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## The impact of implementation of VOIP in call centres : A Western Australia perspective

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THE IMPACT OF IMPLEMENTATION OF VOIP IN  
CALL CENTRES: A WESTERN AUSTRALIA  
PERSPECTIVE.

By

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This thesis is presented in fulfilment of the requirements for the degree of  
Bachelor of Science (Information Technology) with Honours

Faculty of Computing, Health and Science  
School of Computer and Information Science  
Edith Cowan University

Supervisor: Dr Leisa Armstrong

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## Abstract

By fostering the finalization of open standards and the convergence of voice, video and data, the internet protocol provides an ideal driver for the definition of the infrastructure of new multimedia and advanced communications applications (Adams & Bhalla, 2005). The key advantages of Voice over Internet Protocol (VoIP) for enterprises have been the promise of lower costs, infrastructure consolidation and increased flexibility. Carriers are also positioning VoIP as a cost-saving business solution. It is an application which seemed like a godsend to business and people alike who rely on telephony services (Blood, 2005).

The aim of this study was to investigate what factors may influence the adoption of VoIP as a technology as a West Australia context. Specifically the research undertook a case study using an establish call centre in a government agency, City of Melville. The company is a provider of wide range of services including recreation centres, aquatic centres, libraries, crèches, pre-school centres, community centres, food inspection services, citizenships, recycling, planning and building services, maintenance, streetscapes, landscaping disability services, immunisation clinics, cultural and educational centres, environmental preservation and management.

This study analysed the steps through to adoption of VoIP and IP telephony from the original technology for the Melville City Council call centre. Also, the procedures towards acquisition and installation of the supporting framework that eases the implementation and day to day running are depicted. The main impacts on the company as a result of the implementation in terms of cost reduction and implications, staff satisfaction and benefits, ease of business operations has been reported in this study. Statistics of the business functions and operations based on VoIP solutions were critically analyzed.

Results from the research suggested further research needs to be undertaken on factor affecting the adoption of VoIP in a Western Australia context.

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# 1. Introduction

Voice over IP (VoIP) –the transmission of voice over traditional packet switched IP networks is rapidly growing and becoming a mainstream telecommunications service by providing a convergence technology. This convergence technology transfers voice and data over the common Internet Infrastructure (Elliot, 2004). It is now in contention with traditional telephony and it is in the process of challenging existing telephone usage and charge methods. VoIP has become one of the hottest trends in telecommunication industry due to its strategic importance to an organization when implemented. A major implementation of VoIP has been found to occur in call centres of various companies. Industry sectors such as government, banking and finance, telecommunications and insurance have been early adopters of VoIP in their call centres (Adams & Bhalla, 2005).

The current business world is characterised by increasing competition, demanding customers, differentiated products and services and relentless pressure to cut costs. VoIP is considered as a technology which may provide customized solutions to both business and customer (Salvi, Bridgman & Sathu, 2006). The success of VoIP depends upon a number of factors, including the development of user-friendly technologies, payment methodologies and effective regulations. Furthermore, security is an issue that remains intrinsic to its acceptance, both as an individual and enterprise model. In many aspects, forecasting its impact mirrors the previous predictions of e-Commerce and m-Commerce, which historically underestimated the importance of security (Blood, 2004). Further challenges also exist, including overcoming the problems of latency, delay and jitter that are characteristic of voice carried over digital channels. Overcoming these hurdles would then permit the technology to be labelled as “carrier-grade” (Collins, 2003).

Businesses should not approach VoIP in the same way as traditional telephony due to the former's shared use of infrastructure and the inherent problem this brings with variances in load and usage (Herle, 2005). Completely digitizing the switch may be easier than expected as the majority of the core infrastructure of current PSTN networks is already implemented digitally with existing voice digital signals. Nevertheless, government agencies and large telephone networks still exhibit a characteristic inertia when it comes to investing in new technologies. Historically,

large sums of money spent on “immature products” (Hersent, Petit, Gurle, 2005), which fail to impact on profitability have resulted in an underlying industry cynicism which has foreshadowed enthusiastic VoIP take-up. Early negative experiences with other associated technologies such as the Dual Tone Multi Frequency (DTMF) tones which were partially due to oversights on the part of service providers have provided an impression “that VoIP did not work” (Herle, 2005). These perceptions, in conjunction with earlier offerings characterized by delay and jitter have set the standard of future acceptance for VoIP to be “toll quality or higher” (Herle, 2005). A further impediment, albeit somewhat pedantic, is the label of VoIP as “a massive disruptive technology” (Herle, 2005).

Critics of VoIP have argued that the benefits of converged networking are not compelling enough to justify the cost of procuring new systems. Some have questioned the virtue in adopting VoIP to bypass an incumbent operator's traditional billing mechanism when the price for long-distance services has fallen dramatically during the last several years. VoIP has not developed to a point where it has taken over circuit switched networks, which have proven prevalent in voice communications for more than a century. Most voice communication today is primarily provided over circuit switched networks—a technology that lends itself to services requiring high quality and minimum delays. However, the future of circuit voice is under threat (Adams & Bhalla, 2005, p.39).

Nonetheless, all major vendors and operators are committed to put this maximum effort into the success of VoIP implementation (Stuart, 2003). This commitment may lead to the resolution of many of the issues that create obstacles in the way of VoIP development. In the short term, the industry still lacks a compelling story regarding total cost of ownership and feature benefits to entice enterprises to move more rapidly toward IP telephony. Within the short term, the small user shall continue to benefit from inexpensive long-distance call charges and calling cards (Solis, 2004). However, VoIP, in conjunction with the advancement of integrated services, will particularly benefit the corporate segment (Elixman, Hillebrand, Schafer, Ratz, 2006).

VoIP as an alternative technology in Australia and Western Australia in particular is growing up in a great alarm. However, the factors which may influence its adoption and implementation have yet to be explored. Further research needs to be undertaken; a case study of a Western Australia perspective may provide greater understandings in a Western Australia context.

## **1.1 Background of the study**

For more than a century the “existing phone systems have been driven by a very reliable but somewhat inefficient method for connecting calls called circuit switching” (Tyson & Valdes, 2004). Traditional telephony requires a dedicated circuit between two parties making a call. Further the open connection is required to be maintained for the duration of the call. The connection of two points in a bidirectional way means that the connection is termed a circuit. This is the basis of the Public Switched Telephone Network (PSTN) (Chong & Matthews, 2004).

### **1.1.1 Traditional Telephony - Circuit Switching**

On analysis, a typical telephone call is carried out using the following familiar steps (Tyson & Valdes, 2004).

1. The receiver is picked up and a dial tone is listened for alerting the user that a connection to the local exchange of the telephone carrier is available.
2. The number of the desired party is dialed.
3. A switch at the local exchange routes the call to the called party.
4. The resulting connection between the caller and the called party is made through several interconnected switches that make up the route.
5. The called party's phone rings and an answer is received.
6. At this point the connection is opened as a circuit.
7. Conversation proceeds for a time and then the caller hangs up.
8. On hang up, the circuit is terminated and all the lines in between are freed.

Early telephone systems, before 1960, were expensive as the circuit was required to be open for the call duration with a physically dedicated line to the called party. In

comparison present day traditional telephony systems are both cheaper and more efficient (Adams & Bhalla, 2005).

Voice is digitized and transported for most of the journey across fiber-optic cables which have the capability of combining many calls in a single fibre. This technology still requires a dedicated piece of wire between the local exchange and the user's home. Calls are transmitted at fixed rate of 64Kilo bit per second in each direction, resulting in a total transmission rate of 128Kilo bit per second (Collins, 2003). This equates to transmission rate 16 kilobyte each second on an open circuit, resulting in 960Kilo Bytes each minute. A 10 minutes conversation is then equivalent to 10 Mega bit. The greater proportion of the transmission is wasted as while one party talks the other party listens. Consequently, for the periods when there is no talking, the file could be reduced significantly, in some cases more than half (Johnson, 2004). As a result if only the periods of talk are transmitted, a considerable saving in actual transmission occurs which is the basis for packet switching as opposed to circuit switching (Tyson & Valdes, 2004).

### **1.1.2 VoIP phone system: packet switching**

Data as opposed to voice which is carried on current networks do not travel via circuit switching as it would mean far slower speeds for dedicated connections. In today's networks, data is simply sent and retrieved as needed, leading to greater efficiency and faster speeds (Adams & Bhalla, 2005). The data is sent in packets and routed "over a chaotic network cloud along thousands of possible paths to the destination" (Tyson & Valdes, 2004). This "fire and forget" mechanism where the connection is kept open, only long enough for the data to be sent. Packet switching is all about this. On further examination, the following steps are revealed: (Tyson & Valdes, 2004).

1. The sending computer apportions data into small chunks called packets, each of which has a destination address of the receiver.
2. Each packet carries within it a payload which is typically a piece of e-mail, music file or other type of file data to be transmitted.
3. The packet is forwarded by the computer to a neighboring router and forgets. Hence the "fire and forget" label. That router in turn sends it to one of its

neighbours that is closer to the recipient. The forwarding process continues until the destination is reached.

4. The receiving computer gets the packets and uses instructions for the reassembly as they might have not all followed the same path and arrived in sequence.

Packet switching is efficient as it allows the network to route the packets along the lowest cost and least congested lines and its fire and forget method allows the computers to be freed for sending and accepting other information immediately (Solis, 2004).

### **1.1.3 VoIP in call centres**

The most popular choice to keep in touch with business customers in many sectors like finance and banking, information technology and telecommunications etc are call centres. VoIP has emerged as a very popular technology choice in call centres (Snyder & Lassman, 2005). The voice services coupled with other attractive IP packages like computer telephony integration and video conferencing have resulted in reduction in capital costs and administration costs along with increased flexibility and scalability (Solis, 2004). Today, contact centres that are considering switching to VoIP are beginning to see other outcomes especially increased flexibility and scalability. Blood (2004) cites, Betsy Woods a customer consultant manager for Nortel who stated that call centres are moving in this direction because they want a lot of freedom. This research suggested that call centres provide the flexibility to have people anywhere who have secured high speed internet access. For organizations with business at multiple sites or need to communicate with customers at multiple sites, VoIP is considered to be the best solution because of its diverse range of provided facility (Blood, 2004).

Linking various office locations across an existing Wide Area data Network(WAN) using voice over IP enabled phone systems allows companies to enjoy free calls between sites, transfer customer easily from site to site which improves service and centralize the switchboard and administration of all phone systems which improves efficiency (Hunter, 2004, p.2).

In a survey conducted by a market communication company 37% of respondents indicated that widespread VoIP adoption had the biggest business impact over the past year (Hickey, 2006). In addition Hickey reported that many analysts and experts believe that the move to IP is part of a large trend towards the creation of customized, unified messaging networks. These will be able to accommodate traffic for voice, video, messaging and collaborative communication such as teleconferencing. The future for VoIP looks bright because it is really being driven by the organic growth within many organizations. According to Cisco®, a major vendor of VoIP, claims on their web site that companies have saved millions of dollars using their technology (Cisco® System, 2004). Though the full promise of VoIP connectivity has not yet been delivered by the technology industry, the available implementations are now more competitive than their traditional telephony counterparts. VoIP accomplishes all of the features that have become common place and offers a level of future-proofing (Walsh & Kuhn, 2005).

As reported by Cisco® Systems (2004) by the end of 2006, VoIP will gain recognition as a contemporary technology. Similarly Paulson cites Cisco's Hayden Boyd who stated that in ten years it will be hard to find a communications system that is not running over IP (Cisco® Systems, 2004)

There are numerous VoIP product vendors in the market such as Three com®, Avaya®, Cisco® and Nortel®. These vendors provide for capabilities of converging voice and data through IP enabled networks.

VoIP has the proven success record in the business those are using call centres. The major reason for this is that the integration of VoIP into the business processes has made it easier to identify calls and tie them into existing customer information databases. VoIP in the corporation environment requires integrating voice capabilities into IP enabled applications that already exists on the company network (Salvi, Bridgman & Sathu, 2006, p.1).

The strengths of Voice over IP have been summarized by Decina, Trecordi & Milano, (1999) in two remarkable facts: first, the capability to build a global, integrated, and cost-effective network infrastructure with a smooth transition path from the current



situation to a long-term target. Secondly, the availability of a powerful value-added and deployment platform open to a large number of subjects whose main talent over the long run will be creativity. Considering the futures and cost of VoIP, the study concluded that it will be fruitful to deploy VoIP in an organization with large or small call centres as the maintenance and expansion options are proved to be financially more attractive than traditional systems (Decina, Trecordi & Milano, 1999). Similarly in a Gartner survey of IT and business profession, more than 60 percent of respondents emphasised cost savings as a significant benefit of implementing VoIP (Elliot, 2004).

## ***1.2 The significance of the study***

VoIP is one of the fastest growing Internet based applications in the current networking world, emerged as both a threat and an opportunity for telecommunication industry. Forward looking telecom companies indicate that VoIP as an additional service offering and a competitive advantage (Munch, 2005).

The blending of internet technologies and traditional business concerns is impacting all industries and is really the latest phase of the ongoing evolution of business. All companies need to upgrade their business infrastructure and change the way they work to respond more immediately to customer need (Grant, Hurley, Hartley, Dunleavy & Balls, 2000, p 2)

Many Australian businesses are rapidly migrating from traditional PBX systems to systems that use a fundamentally different architecture—IP telephony using VoIP technology (Ramsay, 2004). VoIP enthusiasts promise many benefits over the traditional PSTN. A great numbers of industry reports have been generated about the potential cost savings, the new calling features, and the reduced infrastructure of converged networks in a VoIP implementation.

This research may assist private and business sector to make educated choices of decision when make full or partial implementation of VoIP system. Secondly the proposed research is all significant as no previous studies have been conducted in Western Australia on the effect of adopting and implementing VoIP in call centres. Finally, the research contributes to the general knowledge of the adoption of the new technologies within a industry context. Further the proposed study may provide some insight into whether VoIP is becoming a feasible replacement for traditional telephony system. Findings from this study may also provide valuable information on how VoIP can be implemented in other contexts.

## ***1.4 The purpose of the study***

The study determines the strategies employed by Western Australia call centres to deal with implementation costs, employee perceptions and customer satisfaction adopting VoIP technology. Furthermore the study examines what final issues are driving the success of VoIP in call centres.

## ***1.5. Research questions***

The research examines issues which determine the impact of implementation of VoIP in companies which have call centres in a Western Australia context. The research has attempted to answer the following research question:

What factors are determining the successful adoption and implementation of VoIP in call centres in a Western Australia context?

In order to answer this question a number of sub questions were devised;

### **Sub questions:**

From an IT call centre managers perspective;

- I. What technology factors are determining the successful adoption of VoIP?
- II. What reliability issues are determining the successful implementation of VoIP?
- III. What strategies have been employed to overcome the potential obstacles of implementing VoIP?

## **2. Literature review**

### **2.1 What is voice over IP?**

VoIP –the transmission of voice over traditional packet switched IP networks is emerging as one of the hottest trends in telecommunication industry due to its strategic importance to an organization. One common implementation of VoIP is in call centre industries. Furthermore, it has been adopted within a number of contexts. Among them government, banking and finance, Telecommunications, and insurance sectors are the most prominent. (Adams & Bhalla, 2005, p.13).

VoIP requires an individual to have broadband Internet access. The most common implementation is through the use of a cable modem Direct Subscriber Line (DSL). Data travels over the Internet in packets. In order to travel the voice to the Internet, it must be converted from analog to digital. Once the voice has been converted to digital packets it can be transferred via the Internet. But before the voice can enter the Internet and travel to its destination some information has to be added to it so that it meets Internet Protocol (IP) standards (Blood, 2004).

As elaborated earlier, the voice is broken up into several different packets which must reach the destination. These packets must be reassembled in the right order and converted from its digital form back to an analog form so that the recipient can hear the voice. Each packet of data, which contains a portion of the phone call, has a minimum of 160 bits added to it so it can reach its destination (White & Curtis, 2002). In addition to the IP protocol, it also requires the use of real-time protocol (RTP). "It provides timing information that allows the receiver to reconstruct the original timing of the transmitted material in a way that identifies the content being sent, provides security, and notifies the overriding application of lost data" (Gilmer, 2004). RTP is usually used in conjunction with unreliable Datagram Protocol (UDP). UDP allows for information such as voice and video to be sent without waiting for acknowledgement of it being received. "It is useful in cases where one sender wants to send the same information to multiple receivers and is not too worried if some pieces get lost along the way" (Gilmer, 2004). VoIP requires the use of these three protocols in order to function. For this reason broadband access is needed. The fastest

modem dial up connection using POTS can only achieve 53 kilobits per second whereas cable modems and DSL can achieve speeds of 10 – 100 Megabits per second. The higher speed is needed in order for an actual conversation to take place over the Internet without significant delay. VoIP telephony is relatively new and as such can have some potential drawbacks. Firstly requires access to the Internet. Therefore if there is a power outage the phone service will be lost and then the contingencies need to be made. "Sound quality and reliability are still not up to the level of traditional telephone service" (Trope & Royalty, 2004).

## ***2.2 What is IP telephony?***

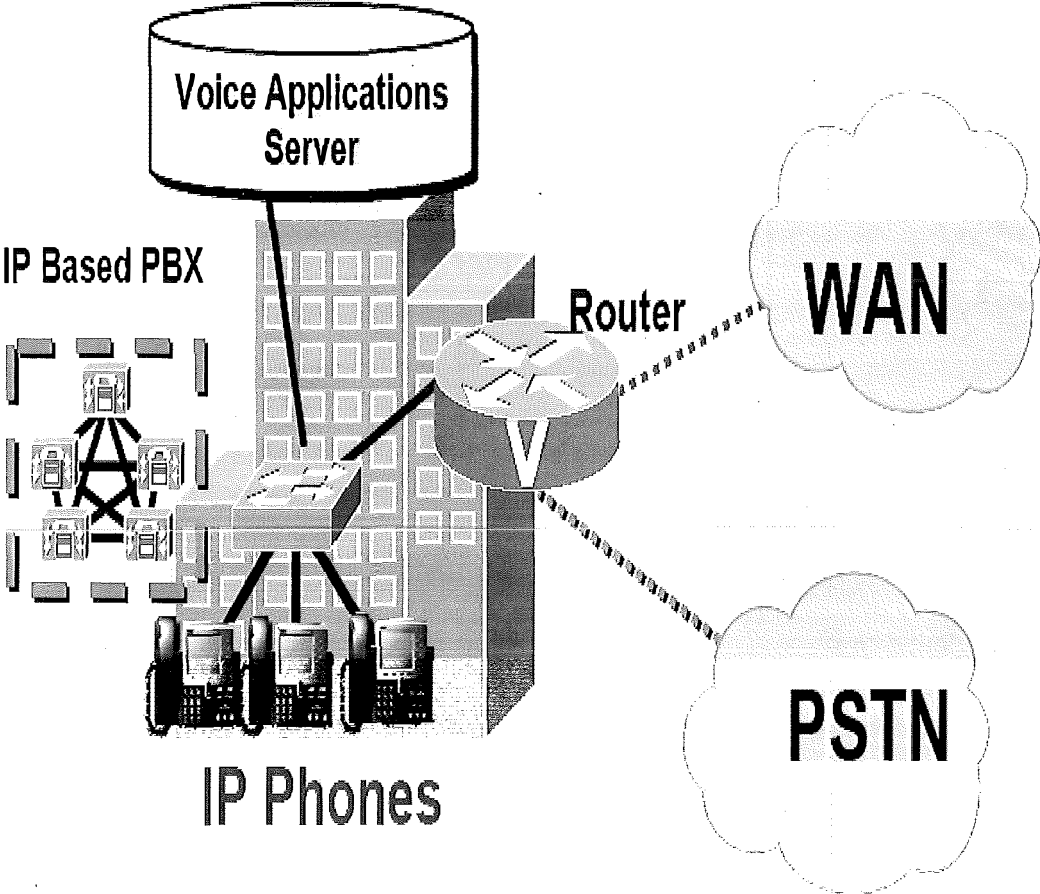
IP telephony can be defined as the two-way transmission of audio over a packet-switched IP network (TCP/IP network) (Abbasi, 2004). When used in a private Intranet or Wide Area Network (WAN), it is generally known as "voice over IP," or "VoIP." When the transport is the public Internet or the Internet backbone from a major carrier, it is generally called "IP telephony" or "Internet telephony" (Blood, 2005).

VoIP is often confused with Internet telephony and IP telephony, which are forms of VoIP where voice packets are sent over the Internet, and private IP LANs and WANs, respectively. IP telephony, in particular, includes the call processing functionality inherent with voice conversation, along with support for a range of newer, end-user application such as personal desktop productivity, multimedia, collaboration and mobility. To make the distinction clear, VoIP relates to the network infrastructure, whereas IP telephony is a larger, more encompassing term used to describe telephony applications in an IP environment (Munch, 2004, p.1).

The productivity applications, such as advance call routing, unified messaging, interactive voice response system and call centres applications are modular and tightly integrated through the use of industry standard protocols. Some examples of these

protocols are SIP, H.323, MGCP, and SGCP. The description of these protocols can be found in the glossary provided at the end of the thesis.

Figure 2 below, describes the four basic components in an IP Telephony system. They are, IP Phone, data switch, IP PBX, and a voice gateway. All of these components are connected to the data network. In a simple setup, a user dials a telephone number using an IP phone. This telephone number is sent to the IP PBX. If the number was an internal extension then IP PBX sends the call to destination IP Phone. However, if the number was for a party outside of company then IP PBX sends the call to the voice gateway which dials outside party through Public Switched Telephone Network (PSTN) (Abbasi, 2005).



**Figure 1: Basic IP telephony setup (Abbasi, 2005, p.2)**

### 2.3 VoIP value chain and business model:

VoIP can be assigned to a rather small number of groups or types despite the fact that multitude of players involved in the provision of VoIP. “VoIP value Chain” can be assigned as the basis of this which reflects the different resources required to enable an end customer to place a call over IP networks (Elixman, Hillebrand, Schafer, Ratz, 2006).

Figure 2 identifies the five types of VoIP service provision defined by Ronald Oliver Solis in his discussion paper “VoIP Business Model”. These types cover different stages of the functional value chain:

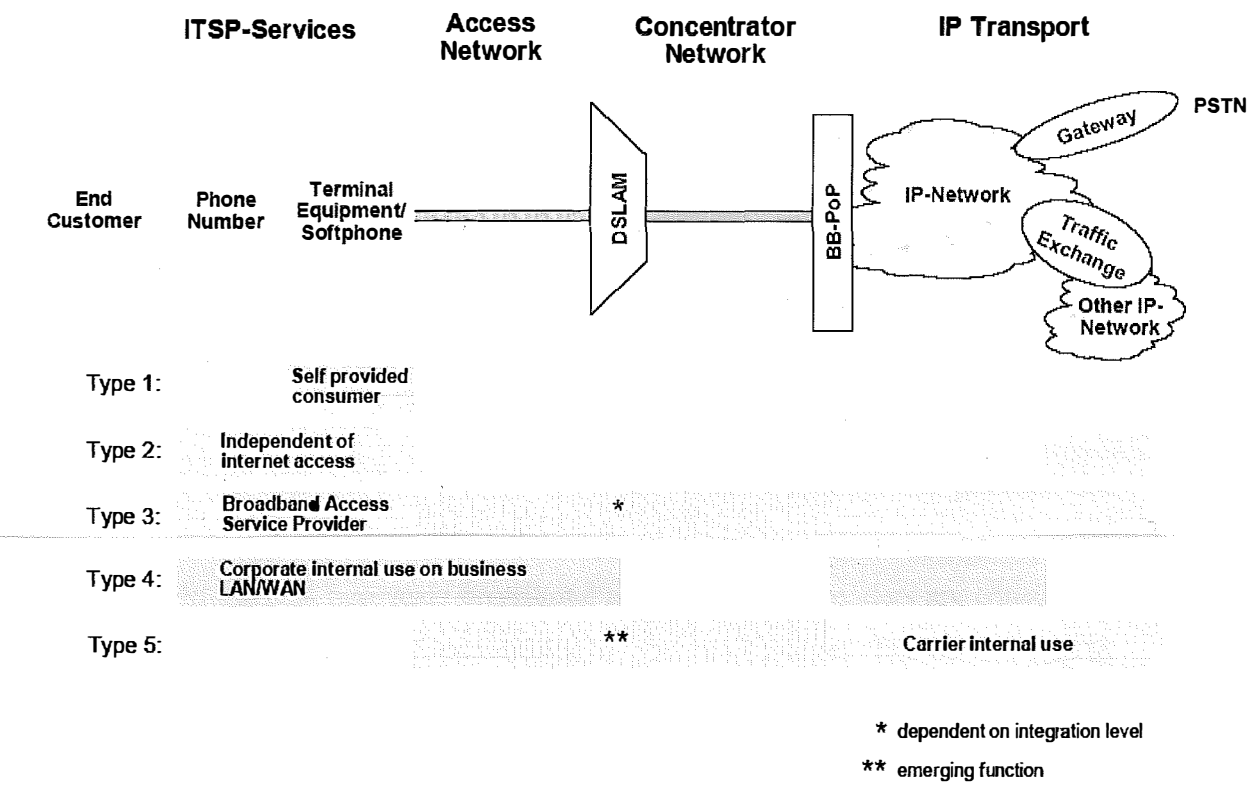


Figure 2: Functional value chain of VoIP service provision (Elixman, Hillebrand, Schafer, Ratz, 2006, p.3)

### **2.3.1 Self provided consumer model**

In this model, each user is a “peer” and carries his or her own costs. The users are connected via the Internet, and neither uses the PSTN to connect to the other (Analyst Research, 2004). Skype as the most prominent representative of this model with more than 25 million registered users originally offered simple PC to PC telephony by using Soft phones. Nowadays, a Skype user can also place PSTN calls (Elixman, Hillebrand, Schafer, Ratz, 2006)

### **2.3.2 Independent of internet access model**

In addition to the contract with an ISP the end user has a relationship with a VoIP service provider which runs a gateway to connect to the PSTN. Companies following independent of internet access business model may need to focus on expanding their geographical coverage as well as enhancing VoIP services in order to increase the customer base. Different strategies are applied to reach similar goals. Vonage (US), for example, expanded its availability of services from the United States to Canada, Mexico and in 2005 also the United Kingdom (Elixman, Hillebrand, Schafer, Ratz, 2006).

### **2.3.3 Broadband access cable model**

In this model the end user has a relationship to an integrated service provider for broadband access, internet access and IP telephony which runs a gateway to connect to the PSTN. In the past two years broadband access service providers are considered to be the driving force for VoIP penetration in the retail market. The central key to this is considered to be the adequate broadband connection. The broadband access service providers market their DSL access line before VoIP (Elixman, Hillebrand, Schafer, Ratz, 2006).



**2.3.4 Internal use on business WAN or LAN model**

In this model the mainstream trend in the segment of corporate customers is the “corporate internal use on business LAN or WAN”. Business customers use IP enabled private branch exchanges for telephony within the company on the LAN or WAN whereas they do not need a VoIP service provider. The expectations from unified communication are cost savings, reduction in operation expenses as well as productivity enhancements. The productivity improvements from enhanced applications are the key indicator of increasing future value of business customer (Ramsay, 2004). VoIP differs in many respects while selecting strategies for productivity improvements. Many companies choose hybrid solutions. Others convert their networks radically into purely IP based systems. The question how to proceed with the new technology without putting a company at risk cannot be answered in general, rather, the answer is company specific (Elixman, Hillebrand, Schafer, Ratz, 2006).

**2.3.5 Carrier internal use**

Fixed line operators recognized the pioneer of VoIP markets use IP for transmission of voice traffic especially on for International calls and for specific applications as IP Centrex. Their primary reason for using this model is provision of international voice services. It deploys dedicated private IP links or wholesale IP transit services in order to bypass high official settlement rates and to take advantage of lower interconnection rates. Many new and incumbent carriers have begun to build IP networks and accordingly have launched their own VoIP solutions (Elixman, Hillebrand, Schafer, Ratz, 2006). The table below comprises a few examples of VoIP companies in various countries of the world:

**Table 1: Providers currently offering VoIP services ((Elixman, Hillebrand, Schafer, Ratz, 2006, p.7).**

<b>Company/Organization</b>	<b>Country</b>	<b>Business model</b>
NTT Docomo	Japan	Covers the whole value chain
Vonage	USA	Independent of internet access model
Prutel.com	Germany	Intermediary, sells VoIP platform services
Comcast	USA	Broadband service provider
Skype	USA	Self provided consumer
callUK.com	UK	Internal use of business local area network
Telio.no	Norway	Independent of internet access
Carrier1.B.V	Netherlands	Wholesale carrier
Ya.com	Spain	Independent of internet access
Tiscali	Italy	Broadband service provider
Telephonica	Spain	Broadband service provider

2.4 Current VoIP applications

Voice over IP (VoIP) is not a new technology as it has been around for over 10 years. It has taken sometime for VoIP to gain worldwide acknowledgement and acceptance, but the year 2005 had proved to be its year when it is given new recognition as contemporary technology. Application of VoIP services offer important revenue generating opportunities, as well as many technical challenges in providing high quality services. The table 1 below summarizes some of the many different VoIP applications that are currently being offered, and notes the providers and users of these services. These applications are not comprehensive. For example mobile VoIP applications are not covered. However, it provides an indication of the opportunities, and challenges, that are relevant to the telecommunications stakeholders, including the Commission and the general public (Stuart, 2003).

Table 2: current VoIP application (Solis, 2004, p.3).

Application	Provider	Users	End user terminals	Benefits	Impact on voice market
Wholesale international toll bypass	Global operators with IP networks internet carriers	Mobile operators corporate operators	Phone to phone	Avoids high international prices charged by incumbents	Drives down international prices and forces liberalization.
Core network migration to VoIP	Not applicable	Local carriers	Phone to phone	Lower cost of core networks, less meshing, bandwidth efficiency.	None
Corporate voice on VoIP VPNs	New carriers, global carriers and potentially more incumbents.	Multinational, multi-site organizations	Phone to phone (may be IP phones).	Low voice prices, efficient bandwidth utilization.	Drives down voice VPN prices.
Low-cost voice for small	Competing retail carriers.	Initially multi site SMEs	Phone to phone.	Free inter-site calls, maximize	Open up SME market for competition,

business.				benefits of broadband.	drives down prices.
VoIP second line for residential users.	Competing carriers.	High-end residential customers and tele-workers.	Phone to phone.	Savings on line rentals, low cost calls.	Drives down residential voice prices.
Retail international toll bypass	Calling card companies, international phone companies.	Expatriates, overseas workers.	Phone to phone.	Low cost (often poor quality) calls	Drives down international prices.
Free phone calls on the internet.	Various web sites.	Students, internet enthusiasts.	Pc to pc.	Free phone calls to family and friends.	Negligible.
Multimedia applications including VoIP	New carriers, global carriers.	Employees of corporate.	Pcs phone or PDAs depending on application	Depends on application implemented.	Negligible.

## 2.5 Voice over IP and IP telephony trends

Voice over IP is one of the fastest growing internet based application in today's networking world. It has just emerged as a threat and as well as an opportunity for telecommunication industry. Forward looking telecom companies indicate VoIP as an additional service offering a competitive advantage. Vonage Holdings Corp®, a New Jersey based consumer VoIP company, recently completed five million VoIP calls. They have successfully implemented VoIP/IP Telephony as a competitive advantage over traditional local and long distance companies. Tech's January 2005 survey of clients- primarily North America and Western European mid tier firms with less than \$2 billion in revenue- found 23 percent of respondents have made some from of investment in VoIP. Another 16 percent plan to make investments within the 2005 calendar year, and another 24 percent said they would be making investments in VoIP within the next three years (Paulson, 2005).

Paulson (2005) citing Alex Hadden Boyd, director of marketing for Cisco®, states that it will be very difficult to buy anything except IP telephony in the future. While it started with universities, state and local government and large financial institutions, IP telephony is being deployed in all industries of all sizes, world wide, from company's with as few as 15 employees to companies with tens of thousands of employees (Paulson, 2005). Even though VoIP has a very small present market share, the trend is increasing towards it. According to a research report by Forrester Research:

Voice over Internet Protocol (VoIP) is racing toward mainstream acceptance, steered by attractive price points--currently \$200 to \$500 per line--proven cost savings in early-adopter deployments and significant improvements in voice quality and reliability(Solis, 2004, p.4).

Furthermore, in December 2003 Telezoo.com conducted a survey of more than 3 million queries from professional information technology managers on 4,000 products and services. Worth some \$45 billion in potential sales, this survey revealed that corporations increased spending on network gear in the first half of 2004 in several product categories. Those categories included call centres, Internet Protocol telephony, data services and security (Johnson & Zwar, 2005). Furthermore according to a research report in November 2003 by Synergy Research Group:

In the year 2003 the U.S. Enterprise IP Telephony market grew 15 percent sequentially and reached nearly one million IP lines shipped. North America was the fastest growing market for Enterprise IP Telephony in the quarter, followed by Asia/Pacific and EMEA, respectively (Synergy Research Group, 2003, p.21).

Another recent Cisco® Systems research report revealed that between 35 and 50 percent of phone system shipments to enterprise, and small and mid size businesses, are IP based. The IP phone sales are good indicator of the velocity. Cisco® has now shipped more than 5 million IP phones. It was more than a three and a half years before the company shipped its first million IP telephones compared to five months to

ship its fifth million. According to the Cisco® report they are replacing more than 10,000 traditional phones every business day (Paulson, 2005).

The table 2 below illustrates the VoIP retail voice revenue compared to traditional telecom revenues over the last few years. In 2004 the Asia-pacific/Japan had 3.4 percent of retail voice revenue earned from VoIP. Whereas North America had .55 percent and Western Europe had 2.0 percent.

**Table 3: Impact of VoIP in retail voice revenue (Abbasi, 2004, p.7)**

	2002	2003	2004
Asia-pacific/Japan	76,074.6(2.1percent)	18,993.8(2.8percent)	80,641.3(3.4percent)
North America	165935.1(.2percent)	160,647.2(.35percent)	160,305.9(.55percent)
Western Europe	113,622.7(.9percent)	112,984.9(1.4percent)	112.243.3(2.0percent)

VoIP has come a long way towards significant change in the way voice and communications services are delivered (Elixman, Hillebrand, Schafer, Ratz, 2006). It is providing future roadmaps for telecom networks. This is only the beginning of a more significant move of convergence. As high-productivity applications, such as unified messaging, Text-to-Speech (TTS), interactive voice response (IVR) system, mobility, audio conferencing and computer telephony integration (CTI) become more mature and reliable it will be very hard to accept anything less than that as an enterprise technology standard (Abbasi, 2003).

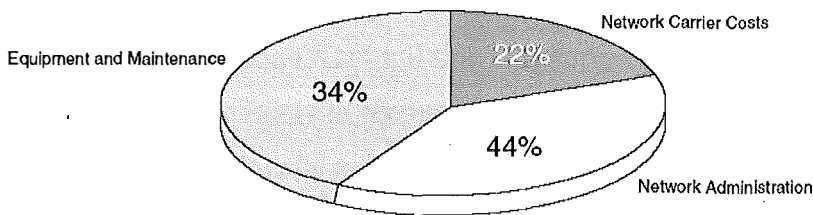
**2.6 Reasons for this VoIP trend**

A number of factors have been reported as drivers for the implementation of VoIP. These includes cost savings, capital and expense savings, reduced call costs, single network infrastructure savings, productivity savings and dynamic added features.

**2.6.1 Cost savings**

Expenses are almost always a driving factor in IT spending decisions. All businesses want to be more efficient and reduce expenditure. Cost is no less a factor when implementing VoIP in any organizations (Chamberlin, 2005). The cost of VoIP can be intimidating, with the need for plenty of new equipment and infrastructure upgrades. A large initial capital outlay can be cost prohibitive for some organizations. However these likely costs are not a potential threat for VoIP implementation. The equipment leasing plans offered by many VoIP companies help to spread the expense over several years and decrease the initial cost. On the other hand, the organization can choose gradual development programme as a means of easing the cost (Johnson, 2004). Each organization generally has a variety of sites like small branches, regional offices, or global headquarters. The Return On Investment (ROI) for VoIP varies with different site types and deployment scenarios. “The best approach to a VoIP implementation is to view it as an investment; it is intended to provide returns in capital and productivity savings” (Coggins, 2005, p33). The VoIP cost savings can be occurred in several different areas.

A comprehensive estimate of VoIP cost savings scenario is displayed in figure 8. A company can save 34 percent of equipment and maintenance, 22 percent of network carrier costs and 44 percent from network administration costs (Coggins, 2005).



**Figure 3: VoIP cost savings scenario (Coggins, 2005, p.11)**

The two reasons most often cited for moving to IP Telephony are cost savings and productivity gains. The following section considers these cost savings as they apply to capital, expenses and productivity.

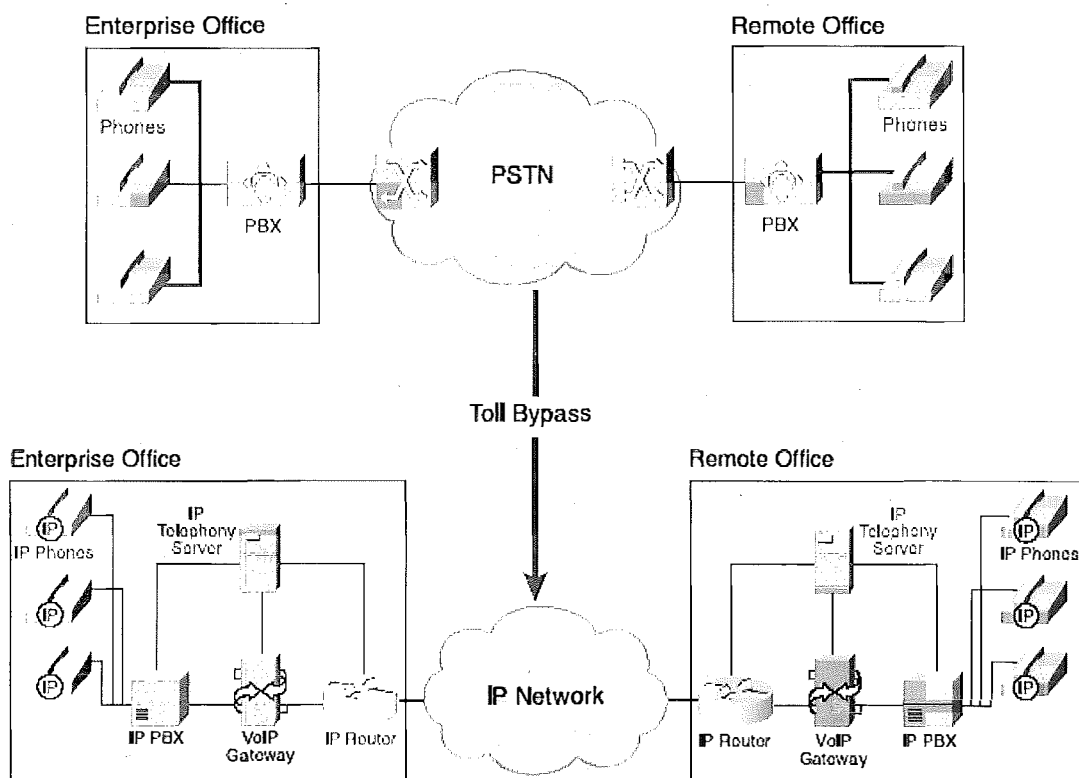
### **2.6.2 Capital and expense savings**

With PSTN technology the network is owned by the telephone provider. When a call is made the customer is billed for using the network. Long distance cost can vary depending on the distance called and the time at which the call occurs. Long distance call can be a major line item in an organization's budget (Johnson, 2004). In a VoIP implementation the network is an IP network. The calling distance doesn't affect the call rate in IP network. If someone owns an IP network or is already paying an Internet Service Provider for bandwidth, then VoIP employs an infrastructure that is already been paid for, so VoIP calls could be considered free (Snyder & Lassman, 2005)

### **2.6.3 Reduced call costs**

Although call costs have dropped dramatically in recent years, long distance charges are still a significant expense. Nowadays, large corporations typically find themselves with offices or supply chains spread out over many geographical locations, in countries all over the world. The average business spends about \$5,000 a year on long distance, and only mid-size businesses is considered, the annual cost can grow to \$25,000 a year or more. With IP-based systems, voice traverses the WAN or the Internet. Like surfing the web, there is no incremental cost for making that phone call. (Jaiswal & Raghav, 2004). Figure 9 below displays Toll bypass methodology. It occurs when a PBX or an IP PBX is connected to a VoIP gateway, which is then connected to an IP network. The call traffic goes from the PBX to the VoIP gateway instead of from the PBX to a PSTN switch, thus avoiding the toll, or cost of using the PSTN. As a result of the PSTN toll rate structure, companies with a large number of international sites are likely to see more cost savings from toll bypass than companies that make most of their calls nationally (Krapf, 2003).





**Figure 4: Toll bypasses (Coggins, 2005, p.8)**

Using Australian Internet Telephony Service Providers (ITSP's) such as Engin®, VCall®, and Destra®, businesses are able to save between 50 percent and 70 percent on telephone bills comprised of local calls, interstate calls, and international calls, fixed to mobile calls, and teleconferencing calls. The example below illustrates the kind of interstate call savings that can be enjoyed with Destra's TalkNet.

The table4 below shows the estimated savings using Talk net's VoIP service rather than Telstra's traditional PSTN service. A estimated of \$407/month can be saved using Talk net's VoIP phone service. This assumes that the company spends only 30 minutes in the working day on inter-company calls between an office in Sydney and an office in Melbourne contrasted against comparative Telstra Business line charges as of December 2003 (incl.GST) (Zulthys Technology, 2005).

It is recommended that organizations shouldn't convert to VoIP completely or all at once (Elliot, 2004). The PSTN lines may still be needed for some time during the migration phase, and some companies may want to keep the PSTN as a fallback

network. Therefore, in most cases, the long-distance costs associated with PSTN usage should decrease after a VoIP implementation (Coggins, 2005).

**Table 4: Comparison between Telstra and Talknet (Zulthys Technology, 2005, p.12).**

	Telstra	Talknet	Savings
Line rental (PSTN) 10	\$350	\$0	\$280
Calls/month @ 25c flag fall 100	\$25	\$0	\$25
Mins/month@ 20c/minute 660	\$132	\$0	\$132

**2.6.4 Single network infrastructure savings**

Maintaining separate network infrastructure is neither cheap nor simple. VoIP offers a single network infrastructure which incorporates significance cost savings in a number of ways, including decrease in cost of ownership, reduced infrastructures and incorporating wireless infrastructure.

The cost of ownership can be decreased by applying a single network. A huge amount of money can be saved if a company spend the money on IP infrastructure rather than buying or leasing a PBX and network infrastructure for PSTN. Both voice and data traffic can take the advantage of this enhancements. These savings allow VoIP to provide a lower total cost of network ownership (Elliot, 2003).

Adding an additional user to a traditional PBX system may require upgrading to a new PBX with greater capacity, thus increasing the per user cost of the system. However, if business growth exceeds the maximum capacity of the base system, then the cost of adding additional switching and control units (or perhaps replacing the old system altogether) could easily run into tens of thousands of dollars. With IP-based systems technologies, businesses can grow from 5 to 250 users without adding any more circuit cards. Adding new employees is as simple as purchasing additional

phones and software licenses. Further new software features make it possible to expand a base system at a single site to include multiple systems located worldwide but all with a single, seamless interface (John & Jeffrey, 2004).

A single network offers reduced wiring costs, especially in new construction. Since both voice and data travel over the same LAN, the number of wiring drops declines by up to 50 percent. PC's and telephones use the same Ethernet ports (Reynolds & Rix, 2001). As well, there is only one set of cables to monitor and maintain. This can also reduce the number of Ethernet switching ports required in the network closet since phones manufactured by many IP phone companies have multiple ports allowing the connection of additional phones and peripherals (Coggins, 2005).

A single network also has the advantage of incorporating wireless infrastructure. Many organizations are turning to wireless networks using 802.11 technologies as it is sometimes expensive to wire home or office for a data network. These wireless networks support IP networks readily, making VoIP easy to implement in this type of environment. However, there are trade offs with regard to security and potential performance issues (James, Chen & Garison, 2005).

Another attractive feature of VoIP is centralized call processing architecture. IP-based telephone systems do not require switching units at each branch of a multi-location business. In this architecture, everything is controlled and administered from one central point with a user interface that can be accessed from virtually anywhere. Centralized call processing is a compelling method to reduce equipment, maintenance and support costs (Coggins, 2005). A small inexpensive gateway at each branch assures smooth interoperability across the entire enterprise. Employees can even call their colleagues at other locations by dialling an internal extension, just as if they were sitting across the hall. Site visits to correct minor problems or to add or remove system features are all but eliminated. Furthermore, companies using IP systems at remote locations are saving up to four weeks in the time it takes to open new offices (Blood, 2005).

### 2.6.5 Productivity savings

VoIP can increase the productivity of IT operations. Traditional PBX system requires one staff to manage the telephony system and another to manage the data network. With VoIP systems the convergence of infrastructure may make it feasible to reduce the internal staff required for support and management of the two separate infrastructures. However this savings may come with a high initial cost for training (Johnson & Jwar, 2005).

The voice network of an organization incurs cost each time a new user is moved, changed or added. Moves, Adds, and Changes (MACs) require costly service calls to physically relocate instruments and modify system software. Telephone equipment dealers will typically charge for several hours of labor to add or relocate a telephone and reprogram system software.” This cost can be as high as \$150 per move, add or change. In one estimate, these actions accounted for as much as 14 percent of an IT budget” (Coggins, 2005, p38). According to a Sage Research study, the single most frequently reported business benefit of an IP communications deployment was the ease of workspace relocation. Almost 75 percent of the survey respondents reported that their businesses realised substantial benefits from faster moves, addition or changes (Zultys Technologies, 2005). Employees can move their own phones, potentially saving thousands of dollars per year. In addition, adding and changing phones become simpler, because they can often be accomplished via a software application instead of a visit by a technician.

Another enhanced feature of VoIP network is number portability. This allows individuals to log into any phone within the organizations and still have their extension number available to them even when they are away from their desk. This particular feature of enhanced mobility has increased employee productivity and morale at the same time reducing facilities and real estate costs (Coggins, 2005).

VoIP has reduced the set up time for a new site as it requires stringing only one set of wire. In certain industries, this new capability is driving significant cost savings and even revenue growth (Krapf, 2004).

### 2.6.6 Added features

VoIP offers many new functions and features which offer productivity improvements for both end users and IT staff. The benefits offered by new applications and features are not easily quantifiable, but arguably offer some of the most compelling reasons to consider a VoIP implementation.” A 5 percent improvement in customer loyalty can improve profitability by 40 to 95 percent” and “cutting customer defection by just 5 percent has the effect of boosting profit between 25 percent and 95 percent” (James, Chen & Garison, 2005). One of the features of VoIP is it allows for easier integration of voice with other application. Web commerce offers voice as a means of helping customers place orders or talk to a customer service agent. VoIP can provide new features and applications like unified messaging, advanced call routing, integration into business application, faster to add new features etc. which may help business to increase revenue:

A 2001 study found that unified messaging can provide 25 to 40 minutes added employee productivity each day (Cisco® system, 2004). The ability to retrieve your message anytime anywhere and in any way makes unified messaging systems an appealing productivity booster. That’s why this widely anticipated VoIP application is being reported to be paying dividends. Nowadays, many vendors are offering voice mail, e-mail and fax integration. Further, users are beginning to take the advantage of unified messaging system. With expanded options for working from home, employs who once had to face a tough choice when they needed to care for a sick child can now complete more of their work without staying in the office (Flynn, 2004).

It can be difficult to communicate with employees and customers in an increasingly mobile workforce. A common inconvenience is “phone tag”, as are time zone disparities. Advance call routing features can help eliminate phone tag and provide better support for a remote workforce. For those employees working at home business, call can be routed to a home telephone. It can also be integrated with Customer Relationship Management (CRM) systems to look up customer information and route support calls to the appropriate support group (Hersent, Petit & Gurle, 2005).

The ability to chat directly from one computer to another has extensive appeal, as statistics indicating the popularity of instant messaging (IM) applications reveal. Instant messaging provides some of the immediacy of a telephone conversation, an immediacy that is lacking in e-mail communications (Flynn, 2004). “ The total minutes U.S. workers spent using the top three instant-messaging applications—from AOL, MSN, and Yahoo—increased 110 percent from 2.3 billion minutes in September 2000 to 4.9 billion in September 2001”(Flynn, 2004). It also noted: “The number of unique users of instant-messaging applications in the workplace also jumped 34 percent, from 10 million in September 2000 to 13.4 million in September 2001”(Flynn, 2004). Microsoft Windows Messenger, which enables instant messaging, also has VoIP capabilities. The possibility is appealing: chatting with someone in an IM session, then clicking a button and calling that person with voice, video, and text communications all integrated into a single application.

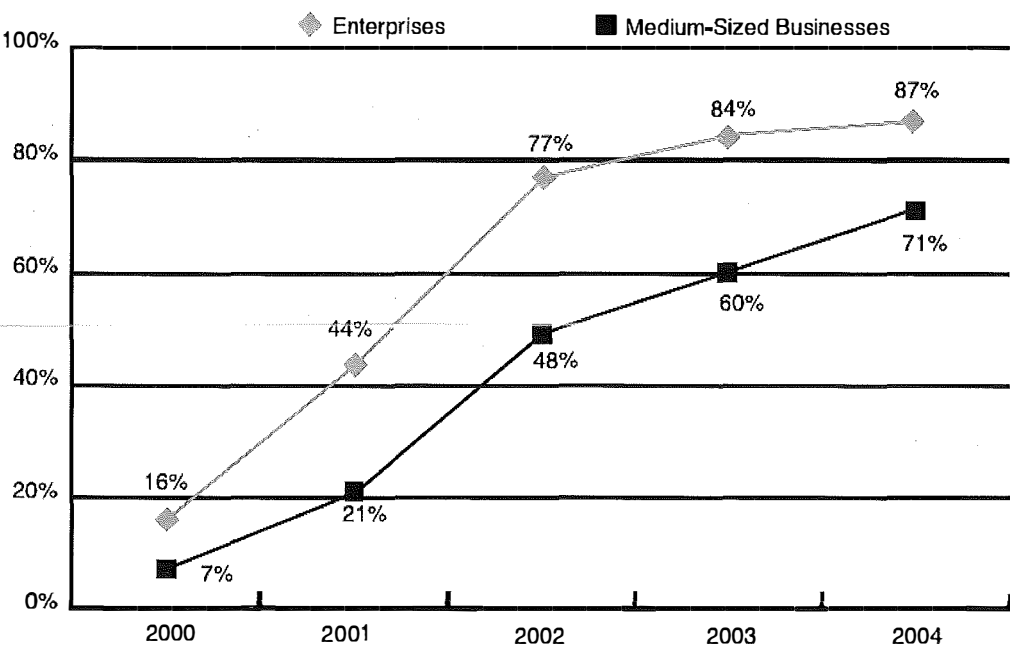
VoIP offers the insertion of new features and facilities more quickly and easily than a traditional PBX system. Traditional PBX systems are proprietary in nature and tend to leave the addition of new features to the discretion of the PBX vendor. VoIP systems are built from common “of the shelf” subsystems. They are compatible with client/server architecture, open development platforms and well-known standards. Thus it can speed deployment of new applications and features (Chamberlin, 2005).

Experts believe that VoIP is running towards its extreme productivity applications. The infrastructure needs to be in place before software and application developers have any incentive to be inventive. Voice-over-IP application development will no doubt rise steeply as the number of converged networks increases (Tolly, 2002, p.7).

## 2.7 Convergence

The consolidation of different types of application traffic in the same IP network is known as convergence. Putting voice, video and data on the same network is a common example of convergence. Most common and envisioned VoIP services are so called converged services, integrating features and functions from multiple existing services. For example, click to dial services allow users to control telephone calls from web browsers running on their personal computers (Solis, 2004). A single scalable network infrastructure that provides for all of your business communication needs, offers cost and management savings (John & Jeffrey, 2004).

Figure 5 below shows that within the next few years, the majority of enterprises to be in the middle of converged network projects. It reveals that the enterprise level business touches the convergence level of 16 percent in 2000 to 87 percent in 2004 and for mid size businesses the level was 7 percent in 2000 to 71 percent in 2004 (Cisco® Systems, 2004).



**Figure 5: Enterprise business convergence level (Cisco® System, 2004, p.9).**

The relatively low bandwidth requirement for voice is the easiest step in convergence. After a VoIP implementation, the next step toward convergence would be to put video

on the network. In many corporations today, video represents a third network infrastructure beyond voice and data (Cisco® System, 2004). This third network infrastructure consists of dedicated ISDN lines that link conference rooms together for videoconferencing. Video streaming is also growing in acceptance for uses such as corporate training and distance learning. Adding video traffic to an IP network can reduce the need for an additional video network infrastructure and provide further benefits in a converged network (Tolly, 2002).

## **2.8 Case studies**

Many companies have identified advanced IP telephony features as a competitive advantage for their businesses. These advanced features increase their business productivity. The businesses believe that it will lead to better bottom line at the end. Some case studies are discussed below in order to determine why VoIP is on businesses Chief Information Officers (CIO's) and management's top list.

The H.B. Fuller Company, a worldwide manufacturer and marketer of specialty chemicals, expects to save approximately \$2 million over five years from a roll out of 3000 IP phones along with Cisco® Unity unified messaging. H.B. Fuller says the primary ROI drivers are the reduction of \$60,000 in annual network administration and training costs, significant annual savings in inter office calling charges, a \$52,000 reduction in wiring costs at one site alone, and the elimination of 85 percent of costs associated with PBX upgrades. In addition, H.B. Fuller expects to save \$37,000 annually in moves, adds and changes costs (Cisco® System, 2005).

In another study, the fourth largest city in the United States, the City of Houston has more than 151 separate facilities that support the city's 2 million inhabitants. The city initially installed stand-alone phone systems throughout its facilities for telephone communications. As that network system grew to include 23,000 phones from multiple system vendors, the city began experiencing inefficiencies, including network outages, expensive maintenance, and productivity barriers. The City of Houston chose to transform its data network and standalone phone systems into a single, converged voice-data communications system based on Cisco® AVVID. This



system will help the city resolve a critical emergency 911-dialing safety issue and will enable greater efficiency and productivity through a centralized call-processing architecture. In addition, the new network was expected to generate \$6.2 million in annual savings for the city and its tax payers, which converts to a payback term of less than one year (Abbasi, 2005).

In another study of Cray Inc., the global market leader in supercomputers, a deployment of 650 IP phones was reported to have generated a seven-month payback on investment and a 33percent productivity increase in network support. Cray says it was able to save \$30,000 in the first year in costs it would have absorbed due to moves, adds and changes with its previous PBX system. In addition, it saved \$25,000 annually in inter-office calling costs now that it has converged voice onto its enterprise network. Cray notes that when it compared the cost of Cisco®'s telephony and data gear to the cost of selecting a PBX, the up front costs were equal. However it was when factoring in additional operating costs and productivity benefits that Cray made the purchase decision to go with an IP/PBX (Cisco®Systems, 2005).

## ***2.9 The IT challenges in considering VoIP***

VoIP services offer important revenue generating opportunities as well as many challenges providing high quality services. It comes with its own set of challenges. These include, but are not limited to technology, infrastructure, security, governance and management related challenges. An organization has to successfully overcome these challenges and obstacles to successfully implement VoIP in their system.

A recent Gartner research report stated that until at least 2007, more than 80 percent of companies that upgrade to IP telephony will fail to evaluate the costs, complexity and risks of interfacing IP telephony with their enterprise applications, and thus they will miss many business and process benefits (Johnson, 2005).

### **2.9.1 The technology challenge:**

VoIP has existed as a technology for more than ten years now, with some reports even earlier manifestation. Its poor history of adoption however, has prevented it from being a true “killer application” (Collins, 2003) in the field of communications and networking. Some have even described it as a technology whose “bubble has burst”, some years back (Collins, 2003).

Organizations who are considering VoIP in their IT and business strategy must weigh the possibility of a disastrous and poorly designed VoIP solutions against its promising new productive and useful features and significant monetary savings (Elliot, 2003). Maintenance is another issue which sometime demands highly comprehensive and sophisticated in demand skills.

Furthermore, VoIP standards are still evolving. Session Initiated Protocol (SIP) has been shipped by Microsoft possibly leading to an industry standard. Cisco® a market leader in IP telephony is pushing Media Gateway Protocol as its standard (Jiang & Schulzrinne, 2003). However all other carriers have long standardized on H.323 protocol for transporting Voice over data network. On the other hand, some vendors support multi-protocol integration; they are not compatible with all VoIP system. Organizations have to take proper care while purchasing these standard compatible to their application (Abbasi, 2005). An organization should evaluate products from multiple stores before deploying it to the system. It is vitally important to run consistent repeatable tests-to compare apples to apples.

For VoIP there is also concern about stepping into the unknown. When an organization begins to implement VoIP, they may not have all the answers in place. The organizations need to invest in post implementation support to avoid potential threat of disaster. They must invest in employee training, hardware and software upgrades and vendor support agreements. A proper management, planning and assessment need to be carried throughout the whole project to get a better output (Munch, 2005).

## **2.9.2 The infrastructure challenge:**

An IP telephony system is comprised of multiple components. The IP telephony vendors often treat this as an advantage over traditional PBXs. Their argument is that network equipment is more scalable and modular than equipment used for the PSTN as the latter consists of proprietary equipment (Jiang & Schulzrinne, 2003). Although it is true that modularity makes it scalable, it typically translates to purchasing of multiple redundant components. Each component needs to be available and have to function properly to run IP telephony system successfully. This means the IT team of a small to medium sized organizations will most likely to manage more components than a traditional single box PBX-system (Abbasi, 2005).

Traditionally, end-users are more tolerant towards data network unavailability than voice system unavailability. Because end users don't see cost savings directly, they are less tolerant of reduced quality and reliability. For example, employees in a particular organization may not care that the organization is saving five cents per minute for VoIP calls if their sales productivity is decreasing because of poor quality calls or dropped calls. The convergence of voice and data together will make the telephone systems dependable to the data network resources. The key challenge is to reconcile the performance requirements of voice with the data on a single network (Trope, 2004).

Providing high reliability performance for a VoIP services is a challenging and multifaceted problem. In a recent article titled "VoIP reliability: a service provider perspective" the author pointed out two performance metric for VoIP reliability. They are end to end VoIP service downtime and Defects per Million (DPM). End to end VoIP service downtime demands 99.93 percent VoIP elements availability. Where DPM is defined as the average number of blocked calls and cut-off calls per million attempted. The key challenge is to maintain this performance and reliability issues to satisfy the end user (Johnson, Kogan, Levy, Saheban & Tarapore, 2004).

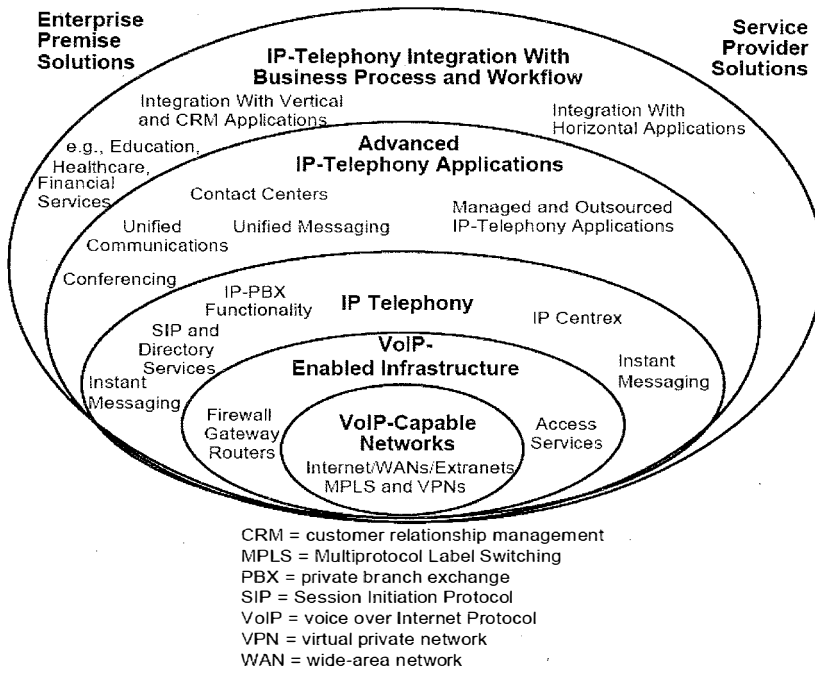
In the same article mentioned above, the author provides information for providing best quality of service. The methods include, constraint-based routing and traffic engineering, bandwidth management and admission control, QOS for established

voice calls and adaptive coding. This includes proper network management and monitoring tools such as NetQ, HP open view, Cisco® works, Tivoli and others (Chong & Matthews, 2004). These network management resources demands properly trained IT staff. Organizations that have fallen behind in technology, resources and skill sets, they should include an infrastructure upgrade prior to implementing IP telephony (Snyder & Lassman, 2005)

A recent research article from Gartner suggests that IP telephony deployment in enterprises should be classified in five layers.

Enterprise architects and managers must explicitly define the end-to-end functional layers of their enterprise VoIP infrastructure and IP telephony application architecture; this will clarify the tasks of integration and cost justification (Elliot, 2003, p.1).

The five functional layers in enterprise IP solutions are shown in figure 6. The lower three layers (VoIP capable networks, VoIP enable infrastructure & IP telephony) provide the enabling network and VoIP infrastructure, while the upper layers (advanced IP telephony application, IP telephony integration with business workflow) emphasizes on IP-telephony applications and communications-enabled business processes. Viewing the enterprise in terms of these functional layers clarifies the technical aspects because the products, vendors and replacement cycle for each layer differ (Elliot, 2003).



**Figure 6: five functional layer of enterprise IP solutions (Elliot, 2003, p.3)**

### 2.9.3 The implementation challenge

Successful implementation doesn't mean only having good technical skills and robust scalable network. The biggest challenge is to design and execute a migration strategy keeping intact the normal business operations (Blood, 2005). This migration strategy should include infrastructure upgrades, system preparation and testing, voice circuit provisioning or migration for new systems and deployment scheduling. The infrastructure upgrades not only consists of making sure proper hardware software and bandwidth exists, but also includes implementation of quality of service and reliability (Abbasi, 2005).

The current plain old telephone system (POTS) network is robust and reliable, and whenever someone picks up the telephone, they expect to hear a dial tone all the time. The actual percentage of telephone service availability is 99.99 percent (the "fives-nines" of reliability). This translates to five minutes of downtime per year. On the other hand the best private data networks are available about 94 percent of the time, on average, meaning that a user can be without the digital equivalent of dial tone about 22 days per year. The public Internet is collectively available only 61 percent of the time, translating to 142 days of downtime annually (Jiang & Schulzrinne, 2003).

In a report on VoIPReview.org, the author states that VoIP is a very reliable system which can be an excellent opportunity to run your business over and replace your home phone line. However, what happens when network connection is lost? If the network system being used is not 99.99 percent reliable then some form of backing up VoIP with a POTS line or cell phones must be used. For these backups to work then some type of system must automatically move traffic from one network to another when the network connection is lost (Chong & Matthews, 2004).

In 2003, Wenyu Jaing and Henning Schulzrinne undertook a study on the reliability of VoIP. In their findings they stated that VoIP reliability was affected by packet losses and network outages. The reliability issues reduced the service availability of VoIP from 99.5 percent to 98 percent. In an article VoIP Reliability: A service Providers Perspective, written in Jul 2004, quality of service was identified by the writers as a reliability issue also. The authors further state that network design impacts reliability. Lastly, a more recent article written on March 2005, states the same conclusions about VoIP reliability in terms of network availability. Reliability is a definitive topic when deciding to switch from the POTS system to VoIP. An organization should consider these reliability issues while implementing VoIP into the system (Jiang & Schulzrinne, 2004).

Careful scheduling and planning is required to deploy IP telephones to replace the existing phones. When deploying new IP telephones, it is typically recommended to remove the user's old phone and replace it with the new IP phone. This creates a total immersion situation. This forces the employees to learn the new operational features of the IP Phone on a much quicker learning curve (Elliot, 2003). It also prevents end-users' aversion to change as the change is made for them. Consultants have learned from previous migrations that leaving both phones in place contributes too much longer learning curves and allows for end-users to resist embracing the new technology. The end-users' learning curve can further be enhanced with formal training with delivery via live instructor-led classes, web broadcasts, or computer-based interactive training (Abbasi, 2003). The groundwork that is required to face the implementation challenge are: Plan thoroughly; gather network topology and inventory data; perform a network assessment (this is absolutely essential); prepare a

business case; expect to upgrade LANs; ensure that established PBX applications will integrate with the proposed telephony (Johnson & Zawr, 2005).

#### **2.9.4 The security challenge**

The most common failure in telephony deployment is neglecting to plan for voice and data network security or failing to include disaster-recovery planning from the beginning (Champerlin, 2005,p.2).

As with any new technologies, VoIP represents both opportunities and problems. It offers lower costs and greater flexibility but presents significant security challenges. The Internet because it's a publicly accessible service, has been a great concern for VoIP deployment (Champerlin, 2005). VoIP presents a number of interesting security challenges that differs significantly from those of traditional telephony. This is one topic that vendors are reluctant to talk about when deploying VoIP in organizations. The reason is simple; in most cases, it has not been addressed (Abbasi, 2005). As companies put voice on their data network, all of the weaknesses that exist in their data networks also become weaknesses in their voice networks. For example, a simple e-mail virus that floods a network with spam mail can also cause voice service to deteriorate dramatically (Walsh & Kuhn, 2005).

VoIP units share physical network connection with the data networks, and in many cases VoIP and data are the same logical portion of the network. Confidentiality can easily be lost through the use of a "sniffer". An attacker can tap into a switch or a router to capture voice traffic packets and use an open source packet sniffer such as Vomit (Abbasi, 2005).

VoIP is also vulnerable to spam over internet telephony (SPIT). The fear here is that advertisers will send numerous voice mail messages to these phones therefore causing a reduction in bandwidth and breaks in service. The strain on network resources when millions of 100-KB voicemail messages are transmitted, compared with 5- or 10-KB e-mails, will be considerable (Gagner, 2005).

The risk of toll fraud and identity fraud is another major thread in VoIP system. Ashley Johnston, director of business development at Texas Instruments' VoIP group stated that voice tapping, toll fraud and identity fraud are at the top of the list of VoIP vulnerabilities (Sicker & Lokabaugh, 2004). Hackers have been able to change how their number appears on the victim's caller ID boxes leading the victim to believe it's their bank or credit card company calling. "It's like you've handed people an entire phone network," said Lance James, who as chief technology officer of Secure Science sees such scams on a daily basis (Gagner, 2005).

VoIP is a perfect target for Denial of Service (DoS) attacks, which can bring a server to its knees and even shield other attacks. VoIP is sure to be disrupted whether the DoS attack is on a router, switch or the server itself. One of the features of VoIP is "extension mobility". This feature allows the attacker to log into any phone and load their personal telephone profile. This is highly vulnerable to DoS attacks. VoIP provides tools of this attack occur in the same network. But if the attacks originate from a different network it is much harder to prevent the attack (Sicker & Lokabaugh, 2004).

There goes a proverb "lock the stable door after the horse has stolen." Business and individuals need to consider security of their VoIP system before the implementation. Security is not an afterthought regarding implementation of VoIP. Individuals and business need to be aware of these vulnerabilities and take actions to thwart them. VoIP service providers are continuously making advances in these areas but at a cost to the subscribers (Sicker & Lokabaugh, 2004).

VoIP systems also represent limitations like emergency service like local 911 services, loss of power, number transfer restriction, line echo etc. Any system affected by these limitations can disrupt system operation and cause communication problems. Some of these problems can be very critical. When implementing VoIP for an organization, a manager must question the vendors on how they are prepared to deliver voice services in case of emergency. If there is an emergency and the 911 call fails to go to the local operator then the delay caused to route it to the correct area could be a matter of life and death. The problem can even affect a country which is fighting cyber terrorism. This problem can make the VoIP system a frequent target of



corporate espionage. This limitation impact VoIP system operation and can create severe business problems if it is not solved (Abbasi, 2004).

### **2.9.5 The governance challenge**

A significant change in responsibility and power is bound to happen when an organization deploy IP telephony on their data network. The responsibility of data team expands throughout the organization. They are always under pressure for timely delivery of new projects in addition keeping thousands of application up to date. Unscheduled unavailability of network resources is generally accepted in data network rather than in voice network (Cisco® Systems, 2004).

VoIP can be treated as a mission critical application on a data network. Treating voice as just another data application running on the network can be devastating to an IT department's reputation. The end users continue to expect same robust and reliable voice experience they received from traditional PBXs. Anything less than that will be considered unacceptable. Unlike most data applications, voice requires very low latency and absolutely no packet losses. (Jiang & Schulzrinne, 2003).

The telecom department inside the organization may feel threatened by data teams as they share control over a major responsibility. The responsible telecom engineers shall make an effort to learn the new IP telephony and become involve with data teams to successfully implement this technology. While on the other hand some people can also create obstacles on the way of its development by making embitter relationship between these two groups (Zulthys Technology, 2004).

Lack of cooperation from telecom or data teams can greatly jeopardize the success of an IP Telephony implementation. Abbasi cites Susan Cramm, former CIO of Taco Bell Corporation states that "business CIOs believe they can make almost any project succeed as long as they have enough business sponsors, subject matter expertise and money. This belief is wrong. Business sponsorship is a weak substitute for leadership." Many CIOs don't understand that full-cycle governance is an industrial-

strength method of improving the success of IT projects. By driving project success, IT value becomes more than a projection—it becomes reality (Abbasi, 2005).

Top management support is a key ingredient to a project's success. IP Telephony is no different. IT executives will face some tough challenges in moulding their IT organizations to align telecom and data teams together. However, "merging the two will make telecom embrace the flexibility and ease of administration of the new VoIP applications. The data staff may come to appreciate voice-management practices and adopt policies such as frequently changing passwords on switches and routers to restrict access" (Abbasi, 2005). To keep it running smoothly the data and network team need to get on the same boat and work together. It is the IT management who will confirm this alignment is done timely and with full support.

## ***2.10 Cost benefits analysis***

Which type of phone service is cheaper, PSTN or VoIP? Costs are more involved than a simple phone bill at the end of the month. These costs are the sum total of hardware, training costs, switch over costs, potential and loss of business in transition. Different companies will have different costs for telephone service based upon whether they are working on the international, national or local level. IT departments considering VoIP anew will find more vendor choices and more permutations for implementing this technology (Paulson, 2005).

These are great starting points, but what is most important at the outset of any such project is to fully determine the process for implementation from design to testing and validation reports. Lisa Pierce, vice president of telecommunications research at Forrester Research opined it's a major change that takes a huge amount of time and it's anything but inexpensive very often (Solis, 2004). There's still a lot of work to be done. On the other hand Paulson in his famous article stated that like any other factor, IT staffs should fully assess the cost versus risk when considering implementing IP telephony. He suggests it can, however, be difficult to quantify costs. There is also this desire to trade-in the devil you don't know for the devil you do know. IT should be looking at VoIP as an application not as a network. Paulson further stated his opinion suggesting the organizations to outsource the application rather the network.

It is considered as a huge shift. Looking at VoIP in this way frees IT departments to use the application in ways that make most sense both technology wise and money wise (Paulson,2005).

Analysts and experts believe that the move to IP is part of a large trend towards the creation of customized, unified messaging networks. These will be accommodate traffic for voice, video, messaging and collaborative communication such as teleconferencing. Goodall suggests the future for VoIP looks bright.” One of the things we’re seeing is it’s really being driven by the organic growth within organizations.” The company CISCO® provides a lot of hardware for VoIP phone service and claims on their web site that companies have saved millions of dollars by using their technology (Cisco® Systems, 2004).

Though the full promise of VoIP connectivity has not yet been delivered by the technology industry, the available implementations are now more competitive than their traditional telephony counterparts. VoIP accomplishes all of the features that have become common place and offers a level of future-proofing (Blood, 2005). Considering the future and cost of VoIP, it will be fruitful to deploy VoIP in an organization with large or small call centres as the maintenance and expansion options are proved financially more attractive than traditional system (Decina, Trecordi & Milano, 1999).

Finally, VoIP is its early stages, but it is growing at a rapid pace. More and more VoIP components are being developed while existing VoIP technology is being deployed in an increasing pace. The cost savings combined with the versatile features including unified messaging, allow business to be far more efficient than before. The maintenance and expansion options are financially more attractive with VoIP deployments. The initial installation and purchase price are comparable (Blood, 2005).

### 3. Methodology

A qualitative research method based on a case study was adopted for this research.

A qualitative approach is one in which the inquirer often makes knowledge claims based primarily on constructivist perspectives (Creswell, 2003, p.18).

In this particular approach the researcher collects open-ended emerging data. The primary aim of this collection is to develop theme from data like finding multiple meaning of individual experiences. This approach is fruitful for the case study method. This kind of methodology manages to establish the meaning of a situation or phenomenon from the participants' viewpoint. One of the characteristics of the qualitative case study research method approach is to reflect participants' behaviour. It also seeks involvement of the participants in the data collection. Open ended interviews and document review can also be included in this method. This method is often taken if the topic of the research is new or has never been addressed with a certain group of people (Creswell, 2003).

The case study method is appropriate for this research as it focused on the experience of one company. This allows for an in depth study and provides an opportunity to draw conclusions based on a wide range of available data.

#### **3.1 Reliability and validity**

Reliability and validity is vitally important in a qualitative research design. The rejection of reliability and validity in qualitative inquiry may lead the research in an interesting shift for "ensuring rigour" from the investigator's actions during the course of the research, to the reader or consumer of the qualitative inquiry. In the article "Verification Strategies for Establishing Reliability and Validity in Qualitative Research" Morse, Barrett, Mayan, Olson and Spiers (2002) argued that reliability and validity remain appropriate concepts for attaining rigor in qualitative research. They also emphasized on reclaiming responsibility for reliability and validity by implementing verification strategies integral and self-correcting during the conduct of

inquiry itself. This ensures the attainment of rigor using strategies inherent within each qualitative design, and moves the responsibility for incorporating and maintaining reliability and validity from external reviewers' judgements to the investigators themselves (Morse, Barrett, Mayan, Olson and Spiers, 2002).

Other methods of ensuring reliability and validity in qualitative analysis, has been mentioned by Lincoln & Guba (1985), and Miles & Huberman (1994). Miles and Huberman argues that reliability in qualitative research depends largely on the skills of the researcher. They identified several characteristics to look for to reliability including familiarity with the phenomenon, strong conceptual interests, a multidisciplinary approach & good investigation skills including doggedness, the ability to draw people out and the ability ward off premature closure (Miles & Huberman, 1994). Northey (1997) said reliability can be further increased by the researcher maintaining an audit trail of the research.

Triangulation is the use of a combination of assessment methods in a study. It's a method of establishing the accuracy of information by comparing three or more types of independent points of view on data sources bearing on the same findings. This study will also use triangulation of sources to increase both the reliability and validity of the findings. It seeks to minimise the problem of bias in a research (Burgess, 1984). This research project will incorporate surveys, interviews, and observations for the triangulations of data sources.

### ***3.2 Target population***

The project was based on a case study on a particular company or organization. The target group for the study was the project group that includes call centre manager, system and infrastructure development manager and IP telephony expert from the management team. In addition, a questionnaire was designed for the 40 to 50 call centre agents. This was to clarify the impact of implementation of the technology on the users. The sampling method for this study was based on convenience related to each participant's involvement in the project. The target sample for this study consisted of all project members, subject to their informed consent and relevant involvement.

### **3.3 Design**

The purpose of this case study was to gain an understanding of the impact of VoIP in a company's call centre department. This research investigated the call centre operations and technology which was a large contributor of a company's profit. The research was predominately qualitative as it asked question that rely on hermeneutics rather than acute statistical analysis. This means the researcher collects open ended emerging data with the primary intent of developing themes from the data. For example: finding multiple meaning from individual experiences.

One of the key elements of a qualitative case study method is to observe participants behaviour and seek involvement of the participants in the data collection. Observations will be made during or after significant milestone of design and development. This observation will include a contextual surveys and an interview session with documentation review. Interviews are the significant strategy to vent the feelings of the participants to an impartial observer. This manages to create extra depth of data collection process and the significance of the study (Miles & Huberman, 1999).

### **3.4 Instruments**

Conventional social research demands a finite list of questions to get the anticipated result. The emergent nature of the research limits the researcher ability to set a finite list of questions. It is anticipated that the questions would emerge from the process of the research. Data was collected for this study from multiple sources to increase the precision of the process. This will included documentation review, interviews, on site observation of networks, questionnaires and e-mails.

### 3.4.1 Documentation review

The following selection of documentation was required for the purpose of the research:

- Organizational documents such as agendas.
- Administrative and financial reports.
- Company network diagrams.

Company approval was obtained for the use of these documents.

### 3.4.2 Interviews

Apart from organizational documentation, interviews are the primary source of data collection. The interview process was consistent and focused on answering the research question. Data gathering was also carried out via emails as well. Interview question was open-ended. This is considered as a distinct characteristic of qualitative research design. The interview process was informal and the participants included: Call Centre Manager, Systems and Infrastructure Development Manager and IP Telephony Expert from the management team. The participants were given an overview of the research being conducted by way of emailing the Information Sheet to each of them two weeks in advance. Informed consent was obtained before the interviews commenced and it was stated to them that they could have full access to the research results if required. A copy of the questionnaire is provided in Appendix section 9.1.1 and these questions were open ended questions.

### 3.4.3 Questionnaires

A questionnaire was administered to 40 to 50 call centre agents regarding comparing the data gathered from the interviews with the management team with the experience of actual users of the technology. This provided an overview of the impacts of implementing this technology from the actual users. It was also help to reveal the user friendliness of this so called godsend technology along with its satisfaction level in

terms of quality and service. A copy of the questionnaire is provided in Appendix section 9.1.1.

### **3.5 Procedure**

The research proceeded in the following way:

- 1) An application to the ethics committee was made detailing the nature of the study and its requirements for human participants.
- 2) Members of the target population were asked to participate in the study after being informed of the nature of the study and its requirements.
- 3) Interview sessions and timeframes were fixed depending on the availability of the members.
- 4) The interview sessions was broken into sub sessions depending on requirements.
- 5) The questionnaires were distributed after the interview period. Emails were sent in order to get quick response along with distribution.
- 6) Steps 2-5 was repeated until a significant portion of the project will be developed.
- 7) The conclusion of the project was developed from the theories and data that emerged from the study.



### **3.6 Data analysis**

The study has examined longitudinally, the data derived from critical reflection and planning for future action. Action research as Eden and Huxham (1996) explains “is not being grounded in data but being grounded in action” (Eden & Huxman, 1996, p 257). Thus it is important that the data analysis be focused on data that emerges from an action. Thus the research was performed by the following fashion:

- The data for this study was analysed both quantitatively and qualitatively.
- Interpretations were made from the journal data and the longitudinal survey.
- Independent observations throughout the study were performed.
- Triangulations of these results were performed to eliminate the subjective nature of the interpretations. Such comparison involved cross-referencing data from the longitudinal survey against the data collected from the interview sessions.
- Further validity was incorporated by also cross referencing the findings from the data against the relevant literature.

For this project, the data that was gathered from interviews along with the data gathered from the questionnaires helped provide an understanding of the current state of VoIP in call centre of the company. The data gathered from the documentation review has given an in depth view of how the use of different technologies has evolved over time in the company. Areas for further debate including issues in the call centre that require greater attention was also identified through observation and literature review.

### **3.7 Limitations**

Data from qualitative research methods are often susceptible with the introduction of bias (Creswell, 2003). Since the project had focused on only one company the result of the research, may not be applicable to other companies. The study has concentrated the impact of implementation of VoIP in a company and has undertaken a case study approach to identify in what ways VoIP has benefited the company and whether there business is growing up with the implementation of this technology. This result can only provide an insight into how the implementation of VoIP may influence other companies. In addition, the scope of this project was to show whether the implementation of new technology can reduce expenses and enhance flexibility. However, the study does not take into account the actual cost that the organization may have payed to change or dismantle their current system.

## **4. Results:**

### ***4.1 About the company:***

City of Melville is the third largest local government authority in the Perth metropolitan region. It consists of 18 suburbs divided into six wards connected by over 1200 kilometers of local, arterial and major roads. The population of this city is about 95,000 and is expected to increase by more than 9838 people to 107,659 by 2016, an average annual growth rate of 0.87%. The main services provide by City of Melville Council are recreation and aquatic centres, libraries and pre-school centres, food inspection services, citizenships, planning and building services and maintenance, landscaping disability services, immunisation clinics, cultural and educational centres, environmental preservation and management, tourist promotions, volunteer resources and support for community organizations.

The government agency operates a large call centre to assist the residents with inquiries and for handling complains and other day to day organizational activities. In 2002 the Melville City Council implemented Voice over IP (VoIP) telephony in order to increase the operational efficiency, save costs and attracted interest and increase customer satisfaction. The City of Melville Council employs more than 1000 workers. The workforce is of varied cultural background which is justified by the range of services which the company offers. The annual turnover of the business activities has reached the non negligible mark of \$ 974,000,000 (Melville City Council, 2007).

## ***4.2 Previous technology: An analysis***

The company upgraded its call centre after outsourcing the operation six years before. At the early stages of call centre operations the system consisted of the traditional analog voice system provided by Alcatel. The implications of the system were such that the call centre should be connected through the traditional phone line system. In the latter system a PABX box was responsible to route call to free agent for handling of customer complaints and requests (Melville City Council, 2007)

The PABX (Private Automatic Branch Exchange), as an automatic telephone system was meeting the communication needs of the medium sized 60 seats call centre at Melville City Council. This system was accommodating several exchange lines with automatic extensions that provided direct connection to the public switched telephone network (PSTN), and full internal dialling between extensions. Incoming exchange calls are received on a small, compact, key-operated switchboard on a table or desk, and are dealt with by the PABX operator in the inbound call centre configuration. A small number of manual extensions and lines to other PBXs can be connected to the system (Melville City Council, 2007)

### ***4.2.1 Technology evaluation:***

Traditional technology presented some advantages but major disadvantages as depicted below:

#### ***4.2.1.1 Advantage of traditional system***

Old system based on voice installed analog system was provided with free of charge maintenance done by providers technical support staff.

#### ***4.2.1.2. Disadvantages of traditional system:***

The main disadvantage of the traditional system resides in the relative difficulty of operators to interact in a user friendly manner. The screen design of the system handling calls at call centre level and inherited from outsourcer did not enhance efficiency and productivity as the human to computer exchange was a frustrating

experience. In addition, the two technologies implemented by the Melville City Council and the outsourcer were not compatible and could not integrate data. Web based Customer relationship management system was implemented to interact and extract data from old systems.

Importantly, in traditional voice based analogue system there was a need to monitor separately calls and data pieces concerning a member or client. Old aged pensioners in care homes possessed a single telephone line which served both for internet and voice calls. This system sometimes does not allow contacting people when they were online (IP telephony at Melville, 2003).

#### **4.3.0 Drivers for changes:**

Melville City Council undertook a market scan to establish the availability and necessity of innovation in technology. As technology evolved there was a need to change to a new system which presented more advantages in many respects.

Melville city council's call centre manager Mr Jenkinson states "the need arose mainly from three issues that came together at one time, leading the City of Melville to take the plunge into new technology, providing new services and saving on costs, as well as delighting customers."

Some of the major reasons those influence the implementation of VoIP in Melville City Council are:

- Some cost savings are due to utilizing a single network to carry voice and data, especially where users have underused network capacity that can carry VoIP at no additional cost. VoIP facilitates integration of internal and external operations that ease exchange through integration, allow businesses slash costs by contracting with remote agents and provides a comparatively lower cost to communicate physically with contact centre. Providers sometimes provide VoIP to VoIP calls free of charge apart from normal Internet service provider's fee, whatever is the distance (Jenkinson, 2003, p.2).
- Legacy systems lacked user friendliness aspect presenting a green interface was handling calls but this system was difficult to interact with. The integration of in-house data with that of the outsourcer was impossible. The

main consideration at that level was to integrate thus, the two systems consisting on one side of the outsourcing company data and system with that of the Melville city council system with the main aim of providing a system which allows an integrated view of customer details in a single unified way (Jenkinson, 2003).

- The proposed technology was offering the possibility of undertaking the main activities softly and easily as VoIP and IP telephony fitted the context on a non negligible manner considering operational parameters (Jenkinson, 2003).
- Stability and flexibility of system. VoIP-enabled call centre may have virtual call centre agents whereby calls are handled from agents home. Furthermore, the technology presented some features of stability and supported wide pool of system components as a result of its ability to handle both voice and data. With VoIP, companies don't have to run separate infrastructures for automatic call distribution, interactive voice response and predictive dialling, as each application can run on network-based services (Jenkinson, 2003).

#### ***4.4.0 Steps to ensure successful implementation of VoIP and IP telephony***

In all companies some executives may be reluctant to change. In Melville city council, call centre management executives found adoption of VoIP as a non profitable process viewing the process as a 'step backwards' (Jenkinson, 2003). This major root problem could have been a considerable hindrance to the implementation of the new system if it had not been handled by proper mediation and diplomacy.

Steps were taken to explain major aspects of the project to executives with little or no idea of project implications and effect in call centre. Importantly, these executives were briefed frequently on progress and need for each steps.

Melville City Council information services manager Mr Jenkinson stated that "a customer relationship management (CRM) system being built by an in-house

development team, which hooked into the legacy system, was the main business driver for the move” (Jenkinson, 2003).

Major concerns about adoption of new system implementation tackle the major aspects to be handled to ensure smoothened process in the 60 seats call centre. Successful VoIP deployment at Melville City Council has relied on the following managerial and technical aspects:

- Careful planning, in which project management aspects were carefully looked into in such a way as not to disturb normal day to day smooth agent to member interaction. Careful redesign of internal processes and procedures.
- Thoughtful infrastructure preparation which involves the careful looks at hardware and software as well as initial configuration aspects amongst which computer telephony integration solution, traditional automatic call distributor and time division multiplexed.
- Infrastructural configurations that allowed the integration of the systems and data in hand from both legacy systems has been checked against factors concerning interoperability based on the VoIP support system.
- A management platform designed for IP telephony's unique real-time performance requirements. The real time aspect of the system has been seen to be a very critical aspect being given the nature of cases to be reported at the call centre level.
- Managing security and confidentiality on communication. The internet is well known as providing potentially unsafe communication as wire tapping and other acts of spying could be an issue, though the functions and data handled by call centre agents is not critical and corporate in nature

(Jenkinson, 2003, p.1).

At the early steps of Melville City Council implements Avaya's IP Media Processor to Offer Voice over IP Solution to Financial Services, Customers Network assessment has been a key component, though the legacy system were making data migration a cumbersome task. The major steps to be used to upgrade system and the shift to new system primarily ensured that proper test cases are designed to calls and data on networks, the need for sufficient bandwidth and ensure services are sustained over years (Melville City Council, 2007).

#### ***4.5 Impact of VoIP in the company:***

A number of significant impacts were found after implementing VoIP. The data presented in this section was obtained through a series of interviews conducted within the company, user questionnaires and through from available company documentation.

##### **4.5.1 Impact on calls:**

Melville City Council introduced the VoIP technology in 2003. In 2004 the organization processes about 16,000 outbound and 3000 inbound calls per day. The call centre initiates about 500,000 outbound calls per month from which about 148000 customer contacts were made. In the year 2005 the call rates didn't see any significant change (Melville City Council, 2007).

In 2006 the organization processes about 20,000 outbound and 6000 inbound calls per day. The call centre initiates about 600,000 outbound calls per month from which about 158000 customer contacts were made. The above figures considerably varied depending upon dialed number quality, agent availability and call answer rate. The call centre handles 80000 inbound calls per month. The figures relating to call handling are far higher than the growth figures prior to VoIP implementation of the company (Melville City Council, 2007).

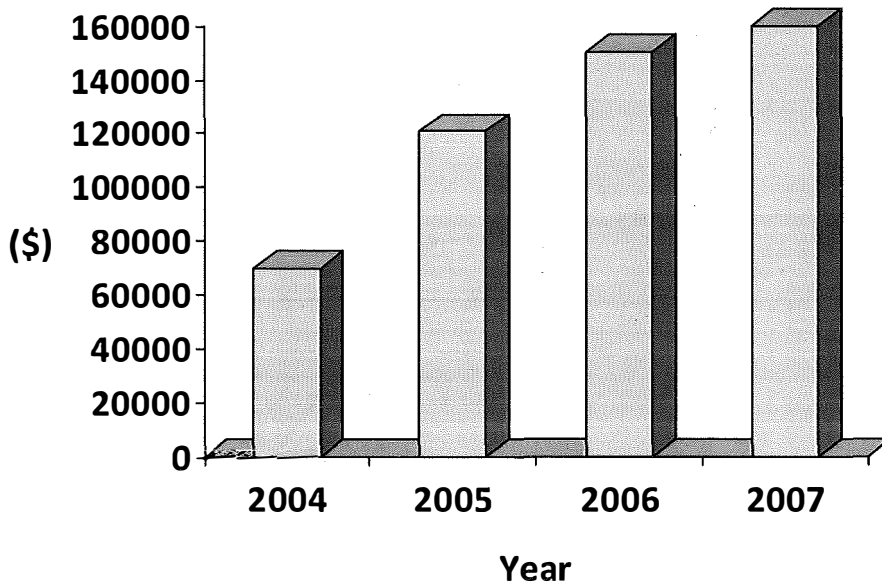


During the interview session the call centre manager states that the call volume is expected to increase by 200% in the next two years as the city's population is increasing and council activities are far more extensive than previous years. With the implementation of VoIP the increased calls are expected to have no effect on the network infrastructure. In addition, the call volume increase rate was found to be about 10% each year after the implementation of VoIP.

**4.5.2 Impact on costs:**

The main driver towards adopting VoIP was cost considerations, such as the need to cut the cost associated to different call centre operations. Cost, though not expressed remains the number one concern before and after implementation of the VoIP solutions. (Jaiswal & Raghav, 2004). Melville City Council has seen a significant impact on cost savings after the deployment of VoIP in the call centre operations. In regard to cost savings according to Jenkinson” This has delivered the planned productivity gains, along with the fact that all calls within the network are free, which has resulted in over \$70,000 in savings in telephony related costs in the first year after the implementation of VoIP. In addition, a single carrier bill from Telstra is much easier administration task to handle, compared to multiple accounts.” (IP telephony at Melville, 2003)

The annual report for the last four years shows significant cost savings for implementing VoIP. Figure 6 below shows that in 2004 the cost saving was about \$70000 which has increased to \$121000 in the second year and in 2008 the amount of cost savings was \$160000.



**Figure 7: Company cost saving analysis chart.**

The annual report for each year concludes that even though the company invests heavily in maintaining and upgrading the technology, the company does see significant cost savings after the implementation of VoIP (IP telephony at Melville, 2003).

#### **4.5.3 Impact on revenue:**

A 5 percent improvement in customer loyalty can improve profitability by 40 to 95 per cent” and “cutting customer defection by just 5 per cent has the effect of boosting profit between 25 per cent and 95 per cent” (James, Chen & Garison, 2005, p.7).

The figure 8 below shows the impact on revenue in the last four years for Melville City Council. The previous year’s financial statement clearly rectifies the success of implementing this technology. The revenue increased by 27% to \$49 million and earnings before interest, tax and depreciation increasing by 59% to \$20 million for the financial year 2003 as compared to financial year 2002. In the financial year 2004 the revenue increased by 40% to \$70.3 million. In 2005 and 2006 the company didn’t see

any significant difference of revenue increasing. Revenue grew only marginally to \$74.7 million. (Melville City Council, 2003)

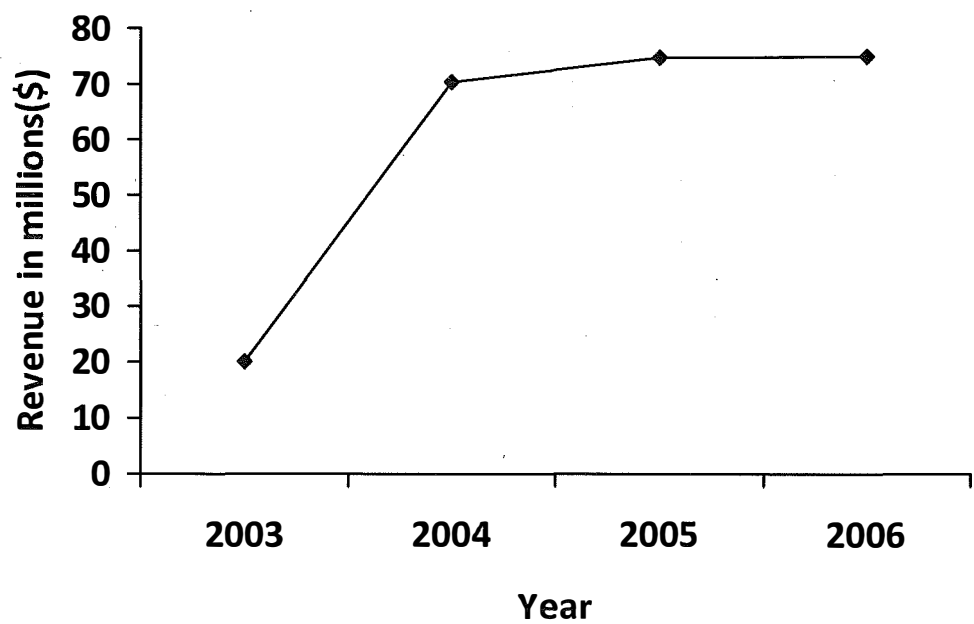


Figure 8: Company revenue analysis chart

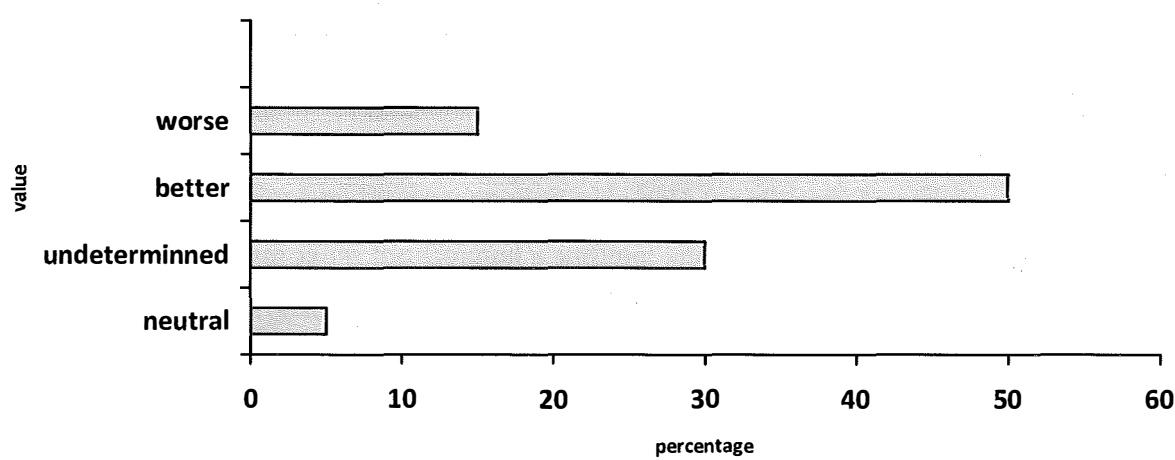
4.5.4 Impact on call centre staff:

To determine the impact on call centre staff/users a questionnaire was made and was distributed to 40 employees. This questionnaire was divided into two sections. The first section was on the basic information of individual employees. A series of question were asked regarding their current position, length of their employment, whether they were employed before or after the implementation of VoIP.

Based on the survey results, the first section concludes that most of the employees (87.5%) of them were employed before the implementation of VoIP and the rest (12.5%) were employed after the implementation of VoIP. Employees that were employed before implementation stated that there were significant positive impacts on call quality, productivity/ customer handled per day and operational procedures.

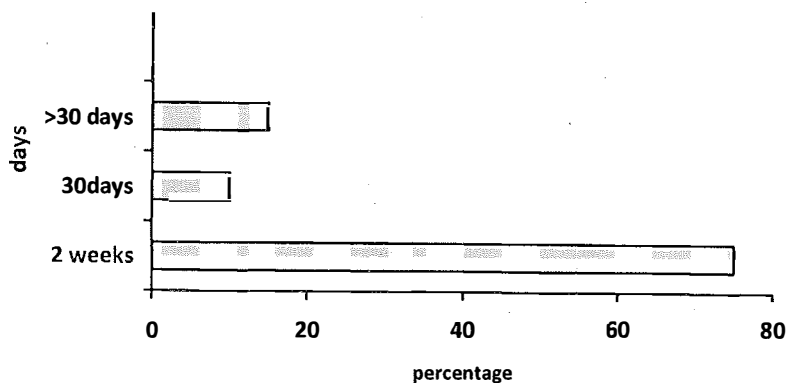
The second part of the questionnaire examined the user's perceptions of sound quality, user friendliness, features of VoIP and its trend towards customer service. Ten questions were asked to the call centre employees based on the use of VoIP as a technology in the call centre.

The first question was based on the sound quality of the VoIP phone system. The question determined the sound quality difference between traditional phone line and the VoIP system. Figure 9 indicates that 50% of the respondents said its better than the traditional phone line, 30% of them indicated that there is too insignificance difference between this two, 15% of then think that the traditional phone line sound system is better and the rest of 5% were neutral.



**Figure 9: Sound quality of the VoIP phone system**

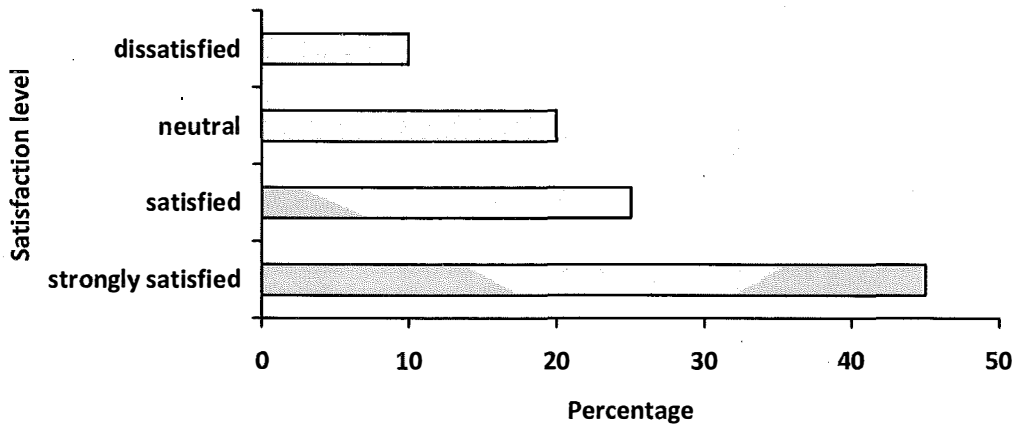
The second question asked respondents of how many days of training session were required for each staff to be accustomed with the new system. This justifies the user friendliness of the VoIP system. Figure 10 shows that 75% of the staff indicated that they need only two weeks of training to know all about this new system and 10% of them needed about a month and the rest of the 15% required more than a month.



**Figure 10: Training day requirement for the staff**

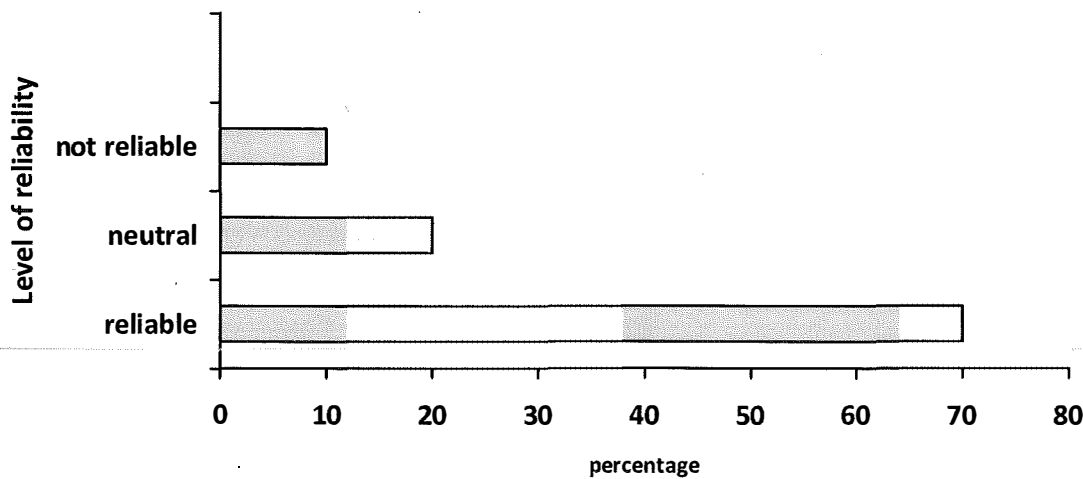
During the interview session, with the call centre manager of City of Melville stated “ Two staff were sent to Sydney to receive formal training in IP telephony and the call manager as no courses were available in WA in that stage. After this training, intensive training sessions on the new phones were held for all staff. In addition, a full virtual training program is on the Council’s intranet site, which is used by new staff and for “refresher” purposes.”

Third important question asked respondent about the impact of VoIP on customer. Figure 11 below indicates that 52.5% of the respondents were strongly satisfied that VoIP can significantly improve the customer service, 27.5% of them were satisfied, 15% of them were neutral and the rest were disagree with that.



**Figure 11: Impact of customer service Satisfactions using VoIP**

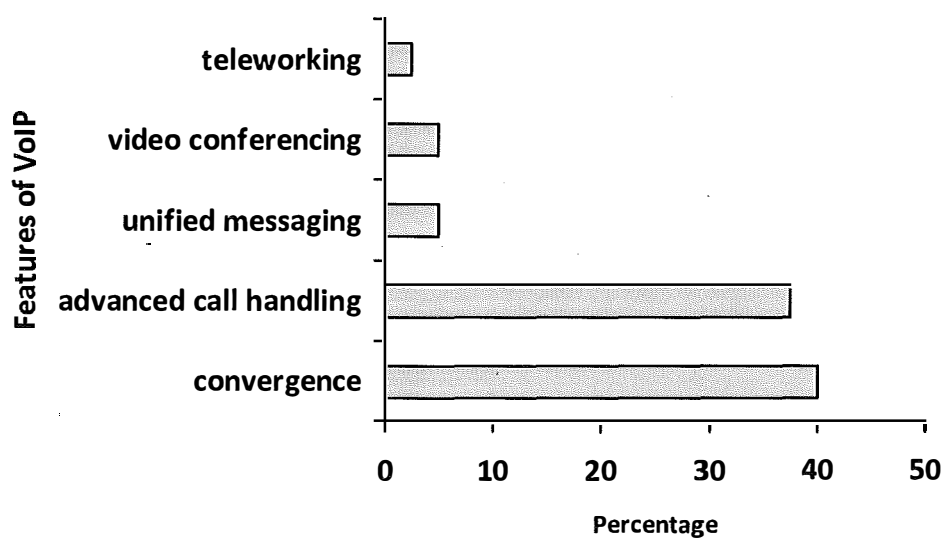
The fourth question dealt with the issue with the reliability. Staffs were asked about the reliability of the current system to the old system. Figure 12 indicates that 70% of the staff answered VoIP as a reliable system, 20% of them were undecided and the rest was voted not reliable always due to power failure and emergency number handle and sound quality issue.



**Figure 12: Issue with the levels of reliability of VoIP**

The fifth question was regarding the features of VoIP. Five options were given to the respondents and out of them they have to choose one features of VoIP that they think is the best. The options were: allows teleworking, convergence of voice, video and data, video conferencing, unified messaging, advanced call handling. Figure 13

indicates that 50% of respondents raised their hands on behalf of convergence of voice, video and data. 37.5% of them think that the advanced call handling features is the best, 5% of them were on unified messaging, 2.5% of them were on allows tele working and 5% were on video conferencing.

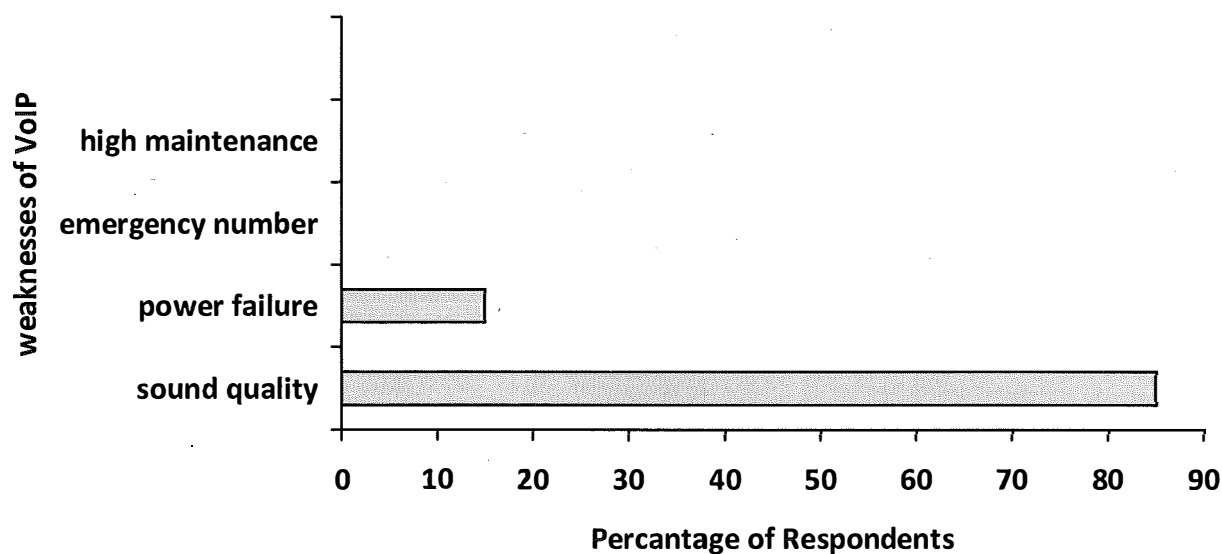


**Figure 13: The features of VoIP**

The sixth question was designed to determine the weakness of VoIP. The respondents were given four options. Out of these four options they were asked to pick the most appropriate one that they thought was a significant weakness of VoIP and what attention needs to be taken to resolve this weakness. The options those were given to the respondents were: sound quality was not always to the expected level, power failure, emergency number dialling and high maintenance. Figure 14 indicates that 85% of the respondent indicated that the VoIP sound system was not to the expected level at the beginning and the rest of the respondents gave their opinion on power failure.

The issue about the weakness of VoIP was raised in an interview session. The call centre manager agreed that at the early stage the sound quality was not the expected level. The issue was taken into consideration immediately. The company carried out a major project to resolve the issue. The project was to make sure that there is a right combination of equipments like sound card, soft or hard IP phone, proper headsets

etc. sound quality is much better now than the previous years. Regarding power failure the call center manager stated that there is a secondary power generator to resolve the issue. Finally regarding the issue with emergency number dialing services the call centre manager stated that they have still left few of the PSTN line just for emergency services.



**Figure 14: The weakness of VoIP**

The next four questions in the questionnaire were designed to gain an insight about the satisfaction level of the employees regarding implementation of VoIP in the organization. All of the respondents highly stated the positive impact of VoIP in their call centre. The respondents thought that the current system was more reliable, which helped to improve better call handling ensuring customer satisfaction which helps to increase productivity of the company.

Based on the above results, it can be concluded that the impact of VoIP was positive on the employees of Melville City Council. All the staff expressed their satisfaction on the adoption of this new technology and they hope that this will benefit the company in future ensuring excellent customer service. During the interview session the call centre manager stated that they have decreased the customer complaints by 10% each month, after implementing this new technology.



## 5. Discussion addressing the research questions

This section will outline a discussion of the research findings in order to address the research questions as outlined in Section 1.5. Research had been made regarding the impact of implementation of VoIP in call centres in the Eastern states of Australia. Lemay (2005) undertook a project regarding the impact of implementation of VoIP, on a Melbourne based international company called Manchester Unity Australia LTD. The company is a service provider in the field of life insurance and health and wide range of other services. Lemay's findings were positive regarding the impact of implementation of VoIP in the company. In this comprehensive study, the main impacts on the company as a result of this implementation are shown in details for in terms of cost reduction and implications, staff satisfaction and benefits, ease of business operations. Also, statistics of the business functions and operations based on VoIP solutions were critically analyzed. "The Manchester Unity projects are designed to revitalize information technology across the organization, which boasts a health fund with 145,000 members, 400-plus residents in its retirement and aged care facilities and financial solutions for an additional 8,000 members" (LeMay,2005, p.3). Similarly Dr Noel Bridgeman along with Salvi and Sathu undertook a project named "Impact of VoIP in the call centre: a case study". This project was based on one of the most business support companies located in Australia. It was a merger of two companies. One was the leading information solution provider in New Zealand and the second was the leading supplier of credit and marketing decision support services in Asia Pacific. Dr Bridgeman in his well known project named the merger of these two companies as "the company". The study concludes about the positive impact of implementation of VoIP in the call centre. The impact on cost was significant by the company, the revenue generated by the company was huge and the impacts on staffs/call centre users were positive. According to Dr Bridgeman these positive impacts are determining the successful adoption and implementation of VoIP in call canthers of the other organizations (Bridgeman, Sathu, Salvi, 2006).

The main research question was regarding the factors determining the successful adoption and implementation of VoIP in call centres in Western Australia. This research carried out a case study on a Western Australia based government organization "Melville City Council". The research paper investigated about the old

technology used by the company, its drawbacks along with the potential benefits of the new VoIP technology. In just six months, the council replaced its obsolete PABX system with the VoIP package. The changeover was rapid, without any technical obstacles. The drivers towards this change were establishing centralization, emphasis on establishing direct communication and gaining efficiency. The research has detailed the major impacts VoIP had on its call centre operations. The company had a large increase on the volume of its calls, significant cost reduction and huge revenue. The impact on call centre staff/users was significant. The call centre users quotes that it has increased the flexibility and customer satisfaction. These are the factors driving VoIP as a leading technology in call centres.

There were three sub-questions relating to the main research question. The first sub question was **“what technology factors are determining the successful adoption of VoIP?”** Extensive literature review has been performed in this research paper about the technology factor of VoIP in call centres. The literature review depicts that convergence of voice, video and data, toll bypass and advanced call handling techniques of VoIP are the most enhancing technology factors that has prompted many organizations to a potential changeover to VoIP. These technology factors contribute to the success of implementation of VoIP in Melville City Council. Due to convergence and toll bypass the company has saved millions of dollars each year. Advanced call handling techniques enable the call centre staff to deliver excellent customer service.

The second sub question was **“what reliability issues need to overcome for the successful implementation of VoIP?”** VoIP implementation demands careful planning. Melville City Council call centre manager states “It is always important to establish a legitimate business requirement before proceeding to the new technology.” VoIP required careful planning. Without careful and proper planning strategy this technology may have negative impact on a particular organization. Business will have to be careful in choosing the right kind of VoIP business model before implementation. At this stage, VoIP has few reliability issues to implement this technology in the system. The most common reliability issues mentioned by the call centre manager of Melville City Council are power failure, sound quality and emergency number dialling. Power failure issue can be resolved by the backup power

management system. Sound quality sometimes not to the satisfaction level at the beginning stage of VoIP implementation but as the technology evolves it improves significantly. Literature review also reveals that these are the common issues with reliability of VoIP in many call centres.

The third sub question was **“what strategies have been employed to overcome the potential challenges of implementing VoIP?”** Abbasi (2003) in his discussion paper “Voice over IP: A discussion of Business and IT challenges” mentioned briefly about the challenges of implementing VoIP in a particular organization. In this comprehensive discussion paper Abbasi outlined about the technology, infrastructure, implementation, security and governance challenges towards the implementation of VoIP discussed briefly in literature review (section 2.9). During the interview session with the call centre manager of Melville City Council, he stated the strategies of overcome this potential obstacles. He mentioned that “the technology challenge can be overcome by knowing the technology and studying previous case study, infrastructure challenge can be overcome by knowing the company’s current network model and determining the exact need, implementation challenge can be overcome by establishing a legitimate business requirements, security challenge can be overcome with company firewalls software or applicable antivirus software and governance challenge can be overcome through extensive training and proper management plan before the implementation of VoIP”. The relative primary difficulty resides in the early steps to plan and prepare infrastructure to accommodate efficiently VoIP. A poorly designed framework could have disastrous consequences to future implementations (Abbasi, 2005).

## 6. Conclusion

VoIP provides a pool of promise to company competitive edge in many parameters ranging from cost reduction to staff fulfilments and productivity through quality of service in call centres (Abbasi, 2003). Any statement to the effect that VoIP is not cost reducing is henceforth false. Melville City Council has as result of successful implementation of original module planning to introduce second module in forecast of major shifts in operations in their core financial services.

City of Melville in particular has been an early adopter of VoIP in Western Australia. The company has successfully deployed the technology on its network. This research paper focused the major impacts that VoIP had on its call centre operations. The council has experienced a large increase in the volume of the calls those are generated in the call centre both the outbound and inbound calls. It has also decreased the call costs and toll charges. The company executives were delighted at the positive result on the revenue on its very first years of VoIP implementation. The revenue is grown by 59% in the financial year 2003 and by a further 40% by the financial year 2004. Hence it can be concluded that the impact of implementation of VoIP in call centre was positive in all respects regarding calls, costs and revenue. In 2003, 11% of Australia's call centres had implemented VoIP, up from 4% in 2002 (Frankland, 2003). The trend in increasing usage is continuing.

This research has investigated the factors those are determining the successful adoption of VoIP in call centres in Western Australia. The research undertook a case study on a WA based government organization Melville City Council. It also reveals the technology evolution, reliability factors and challenges of implementing this new technology. This research concludes that the impact of Implementation of VoIP in the call centre was positive in all respects. Based on the project findings other organizations in Western Australia can successfully implement this technology.

## 7. Glossary

### **ANI**

Automatic Number Identification; A telephone function that transmits the billing number of the incoming call (Caller ID, for example) (IPCB.net, 2005).

### **AS (Autonomous System)**

A group of networks under mutual administration that share the same routing methodology (IPCB.net, 2005). An AS uses an internal gateway protocol and common metrics to route packets within the AS, and uses an external gateway protocol to route packets to other Ass (IPCB.net, 2005).

### **ASP (Application Service Provider)**

An independent, third-party provider of software-based services delivered to customers across a wide area network (WAN) (IPCB.net, 2005).

### **ATM**

Asynchronous Transfer Mode is a technology for switched, connection-oriented transmission of voice, data and video. It makes high-speed dedicated connections possible between a theoretically unlimited number of network users and also to servers. As a switching system ("Cell Relay") it is to be used in broadband ISDN (B-ISDN) and also in the Switched Multimegabit Data Service (SMDS networks). ATM is also becoming increasingly popular in the LAN area in the form of ATM-LAN emulations. ATM is based on high-speed-cell switching (packets of fixed size: 48+5 bytes) that makes it possible to vary bit rates (according to requirements). In connection with ATM one speaks of message blocks or message cells rather than message packets (IPCB.net, 2005).

### **Bandwidth**

The maximum data carrying capacity of a transmission link. For networks, bandwidth is usually expressed in bits per second (bps) (IPCB.net, 2005).

## **Broadband**

Descriptive term for evolving digital technology that provides consumers a single switch facility offering integrated access to voice, high-speed data service, video demand services, and interactive delivery services (IPCB.net, 2005).

## **Call**

Establishment of (or an attempt to establish) voice connection between two endpoints, or between two points which provide a partial link (e.g. a trunk) between two endpoints (IPCB.net, 2005).

## **Codec**

Compression-decompression. In VoIP it is a voice compression-decompression algorithm that defines the rate of speech compression, quality of decompressed speech and processing power requirements. The most popular codecs in VoIP are ITU-T G.723.1 and G.729 (AB) (IPCB.net, 2005).

## **Compression**

compression is used at anywhere from 1:1 to 12:1 ratios in VOIP applications to consume less bandwidth and leave more for data or other voice/fax communications. The voice quality may decrease with increased compression ratios (IPCB.net, 2005).

## **Congestion**

The situation in which the traffic present on the network exceeds available network bandwidth/capacity (IPCB.net, 2005).

## **Connectionless**

Mode of communication in which a connection (circuit or logical channel) does not need to be set up for data transmission between the transmitter and receiver. It is the underlying protocol for packet-switched transmission. The individual data packets can go from the transmitter to the receiver via different paths. A well-known connectionless protocol is UDP (IPCB.net, 2005).

## **DiffServ**

DiffServ (Differentiated Services) is a quality of service protocol that prioritizes IP

voice and data traffic to help preserve voice quality even when network traffic is heavy (IPCB.net, 2005).

### **DTMF**

Dual-Tone Multi Frequency; The type of audio signals generated when you press the buttons on a touch-tone telephone (IPCB.net, 2005).

### **Firewall**

A system designed to prevent unauthorized access to or from a private network. Firewalls can be implemented as hardware, software, or a combination of both. All messages entering or leaving the intranet pass through the firewall, which examines each message and blocks those that do not meet the security criteria specified on the firewall (IPCB.net, 2005).

### **FXS**

(foreign exchange station) is the interface on a VOIP device for connecting directly to phones, faxes, and CO ports on PBXs or key telephone systems (IPCB.net, 2005).

### **Gateway**

In IP telephony, a network device that converts voice and fax calls, in real time, between the public switched telephone network (PSTN) and an IP network. The primary functions of an IP gateway include voice and fax compression/decompression, packetisation, call routing, and control signaling. Additional features may include interfaces to external controllers, such as Gatekeepers or Softswitches, billing systems, and network management systems (IPCB.net, 2005).

### **H.323**

An ITU-T "umbrella" of standards for packet-based multimedia communications systems. This standard defines the different multimedia entities that make up a multimedia system - Endpoints, Gateways, Multipoint Conferencing Units (MCUs), and Gatekeepers -- and their interaction. This standard is used for many Voice-over-IP applications, and is heavily dependent on other standards, mainly H.225 and H.245. (IPCB.net, 2005).

**Hairpin**

Telephony term that means to send a call back in the direction that it came from. For example, if a call cannot be routed over IP to a gateway that is closer to the target telephone, the call typically is sent back out the local zone, back the way from which it came (IPCB.net, 2005).

**IETF (Internet Engineering Task Force)**

IETF can be defined as one of two technical working bodies in the Internet Activities Board. The IETF meets three times a year to set technical standards for the Internet (IPCB.net, 2005).

**IP Centrex**

IP Centrex delivers such services as call hold, call transfer, last number look-up and redial, call forward, three-way calling, but does it on a packet-based network (IPCB.net, 2005).

**Jitter**

The variation in the amount of Latency among Packets being received (IPCB.net, 2005).

**Latency**

(Also called Delay) The amount of time it takes a Packet to travel from source to destination. Together, Latency and Bandwidth define the speed and capacity of a network (IPCB.net, 2005).

**Packet**

In data communication, the basic logical unit of information transferred (IPCB.net, 2005).

**PBX**

PBX stands for Private Branch eXchange. It can be defined as an in-house telephone switching system that interconnects telephone extensions to each other as well as to the outside telephone network (IPCB.net, 2005).



## **PSTN**

Public Switched Telephone Network (IPCB.net, 2005).

## **QoS**

Quality of Service is the Measure of performance for a transmission system that reflects its transmission quality and service availability. Standards based QoS for VoIP usually involves the implementation of Ethernet standards 802.1p and 802.1q at layer 2 across an Ethernet. At layer 3, the IP standard DiffServ defines bits settings in the TOS (type of service) in the IP header which will identify packets as being associated with a specific service (IPCB.net, 2005).

## **RTP:**

Real Time Transport Protocol provides end to end network transport functions suitable for applications transmitting real time data. Such as audio, video or simulation data (IPCB.net, 2005).

## **Route**

A set of parameters predefined by IPCB.net to facilitate routing of traffic between the Gateways/Gatekeepers controlled by an IPCB.net Member either via ownership or via a partnership with the owner. Along with specifying other parameters, an IPCB.net Member using the Gate keeping Service assigns to a Route values specifying the details of both originating and terminating Gateways/Gatekeepers (IPCB.net, 2005).

## **SIP (Session Initiation Protocol)**

An application-layer control protocol, a signaling protocol for Internet Telephony. SIP can establish sessions for features such as audio/videoconferencing, interactive gaming, and call forwarding to be deployed over IP networks thus enabling service providers to integrate basic IP telephony services with Web, e-mail, and chat services. In addition to user authentication, redirect and registration services, SIP Server supports traditional telephony features such as personal mobility, time-of-day routing and call forwarding based on the geographical location of the person being called (IPCB.net, 2005).

## **TCP (Transmission Control Protocol)**

Connection-oriented transport layer protocol that provides reliable full-duplex data transmission. TCP is part of the TCP/IP protocol stack (IPCB.net, 2005).

## **UDP:**

UDP is a communications protocol that offers limited service for exchanging data in a network that uses the Internet Protocol (IP). UDP is an alternative to the Transmission Control Protocol (TCP) (IPCB.net, 2005).

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# 9. Appendix

## 9.1 Questionnaire design

### 9.1.1 Interview question

- 1. How many employees does your company have?
  - a) Less than 25.
  - b) 25-100
  - c) 101-250
  - d) 251-500
  - e) 501-1000
  - f) More than 1000.
  
- 2. Does your company have-
  - a) Single location.
  - b) Multiple locations in the same country.
  - c) International locations.
  
- 3. How long have you been using VoIP?
  - a) 6 to 12 months.
  - b) 1 to 2 years.
  - c) More than two years.
  
- 4. What does your VoIP implementation cover?
  - a) The whole company.
  - b) Some branches/ delegations.
  - c) Some departments.
  - d) Others- please specify. ....
  
- 5. In which category does your VoIP business model fall into?
  - a) Self provided consumer.
  - b) Independent of internet access.
  - c) Provided of broadband service provider.
  - d) Internal use of business Local Area Network (LAN), WAN.
  - e) Carrier internal use.



6. Rank the document according to the relevance of your business. What reasons make your company move to VoIP? (1-most relevant, 5- least relevant).

a) Lower cost of implementation than other system.

1                      2                      3                      4                      5

b) Maintenance savings than other system.

1                      2                      3                      4                      5

c) Cheap phone calls.

1                      2                      3                      4                      5

d) To simplify management of the network.

1                      2                      3                      4                      5

e) To simplify communication of the company.

1                      2                      3                      4                      5

f) To enhance flexible working in the company.

1                      2                      3                      4                      5

g) To increase competitiveness and productivity.

1                      2                      3                      4                      5

h) To improve customer service.

1                      2                      3                      4                      5

i)Other reason please specify .....

7. What features of VoIP does your company considers as the key improvement to the communication system. ( please tick at least three below).

a) Allows tele-working.

b) Convergence of voice, video and data.

c) Video conferencing.

d) Unified messaging.

e) Call cost reduction.

f) Maintenance cost reduction.

g) Reduction in adds/changes/moves cost.

h) Advanced call handling.

i) Others

specify.....

please

j)

8. Please tell us if you agree or disagree with the following statements.

a) More employees of the company work from home.

1.Strongly agree 2. Agree 3 Neutral 4. disagree 5 strongly disagree.

b) Moving to office to another building is easier.

1.Strongly agree 2. Agree 3 Neutral 4. disagree 5 strongly disagree.

c) Relocation to other company location is easier.

1.Strongly agree 2. Agree 3 Neutral 4. disagree 5 strongly disagree.

d) Telephone bills are cheaper.

1.Strongly agree 2. Agree 3 Neutral 4. disagree 5 strongly disagree.

e) The network is easily administered.

1.Strongly agree 2. Agree 3 Neutral 4. disagree 5 strongly disagree.

f) There is reduction in network cost.

1.Strongly agree 2. Agree 3 Neutral 4. disagree 5 strongly disagree.

g) The number of devices and voice mails used has been reduced.

1.Strongly agree 2. Agree 3 Neutral 4. disagree 5 strongly disagree.

h) VoIP phones enable me to accomplish my task more easily.

1.Strongly agree 2. Agree 3 Neutral 4. disagree 5 strongly disagree.

i)VoIP phones can significantly improve the customer service.

1.Strongly agree 2. Agree 3 Neutral 4. disagree 5 strongly disagree.

9. What are the main challenges that VoIP poses to your company?

a) Resistance to change.

b) VoIP security.

c) Try to guarantee quality of service.

d) Technical concerns.

e) Reliability and

f) Others please specify.....

10. Please rank the following examples.

a) VoIP phones can be attacked by the viruses-

1.Strongly agree 2. Agree 3 Neutral 4. disagree 5 strongly disagree.

b) VoIP phones crash and needs to be rebooted-

1.Strongly agree 2. Agree 3 Neutral 4. disagree 5 strongly disagree.

c) Conversations with VoIP outside the company can be intercepted-

1.Strongly agree 2. Agree 3 Neutral 4. disagree 5 strongly disagree.

d) VoIP phone calls can receive spam phone calls-

1.Strongly agree 2. Agree 3 Neutral 4. disagree 5 strongly disagree.

e) VoIP phone calls suffer a delay that makes communication difficult-

1.Strongly agree 2. Agree 3 Neutral 4. disagree 5 strongly disagree.

11. Which IT challenges considering VoIP was difficult to handle? How did you overcome the obstacles?

a) The implementation challenge.

b) The infrastructure challenge.

c) The technology challenge.

d) The security challenge.

e) The governance challenge.

12. How long was the training period of the employees for the new VoIP system?

a) Training period was steady depending upon the employee needs

b) Training period was short as the system was quite user friendly.

c) Training period was long as employees had inadequate knowledge regarding the new system.

d) There was no training period as the employees were given comprehensive user manual prior to the commencing of new VoIP.

13. Please tell me briefly about the impact on calls before and after implementing the VoIP?

### **9.1.2 Survey questions**

In order to assess the relative parameters associated to the implementation of VoIP the following questionnaire has been prepared and applies to call centre agents only.

#### **9.1.2.1 Section 1:**

1. State your position:
  2. Length of employment:
  3. State if you were in employment before VoIP was introduced: Yes/No
    - 3.1 If yes state if there has been change in the following: Yes/No
      - a) Call quality
      - b) Productivity/ Number of client handled per day
      - c) Operational procedures
  4. Have you been informed of the proposed changes to be brought: Yes/No
-

### 9.1.2.2 Section 2 (Quality of VoIP)

- 1) How happy are you with the sound quality of VoIP phones?
  - a) It's better than the traditional phone line.
  - b) It's worse than the traditional phone line.
  - c) It's as good as traditional phone line.
  - d) Too insignificant difference to determine.
- 2) How long did it take to get accustomed with the new VoIP system?
  - a) Two weeks
  - b) 30 days
  - c) More than 30 days
- 3) What is your satisfaction level of customer service using VoIP?
  - a) Very satisfied
  - b) Satisfied
  - c) Dissatisfied
  - d) Neutral
- 4) What do you think about the reliability of VoIP in the current system?
  - a) Reliable
  - b) Not reliable
  - c) Undecided
- 5) Select one of the following features that you think the best in VoIP?
  - a) Allows teleworking
  - b) Convergence of voice, video and data.
  - c) Video conferencing
  - d) Unified messaging
  - e) Advanced call handling.
- 6) Select one of the following weaknesses of VoIP that you think needs to be resolved in VoIP?
  - a) Sound quality
  - b) High maintenance.
  - c) Power failure.
  - d) Emergency number dialing.
- 7) Are you happy with the VoIP service system overall?
  - a) Yes
  - b) No.

- 8) Do you think VoIP will benefit the company?
- a) Yes
  - b) No.
- 9) Finally, which one is better system according to your opinion?
- a) PSTN
  - b) IP telephony
- 10) Any other comments about VoIP system?

### 9.3. Survey questions frequency table

**Q 1:** How happy are you with the sound quality of VoIP phones?

Total Cast	Answers	Frequency	Percentage	Cum Percentage
40	a) It's better than a traditional phone line.	20	50.00%	50.00%
	b) Its as good as traditional phone line.	2	5.00%	55.00%
	c) It's worse than a traditional phone line.(comparable to mobile phone)	6	15.00%	70.00%
	d) It's much worse than a traditional phone line.	0	0.00%	70.00%
	e) Too insignificance difference to determine.	12	30.00%	100.00%

**Q 2:** How long did it take to get accustomed with the new VoIP system?

Total Cast	Answers	Frequency	Percentage	Cum Percentage
40	a) 2 weeks	30	75.00%	75.00%
	b) Less than a month.	4	10.00%	85.00%
	c) More than a month.	6	15.00%	100.00%
	d) Others.....	0	0.00%	100.00%

**Q 33:** What is your satisfaction level of customer service using VoIP?

Total Cast	Answers	Frequency	Percentage	Cum Percentage
40	1.Very satisfied	21	52.50%	52.50%
	2.Satisfied	11	27.50%	80.00%
	3.Dissatisfied	6	15.00%	95.00%
	4.Neutral	2	5.00%	100.00%
	5. Other comments	0	0.00%	100.00%

**Q 4:** What do you think about the reliability of VoIP in the current system?

Total Cast	Answers	Frequency	Percentage	Cum Percentage
40	1.Reliable	28	70.00%	70.00%
	2.Neutral	8	20.00%	90.00%
	3. Not reliable	4	10.00%	100.00%

**Q 5 Which feature is the most impressive in VoIP?**

Total Cast	Answers	Frequency	Percentage	Cum Percentage
40	a) Allows teleworking	1	2.50%	2.50%
	b) Convergence of voice video and data	20	50.00%	52.50%
	c) Video conferencing	2	5.00%	57.50%
	d) Unified messaging	2	5.00%	62.50%
	e) Advanced call handling	15	37.50%	100.00%

**Q 6 What was the weakness of current system of VoIP?**

Total Cast	Answers	Frequency	Percentage	Cum Percentage
40	a) Sound quality was not to the expected level	34	85.00%	85.00%
	b) Power failure was a serious issue	6	15.00%	100.00%
	c) Emergency number dialing	0	0.00%	100.00%
	d) high maintenance	0	0.00%	100.00%
	e) others	0	0.00%	100.00%

**Q7 Are you happy with the VoIP system overall?**

Total Cast	Answers	Frequency	Percentage	Cum Percentage
40	1. Yes	32	80.00%	80.00%
	2. No	1	2.50%	82.50%
	3. Neutral	7	17.50%	100.00%

**Q8 Do you think that VoIP will benefit the company?**

Total Cast	Answers	Frequency	Percentage	Cum Percentage
40	1. Yes	40	100.00%	100.00%
	2. No	0	0.00%	100.00%

**Q 9: Finally which one is better system according to your opinion?**

Total Cast	Answers	Frequency	Percentage	Cum Percentage
40	a) PSTN	3	7.50%	7.50%
	b) IP Telephony.	37	92.50%	100.00%



**9.4 Ethics clearance form    *is not included in this version of the thesis***

## 9.5 Letter of Consent

[The Participant]

14 November 2006

Dear participants,

I am writing this letter to inform you seek your willingness to participate in research study which aims to assess the impact of implementation of VoIP in call centre industry. The proposed research may assist private and business sector to make educated choices of decision when implementing full or partial implementation of VoIP system within the organization.

The proposed research is significant as no previous studies have been conducted in Western Australia on the effect of adopting VoIP in call centres. The proposed research will also contribute to the general knowledge of the adoption of the new technologies within an industry context. Further, the proposed study may provide some insight into whether VoIP is becoming a feasible replacement for traditional telephony system. Findings from the study may also provide a valuable info on how VoIP can be implemented in other contexts

Any data collected will be stored in a secure encrypted format and will not be used for any purposes other than the conduct of this research. Confidentiality of data will be maintained at all times and will not be used to identify your organization or employees within the organization.

Should you have any queries regarding this research please contact me on 0 [redacted] [phone] or e-mail me on [redacted] u or my supervisor Dr Leisa Armstrong on [redacted] or email on [redacted]

Yours sincerely

Moniruzzoha syed

BSc (hons) student

School of Computer and Information Science.

Edith Cowan University