operational cost

The operational cost for Telkom to run the different networks will reduce as the different technology networks are replaced by the common IP based network. To get to the point where only one technology type of network exists could take a long time. For example, electromechanical exchanges took 20 years to be replaced by digital circuit switched exchanges due to the vast amount of capital that was required. The same would be true for the upgrade to IP networks.

IP as a technology also offers operational cost savings e.g. IP networks are self-managed and self-healing. No complex databases have to be maintained. When the VoIP network solution is introduced, operational cost will increase because the IP network will become more complex. However other technologies are progressively replaced (such as ATM), maintenance effort will reduce because fewer networks have to be maintained.

The operational cost will have a major influence on the decision due to the potential substantial changes in the operational cost. Operational cost is expected to increase on the short term but decline on the long term to reduce and can enable or inhibit the implementation.

4.4.1.3.4 Support for the current TDM based network

The current PSTN network will not be supported from 2004 by the vendors of the network equipment. Telkom has the choice to either replace the network with new network equipment or accept the risk that the network may fail.

Because the voice network is Telkom's main revenue generator the risk of losing revenue is high. Both the TDM based network vendors are offering Telkom a migration strategy towards a VoIP Next Generation Network that will ensure that the current network will still be maintainable until the total network has been migrated to a Next Generation Network.

The support for the current TDM based network will have major influence on the decision because Telkom risks losing their main revenue source. Support for the current TDM based network will be an enabling condition to the implementation.

4.4.1.4 Financial

4.4.1.4.1 Economical environment

The IT sector was in a growth phase (in the tornado as described by Moore (1995)) for many years. The telecommunications operators expected that the growth of the IT sector would create demand for more bandwidth and services. This however, never realised and as a result there is an oversupply of bandwidth in the market.

The shareholders and investors expected that the growth would have continued and as a result are currently disillusioned with the ICT sector. Shareholders do not want to provide funds for new ventures except if the potential profits are high. This has created a downturn in the economic environment of the telecommunications industry. Since then, the worldwide economy has also slowed down due to the 11th September incident.

The economic environment currently is an inhibiting condition for any telecommunication project. It should not have a major influence on the decision-makers because they make telecommunication decision on a continuous basis.

4.4.1.4.2 The expectations of the shareholders

As part of the licence conditions that were imposed on Telkom when SBC Communications Inc. and Telekom Malaysia Berhad bought into Telkom, Telkom was required to roll out a large number of ports. Many of these were to rural areas where few people could afford to pay for service. As a result of this capital expenditure, Telkom now has a high debt ratio.

Telkom wants to curb expenditure to reduce their debt. In this environment, to motivate the implementation of new CAPEX expenditure requires an increased return on investment. This makes the motivation for implementing a VoIP network more difficult simply on the grounds of business sense.

Shareholders in Telkom would prefer a strong bank balance instead of a modern network. The requirements of the new shareholders e.g. banks and SBC will have an increasing influence on how Telkom reacts to the telecommunication market and the implementations made in the network.

The expectations of the shareholders are currently an inhibiting condition and have a significant effect on the decision-makers because they earmarked debt reduction as one of their goals.

4.4.1.4.3 The business case

All eight interviewees mentioned the business case.

Telkom has been losing voice traffic revenue because people use VoIP. To counter this loss Telkom has to provide solutions e.g. Telkom has been steadily decreasing its international call prices. Telkom also offers corporate customers special packages for connections via the Clarent international VoIP clearing house solution at reduced quality of service with the associated reduced network resources used.

Corporate customers that favour VoIP solutions need to be provided with solutions to ensure Telkom with a secure revenue stream, especially in the face of the impending deregulation of the South African telecommunications market.

The cost to implement a network wide VoIP network could be inhibitive. Strangely enough none of the Telkom employees mentioned the Rand/Dollar exchange rate as being a major criteria as it was probably assumed as part of the cost of equipment.

A VoIP business case would be difficult to sell/understand, since many 'issues' are involved and there is no easy and salient 'killer revenue opportunity' that can initiate the process and mobilise the necessary funds This means that many issues need comprehensive consideration and a good return on investment might not be too obvious or achievable in the short term, as many of the operational benefits of VoIP are only realised in the long term (van Zyl, 2003).

An interviewee stated that there is a positive business case in general. By selecting the most profitable niche markets it should be possible to exceed the business case criteria e.g. internal rate of return.

The business case plays a major role and will enable the introduction of a VoIP for niche market applications but will be an inhibitor if Telkom considers a general deployment of VoIP.

4.4.1.4.4 Exploiting the existing national network

The existing network is a source of considerable strategic advantage. The investment of the existing network is a sunk cost. Telkom is exploiting the TDM based voice network asset as a cash generator. The TDM voice network is very reliable. The TDM network can be used to generate as much profit as possible by spending as little as possible on improving or maintaining it. Telkom can continue using this network to deploy voice services without the need to invest in VoIP technology.

If Telkom therefore decides to exploit the existing national network it would play a major role on the decision and will inhibit the introduction of VoIP.

4.4.1.4.5 Possible alternative projects

All projects compete for the same funding. Projects that offer Telkom and its stakeholders the biggest advantages will get priority.

SBC as one of the main shareholders and with the right to have a percentage of the management team of Telkom to be SBC employees, sees markets other than South Africa as priority to compete in currently e.g. the American market where they are experiencing competition.

Telkom owns part of Vodacom and will consider investments made in the mobile network compared to those made in the fixed network.

Alternative projects play a major or minor role depending on the advantages that a VoIP project offers compared to other projects and will potentially inhibit the introduction of VoIP.

4.4.1.5 Human resources

4.4.1.5.1 Skilled personnel

There is sufficient expertise in data networking and voice switching in Telkom, which will enable the deployment of VoIP. Re-training of especially the operational employees is required. They need new skills to support IP and VoIP. Due to the cost of this training the implementation may be inhibited.

4.4.1.5.2 Organisational structures

Telkom makes use of certain technologies. The problem is to mobilise existing resources into attaining common objectives, combining skills from traditionally separate domains/islands of expertise and sharing telecommunication and IT knowledge that have been fragmented by the existing company structure. This is not only a convergence of voice and data, but also a convergence of technology domains and a synchronisation or collaboration of skills and effort in attaining such objectives.

Major changes in organisational structures are required to ensure the successful deployment of VoIP.

4.4.1.6 Procurement

The deployment a VoIP network requires the selection of a vendor of VoIP equipment. To select a vendor the following conditions are relevant:

- BEE percentages of the vendor company
- Percentage of network equipment supplied by one vendor
- Telkom executives' relations with the vendors
- The size and trustworthiness of the vendor

For this report the technology selection is relevant. The criteria employed to select a vendor are however, irrelevant.

4.4.1.7 Legal

The Telecommunication Act of South Africa plays a major role in regulating the telecommunication industry. The Act allows Telkom to deploy VoIP in a private telecommunication network or in a virtual private network (VPN) scenario.

Clause 40 of the Telecommunications Act (1996) on Value-added network services states: '(1) (a) Telkom shall be deemed to be the holder of a licence to provide, subject to subsection (3), the value-added network services provided by it immediately before the date of commencement of this Act: Provided that as at the date of commencement of this Act Telkom shall be deemed to have applied to the Minister for a licence in terms of this Act in respect of each such service, and the Minister shall, after the provisions of section 36(6), (7), (8) and (9) have been complied with, in relation to the terms and conditions of the licence, grant the application and issue such licence to Telkom with a period of validity of 25 years from the date of commencement of this Act.'
And states: '(3) No person who provides a value-added network service shall permit that service to be used for the carrying of voice until a date to be fixed by the Minister by notice in the Gazette.'

Clause 41 on Private telecommunication networks states '(4) A private telecommunication network shall not be restricted to the carrying of voice only or data only or to any other such limited use.'

This limits the markets Telkom may deliver VoIP to. Telkom is clearly aware of this legislation if one looks at paragraph 4.5.

4.4.2 Organisational perspective

The organisational perspective is concerned with the affected and affecting organisations. Key words of the organisational perspective are culture, structure, orientation, dynamics, action, implementation, controls and feasibility.

Two interviewees mentioned these conditions but both of them stated that they are of minor importance and that the culture is changing to make business-related decisions.

4.4.2.1 Governmental organisation mindset

Organisational perspective definitely plays a role because many role players are resistant to change. Telkom is changing from a government organisation to a fully privatised

organisation. This requires a change in business values, mission and vision. Most of these factors have changed but in the employees the transition is not complete. This mindset could inhibit the implementation of a VoIP network.

4.4.2.2 Nationalism

Some of the American management team members of SBC are loyal Americans and would prefer seeing improvements in networks in America rather than in other countries. They will also direct business to American businesses. This may lead to a situation where no VoIP solutions are implemented to address the market needs.

4.4.2.3 Struggle between organisational units

Telkom has moved from a technology driven origination to a market driven organisation. This strategic move has been spectacularly unsuccessful. The main reason for this is the lack of vision of the marketing department. The marketing department was also influenced by one of the main shareholders of Telkom, namely SBC who is not familiar with South African market conditions. As a result the balance of power is moving partially back to the technology side of the organisation.

Between the technology areas of voice and data there is some conflict on who would ultimately implement the VoIP network and how the organisational structure needs to change to accommodate the technology that falls into both technology areas.

To find the right balance between the organisational units would be a challenge for the management team of Telkom if success is to be achieved in deploying VoIP in the market place.

4.4.3 Personal perspective

The personal perspective is the filter of the individual's eyes and brain. Examples are intuition, charisma, leadership, and self interest which plays a vital role in matters of policy and decision.

4.4.3.1 Leadership

If Telkom wants to be pro-active to address the market, it will require strong leadership. A 'sponsor' (an executive that is prepared to put his career on the line) for VoIP in Telkom is required. This person will drive the implementation in Telkom.

The lack of leadership in the marketing department was mentioned as a serious concern e.g. the marketing department offers a service to a customer using one kind of technology. No one in marketing is exploiting the opportunity to offer one technology solution that can address different services. IP offers the opportunity to emulate the different technologies across IP.

Although most interviewed parties agreed that VoIP is a technology of strategic importance the lack of leadership is apparent when looking at the services that are pro-actively offered in the market. (Only the international voice gateway was implemented because Telkom was forced to implement it.)

4.4.3.2 Blasé attitude

The management team installed by SBC had a blasé attitude towards spending money when they bought into Telkom. This is another reason for the high debt burden of Telkom. This attitude has changed over the past few years and in the current telecommunication environment. It does not play a major role anymore.

4.4.3.3 Career opportunity

There are individual management members who will use this VoIP opportunity as a motivation to further their careers but not necessarily for the good of Telkom. This is a growing tendency of company executives e.g. Colman Andrews.

Some executives that were sponsors for ATM technology a few years ago now have to reap the consequences of their decisions. Utilising IP over ATM may improve their personal position in the organisation. Powerful personalities could resist or support the implementation of a VoIP network.

4.4.4 Summary of strategic conditions that need to be considered

Table 4.2 provides a summary of the conditions that were mentioned during the key informant interviews. The number of interviewees who mentioned a condition is indicated but no importance can be attach to the number (Refer to paragraph 4.2). The extent of the influence of the condition on the decision is indicated and whether the condition will enable or inhibit the implementation of a VoIP network.

Table 4.2 - Conditions mentioned during the interviews

Paragraph reference	Conditions	Mentioned by number of interviewees	Major or Minor influence on decision	Enabler (E) or Inhibitor (I)
4.4.1	**Technical perspective**			
4.4.1.1	Marketing and Sales			
4.4.1.1.1	The needs of the market	8	Major	E or I
4.4.1.1.2	Potential VoIP revenue generating market segments	8	Major	E
4.4.1.1.3	Competition and market liberalisation	4	Minor	E
4.4.1.1.4	Cost to the customer	3	Major	I
4.4.1.1.5	Perceptions	2	Major or Minor	E or I
4.4.1.1.6	Risk of customer satisfaction	6	Major	I
4.4.1.1.7	Pro-active or reactive market strategy	2	Major	E or I
4.4.1.1.8	New tariff models for telecommunications services	2	Major	E or I
4.4.1.1.9	VoIP PABX/LAN equipment	4	Major	E
4.4.1.1.10	New services	4	Major or Minor	E
4.4.1.2	Technology and system development			
4.4.1.2.1	State and evolution of technology	6	Major or Minor	I
4.4.1.2.2	Convergence of access and core network	4	Major or Minor	E
4.4.1.2.3	Network resources	3	Major or Minor	E
4.4.1.2.4	Reliability of services	6	Major	I
4.4.1.2.5	Features and cost per connection of current voice and data networks	3	Major	I
4.4.1.2.6	Competing technologies	8	Major or Minor	I
4.4.1.3	Operational			
4.4.1.3.1	Business processes required	4	Major	I
4.4.1.3.2	Manageability of the VoIP solution	5	Major	E and/or I
4.4.1.3.3	Operational cost	4	Major	E or I
4.4.1.3.4	Support for the current TDM based network	3	Major	E
4.4.1.4	Financial			
4.4.1.4.1	Economical environment	2	Minor	I
4.4.1.4.2	The expectations of the shareholders	4	Major	I
4.4.1.4.3	The business case	8	Major	E or I
4.4.1.4.4	Exploiting the existing national network	3	Major	I
4.4.1.4.5	Possible alternative projects	4	Major or Minor	I

4.4.1.5	Human resources			
4.4.1.5.1	Skilled personnel	3	Major	E or I
4.4.1.5.2	Organisational structures	2	Major	E or I
4.4.1.6	Procurement	0	Not applicable	
4.4.1.7	Legal	2	Major	E or I
4.4.2	**Organisational perspective**			
4.4.2.1	Governmental organisation mindset	1	Minor	I
4.4.2.2	Nationalism	1	Minor	I
4.4.2.3	Struggle between organisational units	2	Minor	I
4.4.3	**Personal perspective**			
4.4.3.1	Leadership	2	Major	E or I
4.4.3.2	Blasé attitude	1	Minor	I
4.4.3.3	Career opportunity	2	Major	E or I

4.5 The network solutions and strategy to address the VoIP market segments

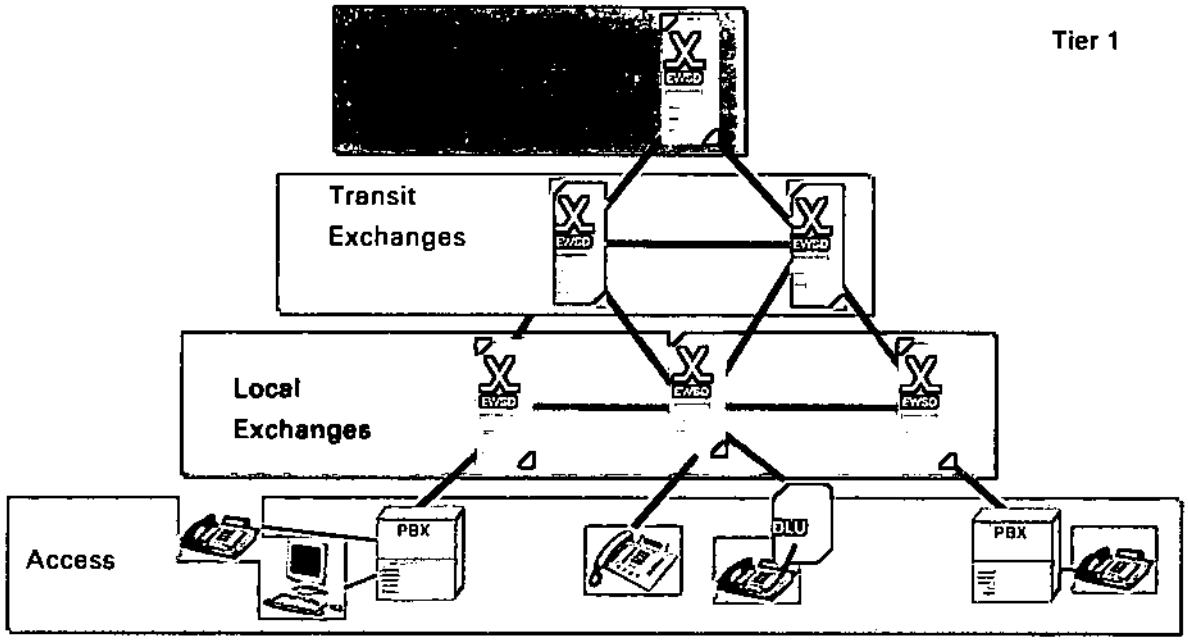
Telkom defined a strategy for the various market segments. The strategy is described in this paragraph. Refer to paragraph 4.4.1.1.2 for an overview of the market segments and refer to paragraph 4.4 for an overview of the conditions that influenced this strategy.

This information was provided by Davis (2003) and was confirmed by all the other interviewees.

4.5.1 The current TDM voice network

The current TDM network can be divided into different layers. The local exchange layer provides access to the public switching network. The transit layer provides for connection of traffic nationally and interconnections to other national operators, while the international gateway exchanges provide connection to other international operators. This network addresses all the above market segments using TDM based technology.

Figure 4.3 - The Current Telkom TDM based network



This network is currently working very effectively and reliably. The network though is starting to age with some components as old as 20 years. As a result it may require replacement. Because there is a decline in subscribers that require fixed voice connections some of the spare capacity components can be redeployed to replace faulty components. It is not clear what Telkom's future strategy is towards this network e.g. will they upgrade the software to provide the latest features and ensure that vendors will support the network for another few years. They would however want to exploit this asset as a cash generator. They are using the revenue to improve other parts of the Telkom organisation e.g. the OSS/BSS. All these items can be related to the end of life period as is described in the Market Development Model (Moore, 1995).

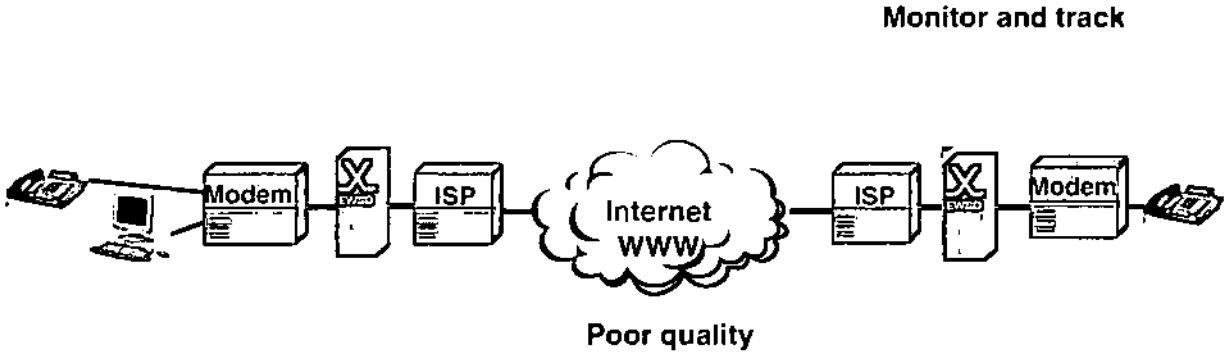
This TDM based network does not offer VoIP. The end users in Telkom started demanding VoIP service and as a result Telkom had to determine a strategy for these needs.

4.5.2 The consumer VoIP traffic

The public end consumer has the capability to utilise the Internet to make voice calls via VoIP. A typical scenario would be where the customer connects to the Internet via a modem connection to his ISP, using the Telkom TDM based local exchange for connectivity. By using the application NetMeeting the consumer will be able to reach any other NetMeeting client. This solution allows for economic low quality voice connections for national or

international connections. These consumers fall in the innovator and early adaptor category of the Technology Adoption life cycle model (Moore, 1999a).

Figure 4.4 - Current consumer VoIP traffic



Telkom is generating revenue from these calls that are passing through the local exchange to the ISP. This method of making a voice call is inconvenient because it requires both users to be connected to the Internet before communication can take place.

Telkom has adopted a strategy of monitoring and tracking this market segment. This strategy was adopted despite the fact that this activity is against the South African regulations. It will be difficult to detect this traffic and requires effort to prosecute. Currently it is not worth the effort.

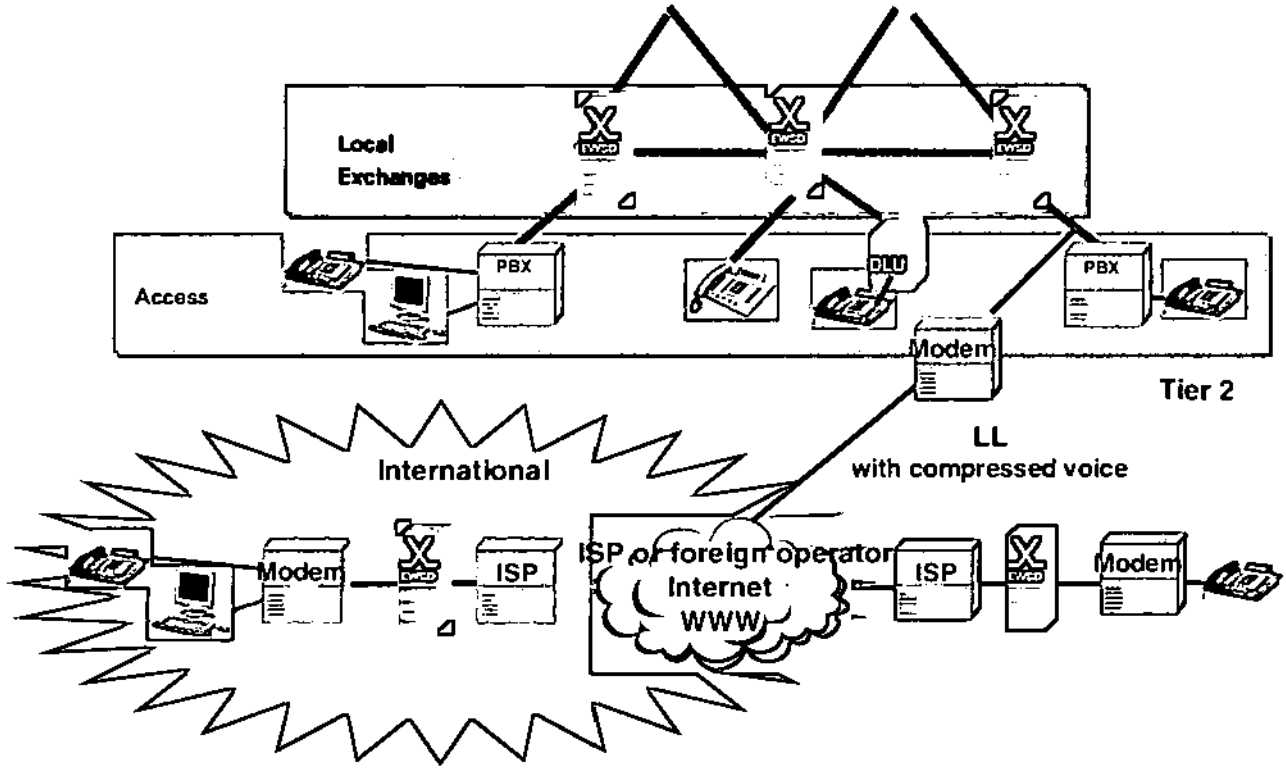
For Telkom to offer an IP connection to the end consumer would require the deployment of a total and extensive and costly IP network. To deploy this network for consumers will generate a low level of revenue and as it will use it mainly be used for a voice connection, which already exists via the TDM based network, does not make business sense.

4.5.3 International VoIP traffic

International traffic is one of the important market segments for Telkom. Corporate customers and Private Telecommunication Network (PTN) operators that do make many international calls utilise a similar solution than the consumer as described in paragraph 4.5.2. The method used to bypass Telkom's TDM based international network and which eroded Telkom's revenue base is indicated in Figure 4.5. These corporate customers would for example rent an international leased line from Telkom. VoIP, which allows for compression of voice is then utilised across the leased line to a foreign operator. The Foreign operator will receive the compressed voice and distribute the traffic from there. Alternatively

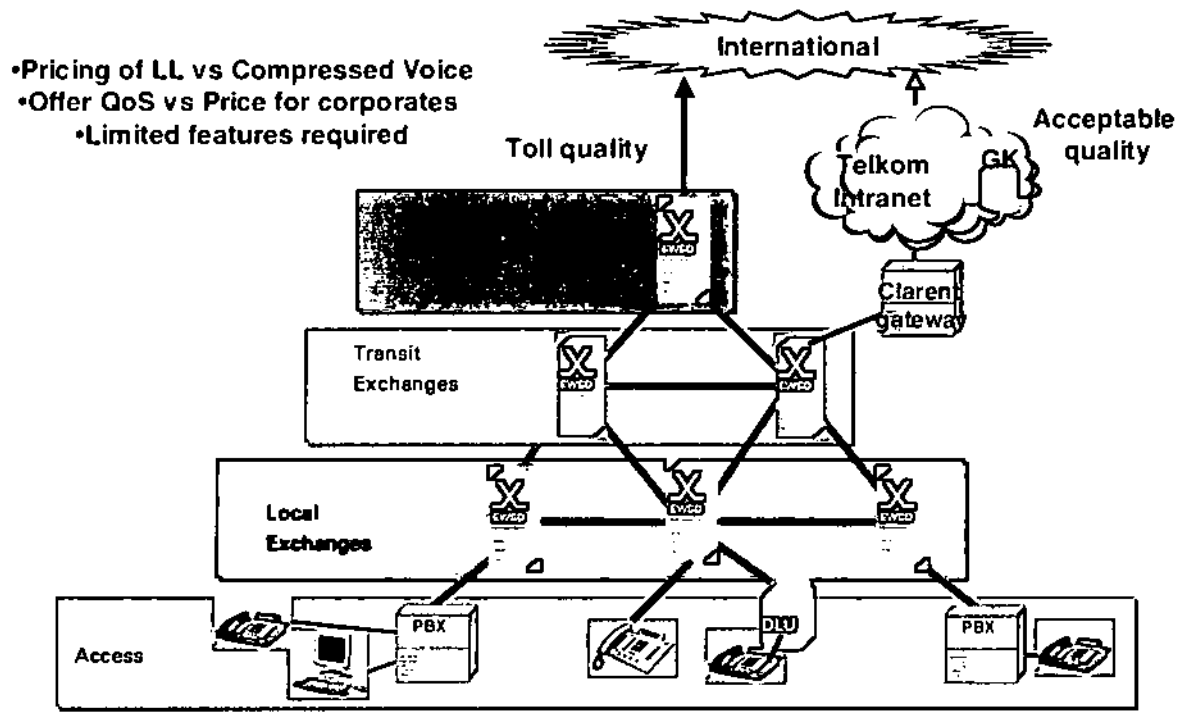
a connection to the Internet for an unreliable and low quality voice connections is also possible.

Figure 4.5 - Method of bypassing the international TDM based network



Telkom had to counter this strategy and implemented their own international VoIP network solution and also had to reduce their international call rates. They are now offering these corporate customers compressed VoIP connections resulting in lower quality connections. Because the compressed VoIP traffic uses less of Telkom's network resources, Telkom can offer the reduced quality connections at reduced rates. At the time of implementation the VoIP technology deployed only had a few features. International connections though required only a limited feature set.

Figure 4.6 - Telkom's international VoIP gateway



The market forced Telkom to introduce an international VoIP gateway. This has resulted in Telkom taking the first step to cross the chasm as is described in the Market Development Model (Moore, 1995). The vendor at that stage had no solution that could address these requirements.

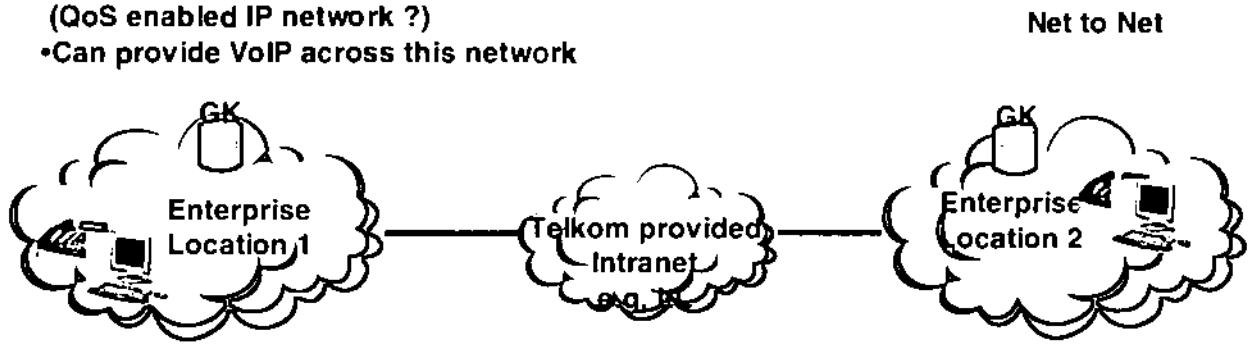
4.5.4 National corporate VoIP traffic

Corporate customers that have deployed VoIP PABX/LAN equipment for their PTN's are now demanding from Telkom connections that will support VoIP. They require the connections to connect to other locations of the corporate world but also to the Public TDM based network of Telkom.

4.5.4.1 Managed net to net data connections

The connection of different locations of the corporate environment can be achieved by providing a managed IP based data connection via IP VPN's or leased lines.

Figure 4.7 - Telkom provided data net-to-net connections for corporate customers



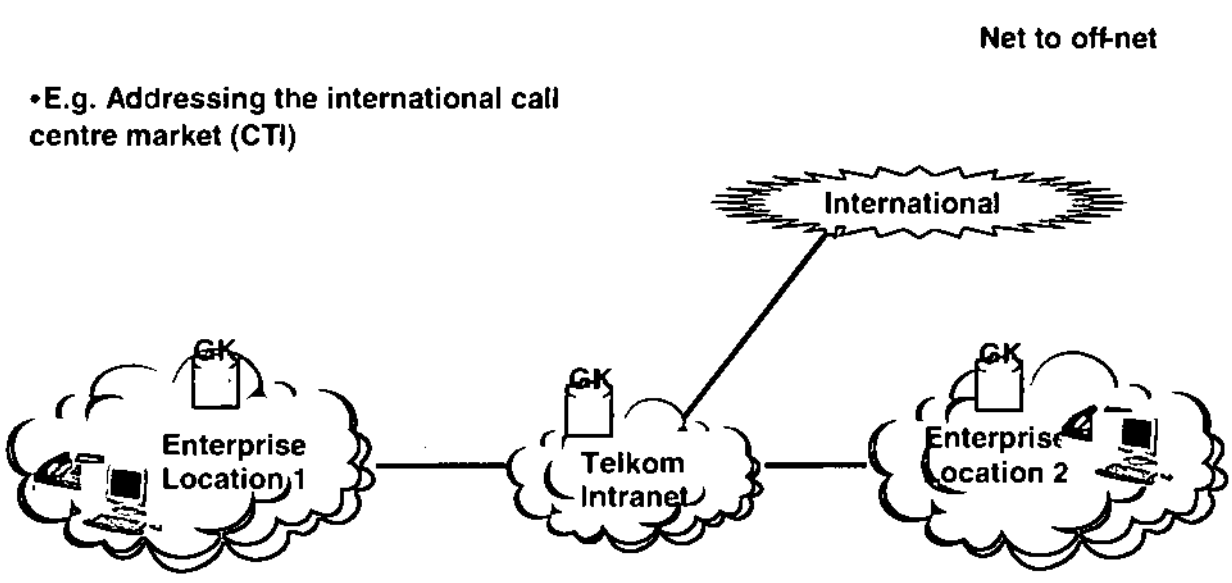
This solution offers little added value (e.g. nailed up connections only) and undermines the national voice traffic revenue base of Telkom. This solution is similar to the circuit switched tie line solution used by corporate customers except that IP technology is now used. Corporates are capable of connecting data as well as VoIP across the managed data network. This network can also be called a managed data network or intranet.

This is the extent to which Telkom currently utilises or allows VoIP to be utilised.

4.5.4.2 Managed net to off-net international connections

This net-to-net solution can be extended by Telkom to include the international traffic scenario. This will allow Telkom to compress the international voice traffic even when it passes through the national network.

Figure 4.8 - Telkom provided net to off-net international connections

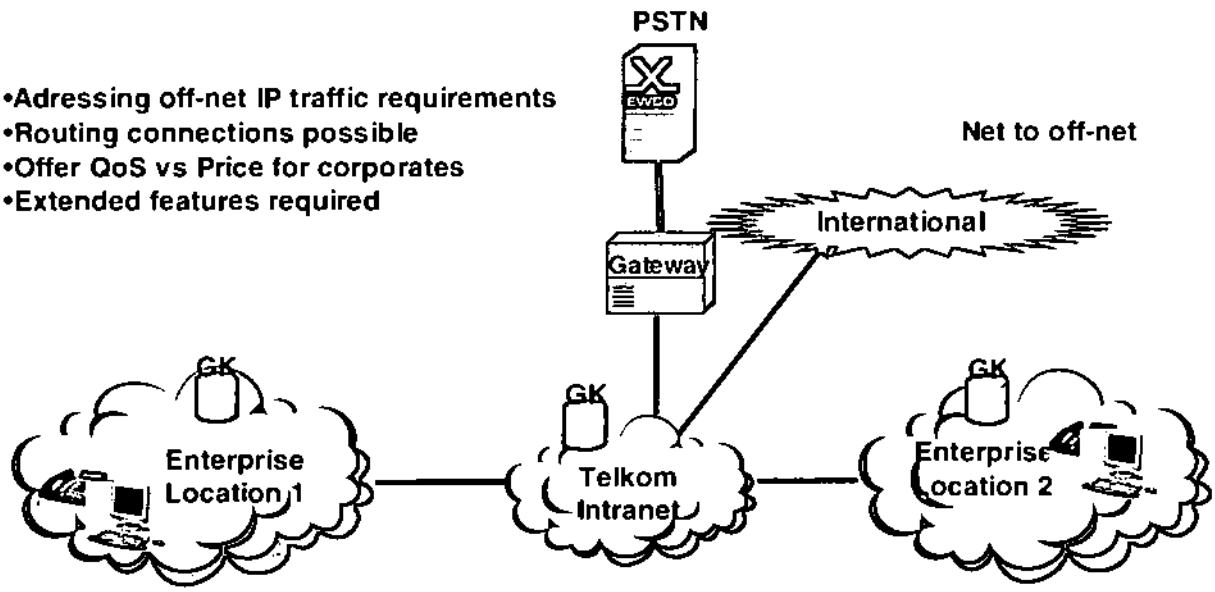


Telkom is currently investigating the possibility of deploying this solution. For the international connections the dynamic routing capabilities are not utilised which would enable IP header compression, which allows further compression.

4.5.4.3 Managed net to off-net national connections

To provide connections to the TDM based PSTN, Telkom would be required to provide a gateway that does the translation of IP voice traffic to TDM. To provide even more added value Telkom could add a Softswitch or gatekeeper that will enable the routing of calls to various locations. In this case the corporates do not have to lease an IP VPN or Leased line. They will be paying for a voice call. This scenario is called net to off-net national connections.

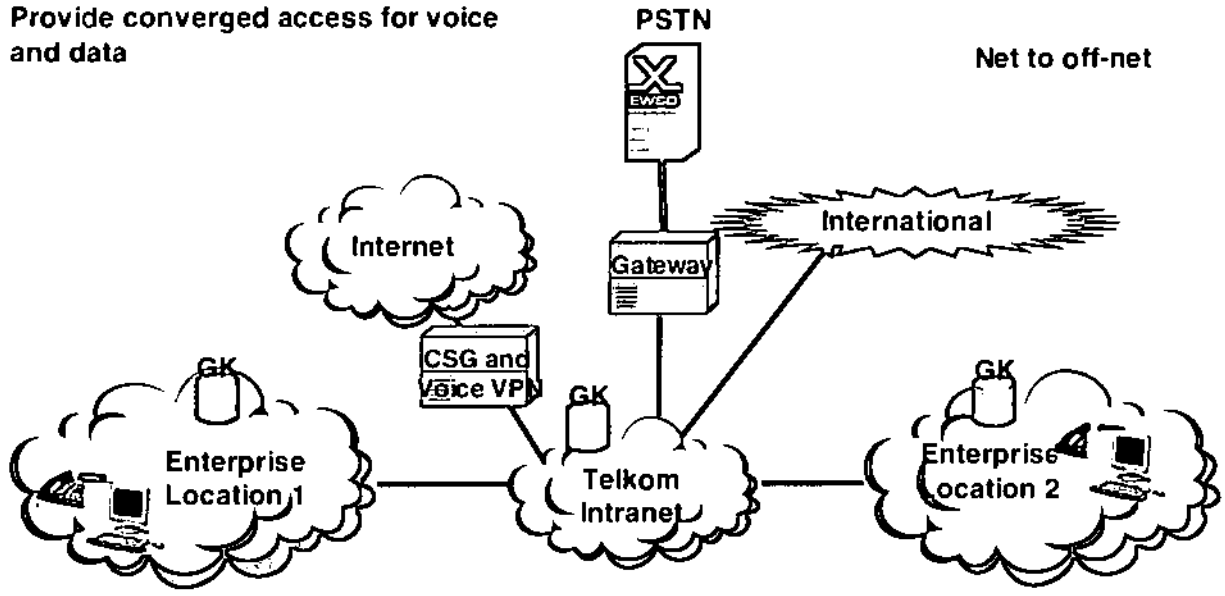
Figure 4.9 - Telkom provides net to off-net national connections to the corporate customer



4.5.4.4 Managed converged access connections

Telkom will now be in the position to provide converged access to the corporate customer thereby reducing the amount of networks required to deliver voice and data services. An example of the data connection used is shown as the connection to the Internet. Real time voice traffic can be prevented from following the data traffic to the Internet by the use of voice VPNs or Content Selection Gateways (CSG).

Figure 4.10 - Telkom provides net to off-net connections to the Internet and internationally



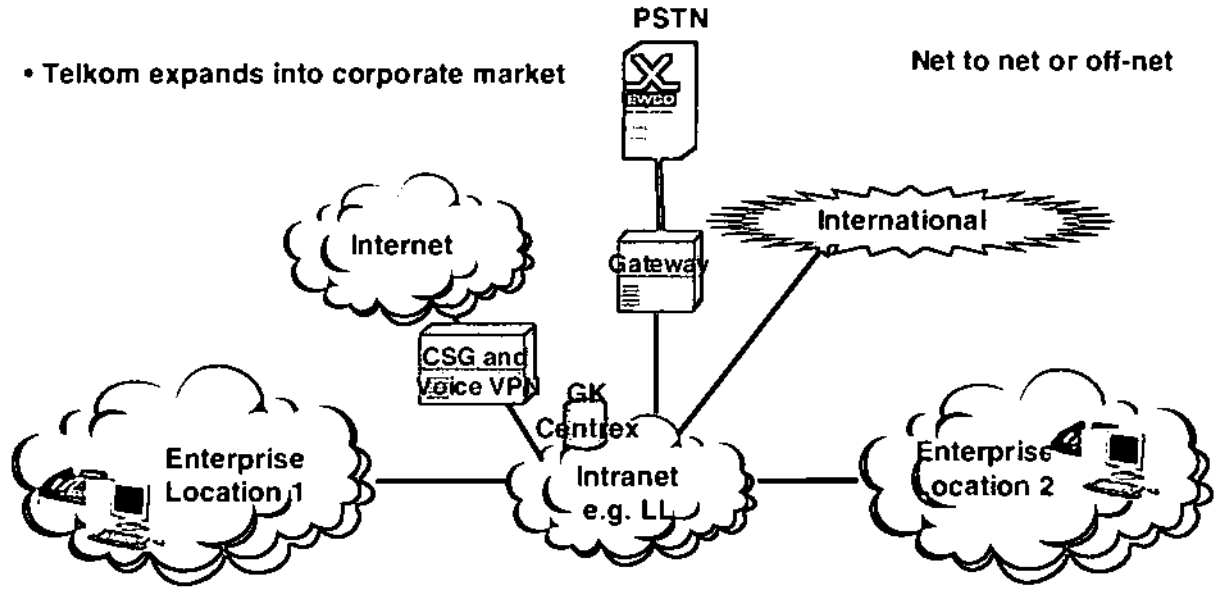
Addressing the corporate/national traffic will ensure that Telkom has entered the bowling alley as described in the Market Development Model (Moore, 1995).

If Telkom does not select the vendor's network equipment for the implementation of these solutions, the current voice market of the vendor is under threat because the next step is the tornado of the market development model, which means the mass deployment of the VoIP solution. The voice network equipment market will then be lost for a long period.

4.5.4.5 Extending the VoIP solution

The potential next step of Telkom would be to introduce IP Centrex, which is a virtual PABX solution. This would allow Telkom to provide service to the enterprise internal network by the Public network. The main motivation for the enterprise is to outsource a non-core business activity to Telkom.

Figure 4.11 - Telkom provides a virtual PABX solution



The next steps were not discussed but can be assumed as follows. More and more corporate customers will be addressed until the VoIP network is extended to provide service to all major locations in South Africa. Once this is the case Telkom may consider deploying this solution to the end consumer market as well.

4.6 The timeframe for implementing a national VoIP network

The implementation of a national VoIP network solution will take place soon. Some interviewees stated that it might start in the next few months while another stated that early in 2004 is a possibility. Five interviewees confirmed this. They motivated their answers to by linking them to conditions such as:

- When customers demand VoIP service.
- The PABX market should be monitored for the number of users wanting to use VoIP PABXs.
- Telkom is deploying a QoS enabled IP network that is a pre-requisite to offering VoIP.
- Telkom is proactively driving to remove the inhibitors to deploying VoIP.

Considering the discussion of how the implementation could take place it is also clear that the next step (refer to paragraph 4.5.4.2) would require Telkom to deploy a softswitch or gatekeeper that would start the implementation of a national VoIP network.

4.7 Conclusion

During the decision-making process, Telkom firstly decided whether a service should be introduced. The approved services will motivate the introduction of the supporting technology. Then only is a vendor selected for the supply of the equipment to realise the service.

Telkom is interested in deploying a VoIP network. ATM will be applied to support existing services and could be used in the access environment only to deliver QoS-managed transport. VoATM will be a competing technology in the access network.

Twenty-eight major conditions were identified. Some of them will enable and other will inhibit the implementation.

Telkom identified niche market segments that are applicable for deployment of VoIP. From the research results it is evident that Telkom intends to deploy net to off-net international VoIP connections soon. This would require the deployment of a national VoIP network that requires a QoS enabled IP network and a gatekeeper or softswitch. Some of the interviewees indicated that the network could be deployed as early as beginning of 2004.

Conclusions need to be made from these results and interpretations. The recommendations aim to refocus the vendor's organisation on the potential market for VoIP equipment.

CHAPTER 5: CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This chapter describes the conclusions that can be made from the interpretation of the results. Recommendations are provided to refocus the vendor's organisation on the potential market for VoIP equipment.

5.2 Conclusions of research

It is possible to come to the following conclusions considering the interpretation of the results:

5.2.1 There is definite merit in deploying a national VoIP network for Telkom. TDM will remain in place as long as this is economically and commercially feasible. ATM will be applied to support existing services and could be used in the access environment only to deliver QoS-managed transport (due to network scalability concerns). Refer to paragraphs 4.3 and 4.4.1.2.6.

5.2.2 Telkom realised that the creation of a comprehensive scenario for the total Telkom network is too complex. Along with the downturn in the telecommunication economy and the world economy it made sense to analyse the markets where VoIP could potentially have the biggest impact. Legislation limits the deployment of VoIP to virtual private networks. Refer to paragraphs 4.4.1.4.1 and 4.4.1.7.

5.2.3 The relevant markets identified for VoIP are:

- International VoIP, which is already addressed.
- Connections for corporate customers who want to connect between different company locations (net-to-net).
- Net to off-net connections for the corporate customer, which is not currently allowed due to legislation.
- The general consumer market.

The main market driver will be the corporate market using VoIP PABX's/LAN equipment. Refer to paragraphs 4.4.1.1.2 and 4.5.1.

5.2.4 As with any complex decision there are several major conditions that would influence Telkom's decision to implement a VoIP. Minor conditions that have little influence on the decision will be ignored during the decision-making process by applying Pareto's principle.

Some conditions will enable the implementation while other will inhibit the implementation of a VoIP network. Refer to Table 4.2 - Conditions mentioned during the interviews for a list of the conditions.

5.2.5 There are a number of conditions that might become more important as well as conditions that can enable or inhibit the implementation of VoIP. These changes depend on the environment, the results of the analysis that Telkom would need to do before taking the final decision and the actions that Telkom take. Refer to Table 4.2 - Conditions mentioned during the interviews for details.

5.2.6 By selecting niche market implementations as indicated in paragraph 4.5 some of the inhibiting conditions can be neutralized. Telkom is now pro-actively also removing the internal obstacles that are preventing the implementation of a national VoIP network. Most of the inhibitors that need to be resolved by Telkom are currently being addressed. Refer to the interview with Andrew Hadley in appendix C.

5.2.7 The deployment of VoIP on the Telkom national network will take place as early as the beginning of 2004. Refer to paragraph 4.6.

5.3 Recommendation to vendors management

As a result of the research in this report the following recommendations can be made:

5.3.1 Up till now the vendor followed an informative and enabling type of strategy. Telkom is already convinced that VoIP is the long-term technology that they should use. This implies that the focus of the vendor should be less on the technology and more on a business-oriented strategy. For example offers should promote the vendor's network solutions and should indicate the strength of the vendor's technical solutions compared to other vendors.

5.3.2 Offers made should be aimed at addressing the niche markets. Network wide offers should be avoided. The niche markets selected should focus on the international, national and corporate market segments. Details of the niche markets are described in paragraph 4.4.1.1.2 and the detailed network solutions required in paragraph 4.5.1.

5.3.3 Offers to Telkom should focus on the potential revenue and operational savings that would enable the introduction of VoIP. Examples of key arguments to be used during the discussion with Telkom are:

- End of support of the current TDM based network
- Potential for niche market profit potential
- The network wide potential cost savings of running one network.

Refer to Table 4.2 - Conditions mentioned during the interviews for a complete list of enabling conditions.

5.3.4 Offers to Telkom should minimise the impact of the inhibiting conditions for Telkom to implement a VoIP network. Examples of key arguments to be used during the discussion with Telkom are:

- The vendor's equipment is reliable. For example customers using the vendor's equipment can be used as reference.
- The vendor could assist Telkom to exploit their existing national networks by offering solutions from this network that can support VoIP as well.
- The vendor would need to indicate to Telkom that the solutions they offer are manageable.

Refer to Table 4.2 - Conditions mentioned during the interviews for a complete list of inhibiting conditions. Not all inhibiting conditions will be under the vendor's control but those that are should be addressed to neutralise their effect.

5.3.5 Telkom is interested in deploying a VoIP solution soon. This requires increasing the current levels of effort that is spent on the acquisition of Telkom as a potential VoIP customer. The following are but a few examples of possible methods to be employed: marketing campaigns, demonstrations of solutions, taking Telkom to satisfied customers, generation of business cases adapted for the Telkom market conditions and even the offering of a free trial system that Telkom can deploy in their network. By intensifying the acquisition effort more Telkom employees can be informed of the advantages of the vendor's network solutions.

5.3.6 Telkom is employing a step-by-step introduction of the new VoIP technology and as a result less implementation resources are required if the implementation commences. The resources should however be fully enabled so that the vendor will be able to rapidly deploy a VoIP network or a trial system.

5.3.7 Feedback to the developers of the VoIP solution indicate that highly scaleable solutions are required or a solution that can easily and cheaply migrate from a TDM to a NGN. This is required to allow the introduction of VoIP cheaply to the niche markets. Solutions for the trunking of compressed voice over IP are required and IP Centrex would be

one of the first features introduced to the end customer. These items should be the focus of the product development effort to ensure introduction of the vendor's VoIP solution with Telkom.

5.3.8 Continuous monitoring of the state of the various conditions are required because new conditions may arise from the environment or some conditions may change as was indicated in Table 4.2 - Conditions mentioned during the interviews. The condition may be major or minor and may enable or inhibit the implementation.

By implementing these recommendations the vendor can ensure that no market opportunities are missed and that internal enabling costs are minimized.

5.4 Summary

As was defined in the problem statement the problem is that the vendor does not know which strategic conditions will be considered by Telkom when making a decision to invest in VoIP equipment for deployment in their national network (Refer to paragraph 1.3).

Therefore this research aimed to determine which strategic conditions the operator should consider when making the decision to implement a national VoIP network. This will result in the vendor knowing how to convince Telkom to implement a VoIP network (Refer to paragraph 1.4).

The goals were to:

- Review the theory that applies when making a decision to implement a VoIP network.
- Use the survey research method using qualitative research by means of the key informant interview technique to determine Telkom employee's views on the strategic conditions that would influence the decision-making of the Telkom executives.
- Conclude whether Telkom might be willing to invest in a national VoIP network.
- Provide recommendations to refocus the vendor's attention to the potential market for its VoIP equipment (Refer to paragraph 1.5).

The strategic management process, strategic technology management theory and technology market management theory were reviewed. This theory is relevant in the decision to implement a national VoIP network. A summary of the potential strategic condition that were identified during the theoretical survey was provided in paragraph 2.10. The conditions

that will have a major or a minor influence during the decision-making process are indicated there.

None of these conditions or the long-term objectives and generic or grand strategies of Telkom excludes the use of VoIP by Telkom. VoIP could actually assist Telkom to achieve their long term objectives and assist them in implementing generic and grand strategies in the right situation.

The survey method of research was selected. Qualitative research was done by means of the key informant interview technique to determine Telkom employee's views on the strategic conditions that would influence the decision-making of Telkom executives. The theoretical analysis was used as a framework during the interviews (Refer to paragraph 3.7).

Telkom is interested in deploying a VoIP network. ATM will be applied to support existing services and could be used in the access environment only to deliver QoS-managed transport. VoATM will be a competing technology in the access network.

Twenty-eight major conditions were identified (Refer to paragraph 4.4.4). Some of them will enable and other will inhibit the implementation. Telkom identified niche market segments that are applicable for deployment of VoIP. From the research results it is evident that Telkom intends to deploy a net to off-net international VoIP connections soon. This would require the deployment of a national VoIP network that requires a QoS enabled IP network and a gatekeeper or softswitch (Refer to paragraph 4.5.4). Some of the interviewees indicated that the network could be deployed as early as the beginning of 2004 (Refer to paragraph 4.6).

There is definite merit in deploying a national VoIP network. Telkom realised that the creation of a fully comprehensive scenario for the whole Telkom network is too complex. The relevant markets for VoIP were identified. As with any complex decision there are several enabling and inhibiting conditions that could influence Telkom to implement a VoIP network.
By addressing only niche market implementations, some of the inhibiting conditions can be neutralized. Telkom is now pro-actively also removing the internal obstacles that are preventing the implementation of a national VoIP network. Most of the inhibitors that need to be resolved by Telkom are currently being addressed. The deployment of VoIP on the Telkom national network will take place as early as beginning of 2004 (Refer to paragraph 5.2).

The following recommendation were made to the vendor's management:

- The vendor's focus should change to concentrate less on the technology and more on business-oriented strategy.
- Offers made should be aimed at addressing the identified niche markets.
- Offers should focus on the potential revenue and operational savings that would enable the introduction of VoIP and would minimise the impact of the inhibiting conditions. This will assist in convincing Telkom to implement a VoIP network
- A small and fully trained pool of resources is required to ensure that the necessary acquisition and deployment tasks can be executed.
- Provide feedback to the development team on the network solution that are required.
- Continuous monitoring of the state of the various conditions because new conditions may arise from the environment or some conditions may change depending on the progress made by Telkom to address the enabling and inhibiting conditions (Refer to paragraph 5.3).

By knowing which strategic conditions will be considered by Telkom when making a decision to invest in VoIP equipment for deployment in their national network, the vendor knows how to convince Telkom to implement a VoIP network.

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Appendices

Appendix A: Glossary

A

Analogue An analogue signal is electrical and varies constantly in voltage, unlike a digital signal, which varies between two constant values, usually denoted as 0 and 1. The value of the analogue signal varies all the time during transmission, whereas a digital signal changes only between two set values without intermediate variations.

Application Layer The top layer in the OSI Reference Model comprising the interface between the OSI environment and a user's application. It does not contain applications, but provides a link from application software on one system to applications on another computer through the OSI environment. Several application layers support different user tasks such as e-mail and file transfer and transaction processing.

Asynchronous communications A method of transmitting data in which each transmitted character is sent separately. The character has integral start and finish start and stop bits so that the character can be sent at an arbitrary time, and separate from any other character. It is the most rudimentary type of communication, as the originating and receiving machines do not have to be synchronized. Cheap, reliable and common among PCs and minicomputers, its disadvantage is the large number of extra bits needed for the data to be interpreted.

ATM (Asynchronous Transfer Mode) A cell- based data transfer technique in which channel demand determines packet allocation. ATM offers fast packet technology, real time, demand led switching for efficient use of network resources. It is also the generic term adopted by ANSI and the ITU to classify cell relay technology within the realm of broadband WANs, specifically B-ISDN. In ATM, units of data are not time related to each other and, as part of the B-ISDN standard, is specified for digital transmission speeds from 34Mbit/s to 622Mbit/s. IBM currently offers ATM at a non-standard 25Mbit/s format. ATM will be the high bandwidth networking standard of the decade.

B

Backbone A high-capacity network that links together other networks of lower capacity. A local backbone network would typically be an FDDI network acting as an in building backbone to link together multiple LANs. A wide area backbone network would typically use digital leased circuits and multiplexers or routers.

Bandwidth The range of frequencies a transmission line or channel can carry: the greater the bandwidth, the greater the information - carrying capacity of a channel. For a digital channel this is defined in bit/s. For an analogue channel it is dependent on the type and method of modulation used to encode the data.

C

CCITT (The International Telegraph and Telephone Consultative Committee) Former name for the ITU (International Telecommunications Union), a specialized Agency of the United Nations.

CCITT Study Groups The ITU (formerly the CCITT) operates as a series of groups considering specialist areas. There are key study groups applicable to networking and communications such as Study Group VII responsible for data communications networks and the X series Recommendations and Study Group XVIII covering digital networks including ISDN.

Circuit switching The transmission technique in which a physical circuit is established between sender and receiver before transmission takes place. When the transmission is complete, the circuit is freed.

Connection-oriented service The transport of packets of information from one network node to a destination node following an established network connection.

Connectionless Service The transport of a single datagram or packet of information from one network node to a destination node or multiple nodes without establishing a network connection.

CPE (Customer Premises Equipment) Telecommunications- communications equipment, including PBXs and wiring, located in a user's premises.

CTI (Computer Telephone Integration) A generic name for the technology automatically relating computers and PABX's via applications such as ACD, power dialling, IVR and other customer facing or agent facing services. Also known by older, proprietary names CIT (Computer Integrated Telephony) and CSTA (Computer Supported Telephony Applications).

D

Data compression A way of reducing the amount of data to be transmitted by applying one of several techniques that reduce the number of bits needed to represent the information. When the data is received it is decompressed into its original form.

DCE (Data Circuit Terminating Equipment) Communications equipment installed in a user's premises responsible for establishing, maintaining and terminating a connection. A modem is an example.

DSE (Digital Switching Exchange) A node in a telecommunications network.

E

Ethernet The most widely used LAN transmission network. Based on a bus network topology, it runs at a maximum 10Mbit/s - in practice far less - and adopts CSMA/CD techniques operating over conventional co-axial cable, thin wire co-axial cable and unshielded twisted pair cabling. A fibre-optic implementation has also been defined. Originally developed by Xerox, Intel and Dec, Ethernet has moved through V1 and V2 proprietary definitions, and has now been standardized by the IEEE as the IEEE 802.3 standard. This has several implementations - 10Base5 for use over conventional co-axial cable, 10BaseF for use over optic fibre, and 10BaseT for use over Unshielded Twisted Pair (UTP) cabling.

ETSI (European Telecommunications Standards Institute) A European standards body established in 1988 by a decision of the CEPT. It has taken over the work of the CEPT the area of developing the Net-Normes European de Telecommunication, Net standards.

F

Fast Ethernet Proposed 100Mbit/s technology for workstation LAN's from the eponymous Fast Ethemet Alliance, which includes 3Com and SynOptics. The IEEE as the basis has adopted it for the 100BaseT Ethernet standard.

Fast packet switching A WAN technology capable of transmitting data, digitized voice and digitized image information. It makes use of short, fixed length packets (or cells) that are all the same size. The underlying switching technology is based on the statistical multiplexing of data and voice in fixed length cells. Any of these packets could carry digital voice, data or digital image information. All the packets travel at Level Two of the OSI Model, and routing is performed on the basis of the Level Two addressing. Fast packet is an effective way of making best use of available bandwidth. It offers the benefits of conventional multiplexing techniques and circuit switching techniques. It is one of the transmission technologies being developed for use with B-ISDN. The switch used to route packets in a fast packet network is termed a fast packet switch. Also, fast packet technology can carry data transmissions that enter the network using a frame relay access method. For particularly high speed

networking, an implementation of fast packet switching known as ATM is being commercially developed.

Frame A group of bits sent over a link. A frame may contain control and addressing information, as well as error detection - for example CRC information - and forward error correction information. The size and composition of the frame varies according to the protocol. Often used synonymously with 'packet'.

Frame relay A data communications interface originating from ISDN is designed to provide high-speed frame or packet transmission with minimum delay and efficient use of bandwidth. It is a variation on the X.25 interface and form of fast packet switching. It derives its name from using the Data Link or "frame" OSI layer two to route or "relay" a packet directly to its destination instead of terminating the packet at each switching node. This eliminates processing overheads and increases throughput speed. Based on the ITU Lap-D standard, it uses variable-length packets and applicable only to sub-broadband, T3/E3 or lower, data transmission. Like Ethernet, or token ring, frame relay assumes that connections are reliable. It does not have error detection and error control within the network, which helps to speed up the protocol. When errors occur frame relay relies on higher-level protocols for error control. Frame relay is often viewed as a replacement for X.25, primarily for LAN-to-LAN bursty traffic. Voice over frame relay is available, but the subject of debate. It will also become an access method for ATM-based WANs.

G

Gateway Network interconnection device and software that operate at OSI Layer Seven. A gateway supports a full stack of the relevant protocol, such as SNA, DecNet, ISO, TCP/IP, and can covert to a non-seven layer protocol, such as async or BSC. It is typically used to provide access to wide area networks over asynchronous or X.25 links from a LAN environment. Examples include pads and protocol converters.

GSM (Global System for Mobile communications) A two-way, pan-European digital cellular system. Its specification is in line with ISDN and ITU System 7 signalling and approved by almost all European countries. GSM operates at 900MHz and is a forerunner to the mass-market Personal Communications Networks, based on the same set of standards. GSM services include current digital subscriber services and the unique Short Message Service - a superior form of paging offering up to 160 alphanumeric characters with guaranteed delivery.

H

I

Interface The place or piece of equipment where interaction occurs between two regions or systems or processes. A common example is the RS232-C port or the AUI on LAN's between the computer and transceiver.

Internet (1) A group of networks that are interconnected so that they appear to be one continuous network, and can be addressed seamlessly at the Network Layer Three of the OSI model. Typical Internets are built using routers, either to form a backbone network comprised of routers, or to link together LAN's at the Network Layer.

Internet (2) A collection of networks and gateways, including the Milnet and NSFNET, all using the TCP/IP protocol suite. It functions as a single, cooperative virtual network. The Internet provides universal connectivity and three levels of network services: connectionless packet delivery; full duplex stream delivery and application level services including electronic mail and EDI.

Internet address An IP address assigned in blocks of numbers to user organizations accessing the Internet by the US DoD's Network Information Centre. Duplicate addresses can cause major headaches on the network, but the NIC trusts organizations to use individual addresses responsibly. Each address is an eight- bit number (0 to 255). There are three classes: A, B and C, depending on how many computers on the site are likely to be connected. The NIC is running out of Class B addresses, so work is in progress to extend the address format to allow expansion into the next century.

IESG (Internet Engineering Steering Group) A US committee consisting of the IETF chairperson and the six area managers. The IESG coordinates activities among the IETF working groups.

IETF (Internet Engineering Task Force) A US committee concerned with short-term and medium-term problems with TCP/IP and the connected Internet. The IETF is divided into six areas, which are further divided into working groups, and its chairperson is a member of the TAB.

IP (Internet Protocol) The TCP/IP standard protocol that defines the IP datagram as the unit of information passed across an Internet and provides the basis for connectionless packet delivery service. IP includes the ICMP control and error message protocol as an integral part. It provides the functional equivalent of ISO OSI Network Services.

IP address The 32-bit address assigned to hosts that want to participate in a TCP/IP Internet. IP datagram - The basic unit of information passed across a TCP/IP Internet.

IRTF (Internet Research Task Force) A technical group working or problems related to TCP/IP and the connected Internet. The IRTF is divided into a set of research groups. The IRTF chairperson is a member of the IAB.

ISDN (Integrated Services Digital Network) An approach to switched digital networking that can handle a range of digital voice, data and digital image transmission. It is intended to provide end-to-end, simultaneous handling of digitized voice and data traffic on the same digital links via integrated switches. There are different access channels, according to geographic location. These include Basic Rate Access (2 x 64Kbit/s 161 + 16Kbit/s) and Primary Rate Access (1.544 (US) and 2.048 Mbit/s (Europe). ISDN standards are defined in the ITU I-Series Recommendations.

J

K

L

LAN (Local Area Network) A communications system that links computers into a network, usually via a wiring-based cabling scheme. LAN's connect PC's, workstations and servers together to allow users to communicate and share resources like hard disk storage and printers. Devices linked by a LAN may be on the same floor or within a building or campus. It is user-owned and does not run over leased lines, though a LAN may have gateways to the PSTN or other, private, networks.

M

Multimedia Generic description of the generation and transfer of voice/data/video traffic between users. Applications to exploit multimedia to the full are emerging in the wake of advanced switching techniques and develop merits in desktop and server processing architectures. It may be essential to a physically separated group that communicates as if it was physically networked.

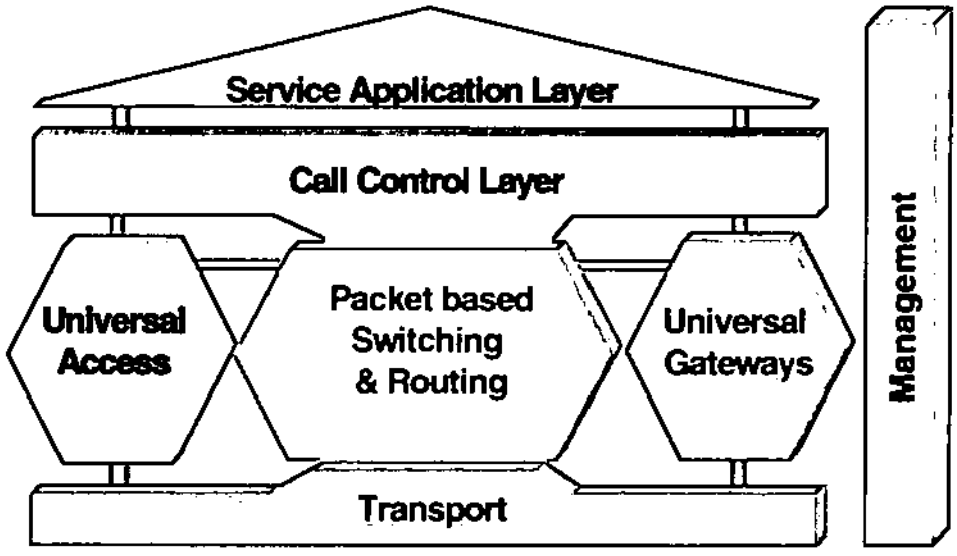
Multiplexer A device that can send several signals over a single line. A similar device at the other end of the link then separates them. This can be done in a variety of ways: time division multiplexing, frequency division multiplexing and statistical multiplexing. Multiplexers are also becoming increasingly efficient in terms of data compression, error correction, transmission speed and multi-drop capabilities.

N

Next generation network (NGN) ETSI defines NGN as a concept for defining and deploying networks, which, due to their formal separation into different layers and planes and use of open interfaces, offers service providers and operators a platform which can evolve in a step-by-step manner to create, deploy and manage innovative services.

NGN architecture The recommendation of the Multi-service Switching Forum (MSF – www.msforum.org), stipulates a network architecture where the service and control layer is independent of the core and access network which is one of the major difference between a TDM based network and NGN.

Figure 5.1 - Next generation network architecture as defined by the Multi-service Switching Forum



O

OSI Basic Reference Model (Open Systems Interconnection Reference Model) An architectural model describing how communications can be achieved between different vendors' systems. It is a logical structure for network operations standardized within ISO and

containing seven primary layers. It enables any OSI compliant computer or device to communicate with other OS 1-compliant equipment. The seven Layers, starting with the lowest are the Physical, Data Link, Network, Transport, Session, Presentation and Applications.

P

Packet A collection of bits, including the address, data and control that are switched and transmitted together. The terms frame and packet are often used synonymously.

Packet Switching A method of switching data in a network. Individual packets of a set size and format are accepted by the network and delivered to their destination. The sequence of packets is maintained, and destination established, by the exchange of control information (also contained in the packets) between the sending terminal and the network before the transmission starts. The network is open to all users, all the time, with packets from the various nodes being interleaved throughout the network. The packets can be sent in any order, as the control information sent at the beginning of the transmission ensures they are interpreted in the correct order at the receiving end. Because each packet carries its own control instructions, it can use any route to reach its destination. The link lasts only as long as the transmission. An ITU standard for packet switched networks information.

Presentation Layer The sixth of seven layers in the OSI model. Its job is to ensure that two computers wanting to communicate establish the ground rules for how they can interoperate.

PSN (Packet Switching Node) PSN is the name of an Arpanet packet switch.

PDN (Public Data Network) A network established by a PTT, PTO or TA to provide data transmission services for public use.

Q

R

Router Network interconnector device operating at OSI Network Layer (Level Three) that supports a particular Network Layer protocol and related stack, such as TCP/IP, DecNet, XNS, SNA, OSI IP, IPX. These days routers tend to support multiple protocols by a variety of methods, such as Protocol Independent Routing. A router can be used to link LAN's together locally or remotely as part of a WAN. A network built using routers is often termed an internet.

S

Switch Equipment used to connect and distribute communications between a trunk line or backbone and individual nodes.

T

TCP (Transmission Control Protocol) The standard transport level protocol that provides the full duplex, stream service on which many application protocols depend. TCP allows a process or one machine to send a stream of data to a process on another. Software implementing TCP usually resides in the operating system and uses the IP to transmit information across the network.

TCP/IP (Transmission Control Protocol/Internet Protocol) The suite of protocols developed and used by DAR PA and the US DOD. They build up to Layer four of the ISO OSI model, but there is no direct correspondence layer for layer. Three main protocols sit above TCP/IP: Telnet, FTP and SMTP.

TDM (Time Division Multiplexer/Multiplexing) Multiplexer, which apportions the time available on its Composite link between its channels, interleaving data from successive channels. The method divides up digital channels to make maximum use of their bandwidth, by taking input from each source in turn. TDM uses one of two methods to achieve this, bit interleaving for synchronous protocols and character interleaving for asynchronous protocols.

Transport Layer The Fourth Layer in the OSI model, drawn up by the ISO. The purpose of the transport layer is to act as an intermediary between the user and the network. All layers above the transport layer are network independent.

U

UDP (User Datagram Protocol) The IP standard protocol that allows an application program on one machine to send a datagram to an application program on another machine. UDP uses the Internet IP to deliver datagrams.

V

Van (Value Added Network)/Vans (Value Added Network Service) A data transmission network which guarantees data security and integrity through added computer control and communications, from the sender to the recipient often in the manner of a door-to-door courier or freight forwarder.

Virtual circuit A link that seems and behaves like a dedicated point-to-point line or a system that delivers packets in sequence, as happens on an actual point to point network. In reality, the data is delivered across a network via the most appropriate route. The sending and receiving devices do not have to be aware of the options and the route is chosen only when a message is sent. There is no prearrangement, so each virtual connection exists only for the duration of that one transmission.

VPN (Virtual Private Network) The provision of private voice and data networking from the public switched network through advanced public switches. The network connection appears to the user as an end-to-end, nailed-up circuit without actually involving a permanent physical connection, as in the case of a leased line. VPN's retain the advantages of private networks but add benefits like capacity on demand.

W

WAN (Wide Area Network) A network, which covers a larger geographical area than a LAN and where telecommunications links are implemented, normally leased from the appropriate PTO(s). Examples of WANs include packet switched networks, public data networks and Value Added Networks.

X

X Series Recommendations drawn up 51 by the ITU to establish interfaces for Terminal Equipment (DTE) and Data Circuit Terminating Equipment (DCE) and public data networks (PDN). The series includes:

X.25 Interface between DTE and DCE for terminals using packets over public data networks.

Appendix B: Research instrument

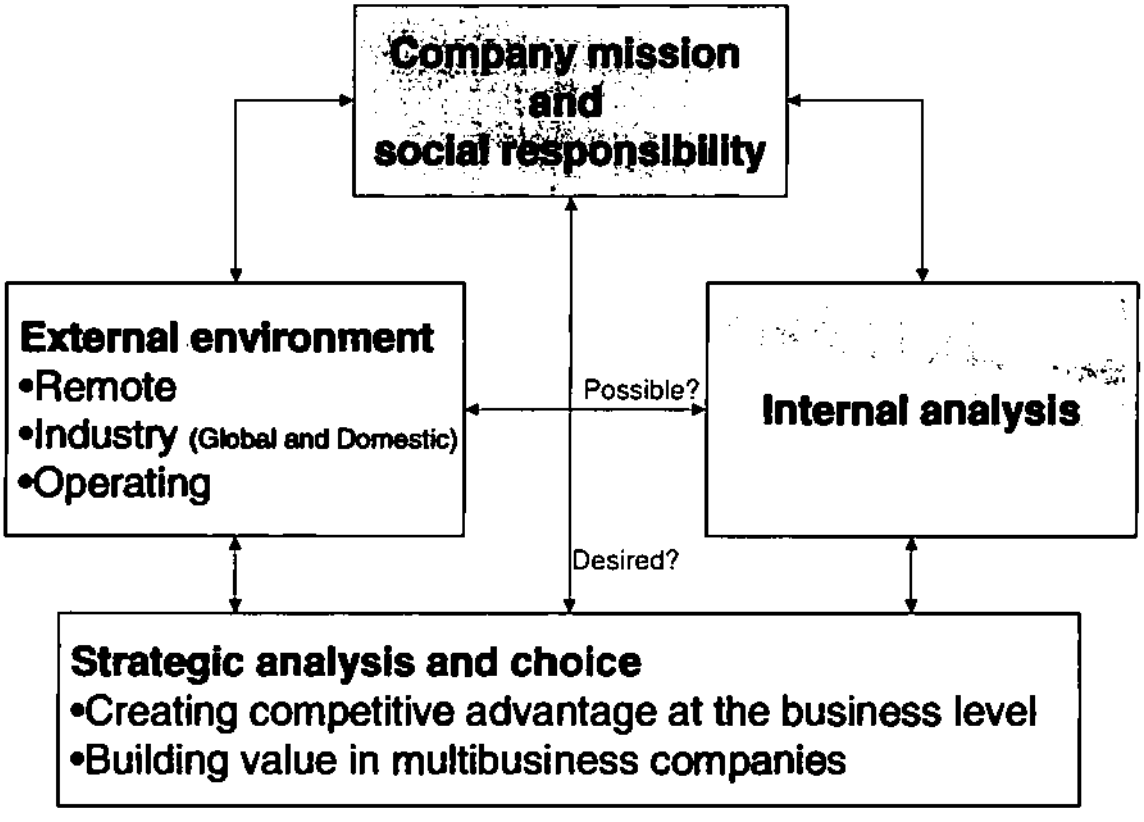
B.1 Guideline used during the interview

Dear Telecommunication industry colleague

I am currently in the process of completing my MBA and as part of my MBA I have to complete a management report.

The topic I have selected is: **Strategic** conditions to be considered by Telkom before investing in voice over Internet protocol equipment for their national network.

The focus is on strategic issues as is explained below in the Strategic Management Model and specifically the formulation thereof:



Would you please be so kind to answer the following questions? Your personal perspective would be appreciated.

Thank you

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B.2 Questions asked

The following questions were asked during the interview:

1. Is Telkom interested in deploying a national VoIP network or would Telkom rather deploy another technology (e.g. TDM, ATM)?

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   .....

2. Why will Telkom invest in VoIP technology?

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3. Why has Telkom not yet implemented VoIP technology for their national network?

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4. When will Telkom implement a national VoIP network?

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5. Do you have anything to add that was not addressed by my questions or that was not mentioned already?

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Thank you for your participation

Notes:

1) Refer to paragraph 2.10, A summary of the potential conditions identified during the theoretical survey is provided in Table 2.2. The table indicates whether the conditions will have a major or a minor influence during the decision-making process.

Table 2.2 - Potential conditions applicable when making a decision to implement a VoIP network for a summary of potential areas of strategic conditions that were determined during the theoretical survey. This framework was only used if the interviewee did not respond to question 2 and 3 in a satisfactory manner or to initiate further thoughts of other potential strategic conditions that were overseen during the interview. For example the following question was used: Is the political environment an area of strategic importance?

2) To reach a deeper understanding of any of the identified areas, the following question was used: Can you please clarify why you think this condition is of strategic importance?

Appendix C: Responses from interviews

Answers from Henry Pahl

1. Is Telkom interested in deploying a national VoIP network or would Telkom rather deploy another technology (e.g. TDM or ATM)?
   Telkom is interested in deploying VoIP.

2. Why will Telkom invest in VoIP technology?
   You know the reasons a well as I do. (Converged networks, compression etc)

3. Why has Telkom not yet implemented VoIP technology for their national network?

A) Technical perspective

1. New technology
   - Before Telkom was the pilot for new technologies and experienced the bleeding edge of technology development. This nearly led to serious degradation of service to the end-user. Reference was made to the introduction of TDM systems relative to electromechanical exchanges about 20 years ago.
   - Telkom will benefit from the mistakes and experience other operators have with VoIP technology before they would invest in this technology.
   - VoIP offers the possibility to address new and current markets by using technology and solutions that were not available before e.g. converged access for data and voice. Before separate access network needed to be built. This brings obvious cost savings in the access network. This benefit is weighed up against the risk of introducing new technologies, which include:
     - Unreliability.
     - Rapid improvements/changes in the network equipment and as a result the equipment is quickly uncompetitive and redundant.
     - New technology normally does not have all the features to successfully introduce and maintain a VoIP network.
2. Market liberalisation. Telkom is aware that any competitor will take at least 6 months after being awarded a licence, to start operating. Telkom is under no competitive pressure to introduce the latest available features or services to their end customers and has a market window to introduce it before a competitor could.
   - The revenue of the potential market that Telkom is not addressing due to the unavailability of certain service is also compared to the risk of new technology.

- Telkom also knows that some of their currently profitable services will be cannibalized with the introduction of VoIP and IP data services.
- SBC sees other markets other than South Africa as priority to compete in e.g. the American market where they are experiencing competition.

3. Telkom has moved from a technology driven origination to a market driven organisation. This strategic move has been spectacularly unsuccessful. The main reason for this is the lack of vision of the marketing department. The marketing department was also influenced by one of the main shareholders of Telkom, namely SBC who is not familiar with South African market conditions.
4. Business processes required

   Telkom is striving for a service oriented operations system. This is one of the fundamental decisions an operator has to make when implementing an OSS/BSS system. This influences the systems required and the way these tools will be used. Offering VoIP services requires a total redefinition of the business processes and even the business models, which the operator is using. A re-analysis of all assumptions and process needs to take place. The potential impact on the operator is great. Examples of processes that need to be redefined are provisioning, fault finding and clearance and charging.
5. The Initial public listing IPO

   This was a major factor that limited Telkom's spending. A decision was made that investors in Telkom would prefer a strong bank balance in contrast to a modern network. Although the listing is completed, investors will still play a roll on the spending patterns of Telkom.
6. World wide there is a downturn in the telecommunications economy.
7. High debt ratio's of Telkom was caused by the license conditions imposed by ICASA.

   To motivate the implementation of new CAPEX items requires an increased return on investment. This makes the motivation for implementing a VoIP network more difficult simply on the grounds of business case.

B) Organisational perspective

1. No power struggle between organisational units.

   There only is constructive tension between different departments. This ensures that all angles of a problem are discussed and considered before a decision is taken.

C) Personal perspective

1. The management team installed by SBC had a blasé attitude towards spending of money when they bought into Telkom. This is another reason for the high debt burden of Telkom.
2. There are individual management members who will use this opportunity as a motivation to further their careers but not necessarily for the good of Telkom. This is a growing tendency of company executives.
3. The American management team of SBC is loyal to America and would prefer seeing improvements in networks in America rather than in other countries.

4. When will Telkom implement a national VoIP network?

   To introduce these services Telkom will be able to build an overlay VoIP network to their current TDM network to offer services to the end customer. This will allow Telkom to implement a VoIP network on a small scale quickly because they already have an IP data network available (This network may have limited capacity and functionality that can guarantee Quality of services (QoS) but is being addressed).

   Telkom has at least 6 months after competition enters the market to put a VoIP network in place to be competitive.

Answers from Paul Ingelsby

1. Is Telkom interested in deploying a national VoIP network or would Telkom rather deploy another technology (e.g. TDM, ATM.)?

   Paul answered yes, Telkom is interested in deploying VoIP and motivated his answer as follows:

   Telkom has already started determining their network strategy towards VoIP in 1997. Telkom realised that after the Packet mode architecture (PMA) tender, the creation of a fully comprehensive scenario for the total Telkom network would be too complex to handle. Along with the downturn in the telecommunication economy and the World economy it made sense to analyse the markets where VoIP could have potentially the biggest impact. Four markets were identified relevant for VoIP:

   a) The global and conglomerate market

   This market is the market of international calls. This market includes big companies that make many international calls and alternate operators of a national or international nature e.g. operators that use Telkom's international connectivity. Telkom addressed this market with the Clarent solution. Siemens had no carrier scale VoIP solution when Telkom implemented this solution. (This solution has some technical problems and cannot scale to the requirements of Telkom if this solution had to be used for their national network.)

   b) The enterprise VoIP market

   Telkom's corporate customers were demanding that they wanted VoIP solutions from Telkom for their enterprise traffic. As a result Telkom selected the Siemens HiPath as an Enterprise VoIP PABX and provided connectivity between enterprise sites via the Telkom TDM PSTN using TDM to IP gateways. Telkom also allowed customers to use Cisco equipment and the Cisco call manager solution for their enterprise traffic.

   c) The public VoIP market (limited to corporate and small and medium enterprises)

   This market requires that the traffic generated in VoIP at an enterprise level stays VoIP when connecting traffic from end to end. This connectivity can then be supplied via the public IP network or IP VPN's on this network. The current IP network is not Quality of Service (QoS) enabled. This is a prerequisite to provide carrier grade voice across IP. To enable this connectivity Telkom is currently upgrading or replacing their current Router network to be quality of service enabled. This will allow Telkom to deliver the required service to these customers.

   d) The general VoIP subscriber market

   This category includes the private telecommunication user and any other user that uses VoIP to make telephone calls via a data centric method. E.g. voice over Internet

using NetMeeting. Currently Telkom is only monitoring and tracking this market for the potential loss of voice traffic and potential loss of revenue.

Follow-up question: What about Operators and ISP's?
These are categories Telkom calls special markets. In this group the ITE clearing house, Operator as CellC, MTN, Vodacom and ISP's are grouped. Each special market segment has its own strategy. For Telkom's VoIP strategy the above-mentioned categories apply.

Follow-up question: Are you considering deploying other technology than VoIP?
The alternate technologies that Telkom is considering deploying are VoATM and VoDSL. VoATM can be used for corporate customers that have ATM networks and that demand this kind of a service. VoDSL (ATM based) can be used in the access network for those customers that have DSL connections. The core network however is planned to be IP. Currently in Telkom there is conflict on how to migrate the access network based on ATM or IP to an ultimately foreseen IP network.

2. Why will Telkom invest in VoIP technology?
   Revenue is the main diver.
   - Telkom has been losing voice traffic revenue because people use VoIP. To counter this loss Telkom had to provide solutions. For example Telkom has been steadily decreasing its international call cost. Telkom also offers corporate customers special packages for connections via the Clarent international VoIP clearing house solution at reduced quality of service with the associated reduced network resources used.
   - Corporate customers that favour VoIP solutions need to be provided with solutions to ensure Telkom with a secure revenue stream.

3. Why has Telkom not yet implemented VoIP technology for their national network?
   Telkom has a strategy in place to address VoIP as discussed in point 1 above. The following inhibitor though will play a role:
   - No clear marketing strategy or specific pricing strategy for VoIP exists.
   - The downturn in the telecommunication economic environment.
   - Telkom has a high debt burden and is trying to reduce it by reducing OPEX and CAPEX spending.
   - The requirements of shareholders will have an increasing influence on how Telkom reacts to the telecommunication market and the implementations made in the network. For example would shareholders prefer to have cash in hand and a

high return on investment compared to having a state of the art network that addresses all market segments. Here the new shareholders e.g. banks and SBC would play a major role.

- Telkom owns part of Vodacom and will consider investments made in the mobile network compared to those made in the fixed network.

4. When will Telkom implement a national VoIP network?
   Considering the strategy described Telkom is already providing solution to customers. To enable the implementation of a national VoIP network, Telkom is implementing a QoS enabled IP network. If customers demand end-to-end VoIP solutions, then Telkom will consider providing the required service for them.

Answers from Billy Fick

1. Is Telkom interested in deploying a national VoIP network or would Telkom rather deploy another technology (e.g. TDM, ATM.)?
   Telkom is considering implementing one core network based on one technology IP on layer 3. Currently Telkom has for each service a different network e.g. Voice, leased lines, X.25, GE (Gigabyte Ethernet), ATM. This is valid for the core and the access side of the network. Almost all traffic types can be emulated across the IP network (X.25, Voice, ATM). VoIP fits into the strategy to converge all traffic onto one network technology.

   ATM has its merits as a layer 2 technology and is good for aggregation and centralised BRAS (Broadband remote access service). Most BRAS traffic needs to be centralised because most Internet traffic is connecting with international destinations.

2. Why will Telkom invest in VoIP technology?
   Three issues were seen as the main enablers/inhibitors and reasons why Telkom would /would not invest in VoIP:
   - If Telkom wants to be pro-active it will require leadership.
     A "sponsor" (an executive that is prepared to put his career on the line) for VoIP in Telkom is required. This person will drive the implementation in Telkom.
     The lack of leadership in the marketing department was mentioned. E.g. the marketing department offers a service to a customer using one kind of technology. No one in marketing is exploiting the opportunity to offer one technology solution to the different services. IP offers the opportunity to emulate the different technologies across IP.
     As part of this point the strategic nature of implementing a technology such as VoIP is also considered.
   - If Telkom wants to be reactive the VoIP PABX market would force/demand service from Telkom to support VoIP.
     The corporate market is the most important market for Telkom especially from a revenue point of view. This point underlines that market forces would force Telkom to implement VoIP. This factor will become even more important as soon as the Second Network Operator (SNO) is operational.

     The reason why VoIP PABX/LAN equipment will force Telkom to offer this kind of service was motivated by the historic development of the telephone industry.

- Electromechanical exchange migration to Digital switches offering POTS was motivated by the scalability of the switches and cost saving because only reactive maintenance is required and no pro-active repairs are required. The systems were also more redundant and reliable supporting the re-active maintenance strategy.
- The migration from Digital switches offering POTS to those offering ISDN was motivated by the phased out MFC PABX's. ISDN PABX's also required SS7.
- The migration of PABX's to VoIP PABX/LAN equipment is seen to be the main driver for the migration to VoIP. The interviewee suggested that the following questions might shed some light on when the migration would take place. When are many of the current ISDN PABX's due for replacement? Does Enterprise VoIP add to productivity increases and is it more economical to implement an enterprise VoIP solution than a TDM PABX?

- The current PSTN network support ends in 2005. Telkom has the choice to either replace the network with new network equipment or to take the risk that the network will continue functioning.

3. Why has Telkom not yet implemented VoIP technology for their national network?
   The same three issues were mentioned as under the enablers but the inverse situation was implied.
   Additionally one item was highlighted. The cost to implement a network wide VoIP could be inhibitive. The CAPEX availability was especially mentioned.

4. When will Telkom implement a national VoIP network?
   This could happen any time from 2004. The main market driver will be VoIP PABX's/LAN equipment. A suggestion was made that Sales of VoIP PABX/LAN equipment should be monitored to provide an indication of the market forces that would be exercised on Telkom.

Answers from Steven White

Unfortunately the interviewee did not want to discuss any other issues than these mentioned below.

1. Is Telkom interested in deploying a national VoIP network or would Telkom rather deploy another technology (e.g. TDM, ATM.)?
   To provide voice services any technology can be used as long as the needs of the customer are addressed. The technology used is irrelevant.
   Telkom is considering VoIP for their national network by using carrier pre-select for a lower quality service. This is due to the perception in the market that VoIP provides services at low quality and at low cost. This perception is caused by the use of VoIP via the Internet or LAN/WAN that is not QoS enabled.

2. Why will Telkom invest in VoIP technology?
   To address the markets needs.

   The requirements of corporate customers that want to use IP PABX type devices and needing to connect the various sites must be addressed. This aspect will be the main driver.

   Firstly IP VPN's have been introduced to corporate customers. This is used to interconnect the PABX's at different locations. The corporate customers normally require more WAN bandwidth than they actually need. VPN supreme is the service to be offered to corporate customers with 4 possible options (structured around quality and bandwidth).

   The next step is the introduction of Voice VPN's. IP Centrex could be used and will be motivated to prevent the use of Premi-cells by corporate customers and also to prevent break out of voice traffic to the internet or data networks that bypass the charging of voice calls by Telkom.

   Converged access could be an opportunity but will cannibalise the access revenue that Telkom currently is generating via all the different access types (LL, PRI and X.25).

   Integration of Telephony with IT applications will be a natural evolution.

3. Why has Telkom not yet implemented VoIP technology for their national network?
   The interviewed person expressed his concern that VoIP is not a mature technology yet. For example, the QoS and manageability of the solutions that can be offered via VoIP.

   The IP PABX market that would be the main driver for the introduction of VoIP is not offering the advantages currently to their corporate customers.

   - Cost: IP handset cost R1500 versus a POTS phone of R50 and there are many hidden costs that implementers of IP PABX's are not aware of e.g. Replacement of LAN cables, improvement of LAN switches and routers to allow real-time traffic.
   - Risk of customer satisfaction: Corporate customers are concerned about QoS and an IP PABX needs to deliver immediately when deployed which is unrealistic for any newly deployed system and especially a new technology. Thus the risk for Telkom to deploy these kinds of solutions is high.

   Most customers require basic voice connections. The number of customers requiring TAPI (Telephony application program integration) does not justify the deployment of an IP network. The very reliable voice network that already exists needs to be retained.

4. When will Telkom implement a national VoIP network?
   Telkom is busy deploying solutions e.g. providing service via a Satellite with a 512kbit DSLAM like solution that will allow the deployment of data and 4 voice channels across the same connection.

Answers from Andrew Hadley

1. Is Telkom interested in deploying a national VoIP network or would Telkom rather deploy another technology (e.g. TDM, ATM.)?
   VoIP will be the preferred technology to use if the interviewee had a choice. VoATM is seen as a legacy type solution.

2. Why will Telkom invest in VoIP technology?
   - Telkom can deploy one technology, namely IP for all technology types to be transported across (X.25, ATM and Frame relay and obviously IP traffic). This eliminates the need for multiple networks and as a result the cost of maintenance. During the transition phase there is a definite bump in cost to maintain the 2 different methods of delivering service, but finally it will be cheaper.
   - IP allows different services across the same network e.g. voice, data and video. Voice alone will not be the only motivator to evolve the current Telkom networks to IP.
   - New golf estates and business parks are prime market opportunities. Managers of businesses live in golf estates and if they experience the advantages of IP at home they will probably deploy it in their businesses.
   - Compression of voice across the network offers major advantages for national and international traffic. (IP gateways are about 3 times cheaper that DCME equipment.) This allows the operator to define services according to classes of quality of a connection and the number of resources used by the connection and as a result the price for the connection. An example of the use of this varying quality is the soon to be launched. VPN supreme will have 4 classes of data connections of varying bandwidth and quality.

3. Why has Telkom not yet implemented VoIP technology for their national network?
   Technical perspective:
   - Telkom may decide to exploit the TDM based voice network asset as a cash generator. The TDM network is very reliable and requires little maintenance.
   - Concern was expressed about the unproven capabilities of IP to deliver voice, data and video reliably across the same network.
   - The maturity of the OSS/BSS systems available to support VoIP is a concern. Internal to Telkom VoIP and IP will have a big impact on the Telkom business process and the way Telkom charges for the services it renders. This will have an

impact on virtually all services. The business processes and billing structures need to be re-designed. This will require time and has many risk because of the limited experience operators have to support VoIP networks and uncertainty on how the market will react towards changing tariff structures.

- Employees need to be re-trained to support the new skills required to support IP and VoIP.
- Is the business case positive to deploy the network and will it provide the benefits as promised by most IP vendors? The interviewee provided the figures comparing VoIP features and cost per connection with current voice and data networks.

Organisational perspective definitely plays a role because many role players are conservative to change.
The market is not ready for the change. The market and Telkom internally still mistrust the quality capabilities that VoIP can deliver. This perception is caused by the use of applications like NetMeeting using Voice over Internet. Voice over Internet is the connections of voice using the Internet. This cannot guarantee the delivery of real-time traffic.

Personal perspectives play a role with powerful personalities not supporting change. There is a lack of leadership in embracing the inevitable technology changes.

4. When will Telkom implement a national VoIP network?
   Telkom is now pro-actively driving to implement a VoIP network. Most of the inhibitors that need to be resolved by Telkom are currently being addressed. It will take place soon, within months.

   The decision-making process requires the following answers:
   - What are the needs of the market?
     In this case the identified need might be that corporate customers using IP PABX's want to interconnect a corporate site via IP and want to connect to Telkom via IP connections for their voice traffic at varying quality of service and price.
   - Pricing of the equipment.
     Would the equipment plus the internal cost to Telkom (OPEX and CAPEX) together make a positive business case?
   - Can the equipment do what you want it to do in the market?

   Ultimately does it make business sense?
   Product development will then include vendor selection.

Answers from John Davis

1. Is Telkom interested in deploying a national VoIP network or would Telkom rather deploy another technology (e.g. TDM, ATM.)?
   In the core Telkom wants to deploy IP and in the access network ATM.

   There is no doubt that IP will be the technology of choice for the network layer of the OSI stack. This will provide a uniform interface to the application layers on the higher layer of the OSI stack. Network diagrams were described and the market needs that will be addressed by these networks were described.

2. Why will Telkom invest in VoIP technology?
   Main reasons:
   - Business – IRR calculation of the business case. Market requirements from enterprises
   - Services – Most applications that provide the final solution is based on an interface to the IP protocol. This is the main reason why IP is seen as the dominant protocol of the future because it allows the integration telephony with applications into a uniform network layer.
   - Universal access – One technology for the network layer that will support the various services.
   - Overselling of bandwidth –Data and voice can be sent across the same bandwidth and when the bandwidth is not used continuously, it can be sold to another user. The compression of voice and silent suppression are examples.

   The solution of choice needs to have the right features and should be billable and Manageable.

3. Why has Telkom not yet implemented VoIP technology for their national network?
   ATM is still cheaper that IP especially for bandwidths bigger than 2 Mbits.
   ATM provides the capability to provide connection on the link layer and to transport network layer connections e.g. leased lines and to connect IP over ATM.

4. When will Telkom implement a national VoIP network?
   No answer was provided to this question.

Answers from Albert van Zyl and Albert van Schalkwyk

1. Is Telkom interested in deploying a national VoIP network or would Telkom rather deploy another technology (e.g. TDM, ATM.)?

   Telkom has been reviewing the deployment of a national VoIP network since 2000 (and to some extent, also prior to 2000). At the time, ITU, ETSI and IETF standards were considered 'sufficiently mature' to deploy VoIP technology that could replace the TDM (PDH/SDH) interconnect topology in the core network. The concerns that existed at that time were:

   (a) Would we save costs as promised by the vendor community?

   (b) Will the solution be sufficiently stable and reliable?

   (c) Will quality be acceptable?

   (d) Will the deployment of VoIP enable the generation of additional revenue?

   (e) Would IP equipment be 'carrier scale/class/grade' to compete on an equal basis with alternative TDM-based solutions?

   (f) Can the 'new generation telecommunication solution providers' be trusted?

   (g) With a stagnant PSTN subscriber base and an over-supply of TDM bandwidth, does it make any economic sense to even pursue VoIP for a pure transport application?

   (h) shouldn't the deployment of VoIP be delayed altogether to:

      (i) enable further evolution of standards / solutions to prevent abortive costs,

      (ii) enable VoIP technology (HW and SW) costs to 'settle' (i.e. become more reasonable / cost-based),

      (iii) learn from the mistakes of other operators that are more pro-active in the deployment of VoIP and who can afford abortive cost and unscheduled expenditures.

   Some of these concerns are still valid.

   Over the past 3 years, much of the 'hype' has settled down about the merits of VoIP. Vendors and operators have toned down their commercial expectations, equipment suppliers have evolved their products: more mature and realistic decisions can now be made. The status quo remains: there is definite merit in deploying a national VoIP network (i.e. Telkom remains 'interested'), with TDM remaining in place as long as this is economically and commercially feasible, ATM will be applied to support existing services and could be used in the Access environment only to deliver QoS-managed transport (due to network scalability concerns).

2. Follow-up question: Why is VoIP important - why not something else?
   With the SIP and H.323 signalling methods and the transport and application of the IP protocol, there is still continuous momentum within the ITU, ETSI and IETF to evolve the maturity of VoIP solutions. The focus on the evolution of VoIP has changed from 'technical' (issues) to 'commercial' (services). There is greater urgency in offering new services with additional revenue opportunities, coupled to an increased understanding of what consumers demand. While some network operators have deployed VoIP solutions in deregulated networks, corporate customers have deployed their own customised solutions that are in many case more advanced than the network services (IP + VoIP VPN). Wireless LAN could also be another enabler for universal service accessibility across the IP stack. Operators cannot afford to important sources of revenue, and with growing consumer comfort and confidence in using VoIP, operators have no choice but to reciprocate and meet consumer demands. Telkom accordingly has no choice.

3. Please list the relevant strategic conditions that will be considered by Telkom during the decision-making process to implement a VoIP network or not. (Conditions that have an influence on the operator that may be relevant for this decision-making process)
   The most important are:
   - Customer communications requirement profile.
   - Competition from SNO, GSM operators or multi-national conglomerates.
   - Cost.
   - End-to-end/top-to-bottom manageability of solution.
   - State and evolution of technology (specifically OSP, open APIs, security measures).

   Other:
   - Legal – Telkom is only allowed to deploy VoIP in a VPN. Refer to the Telecommunication act for details.
   - Financial - There is a positive business case in general. However, the exact quantification is extremely difficult since there is no easy and salient 'killer revenue opportunity' that can initiate the process (and mobilise the necessary funds), which means that many issues need comprehensive consideration.
   - Human resources - There is sufficient expertise in data networking and –services, and voice switching and -services in Telkom. The problem is to mobilise existing resources into attaining common objectives, combining skills from traditionally separate domains/islands of expertise and sharing telecommunication and IT

knowledge that have been fragmented by the existing company HR structure. This is not only a convergence of voice and data, but also a convergence of technology domains and a synchronisation or collaboration of skills and effort in attaining these objectives.

- Market – There is demand in the market: especially for international and enterprise traffic. In future there will be demand for further accessibility from the broad consumer base.
- Competitors – Competition will have an influence on the decision if they offer VoIP. The biggest impact will be in the high-revenue consumer market segment.
- Technical – The IP network will be able to provide the quality of services required with Diffserv and MPLS. He is not convinced that synchronous ISDN services will work.
- Operational – It should offer operational cost savings (but capital cost needs to be contained). The network will become more complex, but if other technologies are progressively replaced (such as ATM), duplication of maintenance efforts should decline.
- Possible alternative projects – All projects compete for the same funding. The project with the best business case gets priority. A VoIP business case probably would be difficult to sell since many 'issues' are involved and a good ROI might not be too obvious or achievable in the short term.

Answers from Rolf Spaeth and Bruce Atherton

The results of these interviews were shared with both these parties. They had nothing more to add except that they mentioned that the following issues are of importance during the vendor selection process:

- Black economic empowerment percentages of the vendor company.
- Percentage of network equipment supplied by one vendor.
- Telkom executive's relations with vendors.