UNIVERSITI TEKNOLOGI MARA

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Year 2011 ISSN 1985-9937

Organizational Study on Voice Over Internet Protocol (VoIP) in Universiti Teknologi Mara (UiTM) Shah Alam

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ABSTRACT

Voice over Internet Protocol (VoIP) becomes popular communication solution. A great evolution on Internet technology has brought up this technology to emerge and expand since it uses data network to transmit voice from sender to receiver which means voice and data travel using a single medium. By upgrading existing PBX to IP PBX, it makes VoIP to easily blend into existing communication technology. VoIP services widely used in United States, European and Asian countries. Informal observation and interviews discovered several organizations in Malaysia have already used VoIP. Therefore, it is a matter of time to UiTM to use this technology as a major communication medium. With almost 27 campuses nationwide, communicate through PSTN, at the same time subscribing such a huge amount of Internet bandwidth, there are opportunities for UiTM to replace PSTN as its major communication medium or at least allowing these two technologies to work together. The reason VoIP can be a great option is because it promotes cost effective in communication especially organization such as UiTM that have many branches.

Keyword: *VoIP, Next Generation Network, Feasibility*

Introduction

The Public Switched Telephone Network (PSTN) has been evolving ever since Alexander Graham Bell made the first voice transmission over wire in 1876. In traditional telephones, devices are limited to communicating with those devices, which are connected directly, and the telephony companies and their protocols must handle all location and routing features. PSTN uses circuit networks (Jonathan and James, 2000).

Today's PSTN provides users with dedicated end-to-end circuit connections for the duration of each call. The PSTN served voice traffic well over the last 100 years, but it success has been paralleled by the rise of separate network to support data traffic (Chong and Matthews, 2004).

As more and more PSTN traffic becomes data-oriented, the trend towards voice and data convergence becomes stronger and here, convergence played a major role in the move towards VoIP.

Living in the world today, we have to grasp all the technologies that exist and implement within our daily work and lives. The global evolution of the internet and the wide spread growth of networks have been made the internet part of our everyday life. Voice over Internet Protocol (VoIP) is one of the fastest growing communication technologies that have been implemented by some organizations which are interested in transmitting their voice communication over the IP network. VoIP is a technology that allows people to make a telephone call using the internet rather than using the traditional over privately managed IP-based networks, the internet, PC-to-PC, PC-to-phone, phone-to-phone and peer-to-peer communications (Castello and Lassman, 2004).

The main objective of this research is to inspect the existing advantages and limitations of Public Switched Telephone Network (PSTN) and data network usage in UiTM.

Voice over Internet Protocol (VoIP)

The VoIP technology would be a key enabler for growth and service delivery in the former case. VoIP is one of nowadays fast growing technologies. There are increasing interests among organizations to transmit their voice communication over IP network. Over the past decade, organizations have been investing in IP-based networks for data communication, such as email, intranet and internet use. With the emergence of IP telephony (IPT), there is a greater interest in transmitting voice over IP networks (Venkatesh and Davis, 2000).

A decade after the first commercial VoIP services were launched, the technology is on the verge of entering the mainstream. It refers to several forms of IP packetized voice transmission over privately managed IP-based networks, the internet, PC-to-PC, PC-to-phone, phone-to-phone and peer-to-peer communications (Castello and Lassman, 2004).

VoIP is the IP packetization of voice. Voice will be transporting on the data networks itself which was generated by the normal telephone or the IPT with a certain conditions. The normal telephone has to be connected to a device within the telephone network and will convert the voice from the analogue form into the digitised form, called gateway. Meanwhile, the IPT just connected to the IP network.

How VoIP Works?

As a new technology, VoIP allows the people to make telephone calls using the data network such as the internet, rather than using the conventional analogue telephone lines. Refer to Figure 2.1 below. VoIP works by converting traditional analogue voice signals into digital signals which can be transported over digital data networks (FCC, 2005). The VoIP, also called IPT offers a new type of service that uses the IP, intranets and extranets to deliver voice information. This distinction results in differences in implementation, quality of service (QoS) and the operating costs (Runsheng and Xiaorui, 2004).

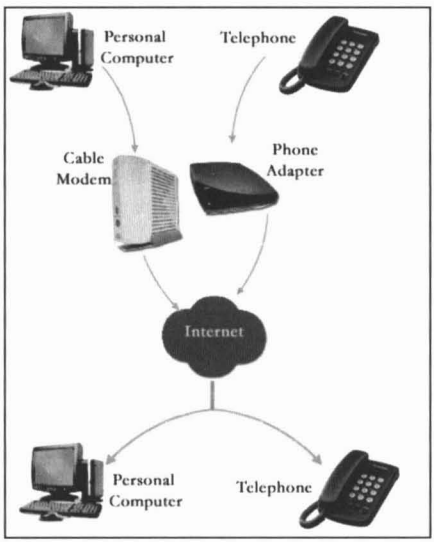

Figure 1: How VoIP Works

Voice data is digitized, compressed, packetized and sent over the internet to a receiving computer, which reverses the process (Dvorak, 2000). The ability to transmit voice over the IP network may have the important implications for technology managers. For example, an e-Commerce manager may wish to provide Web consumers with the ability to talk directly over the network with customer services they surf the website.

Differences between PSTN and VoIP

For a better understanding, Table 1 below shows the detail differences between PSTN and VoIP.

Table 1: Differences between PSTN and VoIP

PSTN	VoIP
Circuit-switching technology	Packet-switching technology
Uses synchrounous time-division multiplexing (TDM) in transmission, resulting in lower channel utilization	Uses asynchronous TDM in transmission, resulting in higher channel utilization
When network congestion occurs, call will be blocked, but once call connection is established, the voice signal will not be lost	When network congestion occurs, calls can be blocked or IP packets can be lost, resulting in reduced voice quality
Uses G.711 Pulse Code Modulation (PCM) voice-encoding scheme without compression and achieves a transmission speed of 64Kbps	Usually uses voice-compression encoding, with the bit rate of encoded voice data ranging from as high as 16Kbps to as low as 5.3Kbps
Short end-to-end transfer delay except in satellite communications and limited delay variation	Relatively long end-to-end transfer delay and significantly delay variation
Guaranteed good voice quality	Voice quality affected significantly by the IP network's quality of service; absent specific measures, voice quality cannot be guaranteed
Given the separate network built to provide telephone services, reducing operational costs is difficult	Sharing network resources by combining with data and other multimedia services on the same IP network helps reduce operational costs

(Source: Runsheng and Xiaorui, 2004)

According to Robin Garries (2005), Nemertes Chief Research Officer, until around 2005, organizations that implemented VoIP did proved the VOIP perceived cost savings over traditional telephony, which in many cases, they did find the substantial savings by:

i. Eliminating costly third-party contracts for moves, additional and changes hardware and software
ii. Reducing the amount of cabling required in new buildings
iii. Leveraging idle capacity in their data network

Even though VoIP offers benefits to users, there are still have issues that must be considered and well taken care of. It offers cheap phone call cost but the quality is not guaranteed as good as PSTN because it depends on current traffic of data network. However, people always attracted to something that offers less cost with acceptable services. That would drive VoIP to continue its growth in the future.

VoIP Benefits

VoIP offers many potential benefits, including reduced costs, new features and converged networks. A lot of industry excitement has been generated about the potential cost of savings, the new calling features and the reduced infrastructure of converged networks in a VoIP implementation. Figure 2 below shows the summary of VoIP benefits.

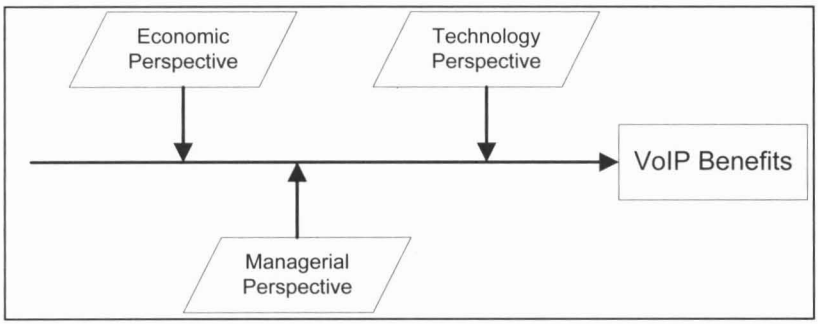

Figure 2: Summary of VoIP's Benefits

Economic Perspective

The main reasons why the VoIP calls are free is in VoIP deployment, the organization will own their IP network or paying for the Internet Service Provider (ISP) for the bandwidth instead of the infrastructures itself, therefore the VoIP calls should be free because of in IP network, the calling distance does not matter. The price advantage alone remains attractive enough to draw customers to VoIP phone services (Runsheng and Xiaorui, 2004). To date, cost reduction has been the primary driver of enterprise VoIP.

As a result, they are more accepting of VoIP's hidden costs such as consulting, training and ongoing maintenance. The initial benefit was the perception of free telephone callings over the internet.

Managerial Perspective

Cronin (2005) had discussed in his speech about the failure of VoIP's switch. As proven by him, after the terrorist attack on the Twin Towers September 11th 2001, it is reported that the PBX systems were offline but the VoIP networks stayed up (Broersma, 2004), since the IP-based networks are more resilient and fault-tolerant (Cronin, 2005). The disaster recovery advantages of VoIP networks are largely due to:

i. greater flexibility in network architecture
ii. the flexibility to be able to connect the IPT to any internet connections
iii. the relatively low cost of additional hardware for redundancy

Another benefits form the VoIP implementation involve savings due to productivity improvements in IT operations. In PSTN, an organization will need a group of staff to handle the voice network and another group is to manage the data network. With the convergence of infrastructure which VoIP support for the merging job, it may be feasible to reduce the staff required to support and manage the infrastructures. However, these savings may come with high initial cost for training (Walker and Hicks, 2002). VoIP requires a significant training for the data group to learn telecom skills or for the voice group to learn data networking skills.

Technology Perspective

A project conducted at Westminster College, Salt Lake City, USA, in 2002 which a feasibility study was outlined in order to replace an outdated phone system with VoIP. The top management views the project as a strong success at the final implementation because they see a huge saving in maintenance and repair and have extra money to spend on new and upcoming technology, since the two separates budget lines for data and voice had been combined into one account (Allred, et.al, 2002).

The main challenge is VoIP's extreme sensitivity to delay and packet loss compared with other network applications such as web and e-mail services. Therefore, by utilizing existing infrastructures, the migration of voice onto a common network with data raises hopes of increased efficiencies and reduced expenditures (Werbach, 2005; Sass, 2006).

Factors Contribute VoIP Implementation in UiTM

Based on current implementation in other countries and existing network infrastructure ownd by UiTM, there are four factors that will drive VoIP to be implemented in UiTM. Figure 3 below depicted the four factors.

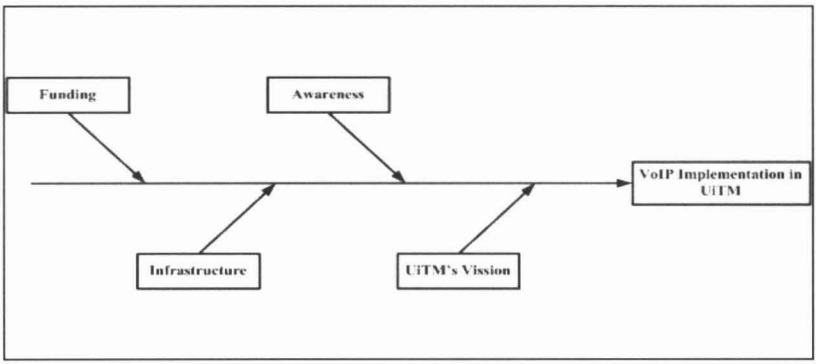

Figure 3: Four Factors That Will Drive VoIP

UiTM's Vision

This is the factor defined by authors which related to UiTM as a whole. UiTM is a higher education institute that aims to become a world class university in the future. Its uniqueness among other higher institutes in Malaysia has driven this university to adapt technology changes that enable in reaching its targets. Recently, several MoUs with top class universities in United States, United Kingdom and China required advanced communication technology to share researches, enable knowledge sharing, enable communication among expertise, and many other things.

Awareness

According to interview with two internal representatives (CIIS and Telecommunication Unit), the emerging and maturity of VoIP technology has created awareness to both units. Millions of money spent every year for two services, the data network and telephone calls. Since VoIP allows voice to transmit over the data network, therefore UiTM able to reduce the costs because the two services able to share the same infrastructure.

Infrastructure

Data network infrastructure has been upgraded from time to time to fulfill needs of UiTM. Started from COINS, later IP VPN and currently Metro-E technology, this university realized what it needs to provide and deliver better services to its customer (students) and to its business partners including among higher education institutes. The Metro-E technology allows data and voice ride together over the data network. Specific amount of bandwidth can be allocated to voice while the rest is for data. The good thing is, it can be dynamically controlled and changed depends on traffic condition.

Funding

Commitment and support from top management open wide opportunities for this university to grow bigger and offer better services including variety of academic programmes. Besides, by having this kind of technology, it opens to a lot of researches in data communication and networking area. Private sectors who involve in this area could have a lot of benefits by creating research center and development with this university. Since UiTM already has VoIP-supported network infrastructure and good support from top management in terms of financial, it could attract private sectors to invest more to this technology.

VoIP SWOT Analysis

The move from traditional phone services to VoIP services is not a minor tactical decision, but it is a strategic decision which needs the board management to addresses the effect before and after deployment the VoIP technology for a long term and a proper representation from all area and department within the organizations. Despite its compelling benefits, the decision should not be made lightly. Table 2 below shows the SWOT of VoIP as a reference for any organization that wants to implement the VoIP service:

Research Design

The data collections are very important and compulsory in this research, as it has been emphasized also in the General Problems Solving Model. Yin (2003) stated, the six most commonly sued sources for data collection in case study are documentation, archival records, interviews,

direct observations, participant observation and physical artifacts. In this research, documentation, interviews and direct observation are considered valuable evidence to obtain such an important and confidential data. Data can be categorized into two types: Primary Data and Secondary Data.

Table 2: SWOT Analysis for VoIP*(Source: Lee, 2004)*

Benefits	**Costs**
• Reduce cost of managing a separate telecommunication infrastructure • Reduce architectural complexity (decrease in communication nodes) • Replace mix-and-match telecom systems with a consistent and standardized data infrastructure • Improve telecommunication reporting due to standardization • Reduce cost of telecommunication organization • Reduce cost of MAC • Improves employees productivity • Reduce cost of internal and external calls	• Customer premise equipment and depreciation • Write-off for existing phone system • VoIP applications and desktop hardware • Network, LAN and WAN upgrades • Data center upgrades, including considerations such as power, floor space and air conditioning • Contract for external managed network • Change management for integrating telecommunication department into IT department • System integration services and migration costs • Training
Risks	**Opportunities**
• Voice and data rely on one network • Security holes • Disruptions from viruses, worms and other attacks • Introduction of VoIP regulations and fees • Turf battles between IT and telecommunication department • Interoperability between VoIP and legacy equipments • Changes in taxable status of VoIP calls	• Create competitiveness • Improve process exploiting VoIP functionality • Raise quality of internal and external communication • Improve governance through standardization especially in sharing services • Tap new features improve productivity and competitiveness

Primary Data

Several interviews have been conducted with the related respondents regarding on this research in order to obtain such an important data. The interview will be performed by asking the respondents a several questions or giving them the set of questionnaire. The data are collected from different view of entities or organization that are providing the VoIP services and also from the end user. The respondents are:

i. UiTM as the main entity for this research
ii. TM as the telecommunication service provider
iii. VADS, Cisco System and D-Link as the VoIP product services

Each interview that had been conducted associates with expert people who are giving their opinions, ideas, suggestions and recommendations regarding deploying the VoIP in UiTM.

Findings: SWOT Analysis of VoIP implementation in UiTM

A SWOT analysis regarding on the ideas of migrating to the VoIP technology in UiTM has been produced, finding from the interview and observation that have been made frm the UiTM respondents. The SWOT analysis represent the "Strengths" of current infrastructures and the management, the "Weakness" and limitations which might have and occur in the current situations, the "Opportunities" UiTM will gain if they implement the VoIP technology and the "Threats" might occur before and after the implementation. Table 3 below shows the summary of SWOT analysis in UiTM on VoIP implementation.

Table 3: SWOT Analysis for UiTM on VoIP Implementation

Strengths	Weakness
• Awareness among the employees • UiTM have many second power generator or backup power • Centralized data center in UiTM Shah Alam • Supports from the UiTM's top management and the government itself • Current network backbone and speed can support the VoIP services • Strong customer services • Knowledge and dedicated employees • Current hardware supported the evolving standards • Stable financial • Skilful and certified technicians on data network. • Strong initiative.	• Infrastructure readiness in terms of reliable and technical concerns • Separate department made difficulties to communicate and relate each other • Quality of services • Current electricity is not enough to support the current infrastructure • Deal with mix vendor; proprietary and open source system • Current bandwidth not enough to support data network, especially during the open semester • Interoperability between the current hardware and new hardware • Lack of skillful staffs on managing the software on PABX systems • The designation of network coverage for VoIP • Difficulties in wiring and cabling at the old placed the PABX
Opportunities	**Threats**
• Current PSTN architecture and infrastructure can be extended and upgraded • PSTN can still be used as a backup phone communication • UiTM can own their technologies • Establish a special unit for maintaining the VoIP phone services • Can develop an expertise on VoIP phone services • Increase the competitiveness among other universities • Current network architecture are scalable	• Staffs are more preferred the quality of PSTN than the VoIP services • Risks may occur during the implementation and usage phase • The potential number of user increase may affect the voice quality • Expandability of hardware • Employees resistance to change • Quality of services • Internal organization structures • Early implementation problems of VoIP • Hidden costs • Political and regulatory • No policies of the internet usage among the students • The mindset of employees on the low QoS on VoIP services

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