

INDUSTRY REPORT 2007  
Volume 3

# IP Telephony

## About the Cover

*The Kuda Kepang is a highly-spirited traditional dance performance from Malaysia's southern state of Johor. Usually performed by nine dancers sitting astride two-dimensional horses, the dance forges the image of great determination with stories of historical and victorious battles told in various vigorous yet graceful movements. The Kuda Kepang image is set against the background of the Istana Budaya, the icon of Malaysian traditional performances and regarded as among the 10 most sophisticated theatres in the world. Much like the dance, the SKMM identifies and weaves the spirit, synergy and story depicted by the Kuda Kepang and the grandiose of the Istana Budaya with our own commitment in bringing about the progressive development of the communications and multimedia industry.*

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# FOREWORD

On behalf of the Suruhanjaya Komunikasi dan Multimedia Malaysia (SKMM), it is my pleasure to present to our readers the Report on IP Telephony.

This report provides a bird's eye view of and discussion on IP Telephony development from PC to PSTN to Next Generation networks orientation, including vendor market, service providers as well as user markets. The scope of issues covered are a comparative of IP Telephony service status across selected countries in terms of subscribers and revenue, including the status in Malaysia and the country's emphasis on the importance of the development of networked content as service choices widen.

The analysis highlights recent developments, issues on security, regulatory and development, including opportunities in the IP Telephony arena. This includes country and regional comparisons.

The issue on blurring of traditional service boundaries from VoIP perspective and the importance of network transition; standardisation; efforts in terms of protocols development in order to support the technology and delivery of such services into the future are also discussed.

The analysis and discussions are based on various information sources such as internal records as well as external data and information purchased or obtained from licensee's company accounts and reports, newswires, economic reports, and industry research reports, conferences papers, and other database sources.

A soft copy of this report is available at the MCMC's website at:

[http://mcmc.gov.my/what\\_we\\_do/Research/industry\\_studies.asp](http://mcmc.gov.my/what_we_do/Research/industry_studies.asp)

I trust this report will provide useful information to the reader. Any feedback and enquires are welcome in order to assist us in future publications. Please send your comments to [webmaster@cmc.gov.my](mailto:webmaster@cmc.gov.my)

Thank you.



**Datuk Dr. Halim Shafie**  
Chairman  
Suruhanjaya Komunikasi dan Multimedia Malaysia

# EXECUTIVE SUMMARY



Despite the many definitions of Voice over Internet Protocol (VoIP), it is essentially a service that offers an alternative of cheaper voice calls that bypasses the public switched telephone network (PSTN). VoIP has evolved over the last two decades from Internet PC to PC voice calls to a service today that can be offered through a range of platforms, be it through the PSTN, via wired or wireless broadband access, cable, and in nascent form over mobile. A wider sense of VoIP is encompassed by the term IP telephony, although the two terms are used interchangeably at times.

IP telephony has been the driver for IP-based communications. Going forward, the service offerings of “Everything over IP” and “presence” are compelling user propositions. “Presence” allows the user an option to turn on and off his or her availability in an “always on” communications environment, and make video calls. Operators for IP telephony are “widening” over time – from the circle of pure VoIP players who do not own a network and offers a voice call service to the larger arena of incumbent operator offering broadband access over which IP telephony can be offered free or at lower charges in combined packages.

Previously, peer-to-peer, IP telephony is today a mainstay in the corporate world through enterprise IP. Thus, IP telephony offers existing fixed line operators avenues for new revenue streams in a declining fixed line revenue scene; and opportunities for alliances with other service providers and content providers. For fixed line operators, IP telephony over fixed wireless or mobile platform is a persistent and potential threat, which needs to be mitigated by acceleration into the next generation network offering fully IP based services.

The development of IP telephony is at various stages across the world. Dual mode handsets and services today offer VoIP calls over wired and wireless modes, for example, integrated fixed-mobile services that use dual mode handsets for VoIP via WiFi and conventional cellular calls such as BT (Fusion) in UK, Orange (Unik) in France, and T-Mobile (At Home) in Germany. In South Korea, VoIP over mobile phone is offered using messenger on mobile network such as Skype, MSN messenger, Google Talk, and Fring; at flat rate charge for data service or Internet access. VoIP over wireless Local Area Network (LAN) is also available using Bluetooth and WiFi, with free service within the LAN area. Japan is reported to have more than 60% of VoIP subscribers worldwide. The compound annual growth rate (CAGR) of VoIP subscribers is reported to be 24.6% from less than 100 million subscribers in 2007 to about 250 million in 2011.

IDC reports Malaysia’s 2007-2011 CAGR in terms of revenue is expected at 14% from about RM730 million or USD218 million in 2007 to RM1.4 billion or USD420 million in 2011. As far as VoIP revenue is concerned in 2003, there were seven operators offering IP telephony service. The Malaysian companies posted total revenue of RM79.7 million in VoIP services alone, with highest contribution from the incumbent player, TM at 81.3%. Meanwhile, in year 2004 the number of operators increased to 12 and revenue grew 86.8% to RM148.8 million. However, in 2005, the 10 operators in the industry reporting VoIP revenue posted a total revenue of RM192.7 million, up 29.5% from 2004. TM maintained revenue above RM60 million for the three year period despite new entrants in 2004 and 2005 such as Redtone and NasionCom.

To achieve adequate quality and reliable voice communications, broadband access (as it is mainly today through DSL line) is seen as an enabler of VoIP market growth. Standards overall facilitate factors of coordination and risk reduction in capex decisions. Standards are also purposed to solve two requirements as in vendor interoperability and service provider interoperability. This is important in convergence as the market moves to open system architecture where standard based phones, call servers, gateways and application servers will interoperate from one vendor to another. The popular standards employed for VoIP are H.323, Session Initiation Protocol (SIP) and MGCP/MEGACO.

Another key challenge is the IPv4 to IPv6 migration. With IPv4, increased device usage is squeezing the capabilities of IPv4 to its limit. IPv6 alleviates this problem along with bringing increased capacities. IPv6 migration challenge lies in the need to ensure proper operation and performance of large scale network systems while containing migration cost.

Regulatory issues in IP telephony are many and they range in a continuum worldwide. This can be from the issues of grey markets and market entry in less developed countries to issues of inclusion of emergency call availability in VoIP service, consumer protection and information, number portability, and universal service contribution for VoIP in developed markets. Other issues include net neutrality, security, numbering, and of course, interconnection.

Amongst issues related to VoIP in terms of problems in network, security factor has highest priority as far as Asia enterprises are concern. About 27% of Asia enterprises have concern on network security since in a public Internet, the packets can traverse through any router and can be intercepted by anyone. Converged IP network is seen as critical to about 55% of Asian enterprises that have embraced converged networking environment.

Today, popular buzz words in IP telephony are mobile VoIP, Fixed Mobile Convergence (FMC), Unified Communications (UC) and Femtocells. IP telephony in its way forward is expected to continue to entice users through its option of cheaper calls or at no charge at all, buoying premium for other services in combination. For enterprise users, the advantages not only centre on cost savings, but also anticipated increased productivity enterprise-wide.

## ACRONYMS

|             |   |         |   |
|-------------|---|---------|---|
| ATM         | Asynchronous Transfer Mode                | MPLS    | Multi Protocol Label Switching                      |
| CAGR        | Compound Annual Growth Rate               | PBX     | Private Branch eXchange                             |
| DPCN        | Digital Private Circuit Network           | PDH     | Plesiochronous Digital Hierarchy                    |
| DSL         | Digital Subscriber Line                   | PSTN    | Public Switched Telephone Network                   |
| FCC         | Federal Communications Commission         | QoS     | Quality of Service                                  |
| HSDPA       | High-Speed Downlink Packet Access         | SDH     | Synchronous Digital Hierarchy                       |
| IMS         | IP Multimedia Subsystem                   | SIP     | Session Initiation Protocol                         |
| IP          | Internet Protocol                         | SPIT    | Spam over Internet Telephony                        |
| IPPBX       | Internet Protocol Private Branch eXchange | TCP/IP  | Transmission Control Protocol/<br>Internet Protocol |
| IPQoS       | Internet Protocol Quality of Service      |         |   |
| IPv4        | Internet Protocol version 4               | VoB     | Video over Broadband                                |
| IPv6        | Internet Protocol version 6               | VoIP    | Voice over Internet Protocol                        |
| IPVPN       | Internet Protocol Virtual Private Network | VoWiFi  | Voice over WiFi                                     |
| LEC         | Local Exchange Carriers                   | VoWiMAX | Voice over WiMAX                                    |
| MEGACO/MGCP | Media Gateway Control Protocol            |         |   |



## IP TELEPHONY LANDSCAPE

### Introduction

The development of Internet Protocol (IP) in the mid-1970s started a whirlwind of change in the telecommunications market. The Internet has many billions of IP-based devices like computers interconnecting to each other. From data services like e-mail and the World Wide Web, IP development has opened a wide range of services, including voice, video and data transmitted over IP enabled networks. One of the services that triggered the overall transition to IP environment is Voice over IP (VoIP).

VoIP or Internet telephony or IP telephony is used interchangeably, but some differences<sup>1</sup> exist. VoIP is the technology used to transmit voice conversations over a data network using IP. The data network maybe the Internet, a corporate Intranet or managed networks typically used by long distance and traditional local service providers and ISPs (Internet Service Provider) that use VoIP.

Internet telephony is deemed the original VoIP, where voice phone calls may be local, long distance, or international, over the Internet using your PC.

IP telephony encompasses a set of technologies that enables voice, data, and video collaboration over existing IP based LANs (local area network), WANs (wide area network), MAN (metro area network), broadband connections and the Internet. Specifically, IP telephony uses open IETF (Internet Engineering Task Force) and ITU (International Telecommunication Union) standards to move multimedia traffic over any network that uses IP. The ITU for their purpose in 2001 distinguished "IP telephony" as "voice over IP-based networks irrespective of ownership". They contrasted VoIP as a voice service over networks competing with incumbent operators.

### VoIP Development over Time

Traditional VoIP<sup>2</sup> as a generic term for voice carried over IP-based networks refers to the time period of mid-to-late 1990s where the Internet phone was offered mainly over the public Internet, for example, FreeWorld Dial-up. By years 2000 and 2002, "VoIP" is a discounted telephony over IP-based networks, for example, Net2Phone and iBasis.

Effectively the year 2004<sup>3</sup> was when a wide spectrum of carriers, be it incumbents, alternative carriers and small software and hardware providers began the change from circuit-switched network for voice to IP network for voice, data and all other forms of media such as local broadband access connections for residential and enterprise customers. Voice over broadband is offered as free or flat rate chat plus discounted calls to PSTN/mobile users, e.g., Vonage and Skype<sup>4</sup>. Corporate IP or Enterprise IP is enjoying attention today as users shift both data and voice to a unified IP platform.

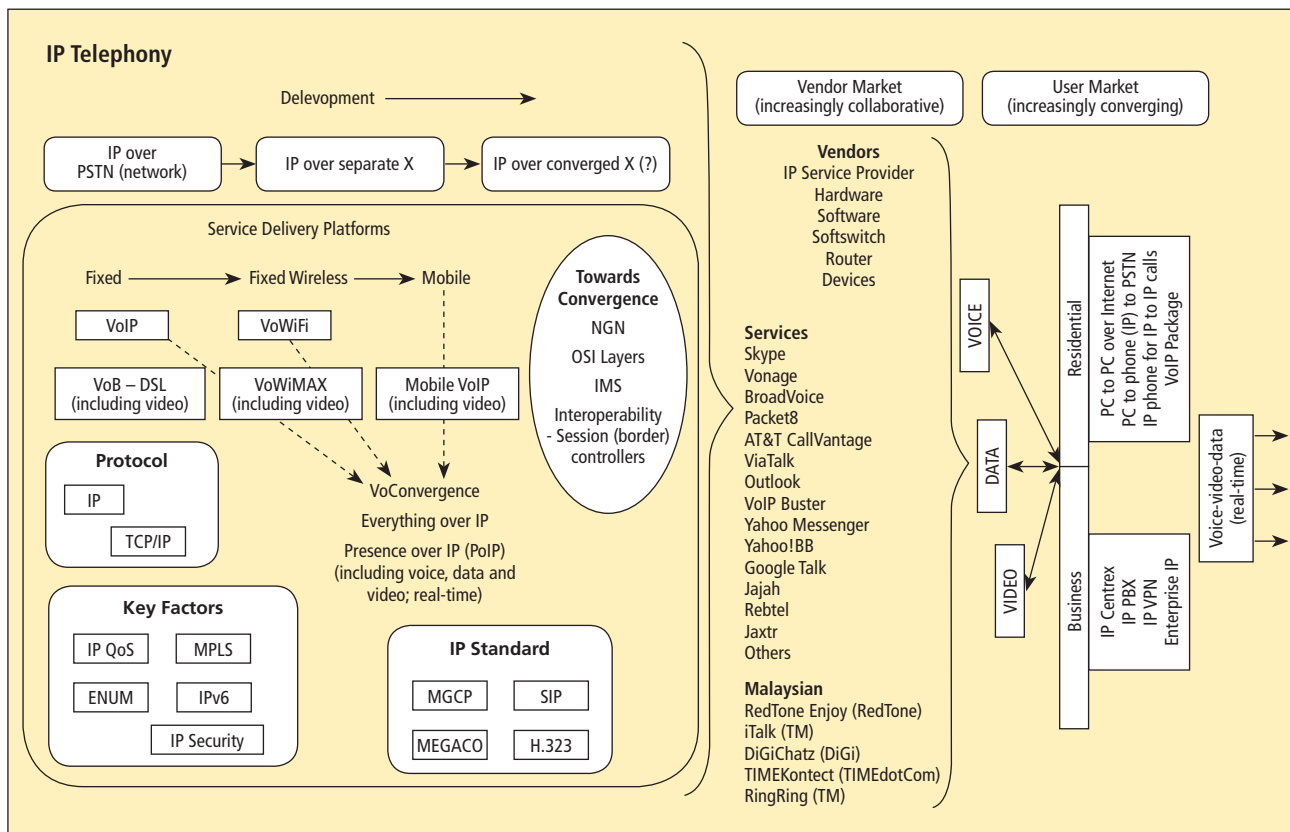
<sup>1</sup> Regulatory Challenges of Voice over IP Telephony: Analysis for Selected South and Eastern European Countries, Paper in ITU Workshop on the Future of Voice, 15-16 January 2007

<sup>2</sup> Presentation on The Challenges and Opportunities of VOIP at LIRNEasia Training Course on Strategies to Achieve Connectivity and Convergence, 25 February – 3 March 2007

<sup>3</sup> The Basics of Voice over Internet Protocol presented by the International Engineering Consortium

<sup>4</sup> Same as footnote 2

## Changes in IP Telephony



Source: Company websites, Informa Telecom & Media, Juniper Research, IEC, TelecomAsia, News Reports

## Everything over IP

Effectively, VoIP in all its various manifestations refer to the transfer of voice services (and associated services) in digital form in discrete data packets using IP over a portion or the entire communication route. VoIP is a driver to an IP networked environment, riding on the practical separation of infrastructure and applications as enabled by IP.

The eventual course of development may be that as the network goes next generation and all IP, the concept of VoIP is likely then to be "Everything over IP"<sup>5</sup>. There is expected also the element of presence as in "Presence over IP" (PoIP)<sup>6</sup>, where the device will automatically select the most appropriate form of communications for the time and place. This is in the context of VoIP integrated with other text and video-based IP services that can be offered in a wide range of desktop, laptop and mobile devices or appliances in a converged communications setting, with VoIP at its centre.

Nevertheless, the reality today as observed by industry analysts is that the general Internet is so far the major IP network in the world. The last few years, however, has seen the built out of several private IP networks for both residential and corporate services.

<sup>5</sup> Presentation on The Challenges and Opportunities of VOIP at LIRNEasia Training Course on Strategies to Achieve Connectivity and Convergence, 25 February – 3 March 2007

<sup>6</sup> Voice over IP – Into The Mainstream by Juniper Research; "Presence" is the network state of a user's IP phone, personal computer or personal digital assistant, and is "not available" which denotes the willingness and ability of the user to communicate





## VoIP SERVICE

### Reasons for VoIP Service

Be it as it may the way VoIP is viewed in terms of mode of service provision, from the perspective of the customer, the simple and age-old reason for taking up VoIP service is to obtain cheap calls. VoIP allows them to make long distance and international calls at lower prices compared to normal PSTN phones.

For service providers, VoIP leads opportunities for reduced cost, seek growth through new markets, including broadband, and potential alliances with service and content providers in new business models in VoIP market. For example, operators can reduce cost of supply through having the voice call, especially international calls, made using fixed line infrastructure to be routed using IP. Cost reduction is by far an alluring incentive especially when the complete or end-to-end national network is going towards an IP-based architecture. Despite the advantages of VoIP, the service has evolving issues including vulnerabilities and risk of security, regulatory, and Quality of Service (QoS).

### VoIP Service Versions

VoIP started off as essentially a person-to-person voice conversation over IP-based networks from previously circuit-switched mode. Today, VoIP is becoming a mainstay even in the corporate world through enterprise IP where a variety of services are offered. For example in Korea, Skype provides the VoIP services that include instant messaging, SMS to mobile phones, calls terminating on regular phones (SkypeOut), the option of a personal phone number (SkypeIn), and conference calls.

VoIP start-ups such as US-based companies, Jajah and Jaxtr, adopt a "carrier-friendly" approach to VoIP enabling network operators to continue making money from voice calls, along with features that an Internet and IP-based service can provide plus call management; integration with social networking websites such as MySpace and Facebook<sup>7</sup>; and presence. These companies use existing carrier fixed and mobile telephony as a base for their service, rather than online clients as in the case of Skype. Furthermore, users use a familiar phone – mobile or fixed, to make a call.

<sup>7</sup> New wave of VoIP players can "carrier-friendly", 19 September 2007, Informa Telecom and Media; Jaxtr is a California-based company started in October 2005

| Different Types of VoIP   |  |          |   |
|---|--|----------|---|
| VoIP Category   | Description  | Gateway* | Example   |
| <ul style="list-style-type: none"> <li>PC to PC communication (over Internet) or IP device to IP device such as IP Phone or 3G phone</li> </ul>                 | Peer to peer. Free calls. Cannot be used for PSTN calls  | No       | Skype   |
| <ul style="list-style-type: none"> <li>VoIP originating from a "soft device" (e.g., IP device such as PC or IP phone) to the PSTN or regular phones.</li> </ul> | PC to PSTN calls. Independent of ISP and broadband access service provider   | Yes      | Vonage<br>Net2Phone   |
| <ul style="list-style-type: none"> <li>VoIP originating and terminating on a PSTN connected device or vice versa.</li> </ul>                                    | Usually IP technology is used for call routing. VoIP via a phone or microphone directly connected to a computer or using a separate device like a Pocket PC or a conventional telephone with a special adapter <sup>8</sup> . Jaxtr users can add on a widget which is a small web-based application to their social network profile page or blogs that has a "call me" button. The widget provides a local phone number that a person can call to reach a Jaxtr user. | No       | Jajah<br>Rebtel<br>Dingaling<br>Jaxtr<br>There is no need for software download for all of the above. |
| <ul style="list-style-type: none"> <li>VoIP service bundled with ISP service and broadband access</li> </ul>  | PC to PSTN calls   | No       | Yahoo!!BB   |
| <ul style="list-style-type: none"> <li>Corporate LAN/WAN or virtual private network (VPN)</li> </ul>  | Networked PBX replacement, including IP Centrex  |          | Corporate IP;<br>Community IP   |
| <ul style="list-style-type: none"> <li>Cable</li> </ul>   | Full end-to-end IP communications services between cable operators with no interconnection required through the incumbent telephone networks.  |          | UPC Netherlands<br>Essent Kabelcom<br>Casema<br>Multikabel, CAIW                                      |

\*A device/software to convert digital data to analogue; connecting to Public Switched Telephone Network (PSTN).  
Source: Juniper Research, Informa VoIP

For adequate quality of voice transmission sufficient bandwidth is required. Therefore, broadband Internet access, especially through a digital subscriber line or fibre, is seen as a vital enabler of VoIP growth. Wireless offers affordable adoption for developing countries which lack fixed line access. VoIP service is also going mobile via use of mobile terminals with wireless broadband and mobile networks (also known as "soft" VoIP).

With these market developments rapidly changing the face of communications services, reports are that the traditional categories of VoIP services are gradually evolving, for example, to include Video over IP. These services include Internet Protocol television (IPTV), Video on Demand (VoD), interactive multimedia service (MS), Web TV and Mobile TV. The availability of broadband access and along with it the promise of greater speeds is driving such change.

Based on an ITU World Information Society Report, the number of countries with broadband commercially available has more than doubled from 81 countries in 2002 to 166 countries in 2006.

<sup>8</sup> Advisory Committee on International Communications and Information Policy (ACICIP) (2005): VoIP: Status and Industry Recommendations. Download: <http://www.isoc.org/pub/pol/pillar/voip-paper.shtml> 15.08.2006



## THE VoIP SERVICE MARKET AND TRENDS

The VoIP business models are extending towards fixed wireless, cellular and, fixed mobile convergent platforms as described in the table below. Price models can range from free of charge when bundled with other services or fixed monthly charge. There is observed increasing collaborative efforts as well as new devices such as dual mode handsets to offer the desired VoIP services to consumers.

### Wireless VoIP Business Models

| Trend                | Features  | Operators  |
|----------------------|---|--|
| Pure-play Wi-Fi VoIP | Offer VoIP via dual-mode Wi-Fi/cellular handsets or a software client download to similar devices sometimes in conjunction with Wi-Fi operators | Skype, Fring, Truphone, Mobiboo                                |
| Fixed-Wi-Fi VoIP     | Fixed-only operators offering dual-mode services that allow VoIP calls via Wi-Fi and cellular calls over mobile operators' networks elsewhere   | Free, Neuf Cegetel, Ya.com                                     |
| Cellular VoIP        | Offer VoIP over 3G networks via handsets and datacards  | 3(X-Series), E-Plus, Skype(3 X-Series)                         |
| FMC VoIP             | Integrated fixed-mobile services that use dual-mode handsets for VoIP via Wi-Fi and conventional cellular call elsewhere                        | BT (Fusion), Orange (Unik), T-Mobile (At Home), Italia (Unico) |

Source: Informa Telecoms & Media

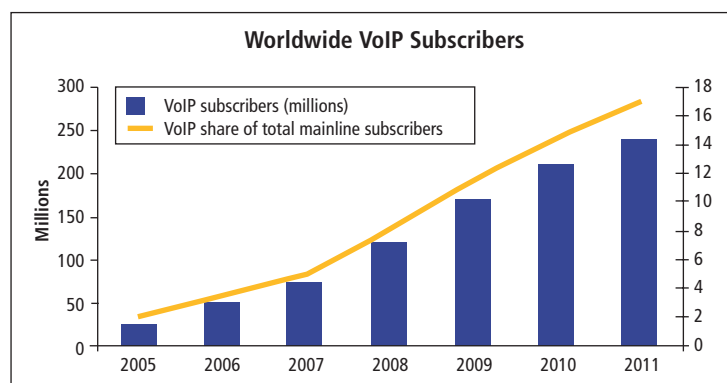
### Operator VoIP Brand Service and Pricing

| Selected Companies | Price          | Service                               | Availability           |
|--------------------|----------------|---------------------------------------|------------------------|
| AT&T               | USD39.99/month | Local and Long Distance (LD)          | 100 US markets 2004    |
| SBC                | USD29-40/month | Local and Long Distance               | 100 cities 2004        |
| Verizon            | n.a.           | Business and Residence DSL, Local, LD | Initial offer 2004     |
| Bell South         | n.a.           | Business service only announced       | 2004                   |
| Time Warner        | USD39.95/month | Partner MCI/Sprint, Local, LD         | Begin 2004             |
| Sprint             | n.a.           | TWC partner service announced         | 2004-2005              |
| Vonage             | USD14.99–34.99 | Local and LD                          | 300,000 customers 2004 |
| i2 Telecom         | USD9.95/month  | Reseller Program announced            | 2004                   |

n.a. not available

Source: International Engineering Consortium

### VoIP Subscribers

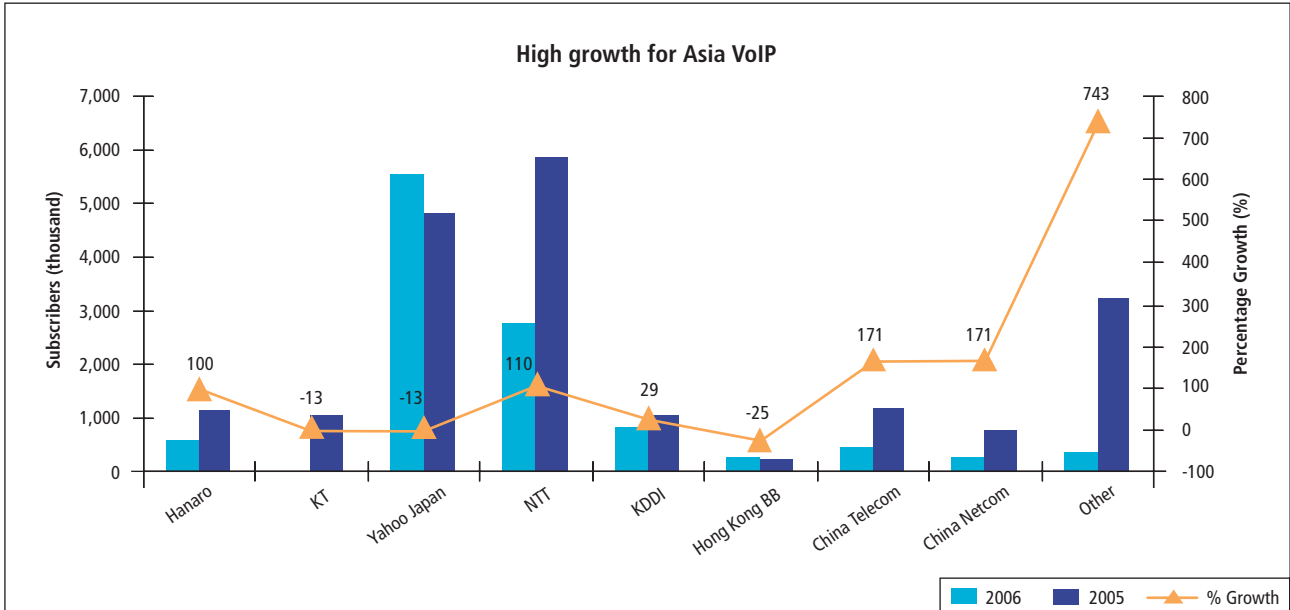


Source: iDATE

| Distribution of VoIP Subscribers Worldwide |            |
|--|------------|
| Country                                    | Percentage |
| Japan                                      | 62%        |
| North America                              | 16%        |
| France                                     | 11%        |
| Italy                                      | 5%         |
| Germany                                    | 2%         |
| Netherlands                                | 1%         |
| Sweden                                     | 1%         |
| Norway                                     | About 1%   |

Source: Point Topic, March 2005

VoIP growth is vibrant in Asia-Pacific compared to other countries. Japan, Korea and China are expected as the Asia-Pacific countries with highest VoIP subscriber growth. Together at 21 million subscribers in 2007, reports indicate that these countries are expected to command a doubling of subscriber growth to 42 million subscribers in 2011.



Source: In-Stat, May 2005

Notes: Japan, Korea and China dominate Asia VoIP markets  
Relatively little VoIP adoption in most other APAC countries

| VoIP Traffic Breakdown by Operator |          |             |
|------------------------------------|----------|-------------|
| Operator Type                      | US** (%) | Europe (%)  |
| Operator branded VoIP              | 53       | 51.2        |
| Vonage                             | 21.7     | Less than 1 |
| Skype                              | 14.4     | 45          |
| Other Third Party Operators        | 10.9     | Remainder   |

\*\*Based on US vendor Sandvine study from 700,000 broadband households  
Source: Informa Telecoms & Media

### VoIP Subscriptions, Selected Operators 4Q05 & 06

| Operator         | Country     | 4Q 05 | 4Q 06 ('000) | Growth % |
|------------------|-------------|-------|--------------|----------|
| Cybercity        | Denmark     | 26    | 63           | 142.3    |
| Telio            | Denmark     | 13    | 17*          | 30.8     |
| France Telecom   | France      | 830   | 2,071        | 149.5    |
| Free             | France      | 1,304 | 1,940        | 48.8     |
| Neuf Cegetel     | France      | 500   | 1,430        | 186.0    |
| FastWeb          | Italy       | 714   | 1,030        | 44.3     |
| Tiscali          | Italy       | 30    | 70*          | 133.3    |
| Casema           | Netherlands | 85*   | 200          | 135.3    |
| KPN Telecom      | Netherlands | n.a.  | 517          | -        |
| Telio            | Netherlands | 1     | 6*           | 500.0    |
| NextGen Tel      | Norway      | 16    | 29           | 81.3     |
| Telenor          | Norway      | 24    | 102          | 325.0    |
| Telio            | Norway      | 63    | 95*          | 50.8     |
| Bredbandsbolaget | Sweden      | 104   | 161          | 54.8     |
| BT**             | UK          | 70*   | 500*         | 614.3    |
| Orange           | UK          | 140*  | 447*         | 219.3    |

n.a. not available

Source: Informa Telecoms & Media, Broadband Subscriber Database

\*Estimate \*\*Excludes Softphone customers



### A Selection of IP Telephony Operators and Their Packages

| Operator     | Details   | Packages  |
|--------------|---|---|
| Skype        | Easy way to make phone calls to any other PC user in the world; it is peer-to-peer program.   | 3 types of Skype products:<br>(1) SkypeOut – a low cost service for calling on traditional landline phones using Skype. Pay by buying Skype credits. Rates are low: cost per minute to most worldwide locations is USD0.023.<br>(2) SkypeIn Beta – allows having a real phone number so users can call from a landline phone. A 12-month subscription to a SkypeIn telephone number is around USD40.<br>(3) Skype Voicemail – send voicemail messages to Skype friends & contacts. Cost is GBP15 a year, or free if subscribe to SkypeIn. |
| Fring        | Free downloadable mobile phone application enabling free mVoIP (mobile VoIP) calls, real-time presence and live chat with multiple IM providers over mobile data networks or a Wi-Fi connection.  | Allows users to roam freely between wireless networks (GPRS, 3G, Wi-Fi), free Wi-Fi Internet access or fixed Internet data plans over 3G or GPRS instead of mobile airtime (GSM) minutes.   |
| Truphone     | Enables mobile phone users to enjoy free/low-cost calls and text messages [SMS] by routing via Wi-Fi and the Internet whenever possible. The service is presently in beta and delivers Voice over IP, SMS over IP and "presence" (showing when contacts are online).  | A Truphone-enabled mobile handset automatically connects to wireless hotspot networks with which Truphone has roaming agreements without requiring user names or passwords, and also connects easily to personal or other open Wi-Fi networks.  |
| Mobiboo      | UK's first commercial VoIP WiFi network operator. Enables customers to make calls over the Internet using a softphone. Partnering with UTStarcom to enable customers to make calls via a mobile handset whenever they are in range of an open WiFi hotspot or wireless router.                              | Mobiboo is free software for PC, Laptop or WiFi mobile. Mobiboo VoIP has significant cost-saving implications, both domestically and when travelling abroad, as international roaming charges become non-existent.  |
| Neuf Cegetel | Has the largest and most advanced alternative network in France, focusing on state-of-the-art "All IP" network, 45,000 km of fibre optic cables, an unbundled network with connections to 1,201 telephone exchanges, covering 70% of target population; and interconnection to all digital local exchanges. | n.a.  |

| Operator             | Details  | Packages   |
|----------------------|--|--|
| Ya.com               | Created in 1999, is now the third biggest ADSL player in Spain, with more than 400,000 subscribers. It has now been acquired by France Telecom in June 2007.   | In addition to Internet access, Ya.com offers a range of innovative services on the Spanish market (ADSL TV, video on demand, unlimited telephony), which three quarters of its clients have already signed up for.  |
| 3 (X-Series)         | The X-Series from 3 is all about having TV, home PC and all the best of the web on mobile. There are 2 types of X-Series which is X-Series Silver and X-Series Gold.   | The two packages are X-Series Silver at USD10 per month and X-Series Gold at USD20 per month (that's not including the extra fees for voice and text services)   |
| E-Plus               | Integrates voice, video, and data networks to streamline IT infrastructure, reducing technology and telecommunication costs, and improved productivity and communication capabilities.   | Products:<br><ul style="list-style-type: none"> <li>– Cisco Systems      – Polycom</li> <li>– 3Com                    – Tandberg</li> <li>– IPcelerate</li> </ul>  |
| Skype (3 X-Series)   | Allows accessing Skype from 3 X-Series mobile phone.   | New X-Series provides 500MB of data usage and 1,000 minutes of Skype-to-Skype calls for USD20 a month, 1GB of data and 2,000 minutes of Skype for USD30, and 2GB of data and 4,000 minutes of Skype for USD40.   |
| BT (Fusion)          | The next generation mobile service – bringing mobile, VoIP calls and Wi-Fi together in one easy to use package. VoIP calls save money when over a high speed Internet connection. Wi-Fi is a high speed wireless Internet connection through BT Fusion mobile, laptop or other wireless device.  | <ul style="list-style-type: none"> <li>– 3 months' FREE line rental-Talk for 4 minutes and use only 1 of your inclusive minutes from home or a BT openzone hotspot</li> <li>– Surf the Internet for FREE at lightning speeds</li> <li>– Choice of great handsets</li> <li>– Inclusive text bundle</li> <li>– FREE BT Home Hub worth GBP89.99</li> </ul>  |
| Orange (Unik)        | A single telephone, a single number, a single address book, at home or on the move. With Livebox, enjoy unlimited calls 7/24 to all fixed lines in France and Orange mobiles. Unik needs an Orange broadband subscription, a Livebox and one of the three specific handsets in the unik range from EUR 99 (UMA technology): Nokia 6136, Samsung P200, Motorola A910  | <ul style="list-style-type: none"> <li>– Unlimited calls 24/7 from the mobile connected to the Livebox to fixed lines in France: EUR10/month</li> <li>– Unlimited calls 24/7 from the mobile connected to the Livebox to Orange mobiles and fixed lines in France: EUR 22/month</li> </ul>   |
| T-Mobile (At-home)   | <ul style="list-style-type: none"> <li>– Enabled the Broadband/Fixed Network division to provide attractive services comprising high-speed Internet access, Internet telephony (VoIP) and television (IPTV) – so-called triple-play services – for a fixed price per month.</li> <li>– Broadband Internet access at speeds up to 50 megabits per second, low-cost DSL telephony and access to more than 130 free-to-air and pay TV channels</li> </ul> | <ul style="list-style-type: none"> <li>– Unlimited calling plan: For unlimited calls made over Wi-Fi, users must pay \$20 a month for a single line or \$30 a month for a family plan. This would be on top of a current calling plan.</li> <li>– Introductory price: For a limited time, T-Mobile is offering HotSpot @Home for \$10 a month for a single line and \$20 a month for a family plan.</li> </ul> |
| Italia (Unico/Unica) | Based on UMA technology, which functions as a multimedia cordless in the home, using the IP network, and as a GSM mobile phone outside.  | Offered as an optional service at 15 euro a month on top of the ADSL access fee, "UNICO" permits calls from home to all fixed-line phones and TIM mobile phones without additional costs; billing will be kept separate for mobile and indoor use.   |

n.a. not available

Source: Company reports and websites

| The Value in Skype |  |
|--------------------|--|
| Skype service      | Founded in August 2003; reported 9.5 million users in first year; downloaded more than 300 million times; more than 8 million subscribers using it at any given time |
| Skype subscribers  | 220 million*   |
| Skype revenue      | USD130 million annual revenue**  |
| Purchase value     | eBay paid US\$4 billion for Skype in October 2005. eBay effectively paid for the database and "virtual social network" developed since Skype was offered.            |
| Skype at eBay      | Skype service integrated into the wider services of eBay, e.g., make a free VoIP call in response to an ad.  |

Source: Presentation on The Challenges and Opportunities of VOIP at LIRNEasia Training Course on Strategies to Achieve Connectivity and Convergence, 25 February – 3 March 2007;

\*Informa Telecom & Media 2007

\*\* Estimate made by analyst in 2005



## VoIP – THE TECHNOLOGY PROVIDING THE SERVICE

### Different types of VoIP Usage and Applications

VoIP support multiple combinations of phones and computers connections as follows:

|                                |   |
|--------------------------------|---|
| Analog Telephone Adaptor (ATA) | User plug the cable from standard phone into ATA to make VoIP call.                       |
| IP Phones                      | Specialized phones with RJ-45 Ethernet connector to allow VoIP call.                      |
| Computer-to-Computer           | Require a microphone, speakers, a sound card, and cable or DSL Modem to enable VoIP call. |

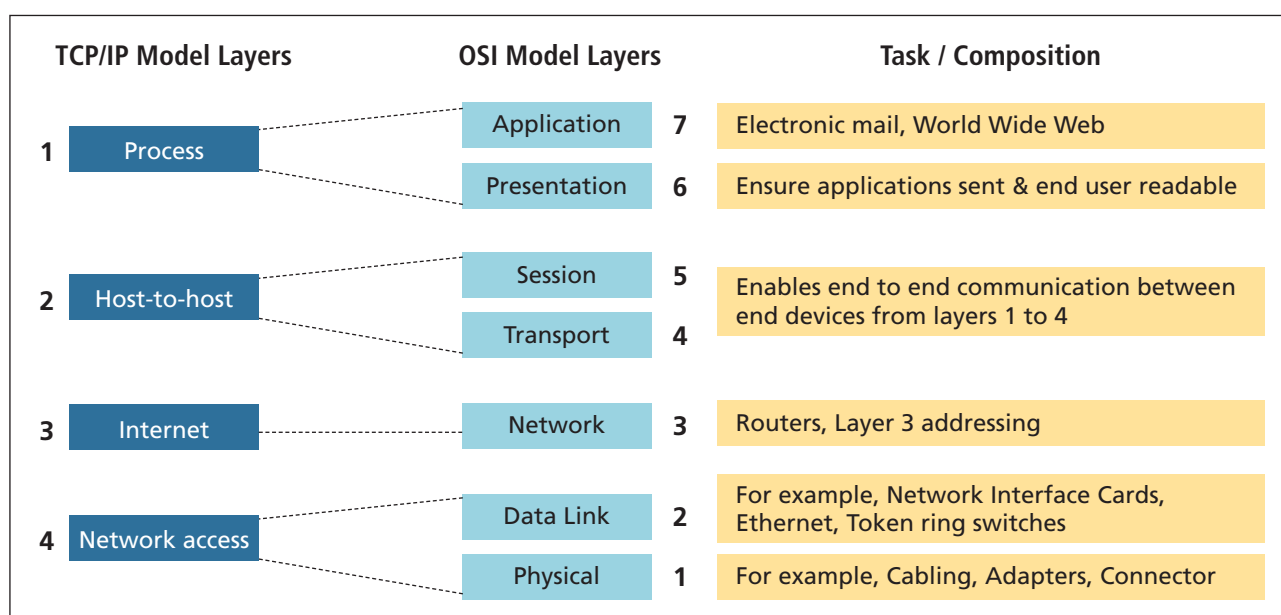
VoIP applications includes IP Softphone, which is a software that allows VoIP services onto users' desktop or laptop, with headset or microphone and broadband connectivity to make calls.

### Heartbeat of IP Technology

The sole purpose of a network is to enable transfer of information from one point to the other point. The notion of a network arises to share infrastructure for cost optimization. This is especially so for an IP network.

The Open System Interconnection or (OSI) model specifies the requirements for communications and communication process between two network systems or in a simpler way between any two computers in a network. The OSI model has been standardised by the International Organization for Standardization to allow for all network elements to operate together, regardless of protocol or vendor compatibility. The communication process is divided into seven layers. Each layer is therefore assigned or designated to support the layers above or beneath it.

Without the OSI model, networks will be in a state of chaos not knowing how to communicate with each other within the network. In fact, before OSI model came into place, Transmission Control Protocol/ Internet Protocol (TCP/IP) was used for network communications, operated in a different layered arrangement compared to the OSI model. TCP/IP model uses four layers to perform the functions of the seven layered OSI model. This means that the functions of the seven layer OSI model are parallel to the four layer TCP/IP model. The diagram shows the relationship between Internet and OSI model which shows activities being performed behind the scene.



## STANDARDS

Standards create a level playing field in respect of coordination in the network and risk reduction in capex decisions. Standards are also purposed to solve two requirements as in vendor interoperability and service provider interoperability. In an IP environment, standards mitigate vendor "lock-in." Often customers are locked into vendor specific solutions that ultimately lead to higher cost of ownership, for example, for applications integration, proprietary handsets, proprietary signalling between PBX. Standards are essential as the market is rapidly moving to an open system architecture where standards based phones, call servers, gateways and application servers will interoperate from one vendor to another.

| Four Logical Components As Endpoints |  |
|--------------------------------------|--|
| Modules                              | Task   |
| Terminals                            | Telephones   |
| Gateway                              | Translates between packet and telephony streams                                  |
| Gatekeeper                           | Performs address translation, admission control and bandwidth management         |
| Multi-Point Conferencing Units       | Multi-Point conferencing units, support multiparty conferences for voice & video |

Source: ShoreTel IP Telephony Pocket Guide

VoIP uses IP to transmit voice as packets over an IP network. There are a number of protocols such as H.323, Session Initiation Protocol (SIP) and MGCP/ MEGACO (Media Gateway Control Protocol). A protocol is a pathway to transmit data between two endpoints.

H.323 is a pioneer ITU-T standard for video-conferencing on LAN network. H.323 defines standard to facilitate multimedia conferencing over IP network. The standard encompasses both point to point communications and multipoint conferences and offers a complete suite of protocols for audio, video and data conferencing.

SIP has emerged as a lightweight and extensible alternative to H.323. Developed by the Internet Engineering Task Force (IETF), SIP is well-suited for Internet and web-based applications where, for example, phone calls and web pages work together in customer call centres environment. SIP function as a gatekeeper is like H.323 where there is requirement for end point intelligence. The key advantage of SIP is that it offers well-defined mechanism for device-to-device beyond handset. SIP is well-architected for communications between multiple proxy and location servers. It is best used for instant messaging and presence. A voice system with SIP is said to be better as it integrates presence and telephony and will be able to deliver a richer suite of applications. SIP is therefore one of the requirements for Next Generation IP voice communication systems.





In conclusion SIP is used in public networks while H.323 is used in enterprise applications. Moving forward the market will likely support multiple standards for IP voice communications with standard optimization. Amongst the three standards, SIP is a strong contender for delivering application rich voice systems over time. This is due to the secured environment with Network Address Translation (NAT) used by firewalls, router or computer.

| A Comparative of Signalling Protocols |                           |                       |               |               |
|---------------------------------------|---------------------------|-----------------------|---------------|---------------|
|                                       | H.323                     | SIP                   | MGCP          | MEGACO        |
| Architecture                          | Peer to Peer              | Peer to Peer          | Master/Slave  | Master/Slave  |
| Media Types                           | Voice, data, Limited Data | Voice, video, data    | Voice         | Voice, video  |
| Scope of Network                      | Intranet and Internet     | Intranet and Internet | Intranet only | Intranet only |
| Extensibility                         | Low                       | High                  | Medium        | Medium        |
| Scalability                           | Medium                    | High                  | Low           | Low           |
| Deploy Ease                           | Low                       | High                  | Medium        | Medium        |
| Standardisation                       | ITU                       | IETF                  | IEFT          | IEFT/ITU      |

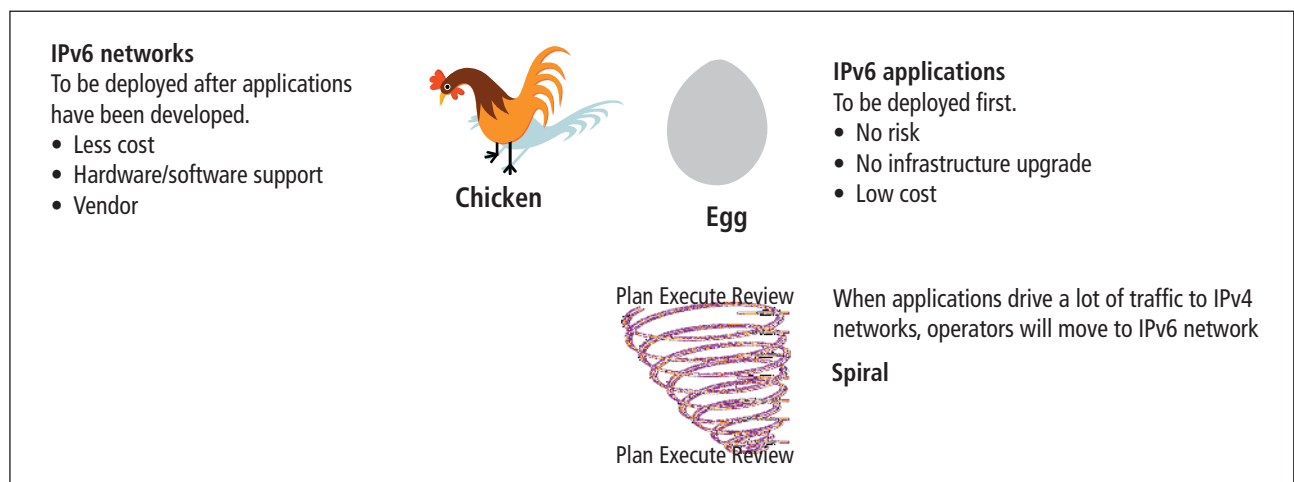
Source: *The Basics of Voice over Internet Protocol presented by the International Engineering Consortium*

## KEY VoIP ISSUES

### Transformation of IPv4 to IPv6

There are two main reasons for the need to adopt IPv6. The first is limited address capacity for IPv4. Today, devices as well as user applications are squeezing the capabilities of IPv4 to its limit. The second reason is new Internet applications with requirement for audio and video delivery at regular intervals in order to keep information flowing without disruption. As such, IPv6 also supports such wider scope applications. IPv6 migration challenge lies in the need to ensure proper operation and performance of large scale network systems while containing migration cost.

### IPv6 Contentions



Source: *IPv6 Business Model, Business Drivers for IPv6, Communication Systems Technologies Co.Ltd, 14/06/2006*

## IP QoS

In contrast to traditional data traffic, multimedia streams used in videoconferencing is extremely bandwidth and delay-sensitive, imposing unique quality of service (QoS) demands on their underlying networks. IP with a connectionless, best-effort delivery model does not guarantee delivery of packets in order, in a timely manner, or at all. To deploy real-time applications over IP networks an acceptable level of quality, certain bandwidth, latency, and jitter must be guaranteed and met so that multimedia traffic can coexist with traditional data traffic on the same network.

When data is transferred throughout IP network, a slight delay with packets is usually not noticeable. Moreover, retransmission of discarded packets usually compensates for the loss of packets. However, when IP packets transport digitised voice, the loss or delay of packets would result in the disruption of speech intelligibility. Therein lies the issue of Voice over IP.

| Importance of Quality of Service in IP Telephony |  |
|--|--|
| Bandwidth  | Multimedia data, and in particular video, requires more bandwidth than traditional networks can offer. An uncompressed NTSC video stream, for example, requires upward of 220 megabits per second (Mbps). Even compressed, a handful of multimedia streams can completely overwhelm any other traffic on the network.  |
| Latency  | The time taken for a multimedia packet to get from source to destination. This has major impact on the perceived quality of call. Latency is due to transmission and queuing delays in network equipment, and delays in host protocol stacks. Latency must be minimized in order to maintain a level of interactivity and avoid unnatural pauses in conversation.  |
| Jitter   | In contrast to data traffic, real-time multimedia packets must arrive in order and on time to be of any use to the receiver. Variations in packet arrival time (jitter) must be below a certain threshold to avoid dropped packets (and therefore irritating shrieks and gaps in the call).  |
| Coexistence                                      | In comparison with multimedia traffic, data traffic is relatively bursty, and arrives in unpredictable chunks (e.g., when someone opens a Web page or downloads a file from an FTP site). Aggregations of such bursts can clog routers and cause gaps in multimedia conferences, leaving calls at the mercy of everyone on the network (including other IP telephony users). Multimedia bandwidth must be protected from data traffic, and vice versa. |

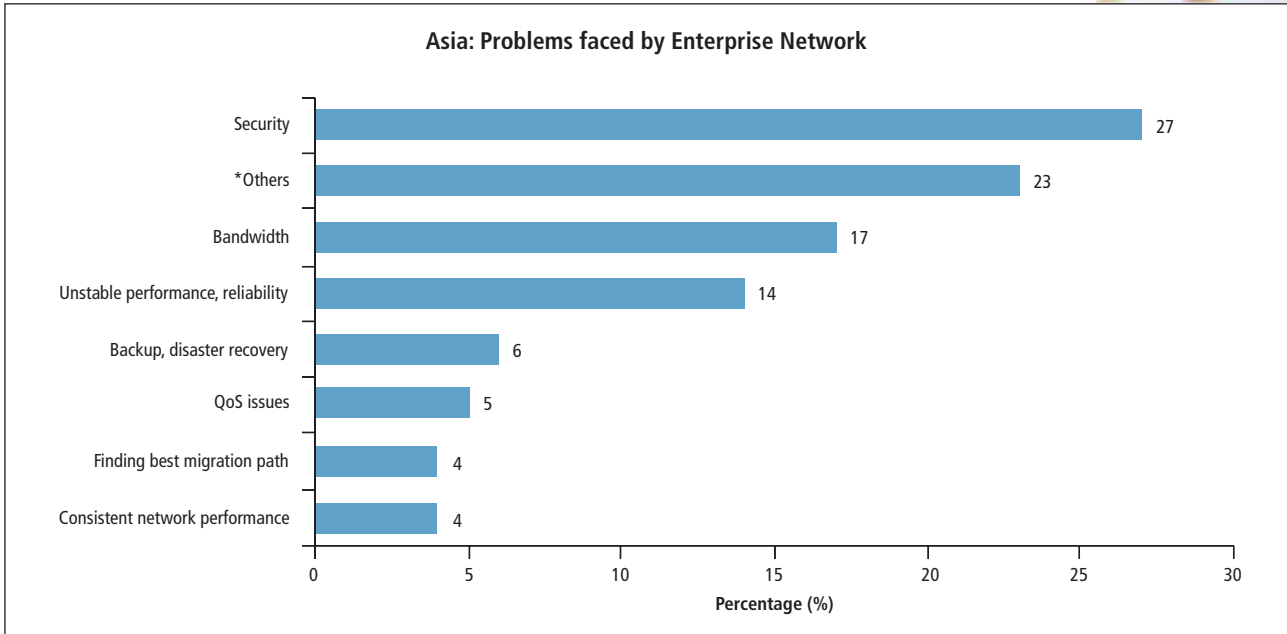
Source: [www.msdn2.microsoft.com](http://www.msdn2.microsoft.com)

## IP Security

Based on ITU, there are four basic security issues:

- User and Data Authentication
- Data Privacy (integrity and confidential)
- Access Control
- Police Management

Network security is related to the routing side of IP. In a public Internet, the packets can traverse through any router and can be intercepted by anyone. Acceptable security can be obtained by encryption and tunnelling.



\*Others: Diversity of threats  
 Source: IP Communications survey 2007

## IP TELEPHONY IN MALAYSIA

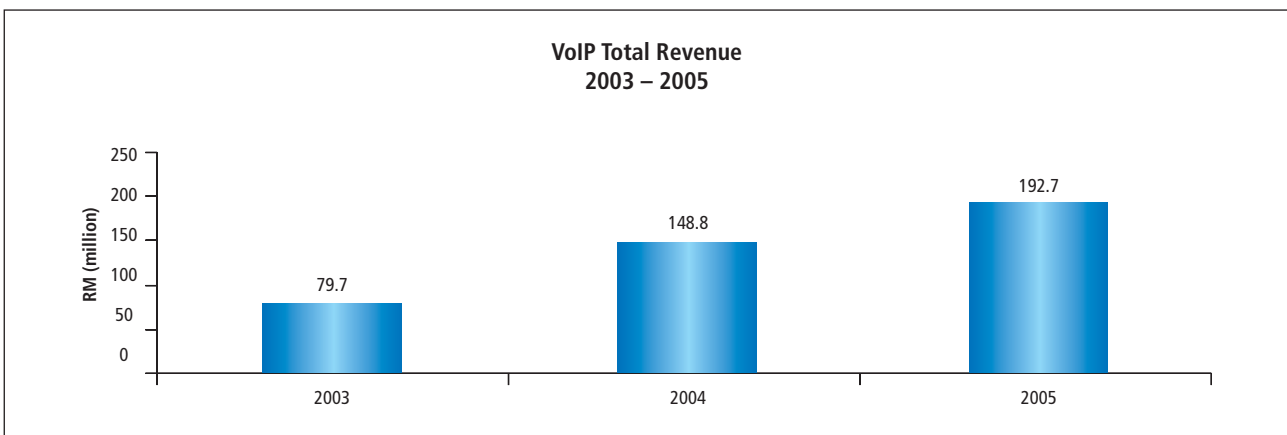
### Market Structure

The Malaysian IP telephony scenario shows a combination of incumbent and small players in the industry. This service is provided under the Application Service Provider Class Licence category from SKMM.

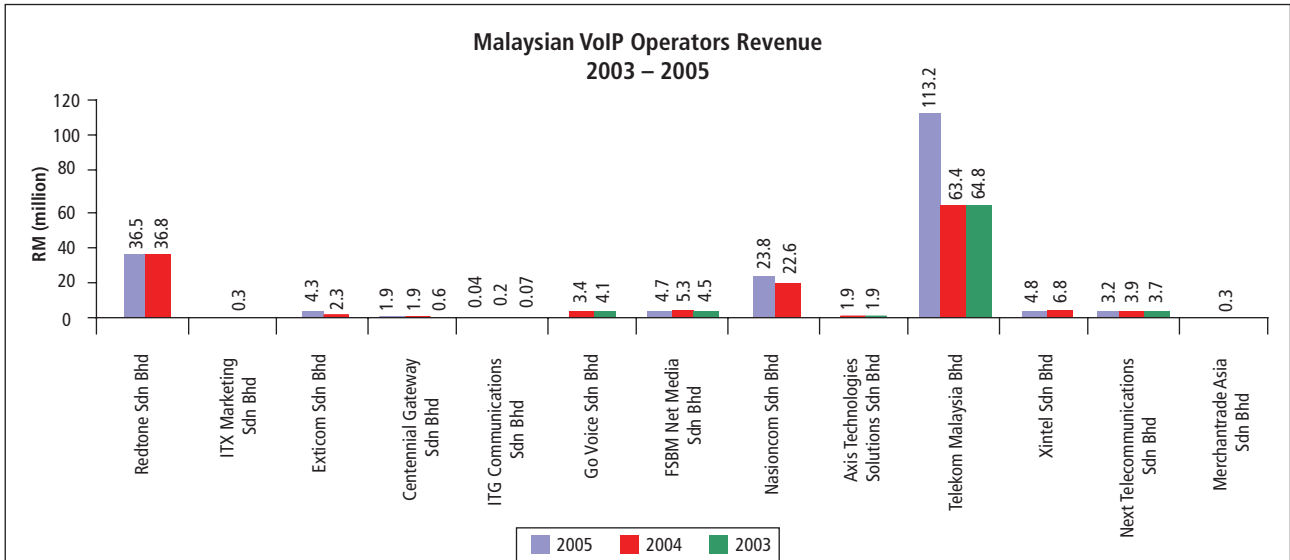
### Revenue Trends

In 2003, there were seven operators offering IP telephony service. The Malaysian companies posted total revenue of RM79.7 million in VoIP services alone, with highest contribution from the incumbent player, TM at 81.3%. Meanwhile, in year 2004 the number of operators increased to 12 and revenue grew 86.8% to RM148.8 million. However, in 2005, the industry comprised 10 operators, with total revenue of RM192.7 million, up 29.5% from 2004. TM maintained revenue above RM60 million for the three year period despite new entrants in 2004 and 2005.

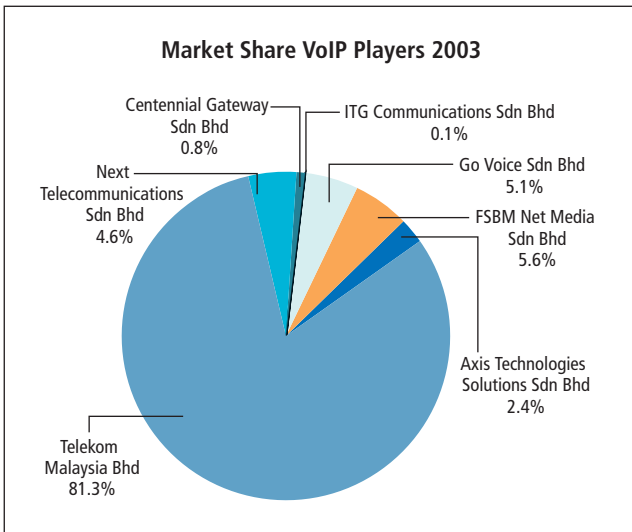
### VoIP Revenue Market Share (2003-2005)



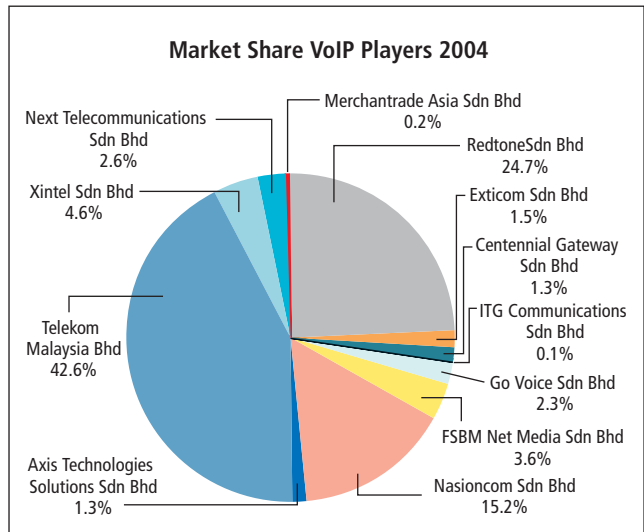
Source: Industry, SKMM



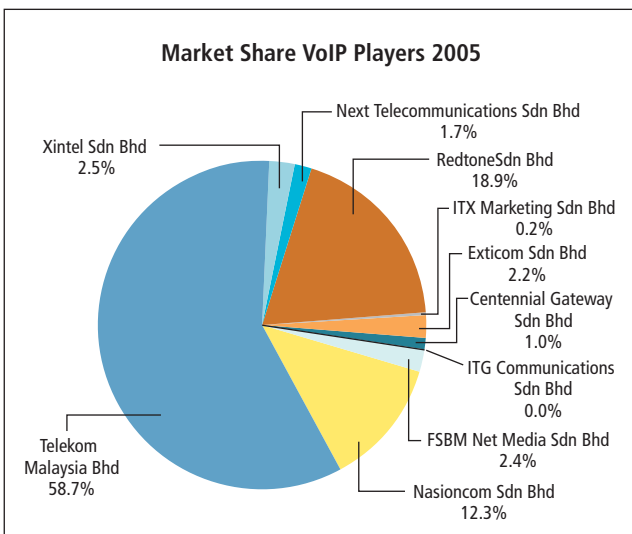
Source: Industry, SKMM Note: 2003-2005 Revenue is based on the operators that have reported revenue



Source: SKMM



Source: SKMM

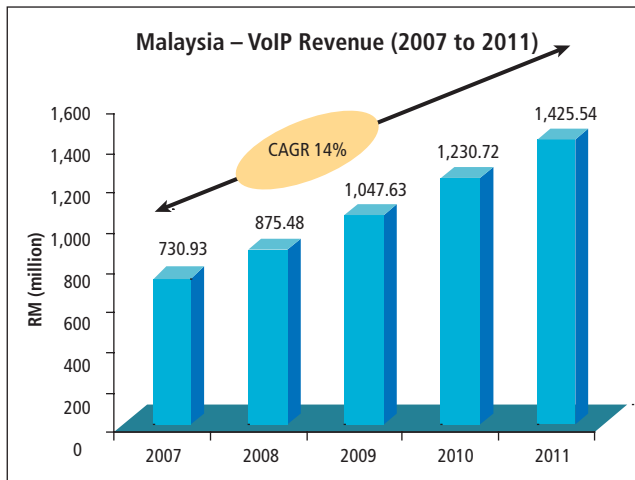


Source: SKMM

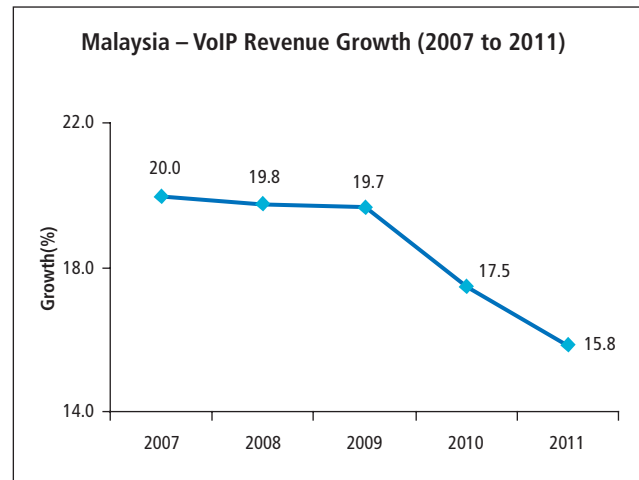
The trend on VoIP revenue from 2006 onwards is promising. The CAGR for Malaysian revenue growth between year 2004 and 2006 was only 4%. This scenario is forecasted by IDC to change from years 2007-2011 whereby CAGR is expected at 14%. This revenue uptrend could be due to the usual price sensitivity of consumers as VoIP becomes more widespread and the onset of broadband access amidst combined services.



## Malaysia VoIP Revenue Forecast



Source: IDC



Source: SKMM

Despite uptrend in terms of revenue, the year on year growth seems to be on a declining state. This could be due to market challenges of strong competition.

## Technology

In Malaysia, a lot of VoIP innovation is based on open source technology such as SIPX, Asterisk and OpenSER, with features as follows:

| Open Source Technology |  |
|------------------------|--|
| SIPX                   | <ul style="list-style-type: none"> <li>• Need an IP PBX that is robust, stable and easy to use</li> <li>• Need a system that offers plug &amp; play management of all the components including phones</li> <li>• It is a mission critical system and therefore require high-availability redundant configuration. A server failure should not interrupt calls</li> <li>• Voice quality is important so therefore need a system that routes media peer-to-peer and not through the PBX</li> <li>• SIP standards compliance that allows flexible call routing including SIP trunking</li> <li>• Need scalability – sipX is known to work for deployments in excess of 5,000 users connected to one redundant server</li> <li>• Unlimited number of simultaneous calls and unlimited number of trunks using distributed gateways</li> <li>• Need IT integration with no special needs for specific hardware. Runs on off-the-shelf Intel servers</li> </ul> |
| Asterisk               | <ul style="list-style-type: none"> <li>• Offers both classical PBX functionality and advanced features</li> <li>• Interoperates with traditional standards-based telephony systems and VoIP systems</li> <li>• Offers advanced features associated with large, high end (and high cost) proprietary PBXs</li> </ul>  |
| OpenSER                | <ul style="list-style-type: none"> <li>• A mature and flexible open source SIP server</li> <li>• Can be used on systems with limited resources as well as on carrier grade servers, scaling up to thousands of call setups per second</li> <li>• Written in pure programming language for Unix/Linux-like systems with architecture specific optimisations to offer high performances.</li> <li>• Customisable, featuring fast load balancer; SIP server flavours: registrar, location server, proxy server, redirect server; gateway to SMS/XMPP (extensible messaging and presence protocol); or advanced VoIP application server.</li> </ul>  |

Source: [www.sipfoundry.org](http://www.sipfoundry.org), [www.asterisk.org](http://www.asterisk.org), [www.openser.org](http://www.openser.org)

## VoIP Development on Malaysian Front

### VOIP – mandatory prices

SKMM has mandated pricing for call origination or termination for networks that are based on IP for numbers beginning with prefix 0154 from 1 August 2007 to 31 December 2008. Further details can be found at the following website:

<http://www.mcmc.gov.my/registers/cma/comdeter/pdf/Determination-AccessPricing-No.2of2007.pdf>

### Importance of networked content

Networked content in the Malaysian context focuses on information-based content in areas of education, entertainment and commerce for mobile communications, broadcasting and online sectors. The approach to develop networked content in a more aggressive and structured way is embodied in the Malaysian government initiated Networked Content Development Grant (NCDG) of RM20 million focusing on Malaysian content for mobile and TV. This is in line with the Malaysian C&M industry development blueprint, namely MyICMS886 and specifically under its content strategy. The NCDG framework was established from strategic collaboration among industry players, government agencies, ASEAN/regional and International bodies.

Networked content focuses on broadcasting (TV), moving pictures (excluding cinema distribution & VCD/DVD sales), online content, mobile/wireless data services (3G, mobile TV and the like), interactive digital TV, and other content that can be created, manipulated, stored, retrieved, and communicated through the use of a network facilities and services.

| Networked Content Development Grant |  |
|-------------------------------------|--|
| Content Priority                    | Information-based content, education, entertainment, e-commerce    |
| Eligibility                         | Malaysian Individuals & SMEs                                       |
| Evaluation basis                    | Unique value proposition; Business potential; Operational capacity |
| Funding                             | Up to 70% of project size  |

Source: SKMM

## REGULATORY ISSUES IN IP TELEPHONY

### A Continuum of Regulatory Issues Worldwide

Regulatory issues abound in the VoIP or IP telephony market. These vary from country to country and also from the perspectives taken in respect of respective regulator or regulatory purposes for intervention. The most severe is outright ban, which disallows the service to be offered in the country due to protection of the incumbent market, e.g., in Jordan prior to 1 January 2005, no entity other than Jordan Telecom was permitted to offer VoIP, including foreign-originated calls terminating on Jordan's PSTN. However, this issue of exclusivity becomes less important as markets liberalised.

The other end of the continuum is the "light touch approach" as taken by FCC and a number of European countries where VoIP is viewed as not part of the main telecommunications network, but a data service over Internet that is largely unregulated. In mature markets, issues are competition, operator obligations and consumer rights.

| Regulatory Treatment of VoIP, 2006                 |                  |
|--|------------------|
| Treatment  | No. of Countries |
| Explicitly banned                                  | 23               |
| Public consultation                                | 22               |
| Under consideration by government or regulator     | 30               |
| Licence required                                   | 26               |
| Explicitly deregulated or "light regulatory touch" | 19               |
| Explicitly legal                                   | 57               |

Source: ITU Telecom Regulatory Questionnaire, 2006



## Market Issues

Market issues, which may be regulatory issues as well, include the following:

- Net neutrality is an issue of traffic prioritization. Net neutrality describes a situation where a broadband customer should be able to subscribe to any service with no intervention by broadband service providers<sup>9</sup>. That is, customers do not have to pay more for higher quality of service (higher priority, faster service) when they visit content-rich website such as Movie Link or Google. Without net neutrality, users who want higher priority delivery of packets would pay a premium.
- Challenges to security such as personal/corporate security that includes Denial of Services attacks; viruses, worms, Trojans and the like; SPIT or Spam over the Internet telephony; Law enforcement that includes lawful (wire tapping) and data preservation or retention.
- The absence or lack of regulation<sup>10</sup>: which is often temporary, whilst the government reaches a decision on regulation or legality, often through public consultation. A grey market may exist. The trend in VoIP offered around the world has been the decline in grey market in VoIP as regulatory and licensing framework was instituted in the country.
- In developing countries, most incumbents have tried to restrict VoIP. However, in developed countries, incumbent operators have packaged VoIP with other services such as DSL that includes telephony with video as well.

| A Comparative of Regulatory Issues In Selected Countries** |  |                     |   |                      |            |                                      |                                  |     |                       |                                      |                                 |
|--|--|---------------------|---|----------------------|------------|--------------------------------------|----------------------------------|-----|-----------------------|--------------------------------------|---------------------------------|
| Issue/<br>Countries  | Legality<br>of VoIP<br>– market<br>entry | Licensing<br>regime | Not regulated<br>to limited<br>regulation | Inter-<br>connection | Numbering* | Universal<br>Service<br>contribution | Emergency<br>call<br>obligations | QoS | Number<br>Portability | Provide<br>clear<br>consumer<br>info | Protect<br>consumer<br>interest |
| Japan  |  |                     | X   |                      |            | X                                    | X                                | X   |                       |                                      |                                 |
| Korea  |  |                     |   |                      | X          |                                      |                                  |     |                       |                                      |                                 |
| Taiwan   |  |                     |   |                      |            |                                      | X                                |     |                       | X                                    |                                 |
| Hong Kong* <sup>1</sup>                                    |  |                     | X   |                      |            |                                      | X                                |     | X                     |                                      |                                 |
| Australia  |  |                     |   |                      |            |                                      |                                  |     |                       |                                      | X                               |
| US   |  |                     | X   |                      |            | X                                    | X                                |     |                       |                                      |                                 |
| EU   |  |                     | X   |                      |            |                                      | X                                |     |                       |                                      |                                 |
| UK   |  |                     |   |                      |            |                                      | X                                |     |                       | X                                    | X                               |
| EU   |  |                     | X   |                      |            |                                      | X                                |     |                       |                                      | X                               |
| Finland* <sup>2</sup>                                      |  | X                   |   |                      |            |                                      |                                  |     |                       |                                      |                                 |
| Iceland* <sup>2</sup>                                      |  | X                   |   |                      |            |                                      |                                  |     |                       |                                      |                                 |
| Norway* <sup>2</sup>                                       |  | X                   |   |                      |            |                                      |                                  |     |                       |                                      |                                 |
| Sweden* <sup>2</sup>                                       |  | X                   |   |                      |            |                                      |                                  |     |                       |                                      |                                 |
| Denmark  |  |                     |   |                      |            |                                      |                                  |     |                       |                                      | X                               |
| Spain  |  | X                   |   |                      |            |                                      |                                  | X   |                       |                                      |                                 |
| Canada   |  |                     |   |                      |            | X                                    |                                  |     |                       |                                      |                                 |
| African<br>countries                                       | X  | X                   |   |                      |            |                                      |                                  |     |                       |                                      |                                 |
| Pakistan   | X  |                     |   |                      |            |                                      |                                  |     |                       |                                      |                                 |
| India* <sup>3</sup>  |  |                     |   |                      |            |                                      |                                  | X   |                       |                                      |                                 |
| Malaysia   |  | X                   |   | X                    | X          |                                      |                                  |     |                       |                                      |                                 |
| China* <sup>4</sup>  | X  | X                   |   |                      |            |                                      |                                  |     |                       |                                      |                                 |
| Indonesia* <sup>5</sup>                                    |  | X                   |   |                      |            |                                      |                                  |     |                       |                                      |                                 |
| Philippines* <sup>6</sup>                                  |  | X                   |   | X                    |            |                                      |                                  |     |                       | X                                    |                                 |
| Singapore* <sup>7</sup>                                    |  |                     |   |                      |            |                                      |                                  |     |                       |                                      | X                               |
| Vietnam* <sup>8</sup>                                      | X  |                     |   |                      |            |                                      |                                  |     |                       |                                      |                                 |

\*Includes specific numbering using a prefix and geographic numbering

\*\*indicates reference in the country's context

\*<sup>1</sup> Plus back-up power supply for "lifeline" devices

\*<sup>2</sup> PSTN regulations

\*<sup>3</sup> Distinction between toll quality and below-toll quality in Nov 2002

\*<sup>4</sup> Skype is deemed illegal

\*<sup>5</sup> Consideration to re-formulate regulatory issues like numbering, access code, routing and interconnection when VoIP growth goes from service based to facilities based operator.

\*<sup>6</sup> VoIP is treated as a value-added service; registration is required, but not authorization; interconnection intervention if need be by regulator.

\*<sup>7</sup> Technology neutral approach; no obligations except to inform users of service limitations and clear information about service capabilities (emergency service access and quality).

\*<sup>8</sup> Subject to price regulation.

Source: "The Status of Voice over Internet Protocol Worldwide", The Future of Voice Workshop, 15-16 January 2007

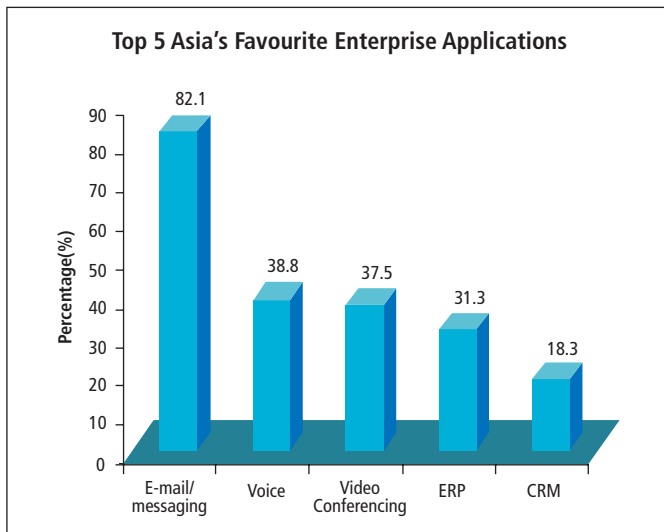
<sup>9</sup> The Future of Communications in Next Generation Networks, The Unsustainability of Access Competition, in the Future of Voice Workshop, 15-16 January 2007

<sup>10</sup> The Status of VoIP Worldwide, 2006 in the Future of Voice conference organized by ITU, 15-16 January 2007

## THE EVOLUTION OF IP TELEPHONY

IP telephony and related technologies have gained ground mainly due to the maturity and robustness of enterprise IP networks and the Internet. As such, IP Next Generation Network is on convergence of infrastructure, services and integration of service offerings. Since the most important networked applications standard of the 21st century is IP and convergence, the network needs to address not only meeting one specific infrastructure, but also to cater for the different technologies and services on many occasions within the same node.

The big five networked applications in Asia that embraced the IP based convergence standard are e-mail, voice, video-conferencing, Enterprise Resource Planning (ERP) and Customer Relationship Management (CRM).



Source: IP Communications survey 2007

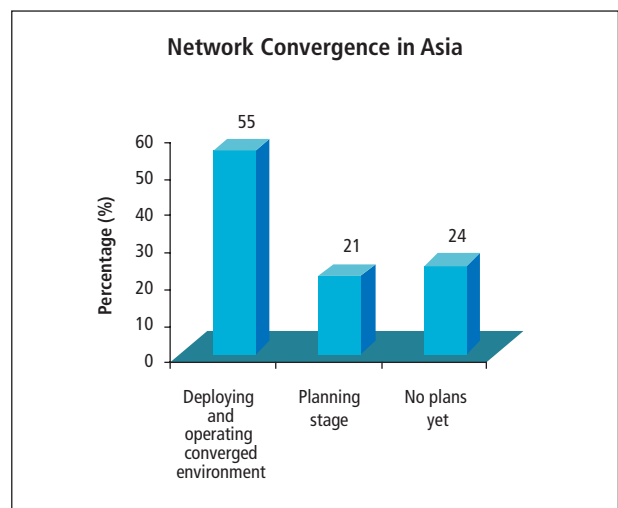
| Asia's favourite enterprise applications | (%)  |
|--|------|
| E-mail/messaging                         | 82.1 |
| Voice                                    | 38.8 |
| Video Conferencing                       | 37.5 |
| ERP                                      | 31.3 |
| CRM                                      | 18.3 |
| Accounting                               | 6.7  |
| HR                                       | 5.4  |
| Backup & Disaster Recovery               | 4.5  |
| SCM                                      | 3.1  |
| Sales force Automation                   | 2.2  |
| Content Management                       | 1.8  |
| Billing                                  | 1.3  |
| E-learning/training                      | 0.9  |

### Present status of IP Adoption in Asia

Adoption of converged network is becoming more prevalent in Asia according to survey conducted by IP communications 2007. Converged IP network is critical to about 55% of Asian enterprises that have embraced converged networking environment for voice, data and video.

About 21% of enterprises say that they are planning to do while 24% do not have any plans yet. The main driver for network convergence is cost, reliability, security plus the performance of the network itself.

While cost is the main driver, there are enterprises that site performance as the main factor for convergence.



Source: IP Communications survey 2007





## ECONOMIC IMPACT OF VoIP

Respective authorities in countries around the globe are reviewing the impact of VoIP applications to provide policy recommendations toward the deployment of technology amidst various obstacles faced by the industry, especially in the transition in the technology involved.

### – On Application Providers

VoIP applications can be downloaded as free software from the Internet at marginal cost. This means that there is a change in the total cost when quantity downloaded changes by a unit. Making an additional call using VoIP application is almost zero because voice takes up relatively little space on the network compared to data and video. Theoretically, the price of voice communication will fall as price approaches marginal cost.

### – On Telecommunications Operators

VoIP take up decreases the voice revenue of traditional telecommunications operators. As downward pressure on the price of traditional voice services increases, a marginal decrease in traditional voice markets are expected. In order to reverse the scenario above, the traditional telecommunication providers are going for a transition from the current circuit based network to IP based network. This is expected to generate more revenue by offering new multimedia services as well as provide options to remain competitive in the market.

### – On Non-Telecommunications

Non-telecommunications companies nowadays are beginning to add VoIP capabilities into their existing hardware and software. This allows for a business to make a call and receive calls from the PSTN at cheaper price.

### – On Consumers

Consumers may not be in a position to disaggregate the prices of “bundled” services. Consumers are also vulnerable to security threats in VoIP services. The top five threats of VoIP are Denial of Service Attacks (DoS), Spam over Internet Telephony (SPIT), viruses, eavesdropping and threat of toll fraud.

*Source: OECD, Directorate for Science, Technology and Industry Committee for Information, Computer and Communications Policy, Working Party on Telecommunication and Information Services Policies, Policy Considerations of VoIP, 20/03/2006*

## BUZZ WORDS IN THE FUTURE OF IP TELEPHONY

Some of the popular buzz words today involved in IP telephony going forward are mobile VoIP (mVoIP), Fixed Mobile Convergence (FMC), Unified Communications (UC) and Femtocells. Vendors, suppliers as well as operators are all competing with each other to provide the best in meeting current customer behaviour or market requirements.

### VoIP + Mobile

| Mobile VoIP (VoIP on a mobile phone)   |   |
|--|---|
| Messenger mVoIP  | Using messenger on mobile network<br>For example, Skype, MSN Messenger, Google Talk |
| Wireless LAN mVoIP   | VoWLAN – Voice Over Wireless Local Area Network<br>For example, WiFi, Bluetooth     |
| mVoIP service type is through –<br>WiFi Hotspot, Dual mode (cellular/WiFi) phone, Telephone local loop (Jajah and Rebtel) and Mobile network |   |

Source: Country Analysis – FMC and mVoIP in South Korea by KTF in Asia VoIP Conference 2007

### VoIP + FMC

FMC is the “inter-marriage” between cellular and Wi-Fi (802.11b) wireless networks into a single mobile handset, that is, the dual mode handphone or smart phones. The increasing popularity of fixed-mobile convergence FMC and Wi-Fi-enabled smartphones is expected to drive the dual-mode handset market upwards.

| Usage            |                                     |
|------------------|-------------------------------------|
| Within WLAN zone | VoIP connected using WLAN           |
| Out of WLAN Zone | Connected through cellular networks |

Source: Country Analysis – FMC and mVoIP in South Korea by KTF in Asia VoIP Conference 2007

FMC avails delivery of UC services which include VoIP telephone services, e-mail, audio and video conferencing, Voice mail, Presence and Contact information, faxes, Instant Messaging and Calendars.

### Femtocell

Femtocell provides cost effective solution for deep indoor coverage. It has been termed as the heart of a “converged house” to provide high speed data and voice service localised in building wireless service provision. Allows for same services inside-home and outside-office or outdoor.

### Conclusion

The face of VoIP is changing in line with technological advancement, network and infrastructure upgrade or revamp, and differentiation in the communications market to garner new revenue streams or rejuvenate the old, be it in pure play plain vanilla terms or in combination with other services or in collaboration with other network operators. Nevertheless, IP telephony in its way forward is expected to continue to entice users through its option of cheaper calls or at no charge at all, buoying premium for other services in combination. For enterprise users, the advantages not only centre on cost savings, but also anticipated increased productivity enterprise wide.

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