Full Length Research Paper

Voice over internet protocol (VoIP) as a communications tool in South African business

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Internationally many businesses have implemented Voice over Internet Protocol (VoIP) as an alternative to the traditional plain old telephone system (POTS). The increased functionality of VoIP offers many benefits, including the enhancement of a client's shopping experience, effective utilisation of staff, and possible cost savings. Business management may be able to gain a competitive advantage by utilising the advantages that VoIP holds, but there are a number of risks to be considered and mitigated. Managing these risks is ultimately management's responsibility. Risks include amongst others eavesdropping or hijacking of calls, and balancing quality of service with security control implementation and costs. This article investigates the use of VoIP compared to POTS as a communications tool in the South African business environment. The article includes a literature review of the topic, an explanation of the basic concept of VoIP, and the identification of major advantages and risks. The article aims to provide management with insight into what VoIP is what possible benefits it could hold for their business, and what the risks are. It is hoped that this article will serve as a tool in the decision-making process by consolidating data that is currently available.

Key words: Voice over Internet protocol (VoIP), plain old telephone system (POTS), communication, risks, business in South Africa.

INTRODUCTION

In business, it is management's task to combine, allocate, coordinate and deploy resources or inputs in such a way that the organisation's goals are achieved as productively as possible (Smit and Cronje, 1997). In a business these resources are classified as financial, human, physical and information resources. The latter is fast becoming one of the most important resources.

The quality of the information resource, which consists of processed or organised data, can also contribute to providing a business with a substantial competitive advantage (Stair and Reynolds, 2008). Business is currently functioning in the information era, in which quality of information can prove to be the difference between a successful and an unsuccessful business. Factors contributing to the quality of information have therefore become

increasingly important. Accuracy, relevance, timeliness and completeness are, among other things, characteristics of good quality information. One of the most important characteristics of good quality information is that it is communicated to the relevant user before it can be regarded as valuable or useful (Wessels et al., 2005). Communication can be described as the process by which information is made available to other users (Wessels et al., 2005), while telecommunications is the digital transmission of information or data from one widely in terms of sophistication and function. Basic methods of communication include telephones and fax point to another (Oz, 2006). Communication varies machines, while newer and more technologically advanced methods would in-clude voice over internet protocol (VoIP).

VoIP and POTS differ significantly, resulting in each having distinct advantages and disadvantages. Telephone systems connect two users via an analogue communication line by reserving the line or connection of lines for the two users as long as they are engaged with the call. VoIP does not require a reserved line to facilitate

communication. The technology converts voice to binary code, which is stored and transferred in packets. These packets are then transferred together with thousands of other data packets on an existing network communication line (Tyson and Valdes, 2004; Uys, 2007).

The liberalisation of the Telecommunications Act in South Africa in February 2005 allowed value-added network services to carry voice using any protocol (Department of Communications, 2004), hereby legalising the use of VoIP. The technology is therefore relatively new to the South African environment and not much is known about the associated advantages and risks. VoIP has been used by businesses all over the world for a number of years and certain risks have been identified as a result of the use of this technologically advanced tool. Utilising VoIP may contribute to the increase of the productive use of business resources and more effective management in business. However, this technology may also pose increased business risk when employed without proper consideration of the risks involved.

The objective of this article is to examine some of the advantages and risks that VoIP holds for businesses in a South African environment when implemented as a tool to communicate quality information. It does not include a highly technical explanation of transferring voice over networks. It will not provide an extensive list of all the advantages and risks that the implementation and use of VoIP could have, but aims to make managers of businesses in South Africa aware of its uses and risks by studying the results of the implementation of VoIP in businesses in other countries.

Research methodology

Research for this article was done by means of a literature study. The literature review aims to provide business management with a review of the risks and advantages of VoIP in other countries, with the possible application of this understanding for business in South Africa.

The literature review included a study of published and internet articles, books and literature on the management of information systems.

Definition

Traditional telephone systems use analogue signals (that is, sound waves), which are carried by a transmission medium from a transmitter to the receiver. Sound waves are carried from one telephone to another via telephone lines. This process has evolved to the translation of analogue signals into digital signals (that is, bits and bytes), which can be transferred over computer networks. Sound can therefore be transferred from one computer to another via a data channel that exists between the two points (Wikipedia, 2007a; Werbach, 2005). Data channels are the links that connect the sender to the receiver in a data communication network. In a local area network it could be a fixed line, such as copper wiring, coaxial cables or fibre optic

cables. Wireless communication, which makes use of electromagnetic waves instead of a form of copper or optical wiring, also exists.

Internet telephony, or VoIP, is the term used to describe the process of transferring voice via the information systems network (this could include the Internet). The set of rules that facilitates the process of transmission and receipt of the digital signals is a protocol known as VoIP.

VoIP can be used as an alternative to POTS, thereby changing the face of traditional telecommunications. The process has already begun as providers of traditional telephone communications have incorporated VoIP as a part of their existing process. Where voice was traditionally carried over miles of telephone cabling across the country, it is now translated into digital packets at a certain point, transferred over the Internet and at some point translated back to analogue signals, which are then relayed in the traditional way over the last phase.

Research conducted by Cox (2004) indicated that there are four different types of VoIP, namely:

i.) Self-provided - mainly used by residential users. This uses software such as Skype, which is installed on a computer and allows free PC-to-PC calls. The only hardware a user requires is a soundcard and speakers, which are included as standard features on most PCs today, together with a microphone. A user can add additional features, such as a webcam, which will allow him/her to make video calls.

ii.) IP telephony (independent of an internet service provider) can be used to make PC or Internet telephone calls to POTS. Vonage and Net2Phone are examples of non-South African suppliers.

iii.) IP Telephony (dependent on an internet service provider) can also be used to make PC or Internet tele-phone calls to POTS via broadband access.

iv.) Business LAN (local area network) or WAN (wide area network) services, where POTS is replaced by a network solution.

Research conducted by Tobin and Bidoli (2006) using semi-structured interviews with key business users of VoIP in the South African Industry, indicated that self-provided VoIP products were popular for home use, but not of a high enough quality for business use. Technological advanced products with greater reliability and quality are needed to make VoIP suitable for use in a business environment. According to Werbach (2005), the most successful business implementations concentrated on two factors. Firstly, the implementation of the new technology benefited business objectives. Cost saving was not a primary objective. Instead, businesses used the advantages that VoIP offers over POTS to benefit their business and increase their competitive advantage. The second factor that successful adopters of the technology focused on was that they viewed everyone in their organisations as a resource, and implementing VoIP meant accessing those resources.

The major advantages and disadvantages of VoIP arise because of the differences between POTS and VoIP. In the next two sections, the benefits and risks of the use of VoIP in business will be considered, with specific reference to the South African environment.

Advantages of using VoIP

The main advantages of using VoIP are the result of the non-reservation of lines for communication purposes and the transmission of packets of data along with other data packets on the data network. This translates into cost savings and effective network utilisation, which can result in further benefits due to the digitisation of the process.

Cost savings on telephone calls

Most international suppliers of POTS split a monthly rental into a fixed rental and call charges, where long distance calls cost more than short distance calls. Overseas suppliers of VoIP, however tend to charge a flat monthly fee, because of the advantage resulting from packet switching and the non-reservation of lines, which results in long-distance transfer of data over the Internet being essentially free (Oz, 2004). An example of this is the Virgin Entertainment Group, which replaced all the POTS with VoIP networks. This resulted in cost savings of up to $700 000 per year on long distance calls alone (King, 2006).

In the South African environment, companies such as Choice Technologies install VoIP systems with technology of the business' choice, with varying prices. Brown (2007) stated that the monthly fees remain the regular fee charges for the data network. As long as calls are made between business networks (LAN or WAN), the calls are free, but as soon as a POTS telephone or cellular telephone is called, Telkom or cellular rates apply. These VoIP-to- POTS charges are reportedly lower than the charges for POTS-to-POTS or POTS-to-cellular calls.

To provide a South African example, the Department of Minerals and Energy upgraded to VoIP in 2005. The department is using IP telephony across its LAN and WANs, which resulted in large cost savings on intra-company calls (Choice Technologies press release on IT Web, 2005).

Effective utilisation of network capacity

Another major advantage of using VoIP is that a business can make use of underutilised network capacity while incurring minimal additional costs (Wikipedia, 2007b). The South African Department of Minerals and Energy reported a decrease in network operating cost in terms of repairs and maintenance because voice and data use the same network (Choice Technologies press release on IT Web, 2005).

Additional facilities and features

VoIP software offers more capabilities than a standard telephone line. Many VoIP packages include messaging, conference call facilities, video calling, caller identification, which might come at an additional cost when using POTS, if these facilities are available at all.

VoIP packages also include the transfer of data files during telephone conversations, which open up a range of new possibilities (Wikipedia, 2007b; Werbach, 2005).

The replacement of POTS with VoIP systems at Virgin Entertainment Group, allowed the company to use the additional facilities to stream digitised content, in their case music, video files and games, to any kiosk in Virgin stores to facilitate customers' buying experience (King, 2006). Thus, depending on the type of business, the different facilities or features can be employed to improve or enhance business and customer service.

Another digitised advantage presents itself where users can indicate whether they are available on the net-work or not, which saves time for the person looking for them, because before the caller picks up the handset to dial the required number, he or she can assess the user's availability (King, 2006; Werbach, 2005). If a user is unavailable, calls can still be made via the business' network to the user's cellular telephone if it is connected to the wireless business network as an internal (free of charge) call, provided the user has VoIP and wireless capabilities on his or her cellular telephone.

VoIP is not limited to a direct facility or location

Whereas the traditional telephone system limits users to a certain geographical range, VoIP opens the possibilities to users working from other locations on the same network. Businesses can allow employees to work from home or any other location and still have their office telephone calls delivered to them directly. This creates the possibility of home-based call centres, and companies can save on the overheads of setting up and running a call centre (King, 2006). Travelling employees retain access to all their VoIP facilities as long as they have access to the Internet or the company's WAN (Wikipedia, 2007b; Werbach, 2005). This leads to further cost savings when workers move desks. With POTS, a technician is required to move telephone lines, but with VoIP a user can simply plug the VoIP phone in at the new location and the trans-fer is complete (King, 2006; Werbach, 2005). Businesses can also make use of mobile handsets, which allow wor-kers that often have to leave their desks to re-main avail-able through wireless networks in the business (King, 2006; Werbach, 2005). This ensures that workers are al-ways avail-able, allowing them to deal better with new situations that arise, as new information reaches them faster. This re-sults in greater productivity.

Compatibility of VoIP and other applications

VoIP can also integrate with other computer applications,

hereby aiding user productivity and effectiveness. Businesses can use the VoIP software to inform users about company information, weather reports and flight schedules, deli-ver video surveillance and a host of other options, depen-ding on the type of business (Meall, 2006; Werbach, 2005).

Centralisation of network controls

Business can control both the data network and the voice network as a single area of control (Meall, 2006). The same types of controls that were previously used to control the data network can now be expanded to control the voice network.

Call history is automatically maintained

In a similar manner to which e-mails are saved, VoIP calls can be saved together with relevant previous history, which simplifies record-keeping of calls (Meall, 20-06; Werbach, 2005).

Speech recognition advantages

Some VoIP packages include speech recognition, which enable a user to dial another user by speaking a name. This will further enhance and increase productivity (Meall, 2006) and create opportunities for disabled users to use tele-communications effectively.

Major risks of using VoIP

Major risks of introducing VoIP in a business environment go hand in hand with risks associated with data networks, hacking, protecting confidential information, the reliability of the system and others listed below. Risks will be classified under the following headings:

i.) Developmental issues
ii.) Operational aspects
iii.) Intrusion risk
iv.) Environmental risks

Developmental issues

Project management risk: Project risk must be properly managed. This involves proper planning and execution either of the change-over from POTS to VoIP or, in case of a new implementation, the installation of VoIP to data networks. Standard and specifically developed solutions: VoIP software packages vary widely in terms of security features (Audin, 2007a). A software solution with proper security features may be incompatible with the current operating system or other types of software that would need to be integrated in order to gain maximum operability of the VoIP solution.

Operational aspects

Quality of service (QoS): Since POTS has been around for a great number of years, it has resolved most of its quality issues. VoIP is in its infancy and certain qualitative issues are still in being resolved, for example those that cause jitter, delays or packet losses. These issues are the result of congested networks and the use of inappropriate equipment (Wikipedia, 2007b; Audin, 2007c).

Reliability of service or business continuity: POTS is usually unaffected by power failures, whereas VoIP is connected to regular computer networks, which are adversely affected by power outages) (Wikipedia, 2007b; Audin, 2007c) . In South Africa, it is not uncommon for businesses to experience loss of power due to the 2008 electricity crisis in South Africa. It can be mitigated if the computer network is backed up with the uninterruptible power supply. POTS systems that operate by switch-board also experience a breakdown in POTS when power outages occur.

Cost of hardware: Hardware needed in the installation and use of VoIP, for example Internet Protocol (IP) telephones and other specialised equipment needed to run a VoIP system, is still in its early phases. At this stage the relatively high cost of migrating to or implementing a VoIP system might deter rather than motivate businesses to initiate such a project. A careful consideration of costs and benefits, both qualitative and quantitative, must be made in order to reach an informed decision. Vulnerability of business continuity due to combined voice and data network systems: Since voice and data would both use the business's computer network to run, the network would be more vulnerable to for example denial of service attacks, viruses and worms amongst others. Special precautions would have to be taken to avoid these attacks, since the disabling of the network would prevent both voice and data transfers from taking place (King, 2006).

Network requirements: Kaven (2006) reported that when transferring from POTS to VoIP, a business has to have spare bandwidth on the existing data network to accommodate the additional voice traffic. It is advisable to employ an expert to assist the business in assessing the spare capacity, due to the technical issues of transferring data via LANs and WANs, whether the business uses a virtual private network or any combination of these. Spare capacity on network hardware, for example routers and gateways, must be taken into account. It may be necessary to direct voice traffic over a more secure network than the current data network.

Intrusion risk

Hijacking a valid VoIP subscription and following communications and eavesdropping on valid VoIP communications: Two attacks on VoIP, documented by Thermos, identified the main risks associated with the use of VoIP. One attack describes the ability to use a VoIP subscription and following communications, the other involves eavesdropping. During such a hijacking attack, a hacker disables a valid user's registration and replaces that with his

Table 1. Summary of risks and benefits.

Major advantages	Major risks of using VoIP
• Cost savings on telephone calls.	• Developmental issues; project management risk, standard and specifically developed solutions.
• Effective utilisation of network capacity.	• Operational aspects; quality of service, reliability of service or business continuity, cost of hardware, vulnerability of business, continuity due to combined voice and data network systems, network requirements.
• Additional facilities and features.	
• VoIP is not limited to a direct facility or location.	
• Compatibility of VoIP and other applications.	• Intrusion risk; hijacking a valid VoIP subscription and following communications and eavesdropping on valid VoIP communications, SPIT (spam over internet telephony).
• Centralisation of network controls.	
• Call history is automatically maintained.	• Environmental risks; possible international legal issues, overall bandwidth availability in South Africa
• Speech recognition advantages	

own. This enables him to make fraudulent calls or redirect communications (Thermos, 2006). During eavesdropping hackers capture data packets travelling from one user to another and decode the data packets, which are then reassembled into the proper voice communication (Thermos, 2006). Some VoIP solutions provide encryption and authentication, but these are not yet widely available.

SPIT (Spam over internet telephony): It is widely acknowledged that spam, or electronic junk mail, costs businesses large sums of money in terms of workforce productivity. Audin (2007d) reached a similar conclusion regarding spam via Internet Telephony, known as SPIT. SPIT causes additional traffic on a network, and uses network capacity in terms of storage space when SPIT is saved in a mailbox. This causes a further loss of productivity when an employee has to listen to the message to determine whether it is a junk voice mail item or not. Network capacity is also wasted on the transfer of the packet, which occupies bandwidth that would otherwise have been used in the transfer of valid and relevant messages.

Environmental risks

International legal issues: VoIP was legalised in South Africa fairly recently (2005), which implies that many other countries are likely to still have laws prohibiting the transfer of voice over data lines or the Internet. Communicating with countries that have not legalised VoIP may

cause additional telephonic costs which businesses might not have budgeted for (Wikipedia, 2007b).

Overall bandwidth availability in South Africa: The SAT-3 cable connecting Portugal and Spain to South Africa, linking many West African countries along the way, continues past South Africa to provide a path to Asia. It is a high-performance optical fibre cable that runs along the bottom of the sea and is the only optical fibre link between West Africa and the rest of the world. It is owned by a consortium of operators, with Telkom having the South African monopoly. As a result of this monopoly, prices are high, reportedly about fifty times more than rates quoted by United States service providers for bits per second. Monopolies were reported to have expired in June 2007, when new license agreements were able to be negotiated (Wikipedia, 2007c) . Reports also indicate that there is a 3GB (gigabyte) "bandwidth gap" for users, which means that a user can only utilise 3GB of bandwidth per month. Users who use more than this are allocated a much slower connection speed, which can lead to a lot of frustration (RSAWeb News, 2005). Should a network's voice and date bandwidth requirements exceed this limitation, costs will be increased and network speed

will be compromised. Summary of risks and benefits are shown in Table 1.

Conclusion

This literature study was performed to inform business managers about the advantages and risks of implementing voice over internet protocol as an alternative to the plain old telephone system (POTS), specifically in South Africa. It aims to provide a non-technical guide to assist businesses and managers in evaluating the business tele-communication options available today.

VoIP is a new technology that can be successfully applied in a business environment in South Africa to gain a competitive advantage over rivals. However, the adoption of any new technology involves a certain amount of risk. Costs and benefits must be taken into account, by minimising residual risk to an acceptable level without the loss of quality. Evaluating risk and managing security is a continuous process: as security evolves, so does risk, and balancing the two is an ever-present task (Audin, 2007b).

In spite of the potential risks, VoIP is a new technology and its use may increase exponentially in global markets in the next few years. It would seem that the trend in informed decisions is moving from whether to implement VoIP, to when and how to implement and secure VoIP (Raitt, 2004; Meall, 2006; Senia, 2006). The factors highlighted in this article, relating to benefits as well as risks, will aid in the decision-making process of a business. Future research on the topic may include an investigation into actual implementation of VoIP in a South African case study stating which benefits were taken advantages of and investigating how risks were mitigated.

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