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1 DEFINITIONS

Voice over Internet Protocol (VoIP) is referred to as and broadly includes Voice over Broadband (VoB), Voice over Digital Subscriber Line (DSL), Voice over Internet (VoI), Voice over Wireless Local Area Network and Internet telephony. In its 2001 Report on IP Telephony, the International Telecommunication Union (ITU) distinguished the term “IP telephony” as referring to voice over IP-based networks *irrespective of ownership*, in contrast to VoIP service, that refers more usually to the provision of voice services over networks competing with incumbent operators¹. These technologies all describe the transfer of voice (and associated services) in digital form in discrete data packets using Internet Protocol (IP) over some or the entire communication route (in contrast to the traditional circuit-switched protocols of the Public Switched Telephone Network or PSTN). These technologies all involve the digitalization, conversion and compression of recorded voice signals into data packets that are transmitted over an IP network (Internet or private network), to be reassembled and converted back at the other end of the network into voice communication.

In practice, there are a variety of different definitions in use (Table 1.1 summarises the key categories of definitions used from Appendix Table 1) and a key part of policy-makers’ and regulators’ work is to establish a relevant definition of VoIP as it applies to their specific market (Appendix Table 1). Regulatory definitions of VoIP and VoIP providers have important implications, not only for regulation, but also for the development of the wider market, innovation and competition (as well as for measurement).

Table 1.1: Main Categories of Definitions*

Definition	Examples (among others)
Quality of service (<i>superceded</i>)	Japan, India
Equipment and terminals used, <i>and/or</i>	India, Japan, Jordan, Malaysia, Spain.
Network architecture, <i>and hence</i>	Israel, Saudi Arabia.
Functionality	Hong Kong
Numbering system	Japan, Taiwan (China).
Whole or part-provision of service over IP/PSTN	Israel, Jordan, ITU.
By service	Some countries distinguish between VoIP services in whether: <ul style="list-style-type: none"> • VoIP is viewed as a data or information service, as opposed to a voice or telecommunication service (e.g. Egypt, Jordan, the United States, Barbados); • VoIP as nomadic and non-nomadic services (Italy); and • Publicly Available Telephone Services (PATS) and Publicly Accessible Electronic Communications Service (PAECS) (EU).
Users/usage	Some countries make further distinctions according to users: <ul style="list-style-type: none"> • Public or closed group of end-users (e.g. Chile); and • Corporate or residential use (e.g. Australia, Tunisia).

Note: * According to different regulators. These definitions are not mutually exclusive and different countries may use one or more of them e.g. Israel bases its definition of VoIP on both network architecture, as well as whole and part-provision of service over IP/PSTN.

Source: ITU research, Appendix Table 1.

Early definitions of VoIP (and the regulatory status of VoIP technologies) were often based on technological distinctions in quality of service (QoS), latency and delay. Examples include Hungary¹, Japan² and India³. However, definitions based on QoS have become less relevant, as innovation has ensured that the QoS of VoIP increasingly matches PSTN quality. Recent technological developments have reduced delays to levels consistent with services offered by circuit-switched voice operators, making distinctions between real-time and non-real-time voice service less significant⁴. India's regulations relating to the quality of VoIP services were amended in January 2004 to abolish the below-toll quality distinction and to apply only to toll-quality QoS⁵, as all VoIP service providers provided toll-quality services by the end of 2003. Some countries still stipulate minimum criteria for QoS (e.g. Japan, Spain). The modern parallel to QoS is functionality, with Hong Kong distinguishing between Class 1 and Class 2 licenses on the basis of whether they offer the same functionality as PSTN⁶ (including emergency call services, number portability, etc.). This offers flexibility with the option of more limited regulatory requirements.

The differences in service offerings and capabilities between the Public Switched Telephone Network (PSTN) and VoIP arise from network architecture and the use of circuit-switched gateways or IP packets for the carriage of voice services. Some of the key differences between PSTN and IP-based networks and carriage of data and voice are summarised in Table 1.2. Nowadays, QoS of VoIP may or may not match the QoS offered by PSTN (this is usually determined by the regulator). The QoS offered by operators and VoIP service providers also takes into account cost and security considerations. For many operators, VoIP is the first incarnation of a Next Generation Network (NGN). However, NGN is a much broader concept, guaranteeing a certain minimum QoS and generalized mobility, that are not offered by VoIP.

Appendix Table 1 lists the principal distinctions in use by different countries. The definition used often depends on purpose, and is often determined with an eye to the regulatory consequences. The OECD has a broad definition of VoIP, but uses a narrow definition for policy purposes in order to focus on those VoIP services that function most like PSTN⁷. Some regulators have reached their definitions of VoIP services, with an eye to the regulatory requirements that become necessary depending on the definition. For example, location and emergency call services may be difficult for new entrants to meet, so within the United Kingdom, classification of VoIP as a PATS has been phased in, with a "policy of interim forbearance policy" by the UK regulator OFCOM to give new entrants time to meet the obligations required of PATS providers (which include location and emergency call services). In many countries, VoIP service providers are required to inform customers of the capabilities and limitations of their service (e.g. in Hong Kong, Ireland, UK).

¹ See ITU Internet case study of Hungary at <http://www.itu.int/ITU-D/ict/cs/hungary/hungary.html>. In Hungary, other providers were licensed to provide VoIP, provided it did not match Matav's QoS, by way of competition.

² In Japan, a Study Group distinguished in February 2002 between three classes of VoIP (Classes A, B and C) based on R-index and end-delay. Compliance in meeting minimum QoS criteria (end-to-end voice quality and end-to-end voice delay) are important for qualifying for the VoIP 050-prefix numbers assigned by the regulator since September 2002. Where quality is as good as PSTN, providers have been allowed to use the same numbers as PSTN since 2003.

³ The Telecommunications Regulatory Authority of India (TRAI) distinguished between toll quality and below-toll quality VoIP services in its "Regulation on Quality of Service for VoIP-based International Long Distance Service" on 15 November 2002, at: <http://www.traai.gov.in/traai/upload/Regulations/29/Regulation%20on%20ILD-QOS.pdf>.

⁴ Page 5, *Final VoIP Statement*, available from the Jordanian TRC at: http://www.trc.gov.jo/Static_English/New%20Stuff/Final%20VoIP%20Statement%20Final.doc.

⁵ "TRAI Amends Regulation on QoS for VoIP ILD Service in the Interests of Consumers of Remote Areas", 27 January 2004 at: <http://www.traai.gov.in/traai/upload/PressReleases/200/Press%20Release%2027%20Jan%2004.pdf>.

⁶ "Know More About IP Telephony Service", OFTA at: <http://www.ofta.gov.hk/en/publications/leaflets.html>.

⁷ The narrow definition of VoIP is a "voice application over IP-based network that enables a VoIP subscriber to call and to be called by a party subscribed to a traditional PSTN service" and therefore excludes Peer-to-Peer VoIP.

Table 1.2: PSTN versus IP-enabled networks for the broader concept of NGN

Factor	PSTN ('Legacy telco') model	IP-based networks
Network/service relation	Different networks providing multiple services.	Unified integrated network providing multiple services.
Mobility of services	Limited mobility of end-user services	Broad-based generalized mobility
Interconnection	Circuit-switched interconnection (transit/termination);	Packet-based, based on IP. Traditional switches are split into a media gateway to ensure transport and the softswitch for call control. This means that a peering and transit model may be more appropriate.
Structure	Vertically integrated.	Horizontally integrated (services and intelligence are separated from the underlying transport technologies).
Control	Network-centric: intelligence in PSTN has centralized control.	'Edge-centric' approach: Services in the intelligent nodes at network edges.
Cost determination	Cost determination from LRIC, determined by "efficient" network; Interconnection(transit/ termination); Calling Party's Network Pays.	Cost-determination based on peering. Bill & Keep (including Receiving Party paying for termination through the internet access charge) has been identified as a good model by some ⁸ .
Key differentiation	Capacity-based. Quality-guaranteed (call quality constant – congestion leads to calls being unavailable).	QoS class (best effort, priority, guaranteed). No differentiated quality connections – congestion leads to packet delay and loss. There is also the possibility to block, degrade QoS, including through routing, interconnection and signalling abilities.
Services	Services – voice, with some data in low bandwidth offerings.	All existing services (including voice and data) with the possibility to offer bundled packages in triple and quadruple play in higher bandwidth offerings.
Sources of market power	<ul style="list-style-type: none"> • Access network and last mile. • Established customer base • Brand name and reputation. • Large sunk investments. 	<ul style="list-style-type: none"> • Leveraging (of market power, in content and of access networks) • Control Points and bottlenecks • Interconnection agreements • Content provision (the driving rationale for service & content provider alliances).
Threats to incumbents' market Power	<ul style="list-style-type: none"> • Asymmetric regulation • Technological change 	<ul style="list-style-type: none"> • Regulatory uncertainty • Uncertain future investments

Note: * These acronyms apply to networks, communications and applications.

Source: ITU

⁸ Scott Marcus' background paper, [Interconnection in an IP-enabled NGN environment](#)⁸, presented to the ITU workshop, "[What Rules for IP-enabled NGNs?](#)". See also the German Wissenschaftliches Institut für Infrastruktur und Kommunikationsdienste (WIK)'s Bill and Keep Workshop, 4-5 April 2006, at www.wik.org.

1.1 Summary overview of how VoIP technology works

VoIP as a technology is based on different signaling and communication protocols. It works by sampling the sound “ ” by a computer at very high rates (at least 8,000 times per second or more) and recording or storing these samples. The computer then compresses the sound, so they require less space, using a compressor/de-compressor algorithm (CODEC). These significantly reduce the bandwidth used, relative to an uncompressed audio stream. Once recorded and compressed, the sounds are collected into larger data packets (*‘packetisation’*) and sent over the IP network. Generally, an IP packet will contain 10 or more milliseconds of audio (20-30 milliseconds is the most common).

Packet loss during transmission is compensated for by filling in the gaps, a process called *Packet-Loss Concealment* (PLC). Other methods to ensure completeness of packets include sending duplicate packets multiple times (*redundancy*) and including some overlap of data within packets to allow reconstruction of lost packets (*Forward-Error Correction*). Packets can also be delayed through jitter (which is a particular problem for voice). Jitter can result in choppy voice or temporary glitches, so VoIP devices must implement jitter buffer algorithms to compensate for jitter. PLC algorithms can also smooth the audio and compensate for late arrival of packets (which are then discarded). Video works in a very similar way – video information is broken into small pieces, compressed using a CODEC, placed into small packets and transmitted over the IP network. This means that other media including video can be added onto VoIP in a relatively simple manner.

In order for computers to communicate in this way, there must be agreed protocols for how computers find each other and how information is exchanged in order to allow the flow of packets between the communicating devices. Some of the main protocols for the different functions are:

1. Call-signalling protocols – to find the remote device and negotiate the means by which media can flow between the two devices to establish multi-media communication. The two most popular protocols are [ITU-T Recommendation H.323](#) and Session Initiation Protocol (SIP).

1.1 ITU-T Recommendation H.323 is an ITU-T Recommendation that builds on earlier protocols for the transmission of voice and video over PSTN, ISDN and ATM. It borrows heavily from legacy communication systems and is a binary protocol, which means that it has better interoperability with PSTN and offers better support for video and reliable out-of-band transport of DTMF. It is the most widely adopted protocol for the transmission of VoIP, partly because it was first published as a standard early on in 1996. It does not, however, encompass all aspects of VoIP communications and each vendor can have their own variations of the overall network architecture and speech compression algorithms.

1.2 Session Initiation Protocol (SIP) is the other main end-to-end signaling protocol. It facilitates communication between 2+ SIP-supported devices, but further protocols may be needed to make VoIP calls, including SIP extensions to carry the necessary information and provide the necessary functionality. It was not designed to address the problems raised by legacy communication systems, but can prove easier to implement and troubleshoot, according to some. SIP is most popular for instant messaging systems.

2. Device control protocols – governing the interface between the Media Gateway Controller (MGC) containing the call control logic and Media Gateway (MG) interfacing with the PSTN in the split gateway. These protocols include [ITU-T Recommendation H.248](#) and Media Gateway Controller Protocol (MGCP).

Beyond these protocols, there are also other, non-standard protocols such as Skype that have proved popular in the market.

Figure 1.1: Topology of the ITU-T Recommendation H.323 and SIP protocols

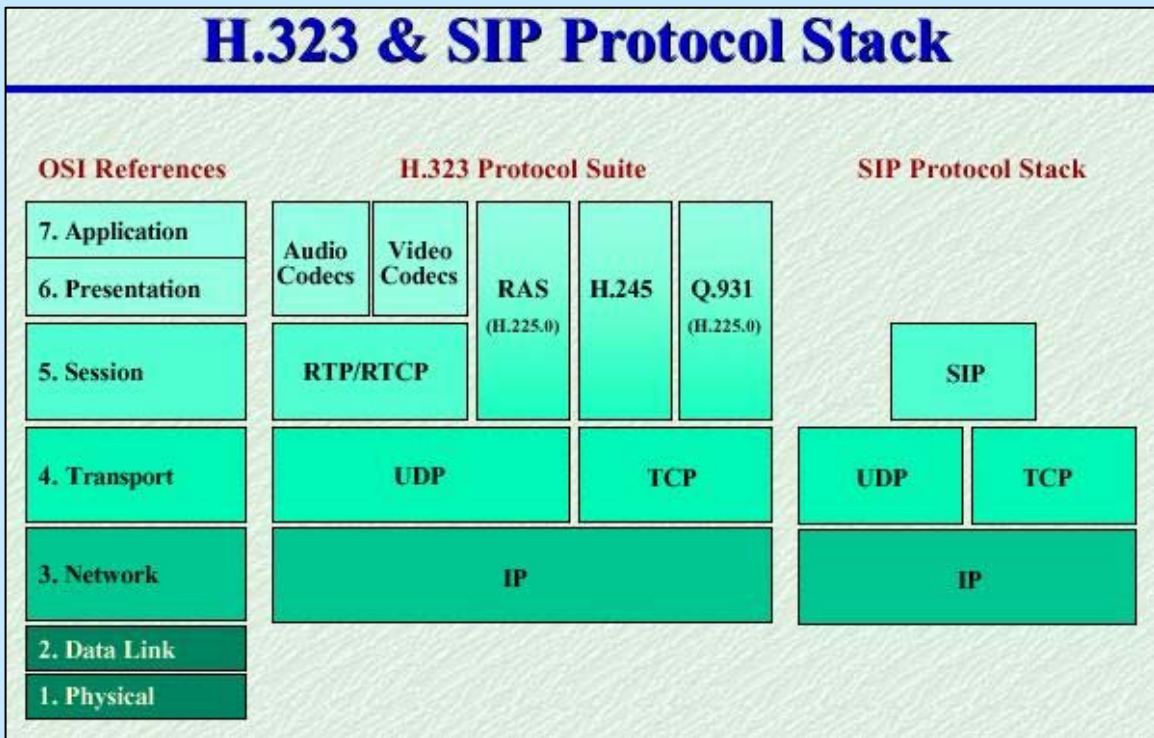
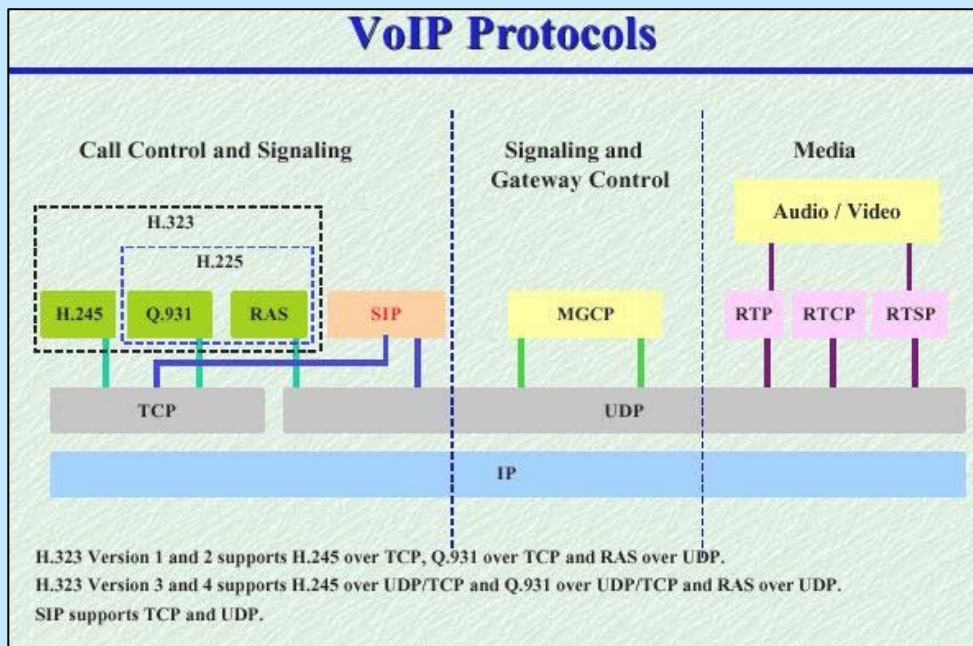


Figure 1.2: Different protocols involved in VoIP



2 DRIVERS AND OBSTACLES TO VOIP DEPLOYMENT

VoIP services are currently offered by local telephone operators, long-distance operators, cable TV companies, Internet service providers, non-facilities-based independent providers and, in some countries, mobile operators. ITU (2001) distinguishes between incumbents and competing networks, as well as independent providers (e.g., Vonage). Regulatory approaches may need to distinguish between different classes of providers in order to address market dominance and competition issues (see Section 5). VoIP is also showing strong growth by all metrics (see Section 3). In some markets, however, growth in VoIP does not seem to be achieving its full potential, and some of the obstacles to growth (section 2.2) are limiting market gains.

2.1 The main factors driving VoIP take-up and deployment include:

For businesses:

- **Security at a lower cost:** for institutional and business users, the prospect of a private network can offer greater security and reliability, with no discernible loss in quality of service. Cost efficiencies may or may not be a consideration in this case.

For consumers:

- **Significantly lower costs** may arise for consumers (who, in some cases, are prepared to sacrifice some quality of service or functionality for a reduction in price). The explosive growth of companies such as Skype and Vonage demonstrates that a key driver of the growth of VoIP is consumer demand, with consumers wishing to spend less to stay in touch. Consumers may also find bundling and flat-rate pricing packages attractive in an increasingly complex multimedia environment. The possibility of a single and/or fixed bill per month for telecommunications may be enticing to some consumers, in particular for ADSL.

For service providers

- **Lower investment, capital and operating costs for operators** through:
 - Economies of scale;
 - Reductions in the bandwidth required to send any given voice message; and
 - The possibility of converged services running over one network (as opposed to multiple, older legacy networks).

Cost savings depend partly on the structure of the telco's traffic, with greater savings possible for long-distance and international traffic, as these omit the access charges imposed by local telcos on long-distance carriers for origination/termination of the local part of the call. For many operators, VoIP networks are perceived as a first stepping-stone towards Next-Generation Networks (NGN).

- **Locking into growth** - Instead of being perceived as a threat, growing VoIP revenues could compensate for flagging traditional voice revenues and lock into growth in the broadband market. This is certainly the strategy being pursued by BT, for example, in what it refers to as its 'New Wave' service (including broadband and broadband voice, as well as its VoIP product, BT Communicator).
- **Entry into new markets, conferring market power and leverage:** VoIP can be used by operators to offer telephony (voice), broadband Internet access (data) and a host of other broadband audio-visual services (video). Services such as VoIP and TV/video can be bundled with broadband access and are important in reducing churn and increasing service differentiation in competitive markets. Whilst these could be used by dominant operators to leverage their market dominance in

certain segments to gain a foothold into new markets⁹, bundled VoIP offerings can also provide new points of entry into new market segments and enable content providers to move into service provision¹⁰. VoIP can also lower barriers of entry to new geographical markets for multi-national companies with international operations that are moving to adopt IP telephony and internal VPNs. VoIP can serve as an entry point into enhanced multimedia services.

- **Enhanced innovation**, converged services, new revenue opportunities and greater choice (including N-play package offers). The mechanics of IP-based transmission mean that it is relatively simple to add in other media on IP-based communications. Other and new services can also be offered over a converged IP network. This also includes the possibility to offer videoconferencing, fax, audio/video and a number of other new VoIP-related applications. Furthermore, some of these applications can be added in by upgrades or interfaces with existing PSTN equipment – not all these services require the loss or removal of older equipment.
- **New business models for operators**: VoIP offers the possibility to move towards new business models, including the bypass of the traditional accounting rate settlement system as a settlement mechanism, as well as flat-rate pricing in billing. Flat-rate pricing is growing rapidly in popularity, due to its clarity and simplicity in billing operations.

2.2 Drawbacks and obstacles to further growth in the market include:

- **Problems with QoS and reliability**, including continuance of service during power cuts and security. For multimedia services provided over broadband networks, voice, video and high-speed data have different requirements, so bundled products place different burdens on telecom networks. Voice is particularly affected by jitter (the variation in time between packets arriving over the network), while video and data are most sensitive to packet loss or reordering. The provision of bundled services over one network means that the network has to cope with a range of different QoS requirements. The ability of the network to continue to function despite power shortages is cited as a particular problem in developing countries, given the frequent power shortages. In terms of security, only limited calling party information may be available.
- **Best effort** - VoIP services provided by operators without their own broadband network are provided on a best effort basis only. This means that traffic may be downgraded and may not be as highly prioritized as other operators' traffic, whether by intention or accident. In some instances, incumbents have sought to inspect, block or degrade VoIP traffic carried over their networks through 'deep packet inspection' and packet sniffers.
- **Resistance by incumbents** and established operators, which see VoIP as a threat to their established PSTN revenues, mainly in countries where the telecommunications market is monopoly-based or less mature. Operators in several developed countries and a few developing countries have chosen to engage with VoIP, however, in the hope of being better prepared for the future direction of the market. These operators are seeking to position VoIP as a complement to their existing services, rather than substitute.
- **Regulatory uncertainty**. Operators argue that, in order to justify the investments required in VoIP, they must be guaranteed a clear regulatory framework that will reduce the risk inherent in regulatory uncertainty and help clarify (guarantee) returns on their investment in advance. Some commentators note that, if internet telephony is to be a success in the European mass market, policy-makers and regulators have to address the task of promoting broadband technologies,

⁹ "On the Question of Bundling Again", column by Mr. Au, Director General of the Hong Kong OFTA, 1 May 2005, at http://www.ofta.gov.hk/en/dg_article/au_articles/article.html.

¹⁰ In Hong Kong, operators are especially concerned about whether services-based operators who do not invest in network facilities should be admitted into the IP service market, Article by Mr. Au, "The Regulation of IP Telephony (2)", 15 May 2005, available from: http://www.ofta.gov.hk/en/dg_article/au_articles/article.html.

without simultaneously reinforcing the structures of the former incumbents¹¹. In some countries, incumbents are also interested to limit the regulatory freedom that new entrants to the VoIP market enjoy.

- ***Increased and/or specific regulation.*** Some countries (e.g. United Kingdom, United States) are developing regulations relating to VoIP (e.g. emergency call obligations, etc. – see Table 3) that may make it harder for new entrants to offer VoIP services. In recognition of this, some countries have used staged transition periods (UK), while others distinguish between classes of VoIP service according to functionality (e.g. Hong Kong distinguishes between Class 1 and Class 2 VoIP service based on whether full PSTN functionality in, for example, number portability, is offered by the service provider).

3 MARKET PROSPECTS

Estimates of the total VoIP market size vary significantly, in part due to the problems in definition, definitions by sector (business/residential) and by the different technologies in use (Appendix Table 1). Quantifying the number of VoIP subscribers or minutes of traffic is difficult, and to some extent meaningless, since the migration to VoIP is taking place within the context of a broader migration to IP¹². In the more industrialized economies that are moving to install IP networks, the number of subscribers or proportion of traffic carried over the IP-based network depend upon the rate of migration and completion of the incumbents' IP network. This will depend on the state of their legacy network, inter-connection and structure of their traffic (and revenues). What is clear, however, is that however it is measured, the VoIP market is growing in terms of subscribers, revenues and traffic, and will restructure voice revenues worldwide.

The growth of VoIP is all the more remarkable given that, initially, VoIP technologies are often resisted by incumbents, Ministries and governments in many countries where the incumbent is state-owned, including many developing countries. For example, in Panama, prior to the end of the monopoly in 2003, the Public Services Regulator mandated all ISPs to block IP ports identified with VoIP services (domestic VoIP has now been allowed). For many incumbents, the initial stages of introduction of VoIP technologies offers the prospect of larger margins (often the incumbent maintains the high price of telecom services, whilst reaping the benefits and greater profit margins offered by lower costs, as has been the case for some African incumbents, at least while the grey market remains relatively immature¹³.

More recently, however, operators and regulators in industrialized countries have sought to engage with and develop VoIP, rather than exclude it, in recognition of its substantial and growing market size (however it is defined). The UK regulator, OFCOM, anticipates that all voice traffic will shift over to IP technology¹⁴, while the Irish regulator, ComReg, anticipates a similar market outcome¹⁵.

¹¹ "Internet telephony: media darling still a far cry from the mass market", 9 August 2005, Deutsche Bank Research, at: <http://www.dbresearch.de/servlet/reweb2.ReWEB?rwkey=u1575058>.

¹² For example, BT is installing its IP-based 21 Century Network to drive growth in 'New Wave' revenues to compensate for declines in traditional fixed voice revenues and mitigate high maintenance costs associated with its legacy network (BT Annual Report 2006).

¹³ "An Overview of VoIP Regulation in Africa: Policy Responses and Proposals", Balancing Act Africa, June 2004, Tracy Cohen & Russell Southwood, available from <http://www.balancingact-africa.com/>.

¹⁴ "Regulation of VoIP Services", <http://www.ofcom.org.uk/consult/condocs/voipregulation/voipregulation.pdf>.

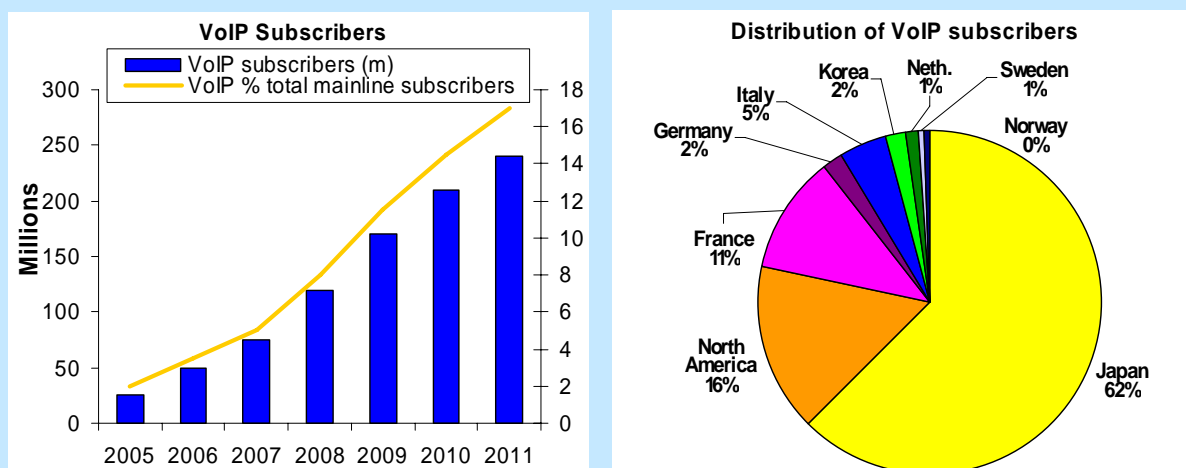
¹⁵ "Review of the VoIP Framework in Ireland", http://www.comreg.ie/_fileupload/publications/ComReg0613.pdf.

3.1 VoIP Subscribers

Estimates of the number of VoIP subscribers vary significantly, due to the definitions used and whether they describe home or residential VoIP versus total (including the significant number of business subscribers). For example, Silicon.com reports that by May 2004, there were fewer than 200,000 VoB users¹⁶ (rather than subscribers), whilst Merrill Lynch estimated that there were around 4 million VoIP subscribers in the US alone at the end of 2003¹⁷. By end of March 2005, an estimated 11.5 million people worldwide were using retail VoIP services for some part of their telephone calls¹⁸. Adding in PC-based ‘soft-client’ VoIP services (such as Skype) and adjusting for the number of minutes, this estimate grows to some 17.5 million people using VoIP services by March 2005¹⁹. Excluding PC-to-PC VoIP which is most difficult to ascertain, the number of subscribers to VoIP services has been estimated for the end of 2005 at around 25 million worldwide²⁰. The number of worldwide VoIP subscribers is expected to surpass 47 million subscribers at the end of 2006, double the number of subscribers at the end of 2005²¹. This is estimated to grow to approximately 250 million by the end of 2011 (Figure 3.1, left chart).

Figure 3.1: VoIP Subscribers worldwide

Estimates of VoIP subscribers, total and as a proportion of mainlines worldwide, 2005-2011 (left chart); and the distribution of VoIP subscribers worldwide, March 2005 (right chart).



Source: iDATE (left chart), Point Topic (right chart).

Japan remains the largest market worldwide, with an estimated 60 per cent of total VoIP subscribers in March 2005 according to Point Topic (Figure 3.1, right chart), due to its early regulatory framework and liberalization of VoIP services. Strong growth has been registered in France, where the regulator ARCEP

¹⁶ www.silicon.com/comment/0,39024711,1000604600.htm.

¹⁷ Merrill Lynch, Everything Over IP, p.20, 12 March 2004.

¹⁸ Point Topic, www.point-topic.com/content/dslanalysis/voipana050706.htm (6 July 2005). The study estimates the following residential VoIP users as of March 2005: North America (1.8 million); Japan (7.2 million); France (1.3 million); Europe (2.3 million), PC-based VoIP users (5.9 million).

¹⁹ Point Topic, www.point-topic.com/content/dslanalysis/voipana050706.htm (6 July 2005). The study estimates the following residential VoIP users as of March 2005: North America (1.8 million); Japan (7.2 million); France (1.3 million); Europe (2.3 million), PC-based VoIP users (5.9 million).

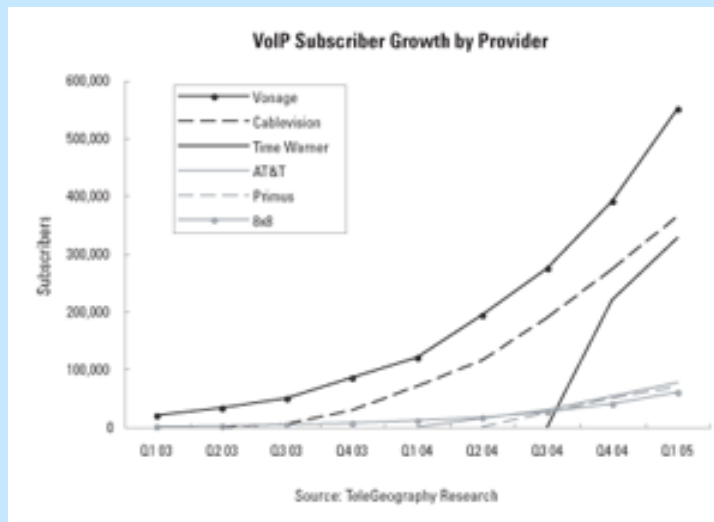
²⁰ iDATE, available from (in French).

²¹ Infonetics Research, August 2006, available at <http://www.infonetics.com/resources/purple.shtml?ms06.ngv.pbx.2q06.nr.shtml> and quoted at: <http://www.internetnews.com/stats/article.php/3624291>.

reported that the number of VoIP subscribers amounted to 1.5 million at March 2005, which accounted for 1.5 billion minutes or 6% of total traffic over the first quarter of 2005²². BT reports that its Broadband Voice subscriber base amounted to 22'000 at the end of 2005. However, this is in stark contrast to estimates by the UK regulator, OFCOM, which estimates that by March 2006, there were more than 1.8 million active residential VoIP households in the UK. Of these, OFCOM estimates that around 300,000 were using BT's VoIP products (Broadband Voice and Communicator); roughly 150,000 were using Wanadoo/Orange's service and the remainder (1.35 million or 75%) was using other VoIP services, such as Skype and Vonage.

The estimation of these PC-based 'soft-client' VoIP services is particularly problematic. Skype had a registered 31 million accounts by 2004, but there were no indications of the number of active users. Until fairly recently, Point Topic adopted a method of estimation of the number of users based on the total minutes of traffic, but this depended on assumptions about the average usage pattern. Recently, Point Topic has changed its estimation method to one based on revenues. The significant finding, however, is that by all estimates, PC-to-PC VoIP and Skype and Vonage have cornered significant market share in most markets, from 75 per cent of households in the UK to the bulk of US subscriber growth (Figure 3.2).

Figure 3.2: VoIP Subscribers by Provider for the US



Source : Telegeography, available from: http://www.telegeography.com/products/us_voip/index.php.

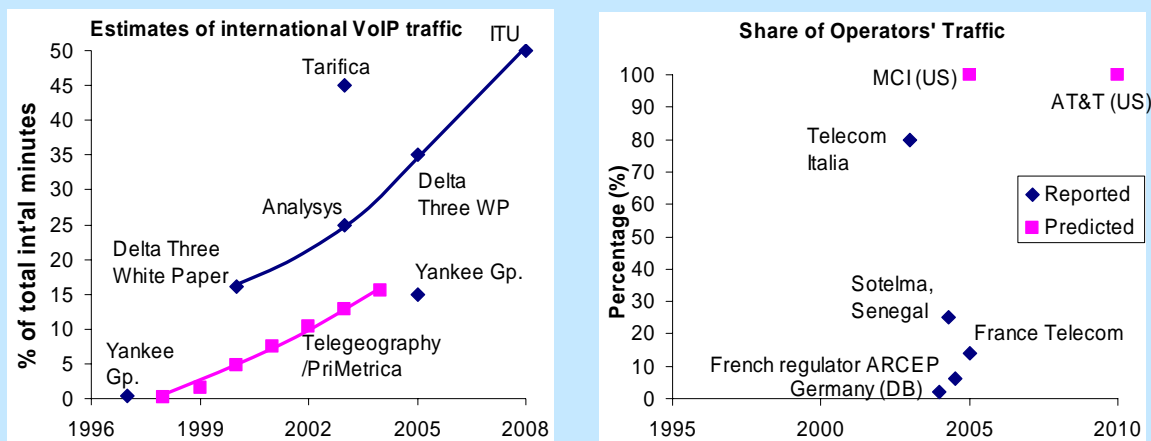
3.2 VoIP Traffic

Estimates of VoIP traffic are difficult, since voice traffic sent over the Internet looks no different to most types of data. Considering the definition of VoIP as the transfer of voice traffic over IP networks, a number of estimates have been made of the total proportion of voice traffic carried over IP networks globally (Figure 3.3, left chart), while some operators have published information on their traffic (Figure 3.3, right chart).

²² <http://www.silicon.fr/articles/11521/VoIP-15-million-d-utilisateurs-en-France.html>.

Figure 3.3: VoIP Traffic

Estimates of VoIP traffic worldwide, and by individual operators.



Source: ITU.

Note: In the left chart, Telegeography/PriMetica estimates (shown by the pink line) are considerably lower, as they draw mainly on traffic estimates from US operators. The ITU estimate refers to IP telephony. The right chart presents different estimates of VoIP traffic as a proportion of total traffic from diverse sources, which are not measured using a single, consistent methodology.

In terms of individual markets, upon completion of the first phase of its 21 CN, BT reports 23 million customer calls every year carried over its IP-based network, Twenty-First Century 21CN, in the experimental phase, equivalent to 625,000 live customer calls a day.

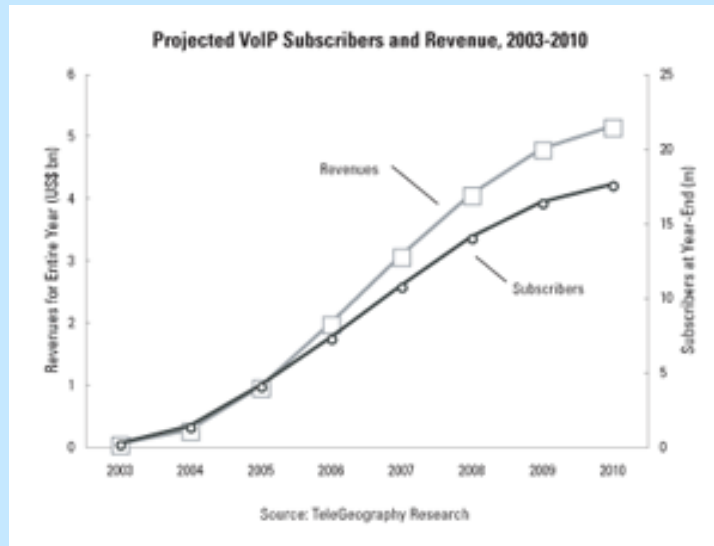
3.3 VoIP Revenues

In terms of revenues, Point Topic estimates that revenues from “IP Telephony services” (defined as full-service telephone services using the Internet for part or all of the call) grew from US\$ 833 million in 2004 to US\$ 1’834 million in 2005, a growth of 89 per cent during 2005 reflecting the growth of VoIP in Japan, France and North America (mainly through cable operators). Telegeography predicts that revenues from VoIP will reach US\$ 5 billion by 2010 (Figure 3.4). Other estimates are much higher - revenues from VoIP services in the business sector alone will reach US\$ 18 billion by 2010, with hosted VoIP business revenues reaching US\$ 7.6 billion by 2010, according to Juniper Research²³. In North America alone, VoIP service revenue was estimated at around US\$ 2.6 billion in 2005²⁴.

²³ ‘Global VoIP – Hosted & Non-Hosted Services: Business & Enterprise Markets, 2006-2010’, 20 March 2006, www.juniperresearch.com, quoted at <http://www.totaltele.com/View.aspx?ID=3168&t=1>.

²⁴ Infonetics Research, August 2006, available at: <http://www.voip-news.com/news/voip-revenue-report-072706/>.

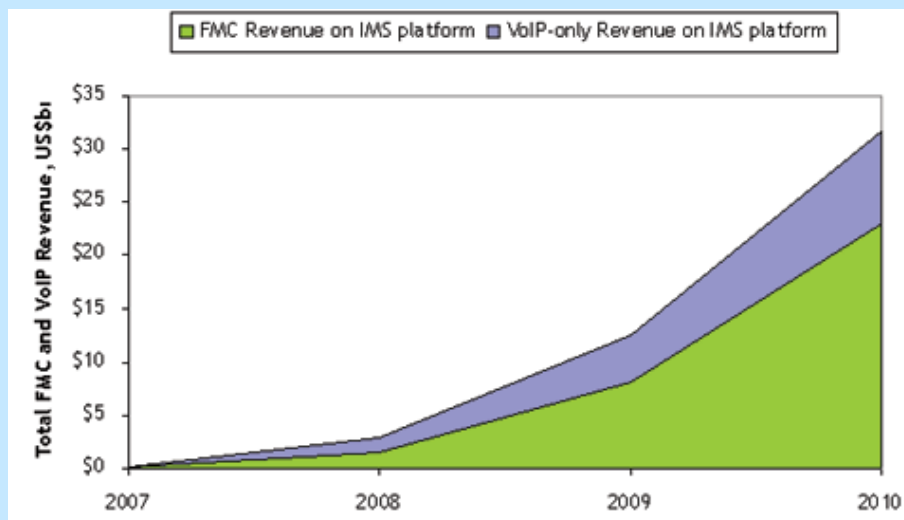
Figure 3.4: Projected Growth in VoIP Subscribers and Revenues, 2003-2010



Source: Telegeography, available from: http://www.telegeography.com/products/us_voip/index.php.i

In the UK, British Telecom reports that its Multi-Protocol Label Switching (MPLS) revenue grew by more than 34 per cent during the 2006 financial year to exceed GBP 400 million for the year ended 31 March 2006²⁵. The Korean domestic VoIP service market was estimated to be worth around KRW 42.5 billion (USD 36 million) in 2003, and is anticipated to grow by some 85% annually to reach KRW 320 billion (USD 272 million) by 2007²⁶. Telegeography considers that consumer VoIP services are beginning to have a meaningful impact on switched service revenues.

Figure 3.5: Projected Growth in Revenues on IMS Platform, 2007-2010



Source: Pyramid Research, available from: http://www.pyramidresearch.com/store/rp_ims.htm?SC=EM8ims1.

²⁵ Page 12, BT Annual Report 2006, at: <http://www.btplc.com/report/report06/pdf/Annualreport2006.pdf>.

²⁶ <http://web.net2phone.com/about/press/releases/20030205.asp>.

For countries where estimates of the grey market are available, the scale of revenues (or losses) reported is significant, suggesting a large market with strong demand – Jordan Telecom states that it sustained losses as a result of VoIP exceeding 7.5 million Dinar (around 10 million USD) for 2001²⁷. In Pakistan, illegal grey traffic is estimated to cause losses of around Rs.3 billion annually (50 USD million)²⁸. Such estimates of the amount of ‘lost traffic’ suggest that strategies to close down ‘grey market’ operators and prevent access by users to VoIP service have not been successful²⁹.

Measures of the grey market in Internet telephony in African countries are similarly significant, at around 10-20 per cent³⁰. VoIP was illegal in most countries in Africa (Mauritius was the first country in Africa to launch fully liberalised and free VoIP services at the start of 2004). However, the huge margins between the consumer prices charged by monopoly incumbents and the prices that they can obtain for traffic on the international market have meant that parallel market operators (including ISPs and cybercafés) have sought to bridge the gap, by proposing cheaper calls, while realising profits. Parallel markets have developed rapidly. The Nigerian operator Nitel, estimated in 2004 that, before its 2004 reduction in the price of international calls, 90 per cent of international calls went through the parallel market. Ghana Telecom estimated that the parallel market in Ghana amounted to approximately US\$15-25 million in 2003 (depending on estimates of rates and volumes).

4 REGULATORY ISSUES

This section reviews some of the current regulatory approaches towards VoIP, based on the survey of country approaches listed in the Appendix Table 2. Faced with such strong market growth, regulatory responses can be broadly classified into those countries where:

- 1) ***VoIP has been made illegal***, often to protect the revenues of the incumbent (and government, in those markets where the incumbent is a State-Owned Enterprise). These are often developing countries. According to ITU’s analysis, VoIP was illegal in 24 countries and restricted in 37 countries at the end of 2004.
- 2) ***VoIP is unregulated***, through a regulatory decision that VoIP should not be regulated. (This is different to category 3 below).
- 3) ***The absence or lack of regulation***: which is often temporary, whilst the regulator reaches a decision on regulation, often through public consultation.
- 4) ***VoIP may be subject to similar/same regulation as PSTN***, or some forms of VoIP are subject to some/all of the same regulation as PSTN, depending on the technology used (hence the importance of definitions). This can amount to a ‘light regulatory touch’ e.g. in the US.
- 5) VoIP may be subject to its ***own set of regulations***, with its own specific licenses.

A number of countries have yet to formally conclude on their framework for VoIP regulation, including countries which have held formal public consultations (including Belgium, Cyprus, Denmark, France, Germany, Ireland, Italy, Malta, Netherlands, Norway, Poland, Saudi Arabia, Russia, Sri Lanka, Spain,

²⁷ Page 4, *Final VoIP Statement*, available from the Jordanian TRC at: http://www.trc.gov.jo/Static_English/New%20Stuff/Final%20VoIP%20Statement%20Final.doc.

²⁸ “*Comprehensive Strategy Will be Developed Against Grey Telephony*”, Press Release, 16 June 2006, Pakistan Telecommunications Authority, available from: http://www.pta.gov.pk/index.php?option=com_content&task=view&id=760&catid=92&Itemid=301.

²⁹ The GSR discussion paper, available from www.itu.int.

³⁰ “*An Overview of VoIP Regulation in Africa: Policy Responses and Proposals*”, Balancing Act Africa, June 2004, Tracy Cohen & Russell Southwood, available from <http://www.balancingact-africa.com/>.

Trinidad & Tobago, UK, among others) but also those countries where the regulatory framework for VoIP is officially or unofficially “under consideration” (including Bulgaria, Cuba, Egypt, Germany, Ghana, Kazakhstan, Mali, Poland, Russia, Senegal, Sri Lanka, Trinidad & Tobago, Tunisia, UAE).

In arriving at their regulatory approach, some of the questions that different regulators have sought to address include:

¹ See “IP Telephony 2001”, published by the ITU, Geneva.

Table 4.1: Regulatory Questions in relation to VoIP, mid-2006

Question	Implications	Examples
1. How should VoIP services be defined? What does the regulator consider VoIP services to be?	This determines the scope of services considered to be included as VoIP and hence subject to regulation. (A related question is the criteria that make it possible to regard a service as being publicly available telephony).	See Appendix Table 1.
2. Is the provision of commercial VoIP services legal and authorised?	If No, the country falls into Category 1 (<i>Illegal</i>). If yes, proceed to Question 3. The answers and approach adopted to these questions determine the legal basis for proceedings against operators (often alternative operators) providing VoIP services.	Countries where VoIP is explicitly banned (according to most recent data): Benin, Bolivia, Botswana, Cameroon, Comoros, Costa Rica, Cote d'Ivoire, Eritrea, Ethiopia, Gabon, Ghana ("yet to legalise VoIP"), Guinea, Guyana, Honduras, Kuwait, Liberia, Mozambique, Namibia, Paraguay, Qatar, Seychelles, Swaziland, UAE.
3. If legal, are VoIP services regulated?	If no, country falls into category 2 (<i>unregulated</i>). If yes, the country falls into category 4 or 5 (<i>regulated</i>).	VoIP is explicitly deregulated or subject to only light regulation in Argentina, Azerbaijan, Brazil, Barbados, Canada, Czech Rep., Denmark, Estonia, France, Greece, Hungary, Ireland, Italy, Poland, Nicaragua, Romania, Turkey, Uruguay, US.
4. Is it necessary to obtain a license?	A licensing framework gives regulators an opportunity to lay out clear and distinct terms and conditions relating to the provision of service. The licensing framework for VoIP is also being considered in moves towards unified licensing framework. Licenses are frequently used as the means by which VoIP business is safeguarded for the incumbent in some markets.	(Certain) VoIP services may require a license in Algeria, Bangladesh, Barbados, Brunei, China (to be officially confirmed), Croatia, Dominican Rep., Egypt, Israel, Luxembourg, Mauritius, Mexico, Morocco, Nigeria, Pakistan, Peru, Portugal, Singapore, Saudi Arabia, Slovak Rep., South Africa, Spain, Taiwan (China), Tanzania, Uganda, Venezuela. VoIP services may be provided by the incumbent (only) in Bahrain, DRC Congo, Jordan, Oman, Tunisia, Uganda, Viet Nam, and Zambia.
5. Should VoIP services be regulated like PSTN? (& what regulations apply to PSTN).	If yes, country falls into category 4 (=PSTN). If no, the country falls into category 5 (<i>own regulations</i>).	PSTN – Finland, Iceland, New Zealand, Norway, Sweden, Switzerland, UK.
6. In more mature markets: - Interconnection of VoIP operators - technical and QoS standards; - Allocation of numbers for VoIP services? - Emergency call service, caller ID and number portability; - Info to be provided to consumers - Protection of consumer interests	These questions are vital in determining: - sophistication and capabilities of the service on offer; - the scale of investment to establish service; - market entry of new/new types of operators (e.g. start-up versus established content providers); - ultimately, whether the VoIP market is competitive; - and the importance of consumer rights.	VoIP is (explicitly) legal in Algeria, Australia, Austria, Argentina, Azerbaijan, Bangladesh, Barbados, Belgium, Brazil, Canada, Chad (internationally), Chile (at the local level), Colombia, Croatia, Czech Rep., Denmark, Estonia, Finland, Hong Kong, Hungary, Iceland, India, Israel, Italy, Japan, Kenya, Rep. of Korea, Luxembourg, Malaysia, Mauritius, Mexico, Morocco, Nicaragua, Nigeria, Norway, Panama (domestically), Philippines, Portugal, Romania, Singapore, Slovak Rep., Slovenia, S.Africa, Spain, Sweden, Switzerland, Taiwan (China), Tanzania, Thailand, Togo, Turkey, Uganda, UK, Uruguay, US, Viet Nam, Zambia.

Source: ITU

5 REGIONAL TRENDS IN REGULATORY APPROACH TO VOIP

Based on the review of different regulatory approaches in different countries, the development of regional approaches is apparent in some areas. This section draws together the main approaches being followed in different regions.

5.1 North America

In the US and Canada, where VoIP applications are legal, different service models are developing – some VoIP providers are offering their services for free, bundled in with other service offerings. Other service providers charge for long-distance calls carried over VoIP, similar to traditional fixed-line telephone services. Other VoIP providers allow flat-rate calling regardless of distance, a business model that is gaining in popularity.

As defined by the 1996 Telecommunication Act that distinguishes telephone services from information services, the FCC in the United States does not consider VoIP as a traditional telephone service, but as a computer-based ‘information service’, that is relatively unregulated. USA has adopted a liberalized approach to VoIP, since it is considered an Internet application/Information Service. The FCC has sought to adopt a “light regulatory touch”. approach There are no licensing requirements, but a Universal Service contribution is required.

5.2 Europe

VoIP is not explicitly regulated in the EC framework, and European countries have tended to develop their own approach to VoIP in terms of regulation. This has been called by some a “laissez-faire” approach to VoIP regulation.

In the Scandinavian countries, regulators have tended to adopt a light regulatory touch on the basis that “voice is voice”, so Finland, Iceland, Norway and Sweden have referred back to the PSTN regulations. France and Ireland adopted an early and relatively liberalized approach to VoIP and actively advocated VoIP for open competition, greater choice and lower prices. Ireland has focused on consumer protection issues, as illustrated by its publication of “Guidelines for VoIP service providers on the treatment of consumers” in 2005³¹. Access to emergency services was a specific topic of concern for the UK³². OFCOM developed an interim forbearance policy allowing VoIP providers to offer emergency services, without other regulatory requirements for PATS³³. This was to “diminish the disincentives” to provide access to emergency services. After consultation with the European Commission and European Regulators’ Group on the New Regulatory framework, OFCOM ended its policy of interim forbearance policy and introduced a mandatory code of practice for consumer information for VoIP providers³⁴. Italy has adopted an original approach to VoIP legislation in terms of nomadic and non-nomadic services. Germany and Poland are still under consultation in relation to VoIP services.

These different approaches have been broadly observed by the European Commission. At the European level, there have been moves by the European Regulators’ Group to formulate a common approach to regulation, with pro-competitive policies a particular concern of the European Commission. More recently, the EU Information Society and Media Commissioner has suggested that EU operators may be required to split out their infrastructure and services divisions in order to guarantee fair access and promote competition and investment.

³¹ “Guidelines for VoIP service providers on the treatment of consumers”, ComReg document 05/50, 14 October 2004, available from: <http://www.comreg.ie/fileupload/publications/ComReg0550.pdf>.

³² “Regulation of VoIP Services”, <http://www.ofcom.org.uk/consult/condocs/voipregulation/voipregulation.pdf>.

³³ “New Voice Services: A consultation and interim guidance”, 6 September 2004, available from www.ofcom.org.uk/.

³⁴ Consultation on the Regulation of VoIP Services, Summary of the Consultation available from: http://www.ofcom.org.uk/consult/condocs/voipregulation/voip_pec/pec.pdf.

5.3 Africa

Until recently, VoIP was banned in many African countries. Many African governments continue to prohibit VoIP adoption except by monopoly incumbents, with the notable exceptions of Mauritius (the first country to explicitly liberalise VoIP and implement a licensing regime for VoIP services on the continent), Nigeria and South Africa. Regulatory statements include many references to technology neutrality and service specificity, but in practice, on the basis of the regulators' statements, VoIP is frequently only legal for those holding an international gateway license and whilst there are moves to extend these to mobile operators, in many countries, currently only incumbents hold international gateway licenses.

African incumbents' initially sought to exploit profit margins between falling costs in international minutes to relatively low prices, whilst continuing to sell them at higher PSTN prices. According to Balancing Act Africa, these price differences arose mainly for three reasons:

- The introduction of international competition (helped by the push to deregulation and commitments made under WTO GATS) that has pushed costs down.
- The shift to cheaper call rates through the use of data networks.
- Growing demand for international calls and the transformation of the international calling market from a low-volume, high-margin market to a higher-volume, lower-margin market (through greater demand from multinational corporations and migration).

This led to a large, grey market in VoIP-based calling, with VoIP service providers exploiting 'arbitrage' opportunities. This phenomenon even resulted in declines in the annual international traffic volumes of some African incumbents according to Balancing Act Africa, as traffic went over to the grey market. Balancing Act Africa concludes that "African incumbents have been faced with a much starker choice than their developed world counterparts: to watch their traffic disappear into the grey market or devise a strategy for attracting it back".

5.4 Asia-Pacific

There is work underway on adopting a common approach to VoIP as part of work on NGN by APEC (Asia Pacific Economic Cooperation). However, Asia reflects the huge diversity of approaches from early and liberalised approaches to VoIP (e.g. Australia, Japan, Rep. of Korea, Malaysia and Singapore) to well-developed licensing systems (e.g. Bangladesh and India) outright bans (several of the Arab states, including Kuwait, Qatar and UAE). Where the Arab states permit VoIP, it has been mainly adopted by incumbents. For example, in Jordan, early concerns over the introduction of VoIP originated with concerns to preserve Jordan Telecom's exclusivity rights, as guaranteed under its License. No entity other than Jordan Telecom was permitted to offer voice service to the public using VoIP prior to 1 January 2005, including foreign-originated calls terminating on Jordan's PSTN³⁵. Further, the use of VoIP technologies by commercial service providers other than Jordan Telecom to convey foreign-originated voice calls for termination on Jordan's PSTN (including mobile networks) was deemed an infringement of JT's License.

5.4.1 Strategy on grey market: Focus on Pakistan as an example

Of particular interest in Africa and some countries in Asia is the approach adopted towards grey operators and the grey market³⁶. In Pakistan, illegal grey traffic is estimated to cause losses of around Rs.3 billion annually³⁷. Pakistan has established a clear strategy to eliminate grey traffic and reduce illegal call termination. In June 2006, a Vigilance Committee on illegal telecom traffic was established³⁸, including the

³⁵ Formal Statement Regarding VoIP, Page 7, *Final VoIP Statement*, available from the Jordanian TRC at: http://www.trc.gov.jo/Static_English/New%20Stuff/Final%20VoIP%20Statement%20Final.doc.

³⁶ Defined as the use of illegal gateway exchanges to bypass legal gateways, including the use of VoIP gateways, GSM gateways, WLL phones, mobile SIMs or other related equipment to terminate illegal traffic from abroad and bypass PTCL gateways. This traffic may then be distributed onwards using WLL and mobile numbers.

³⁷ Formal Statement Regarding VoIP, Page 7, *Final VoIP Statement*, available from the Jordanian TRC at: http://www.trc.gov.jo/Static_English/New%20Stuff/Final%20VoIP%20Statement%20Final.doc.

³⁸ "Comprehensive Strategy Will be Developed Against Grey Telephony", Press Release, 16 June 2006, Pakistan Telecommunications Authority, available from: http://www.pta.gov.pk/index.php?option=com_content&task=view&id=760&catid=92&Itemid=301

Ministry of IT & Telecom, the Pakistan Telecommunication Authority (PTA), PTCL, telecom operators and other concerned agencies. The Government of Pakistan sees grey market telephony as a serious concern, causing revenue loss not only to Government, but also to all stakeholders. DSL operators and Internet Service Providers (ISPs) were asked to provide antecedent static IP addresses to PTA on monthly basis so that suspected IP users can be located. The PTA has developed Call Data Record (CDR) analysis that enables PTA to identify illegal sources of call termination. This may result in Long Distance & International (LDI) licenses being cancelled. Steps are being taken to curb the illegal call termination business. Last year, PTA reduced the Accounting Settlement Rate by 38.6 per cent to reduce the financial incentives for grey telephony and conducted 20 raids against illegal call termination business (with the help of PTCL and the FIA). Technical solutions to monitor grey traffic are being explored. Illegal grey traffic is estimated to cause losses of around Rs.3 billion annually. PTCL has been supportive of PTA efforts against grey traffic.

6 APPENDIX TABLE 1: MAIN REGULATORY DEFINITIONS OF VOIP IN USE

Country	Definitions
Australia	The Australian Government notes services with different levels of integration ³⁹ : <ul style="list-style-type: none"> • <i>Peer-to-peer VoIP services</i> for on-net calls (not connected to the PSTN) provided online, requiring the user to have a separately-sourced broadband connection; • <i>VoIP over broadband services</i> provide interconnection with other types of voice services (typically provided by online providers with the user having a separately-sourced broadband connection); • <i>Vertically-integrated VoIP services</i> offering interconnection with other voice services, bundled with both a broadband connection and ISP service; • <i>Corporate or enterprise VoIP services</i> providing the highest QoS of all the VoIP service types, with interconnection to other types of voice services.
Belgium	“The electronic communication service offered to the public for the purposes of conveying speech wholly or partly over an IP network, where at least one of the network connection points is connected to an IP network”. VoIP offerings must thus have at least one of the end-users directly connected to an IP network.
Chile	Three types of VoIP services are distinguished, and assessed according to location, access medium, numbering, licensing and quality: <ul style="list-style-type: none"> • Unidirectional web services: including PC-to-PC or PC to PSTN; • Private or restricted service: between a closed group of users; • Public voice services: through direct integration or Internet access of the physical network with IP.
Hong Kong, China	Distinguishes between: <p>Class 1 services – providing the same functionality as traditional phone service; and</p> <p>Class 2 IP telephony service – which does not provide full traditional phone functionality (notably, excludes number portability).</p>
India	Internet telephony includes ⁴⁰ : <ul style="list-style-type: none"> • PC to PC (within the country, as well as abroad); • PC to phone (PC in India, Phone abroad); • IP-based H.323/SIP terminals in India to similar terminals both in India and abroad, employing the IP-addressing scheme of IANA.
Israel	The Ministry distinguishes between four types of VoB services ⁴¹ :

³⁹ Page 15, ‘Examination of Policy and Regulation relating to Voice over Internet Protocol (VoIP) services’, Dept. of Communications, Information Technology & the Arts, Australian Government, http://www.dcita.gov.au/data/assets/pdf_file/34194/VOIP_Report_November_2005.pdf.

⁴⁰ http://www.trai.gov.in/PressReleases_content.asp?id=280.

	<ul style="list-style-type: none"> • Model A: Pure Internet telephony (PC to PC, including IP phones); • Model B: VoB calls connecting to the PSTN; • Model C: telephony provided by an ISP; • Model D: An IP/VPN where enterprise networks are managed using IP. <p>In practice, for licenses, the Ministry distinguishes between domestic and International (outgoing) VoB services.</p>
Italy	<p>The Italian regulator distinguishes between three main types of VoIP services:</p> <ol style="list-style-type: none"> 1) PATS VoIP services that are equivalent to the traditional PSTN service (e.g., non-nomadic services). 2) Nomadic PATS VoIP services and PATS VoIP-enabled services that have characteristics that are different from the traditional PSTN service. 3) VoIP-enabled services accessible to the public that do not require resources from the national numbering plan (but may use numbering/addressing resources that are different from E.164 numbers).
Japan	<p>VoIP services are classified as:</p> <ul style="list-style-type: none"> • Communication between two telephone terminals. • Communication between two data terminals (PC to PC). • Communication between two types of terminals – telephone and data terminals. <p>A study group report (February 2002) also classified services according to quality:</p> <ul style="list-style-type: none"> • class A: quality for fixed telephony (R index: > 80; delay (end-to-end): <100ms); • class B: quality for mobile telephony (R index: > 70; delay(end-to-end): <150ms); • class C: quality enables speech (R index: > 50; delay (end-to-end): <400ms). <p>(Where "R index" is defined by ITU-T G.107 and "delay" from ITU-T G.114).</p>
Jordan	<p>The Jordanian Telecommunications Regulatory Commission has distinguished⁴²:</p> <ul style="list-style-type: none"> • “Phone-to-phone” VoIP: users originate calls using a telephone connected to the PSTN and VoIP service providers carry the calls using ‘gateways’ that connect the call to its data networks (or Internet) to another gateway connected to the PSTN that routes the call to another telephone; • “PC-to-PC” VoIP: users use computers or other devices to connect to the Internet or other data network that transmits voice calls to another computer or other device connected to the Internet, where the other participant is located; • “PC-to-phone” VoIP: users use PCs or other devices connected to the Internet to transmit calls to a gateway that switches the call onto the traditional circuit-switched network, usually close to where the terminating caller is located.
Malaysia	<p>The Malaysian regulator, the Malaysia Communications and Multimedia Commission, distinguishes between two sorts of VoIP service provision⁴³:</p> <ul style="list-style-type: none"> • “PC-to-PC” VoIP: based on what is known as Internet telephony; • “Phone-to-phone” VoIP: based through PSTN, which involves multi-stage access dialing, known as VoIP.
OECD	<ul style="list-style-type: none"> • A broad definition: “conveyance of voice, fax and related services partially or wholly over packet-switched IP-based networks, including P2P VoIP services and VoIP services connected to PSTN”; • A narrow definition: “voice application over IP-based networks that enables a VoIP subscriber to call and to be called by a party subscribed to a traditional PSTN service” (therefore excludes Peer-to-Peer VoIP).
Saudi Arabia	<p>The Saudi Communications and Information Technology Commission (CITC) distinguishes between two types of telephony⁴⁴:</p>

⁴¹ “Policy Paper: Licensing of Voice Services Provided Over Broadband Access (VoB)”, available from the Ministry of Communications website at: http://www.moc.gov.il/new/documents/pol_22.6.05.pdf.

⁴² Formal Statement Regarding VoIP, Page 7, *Final VoIP Statement*, available from the Jordanian TRC at: http://www.trc.gov.jo/Static_English/New%20Stuff/Final%20VoIP%20Statement%20Final.doc.

⁴³ MCMC website at http://www.cmc.gov.my/mcmc/facts_figures/codes_gl/guidelines/voip/glvoip.asp.

	<ul style="list-style-type: none"> • VoIP: the generic name for the transport of voice traffic using IP technology. VoIP traffic can be carried on both a private managed network or the public Internet, or combination of both; • IP telephony: IP telephony services relate to a form of VoIP that requires gateways, telephone devices and E.164 numbers.
Spain	<p>VoIP providers need authorization depending on technology/network:</p> <ul style="list-style-type: none"> • Communication between two telephone terminals (individual license required). • Communication between two data terminals (general authorization required). • Communication between the two types of terminals – telephone and data terminals (provisional authorization is needed).
Switzerland	<p>VoIP includes all mechanisms to transport voice in a packetised manner over the Internet Protocol. Generally, two aspects have to be distinguished⁴⁵:</p> <ul style="list-style-type: none"> • Interface protocols to set up a connection, to authenticate and authorize the use of the service, to route and charge a call; • Interface protocols on how to code and packetise the voice and transport it over an IP network with acceptable quality.
Taiwan, China	<p>Internet Telephony Services refer to voice services received and transmitted through Internet provided by operators⁴⁶:</p> <ul style="list-style-type: none"> • E.164 Internet Telephony Service” means Internet Telephony Services run by E.164 number allocated by DGT in accordance with ITU-T Recommendation. • Non-E.164 Internet Telephony Service means Internet Telephony Services provided without E.164 number.
United Kingdom	<p>VoIP services include the New Voice Services referred to in the 2004 consultation, as well as services provided over IP, which include voice services provided over the public Internet, voice over broadband (managed and unmanaged services), voice over Unlicensed Mobile (Wireless) Access, voice over licensed wireless, including 3G data and (pre)WiMax-based services. The regulator OFCOM also distinguishes between:</p> <ul style="list-style-type: none"> • PC-based services (e.g. Skype PC-to-PC service); • Secondary-line services; • Replacements for traditional PSTN-based call services; • Services targeted for mobile and nomadic use, including ‘Voice over wireless’ services.
United States	<p>The United States does not treat VoIP as a traditional telephone service, but as a computer-based ‘information service’ (as defined by the 1996 Telecommunication Act⁴⁷ that distinguishes telephone services from information services).</p>

⁴⁴ “The Regulatory Policies Related to Fixed and Mobile Services Licensing in the Kingdom of Saudi Arabia” at: www.citc.gov.sa/NR/rdonlyres/4DD56B2A-FC25-43F1-A234-28A863210C5E/0/PublicConsultationDocumentOnTheProposedPoliciesRelatedToFixedAndMobileServicesLicensing.pdf

⁴⁵ See the VoIP Working Group’s Working Document on VoIP, published in June 2003, available from: <http://www.bakom.admin.ch/themen/telekom/00461/00895/00915/index.html?lang=en>.

⁴⁶ “Administrative Regulations on Type II Telecommunications Business”, 15 November 2005, from the Directorate General of Telecommunications at: <http://www.dgt.gov.tw/english/Regulations/dgt42/dgt42-Type2-3609.htm>.

⁴⁷ Available from <http://www.fcc.gov/telecom.html>.

7 APPENDIX TABLE 2: REGULATORY STATUS OF VOIP BY REGION

7.1 Latin America & the Caribbean

Country	VoIP Status
Antigua & Barbuda	
Argentina	Email, online and database extraction of information, EDI, extended fax, data processing and/or online information, including transaction processing. VoIP is a deregulated telecommunication service. A contribution to the Universal Service Fund (USF) will be required, once the Fund is created.
Aruba	
Bahamas	
Barbados	<p>Until March 2005, VoIP was considered as an information service and was not subject to price regulation¹. VoIP for private use by individuals is permitted without regulation or licensing. Cyber Cafés providing VoIP services had to register with the Government Telecommunications Unit for a one-off registration fee of \$100. VoIP equipment distributors had to hold a valid Sellers and Dealers License from the Unit. VoIP suppliers to the public using an adaptor were allowed to set up VoIP service a license for the first year, before they had to submit audited statements of annual gross turnover to the Ministry. If turnover exceeded a certain limit, providers were asked to pay 1.5% of turnover to the Ministry.</p> <p>In March 2005, the Telecommunications Unit conducted a public consultation on VoIP and other IP Services², based on a consultative document. The Ministry of Energy and Public Utilities has been tasked with the formulation of a policy on VoIP is expected to encourage innovation and investment, the development of VoIP and IP-enabled services, including IP telephony; and provide businesses and consumers with greater choice. Greater competition has resulted in access to IP (Internet Protocol) technology-based solutions including VoIP. According to the Minister of Finance, this has resulted in 70-80% in savings for customers³.</p> <p>TeleBarbados Inc. and Cable & Wireless (Barbados) Limited are the two holders of full Domestic Telecommunications Licenses issued by the Ministry of Energy and Public Utilities⁴, that entitle them to provide domestic services including fixed wireless, WiMax and Wi-Fi, data communications, VoIP and payphones. There are five holders of international telecommunications licenses⁵, including Blue Communications, Cable and Wireless (Barbados) Ltd, Digicel Barbados Ltd, Sunbeach Communication Inc. and TeleBarbados Inc. These licenses are technologically neutral and permit licensees to use VoIP.</p>
Belize	BTL is launching VoIP service with its WebTalk service, its new Internet Phone Service, in August 2006, which it predicts should provide even cheaper call rates ⁶ . It has recently slashed international call rates ⁷ .
Bermuda	
Bolivia	VoIP illegal - prohibited as a value-added service. VoIP is considered as a telephony services, as the Telecommunications Regulations define a telephony service as a real-time voice communication, regardless of how the service is transmitted.
Brazil	IP telephony authorized as a form of telephony. Vo Internet is deregulated. The Brazilian operator TVA offers 'triple play' services, with voice, Internet access and television.
Canada	<p>PSTN-interconnected VoIP services have the regulatory status of telecommunication services. No license requirements (or registration) are required, but a contribution to the USF is necessary.</p> <p>CRTC issued its views on the regulatory framework for VoIP services in April 2004. CRTC considered that the existing regulatory framework should apply to VoIP services, with VoIP treated as local exchange services and subject to the local competition</p>

	regulatory framework to the extent that VoIP services provide subscribers with access to/from the PSTN.
Chile	Permitted at the local level. The regulator held a public consultation on the Regulation of VoIP Services in July 2004 ⁸ . Regulation of VoIP is based on principles of public benefit, technological neutrality, fairness and non-discrimination, consumer protection, innovation and minimum necessity. Where VoIP services are offered through the PSTN network, operators are required to comply with the regulations for PSTN services. Where VoIP services are provided over the Internet or privately for a closed group of users, they are not subject to the same conditions. A regulatory review is underway to permit/facilitate VoIP services over broadband, including a possible licence for this. SUBTEL is conducting a Consultation on Telecommunications Development over the Short-term in 2006 that includes VoIP ⁹ . In 2005, the Chilean broadband operator VTR launched the first network for residential services based on IP technology.
Colombia	<p>VoIP has recently been made legal: in April 2006, the Ministry of Communications published a policy paper on VoIP that made it legal in Colombia¹⁰. The Ministry of Communications originally issued a public consultation on VoIP in June 2004. Originally, operators offering voice services needed a PSTN licence. In telephony, long-distance operators were allowed to provide the service (qualifying title)¹¹. From PC to PC, VoIP was a value-added service. The use of a PC to make calls over the Internet was not restricted. Following the consultation, a decree was passed that gave VoIP its own specific license category class.</p> <p>VoIP is used in Colombia by different operators, including long distance operators (Telecom, ETB and Orbitel, which launched its “Voipiar” offering to local users in early 2006) and some value-added operators providing corporate voice services, according to the definitions set out by the Ministry of Communications in Decrees 600 and 3055 of 2003 on value-added and telematic services. These decrees permit the transport of corporate traffic over the data networks of value-added operators, as long as it is not used exclusively for voice communications to or from the PSTN, nor among closed user groups. Failure to keep with these conditions could represent a transgression of the regime that governs telecommunications, as well as competition.</p>
Costa Rica	VoIP not allowed. VoIP is permitted only as domestic telephony over the Internet.
Cuba	ILD only through the concessionaire ETECSA. VoInternet under study. Closed VoIP networks under consideration.
Dominica	
Dominican Republic	IP telephony requires a concession (licensing restriction).
Ecuador	Permitted in final end-user applications. There is a new telecommunications law pending ¹² . In February 2005, the regulator CONATEL published regulations covering cyber-café and telecentres, limiting the number of terminals that can be used for VoIP.
El Salvador	Currently being defined as telephony or SI service. VoInternet is an added value service and is not regulated.
Grenada	
Guatemala	
Guyana	VoIP not allowed.
Haiti	
Honduras	VoIP not allowed. Internet telephony is not legal. However, recent moves have been undertaken to permit VoIP, provided that operators contract with the incumbent Hondutel (these operators are described as ‘sub-operators’ and can have their own networks and sell other licensed services). All international traffic had to be conveyed through Hondutel until 24 December 2005. On this basis, the Honduran internet provider GlobalNet Honduras will soon launch VoIP over DSL network. GlobalNet will use Thomson's Cirpack softswitch solutions for corporate and residential services to launch service in October 2006. GlobalNet expects to reach 25,000 VoIP subscribers by year-end ¹³ . GlobalNet expects to launch triple-play in 2007.

Jamaica	VoIP services are widely used, vendors are actively marketing services as well as equipment. Cable and Wireless internet subscription contracts prohibit the commercial resale of VoIP services by the subscriber to third parties. Most government purchases of voice services or PBX replacements are based on requirements for VOIP technology. The Central Information Technology Office (CITO) has started a project to set government standards for VoIP PBX services to ensure inter-connectivity “down the road” when a government-wide network is implemented.
Mexico	VoIP was previously illegal, but has now been legalized. VoIP providers are required to get a license, as are any other voice telephony operators. There are currently five registered VoIP providers, authorized to provide VoIP. IP telephony requires a concession (licensing restriction). ILD is excluded for the moment. Telmex has already implemented IP for the majority of its core network and various Mexican carriers are conducting trials.
Nicaragua	Full competition allowed in VoIP.
Panama	Prior to the initiation of market liberalisation in 2003, the Public Services Regulator had mandated all ISPs to block IP ports identified with VoIP services, which was originally intended to continue beyond the end of the incumbent’s monopoly (a Cable & Wireless concession). However, in November 2002, a Supreme Court ruling annulled the order blocking the use of VoIP for ILD calls ¹⁴ . Subsequently, domestic VoIP has been allowed. Operator calling rates are authorised (for VoIP or Basic) at 12 per cent.
Paraguay	VoIP not permitted. Internet telephony is not permitted.
Peru	Regulation is based on the principle of functional equivalence. Telephony services require a concession. Telephony over the Internet provided by an authorized operator is regarded as a value-added service.
Puerto Rico	
St. Kitts & Nevis	
St. Lucia	
St. Vincent & Grenadines	
Suriname	
Trinidad & Tobago	Trinidad and Tobago is conducting a public consultation on VoIP.
United States of America	The United States is not treating VoIP as a traditional telephone service, but as a computer-based ‘information service’ (as defined by the 1996 Telecommunication Act that distinguishes telephone services from information services), that is relatively unregulated. USA has adopted a liberalized approach to VoIP, which is considered an Internet application/Information Service. There are no licensing requirements, but a Universal Service contribution is required. The FCC is examining issues for ‘IP-enabled services’ including VoIP addressing social issues (e.g. Universal Service) and the classification of services for regulatory purposes ¹⁵ . In 2005, the FCC changed regulation so that VoIP services connected to the PSTN must provide access to emergency services.
Uruguay	VoIP not regulated. ANTEL is performing IP telephony tests. VoInternet freely available.
Venezuela	Phone to phone VoIP is a value-added service (concession).

7.2 Asia-Pacific region

Country	VoIP Status
Armenia	
Australia	VoIP permitted. Most VoIP services connected to the public network are considered a standard telephone service and will attract regulatory obligations ¹⁶ (not P2P services). However, the regulator has flexibility in exemptions of obligations for standard telephone services, and has used these exemptions to assist in the deployment of VoIP services, e.g. for Neighbourhood Cable services ¹⁷ . Regulation of telephone services does not impinge on

	<p>P2P services or corporate networks¹⁸.</p> <p>The Australian Communications and Media Authority (ACMA) issued a Discussion Paper on <i>Regulatory Issues Associated with Provision of Voice Services Using Internet Protocol in Australia</i> in October 2004 and held public consultations on VoIP service regulation throughout 2004.</p> <p>VoIP is used extensively in corporate networks, while broadband suppliers are now offering VoIP to the residential market¹⁹. Australian providers of VoIP recognise that current regulatory arrangements for voice services and existing consumer safeguards apply to their services.</p>
Azerbaijan	<p>VoIP is legal and permitted, but VoIP services are available only and limited to international calls. There is no official provider of VoIP service inside of Azerbaijan - the only organization currently providing VoIP service is "Azeurotel" Joint Venture in Baku. For using VoIP, it is necessary to get the special IP card of "Azeurotel". They provide this service to a limited number of users - only to the subscribers of 3 ATS - 493/497/437 (about 30 000 phone numbers). The cost of VoIP phone call is around 50% lower than average PSTN cost, however, there is no approved state tariff for VoIP. Other private and state companies are likely to provide VoIP service in the nearest future. VoIP service will soon be included in the list of services of the Ministry of Communication and IT, whereupon an uniform rate will be approved.</p>
Bahrain	<p>Bahrain requires a license for all services with the exception of VoIP over private networks. Only the licensed PTO can provide VoIP services.</p>
Bangladesh	<p>VoIP is legal and requires a specific VoIP license. BTTB is currently commissioning a common IP-based platform, to which VoIP licensees will be required to migrate. The regulator, the Bangladesh Telecommunication Regulatory Commission (BTRC), has issued "Regulatory and Licensing Guidelines For Invitation of Applications for Issuing VoIP Licenses for VoIP services in Bangladesh" on 21 September 2006²⁰. In the meantime, VoIP licensees must connect to BTTB's submarine cable and/or BTTB's satellite for international VoIP services. BTTB has to inform BTRC of the start of its common platform one month prior to operations, and VoIP licensees will then be required to conclude operational agreements with BTTB for the use of the common platform. Licenses last five years, with different license application fees and annual charges applying depending on the type of operator. Revenue-sharing agreements apply, with cellular mobile operators (category A) contributing 5% of annual revenue to BTRC. PSTN operators (category B) pay 2%, while nationwide ISPs (category C) must pay 1% of annual audited gross turnover. Minimum QoS standards apply, with a Minimum Opinion Score > 2.6 or R-scale > 50 (as defined by ITU Recommendation G.107).</p> <p>In September 2006, the Bangladesh Telecommunications Regulatory Commission (BTRC) invited bids from private sector for Voice over Internet Protocol licenses, following cabinet approval of VoIP in the private sector in November 2003. The commission invited bids through its website (www.btrc.org.bd) and national dailies. The 'regulatory and licensing guidelines of VoIP' state that VoIP licenses will be awarded to the interested operators who fulfill the technical and financial specifications of the regulatory commission. The last day of submission of the bids is October 8. Licences will be given initially for five years with a renewal option.</p> <p>According to the licensing conditions, a mobile phone operator has to pay Tk 10 crore to the BTRC as license fee, plus Tk 2 crore in annual license fees and 5% of VoIP revenues. The regulatory commission will keep Tk 20 lakh in security deposit in case of prepaid VoIP services. A land phone operator will have to pay Tk one crore for license acquisition, Tk 20 lakh in annual license fees, and 2% of its VoIP revenues. The commission will charge a nationwide internet service provider Tk 50 lakh for a VoIP license, Tk 7 lakh in annual fees, and 1% of revenues. An ISP has to keep Tk 5 lakh as security deposit with the commission for offering prepaid VoIP services. The licensed operators have to use BTTB's</p>

	<p>VoIP platforms to be set up at four places — Dhaka, Chittagong, Sylhet, and Bogra — for monitoring voice traffic.</p> <p>“Bids Invited for VoIP Licenses”, 23 September 2006. http://www.deshimobile.com/news_main.php?nid=686</p>
Brunei Darussalam	<p>VoIP constitutes a Value-Added Service (VAS) that needs a SeTi Licence: “Operators licensed to provide this service may provide value-Added Services that are accessible through the telecommunication services (mobile, non-fixed, fixed or resale of telecom services)”²¹. A SeTi Licence is required by operators who sell services to consumers or corporate customers (operators do not own infrastructure outside of their own premises, but use the infrastructure provided by InTi Licensees). Invites for SeTi Licenses are initiated by the regulator, AiTi, and require the authorisation of AiTi and the Broadcasting Unit.</p> <p>However, VAS that are accessible through the Public Internet Access License but not through the telecommunication services are not included and do not need a SeTi Licence (this includes operators who store and forward, store and retrieve and audiotex services and includes providers of mobile ringtone, download and chat providers).</p>
China	<p>Until as recently as 2005, the Chinese MII had not formulated guidelines concerning VoIP businesses and that many VoIP businesses were considered potentially illegal. However, basic telecommunication licensees were allowed to offer VoIP services and use IP technology in their core networks, with the deployment of IP technology driven by the basic service operators (China Unicom, China Telecom and China TieTong). ISPs could only offer PC-to-PC VoIP services. VoIP was not classified as either a value-added network service or basic service.</p> <p>However, in mid-2005, the Ministry of Information Industry (MII) announced VoIP trials for industry segments to begin deployment of VoIP services in four Chinese cities²² (e.g. Koncept won a bid for the VoIP trial in cooperation with Shenzhen Telecom, to become a selected VoIP 'Internet Communications Engine' for authorized Chinese Internet Content Providers). MII will now issue VoIP licenses. The Government is still considering whether to ban the use of VoIP services provided by those other than licensed operators²³. The use of Skype has been deemed illegal²⁴.</p>
DPR Korea	No information available.
Georgia	
Hong Kong, China	<p>OFTA conducted a public consultation on IP telephony in 2004 and announced its regulatory framework for IP telephony services in June 2005²⁵. More recently, in October 2005, the Numbering Advisory Committee launched a consultation into the emergency numbering for VoIP services. There are two classes of IP Telephony service: Class 1 service and Class 2 service²⁶. Class 1 service is an IP telephony service that has all the attributes of the conventional telephone service. These carry eight-digit numbers and a ‘2’ or ‘3’ as prefix. Class 2 services do not have all the attributes of the conventional telephone service and are distinguished by their ‘57’ or ‘58’ prefix. Providers must also declare that their service is Class 2.</p> <p>Both classes of providers are obliged to provide free emergency call services and back-up power supply for ‘lifeline’ devices. However, number portability is provided only by Class 1, but not by Class 2 IP telephony service.</p> <p>In Hong Kong, industry is particularly concerned about whether services-based operators who do not invest in network facilities should be admitted into the IP service market, an issue that the Director of OFTA notes is a ‘given’ elsewhere²⁷. The network operators are worried that diversion of revenue to the services-based operators would undermine the incentive to invest in the networks. Hong Kong Broadband Network has launched its second generation of broadband phone services. The 2b Broadband Phone service opens a new chapter in the development of HKBN and is a software-based VOIP phone service²⁸.</p>
India	The Telecom Regulatory Authority of India (TRAI) provided its recommendations to Government on Internet telephony on 20 February 2002 ²⁹ to foster competition, improve

	<p>options and prices for the consumers and provide technological flexibility to the providers while maintaining QoS. VoIP has been legal since 1 April 2002. Facility-based operators can provide Internet telephony and use VoIP technology to manage their networks, subject to QoS considerations.</p> <p>TRAI issued regulations on quality for VoIP ILD calls, differentiating between toll quality and below-toll quality in November 2002³⁰. Subsequent amendments abolished the below-toll quality distinction and refer only to one category of toll-quality QoS³¹. TRAI has recommended that: the one-way end-to-end delay should in no case exceed 150 μseconds; that variability (jitter) should be less than 5%; and that packet loss should not exceed 1%. Tariffs for toll quality service offered by facility-based operators should be the same as for equivalent PSTN-based services. The tariffs of VoIP services offered by ISPs over the public Internet are not regulated, as this is an application of a Value-Added Service.</p>
Indonesia	<p>VoIP license is generally awarded to ISP – Internet Service Provider. To date, the Government has issued 14 licensed VoIP (phone-to-phone) operators, including existing PSTN and cellular operators.</p> <p>These VoIP operators are classified as service-based operators, because they do not have their own customer base, but provide services to the customers of PSTN and Mobile operators. Almost all of VoIP operators are using a two-step dialing scheme using the 170XY access code and dependent of E1 line from PSTN and/or mobile operators. Other than the existing PSTN and cellular operators, other operators may be given single step dialling using 010XY access code, but they can not operate this method before they have the agreement of the incumbent PSTN and mobile operators. Given the present network condition in Indonesia, where the majority of the networks are still narrow-band, VoIP PC-to-PC is classified as an ISP service. But in the near future, VoIP operators will probably be able to build their own customer base using the IP networks (e.g WiFi-WIMAX). The Government is now considering the growth of VoIP for network or facility-based operators, instead of as service-based operator as it is now. Therefore, it will be necessary to re-formulate some regulatory issues like numbering, access code, routing, interconnection etc.</p>
Israel	<p>VoIP and VoB are permitted. It is permitted to provide telephony services by VoIP technology, using the broadband access service provided by a Domestic Telephony Provider (DTP) under Specialized DTP (SDTP) licenses. Licenses for VoB have been issued since mid-2005. The Government conducted a hearing on telecommunications and review of licensing during 2004, as a result of which, the Ministry approved its licensing policy principles for the provision of telephony services supply through broadband access services (VoB or Voice over Broadband) at the end of November 2004³². These principles, were published by the Israeli Ministry of Communications in its “Policy Paper: Licensing of Voice Services Provided Over Broadband Access (VoB)” on 28 November 2004³³. The Ministry distinguishes between four types of VoB services:</p> <ul style="list-style-type: none"> • Model A: Pure Internet telephony (PC to PC, including IP phones) -“following accepted practice in many countries worldwide, the Ministry policy is not to regulate such activity with licenses according to Law” (p.4); • Model B: VoB calls connecting to the PSTN – this is telephony in quality and substance and should be regulated by licensing; • Model C: telephony provided by an ISP - this is telephony in quality and substance and should be regulated by licensing; • Model D: An IP/VPN where enterprise networks are managed using IP technology – regulation shall be carried out within the regulation of consumer premise equipment. <p>Domestic VoB services for wireline communications will be regulated by SDTP licenses and regulations. Licenses for VoB shall be granted in 2005³⁴. International (outgoing) VoB services are regulated in the framework of ITP licenses and are only given to International Telephony Provider (ITP) licensees who provide the full range of ITP services.</p>
Japan	<p>VoIP is permitted and is subject to minimal regulation. The legal framework distinguishes three types of VoIP services, based on the quality of service. Providers that do not need</p>

	<p>numbers for their operations (e.g. PC-to-PC communications) do not have to comply with QoS requirements;</p> <ul style="list-style-type: none"> • If the provider can ensure minimum standards of QoS (in end-to-end voice quality and end-to-end voice delay), they qualify for the 050-prefix numbers assigned by the regulator since September 2002. • Where quality is as good as PSTN, providers have been allowed to use the same numbers as PSTN, since 2003. • Tariffs and access charges for VoIP services are not regulated. Emergency calls and direct access must be available from VoIP lines, and numbers must observe location correspondence. <p>Only if the VoIP provider is a facility-based operator is interconnection required. VoIP providers have to pay access charges to the PSTN operators when calls are terminated on their networks.</p>
Jordan	<p>The Ministry of ICT undertook a public consultation on the proper regulatory treatment of VoIP technologies in late 2002. The Telecommunications Regulatory Commission published a Final VoIP Statement in 2003 to clarify the position on Jordan Telecom's exclusivity for the provision of communication services. Prior to 1 January 2005, users could use a computer or other device attached to the Internet or other data communication network to make voice calls, so long as there was no involvement with a service provider in Jordan³⁵. No entity other than Jordan Telecom was permitted to offer voice service to the public using VoIP prior to 1 January 2005, including foreign-originated calls terminating on Jordan's PSTN³⁶. Voice services using VoIP technology were viewed by the regulator as the equivalent of voice services provided using circuit-switched technologies³⁷. The regulator adopted a technologically neutral position with regards to the technologies used to transport voice traffic and provide services to end-users³⁸.</p> <p>On the 21st of October 2004, the Council of Ministers approved the TRC's new licensing programme, which opened the fixed market to competition from 1 January 2005 and introduced a simple integrated license allowing licensees to offer any service. Existing Class licensees –including all ISP licenses- were brought under the new integrated licensing regime as new infrastructure-based operators and can now offer their own VoIP services³⁹.</p> <p>On 9 May 2005, the regulator issued a consultation document on the delivery of voice communication services delivered using the IP, including issues of distinctions between different types of services, provision of information, numbering, emergency services, interconnection, the requirement for class licenses and QoS issues⁴⁰. Licensed PTO and Other operators can compete in this market.</p>
Kazakhstan	<p>In Kazakhstan, there are currently no specific regulatory provisions with regards to VoIP⁴¹. However, the situation is likely to change, since a Program on the Development of the Telecommunications Industry in Kazakhstan for 2006-2008 was adopted recently. According to this programme, the regulator will take measures towards development of the IP telephony, including rules regulating the data transmission services and VoIP⁴². Meanwhile, Kazakh Telecom is constructing a trunk (backbone) data communication network based on IP MPLS technology⁴³, with new access networks based on "Metro Ethernet" technology. All large cities now have broadband, and Kazakhtelecom is moving from the provision of traditional services to services such as IP/VPN, VoIP, VoD (video), e-commerce and other services.</p>
Korea, Rep.	<p>VoIP is legal, with approval from the Ministry of Information and Communications of Korea. The Ministry is a firm proponent of VoIP, as it considers that the voice market will surely be evolving towards VoIP technology, despite outstanding questions over tariff structure. At the end of 2004, the Ministry approved the practice of VoIP resale for VoIP resellers Samsung Networks, Anyuser Cybertelco and seven others. In July 2005, seven backbone ISPs (including KT, Hanaro and Dacom) were also approved. In 2005, policies on VoIP to PSTN calls were established to standardize connection and call fees⁴⁴. The Ministry approved a separate numbering system for VoIP services. Based on these policy</p>

	directives, Samsung Networks and Anyuser formally began VoIP services using the identifier code 070 in August 2005, and the backbone ISP, KT, began services in November 2005 with Hanaro Telecom and SK Tellink following suite in December.
Kuwait	VoIP services are prohibited ⁴⁵ .
Kyrgyzstan	
Lao PDR	
Lebanon	Lebanon does not have a specific law on VoIP and the government is currently undecided about allowing VoIP, considering that it may have an adverse effect on international phone traffic. The government has stated that ISPs can provide a maximum upload speed of 32kbit/s for residential broadband services, at speeds that are insufficient for the provision of VoIP services. However, a Memorandum of Understanding was signed by the Ministry of Telecommunication in January 2006 for the commercial launch of DSL from March 2006 onwards ⁴⁶ . This means that in practice, VoIP is rather more a future prospective, rather than current reality.
Macao, China	
Malaysia	VoIP is legal in Malaysia. The Ministry of Energy Communications and Multimedia had previously issued a policy position that the provision of PC-to-PC base internet telephony was not subject to licensing. However, the provision of VoIP services requires an Applications Service Provider (ASP) Individual licence as stipulated in the Communications and Multimedia (Licensing) Regulations 2000 ⁴⁷ . VoIP can be offered by both Network Facilities Providers and Network Service Providers, under the terms of their licenses ⁴⁸ . Currently, there are more than 80 providers licensed to offer VoIP ⁴⁹ . VoIP service providers are responsible for ensuring that QoS criteria are met and voice passes through their networks with minimal loss and unauthorized access, in accordance with the performance indicators benchmarked by the VoIP service provider. Access to the VoIP service is through a special dialed code. The Malaysian regulator, the Malaysia Communications and Multimedia Commission, has issued non-binding guidelines on the provision of VoIP services (including a Freephone helpdesk and investigation of complaints) ⁵⁰ . In the event of breach of licence conditions, the Commission can take action according to the licence conditions.
Maldives	
Mongolia	
Myanmar	
Nepal	VoIP had not yet been explicitly legalized as recently as 2004 ⁵¹ . The Nepal Telecommunications Authority has however, been conducting consultations with operators as to the future regulation of VoIP. It held a conference on VoIP in September 2004 involving all the local stakeholders ⁵² . As of September 2004, the licenses of NDCL and UTL did not specify any technology to be used for the carriage. Operators can use managed IP as the transport technology for voice traffic. However, as of September 2004, UTL was using TDM for voice ⁵³ . NTA considers that: <ul style="list-style-type: none"> - PC-to-PC should be exempted for present licensees for QoS below toll quality; - PC-to-Phone abroad should be exempted for present licensees for QoS below toll quality; - Any operator or ISP that is willing to transmit through a single VoIP gateway should be allowed to operate Phone-to-Phone service using VoIP - NTA considers that incoming VoIP calls should be restricted for the time being (as in India) - VoIP should be implemented for NLD.
New Zealand	VoIP providers are defined and treated in the same way as PSTN operators and are subject to the same regulations.
Oman	VoIP is legal. It is defined as a telecommunications service. VoIP services can be offered by operators in possession of a valid class I license ⁵⁴ . Omantel is the only licensee in the Sultanate authorized to provide voice services, by virtue of its Fixed-line Class I License. It also has the “full right to curb any illegal activities being conducted by its subscribers,

	<p>which may hurt its licensed business activities”⁵⁵. The regulator, the Omani Telecommunication Regulatory Authority, emphasizes however that VoIP has not been banned or declared illegal, as it is authorised for Class I License holders (i.e. Omantel). Omantel has recently been engaged in the blocking of unlicensed voice services. Omantel has announced that it will introduce an end-to-end IP communications services network.</p>
Pakistan	<p>PTA has issued technology-neutral licenses. VoIP services may be offered by Long Distance & International (LDI) and Local Loop (LL) licensees. 11 companies in Pakistan offered VoIP in 2005⁵⁶. Some new operators are looking to deploy IP-based networks and PTA is working on the necessary arrangements to tackle issues of QoS, numbering plan, internet telephony and costing methodologies etc.⁵⁷ ISPs are not allowed to offer VoIP. ISPs are licensed as either Electronic Information Service (EIS) or Non-Voice Communication Network Service (NVCNS) providers, neither of which permits licensees to allow voice over their data circuits⁵⁸.</p> <p>‘Grey telephony’ is illegal in Pakistan (the use of illegal gateway exchanges to bypass legal PTCL gateways and terminate/originate international traffic, including through VoIP gateways, GSM gateways, WLL phones, mobile SIMs or other related equipment. This traffic may then be distributed onwards using WLL and mobile numbers). PTA has issued policy guidelines to ISPs, PTCL, cellular mobile, LDI, LL and WLL operators to address illegal call termination/origination. Different guidelines have been issued to licensees, depending on the nature of their businesses. Licensed operators are responsible for maintaining updated client records, monitoring clients (in specific categories such as heavy users, users with a specific pattern of usage etc.), the correctness of their customer’s antecedents, and for overseeing clients on the transportation of voice on data circuits and formulation of their SOPs /procedures to discourage illegal activities and helping PTA⁵⁹. A clear strategy and a Vigilance Committee have been established to eliminate grey traffic and illegal call termination in June 2006⁶⁰, comprising the Pakistan Telecommunication Authority (PTA), the Ministry, PTCL and other operators. PTA now regulates international bandwidth rates⁶¹ and has directed PTCL to review its rates to promote broadband in Pakistan, building on Pakistan’s Broadband Policy published in December 2004⁶².</p>
Palestine	<p>In 2000, the Palestinian Telecommunications Company (Paltel) signed an agreement with Startec Global Communications Corporation, an integrated communications provider for VoIP, data and Internet services, to deliver inbound and outbound VoIP services to the Palestinian market⁶³.</p>
Papua New Guinea	<p>Telikom PNG has plans to introduce broadband Internet shortly⁶⁴. Otherwise, no information available.</p>
Philippines	<p>In August 2005, the National telecommunications Commission issued new regulations treating VoIP as a value-added service. Registration is required, but not authorisation. Commercial VoIP providers with no networks of their own are required to enter into interconnection agreements with network operators (NTC will intervene where necessary to ensure fair terms for interconnection). Local exchange and inter-exchange operators and overseas carriers who have previously received authorisation are not required to register with the NTC when providing VoIP services.</p>
Qatar	<p>VoIP is illegal - the provision of VoIP services is banned.</p>
Saudi Arabia	<p>On 2 January 2006, the Communications and Information Technology Commission (CITC) announced its intent to issue new licenses for the Fixed and Mobile Telecommunications Services⁶⁵. Throughout Q1 2006, CITC undertook a Public Consultation on the Development of Policy Positions on key issues including Scope of Services, Resale, Carrier Selection and VoIP⁶⁶. CITC has published a Public Consultation Document entitled “The Regulatory Policies Related to Fixed and Mobile Services Licensing in the Kingdom of Saudi Arabia” to summarise proposed regulatory policies for licensing and invite comments⁶⁷. It addresses: Scope of Services, Interconnection, IP Telephony and VoIP, Spectrum Management, Unbundling, Carrier Selection, Local Number Portability and QoS. According to the public consultation document, all IP telephony Facilities-Based Providers (FBPs) should provide the same emergency services for VoIP as for PSTN, a new</p>

	numbering scheme and access code, lawful interception. FBPs will not be allowed to block traffic without prior approval from CITC. CITC is formulating guidance on QoS criteria and the technical aspects of IP telephony interconnection in conjunction with industry and market groups (page 30).
Singapore	VoIP is legal. The Singaporean regulator InfoComm Development Authority (IDA) proposed a Policy Framework for IP Telephony and Electronic Numbering in September 2004 ⁶⁸ and published its Decision on the Policy Framework for IP Telephony on 14 June 2005 ⁶⁹ , including an Explanatory Memorandum ⁷⁰ and Licensing Guidelines ⁷¹ , with a policy of regulatory forbearance where appropriate. IDA seeks to regulate in a transparent, non-discriminatory and technologically neutral manner – IDA does not specify which technologies should be used, but leaves technological decisions to industry. VoIP operators are not required to meet number portability, directory or emergency services or IDA’s QoS levels, but must inform users of service limitations and provide clear information to subscribers about service capabilities (emergency service access and quality). The IDA issues licenses and phone numbers for VoIP services to facilitate the entry of companies interested in offering IP telephony. Both facilities-based operators (FBOs) and service-based operators (SBOs) can be licensed. IDA will issue a new 8-digit number to both FBOs and SBOs. There are minimal regulatory obligations to promote the expansion of VoIP services – operators are not required to provide number portability, emergency service connection, directory services or conform to the QoS levels set by IDA. In March 2006, IDA announced its NGN National Infocom Infrastructure plan, which will enable facilities-based competition and allow players from the whole telecom value chain to participate in the market.
Sri Lanka	VoIP has not been formally authorized, but nor has it been formally prohibited. Under the terms of their license, any operator that has a license to provide voice telephony services can use any form of <i>technology</i> to provide that service; so voice is a service, VOIP is a technology; and according to the terms of the license, there is no real legal issue. The legality of using VoIP is, however, in question for ISPs – here, the ISP license is not for voice transmission, so VOIP is in effect "illegal" when provided by ISP operators who do not have a license for voice telephony. The terms of the international gateway licenses specify that voice would have to be converted from IP-based to circuit-switched when handing over to local operators. VoIP is used widely, particularly in the Western Province and even advertised to some extent, but no operator has been formally authorized to offer VOIP services. The position of the 3 fixed and 4 mobile telephony operators is that VOIP ought to be legalized, as they consider that VOIP can help grow their business as technology changes. Under the leadership of its new Director General, the Regulatory Commission considers that connectivity and access are key and a specific statement on VOIP is likely to be issued soon.
Syria	According to the Syrian Ministry of Communications and Technology's website, VoIP is now legal and the government is planning to permit ISPs to provide VoIP ⁷² . By April 2006, the Ministry had already started implementing an infrastructure project for providing high-speed internet services. The project will make possible the provision of a variety of online services, such as e-government & e-commerce services, VoIP, and other related services. The project consists of creating a national network based on 3 IXP-related through-fiber optic secure connections, which will be linked to 50 servers with capacity of 20 000 web pages dedicated to different online services. International secure connections will also be established. over 30 ISP are expected to provide these services shortly.
Taiwan, China	VoIP is legal and regulated in Taiwan. “Internet Telephony Service” is defined as voice services received and transmitted through the Internet provided by operators. The Directorate General of Telecommunications (DGT) published its Administrative Regulations on Type II Telecommunications Business on 15 November, 2005 ⁷³ . Internet Telephony Service Operators (both E.164 and non-E.164) need to apply for a “Type II Telecommunications Special Business” license from DGT. The governing authority of Type II Telecommunications Business is the Ministry Of Transportation and

	<p>Communications, and DGT is responsible for their licensing, supervision and regulation. To provide E.164 Internet Telephony Service in Taiwan, operators must submit documents relating to provision of free emergency telephone service, information verification for customers whose E.164 numbers are allocated by foreign authorities, and assistance in enforcing legal interception.</p> <p>Taiwan has a flourishing VoIP market. By 30 June 2006, there were a total of 87 non-E.164 Internet telephony service providers registered with the Directorate General of Telecommunications⁷⁴.</p>
Tajikistan	
Thailand	CAT offers international VoIP service.
Turkmenistan	
UAE	<p>The Telecommunications Regulatory Authority (TRA) and Supreme Committee have formulated a National Telecom Policy to make UAE an ICT hub for the region. Value-added services and an advanced network infrastructure are a key part of the NTP⁷⁵. VoIP is currently not allowed in the UAE at present, but the TRA is working on a regulatory framework for it. Once the TRA has finalized the framework, they will announce it. The TRA currently distinguishes between Short Number Services (that all users with UAE must be able to reach) and Value-Added Services using non-geographic numbers.</p> <p>In preparation for the introduction of VoIP, the Dubai Internet City uses an IP telephony system⁷⁶ and Etisalat Corporation is moving forward with plans to migrate to an all-IP network and extend IP applications to its customers in the UAE market⁷⁷. Etisalat reports that it offers fixed line services over its new Next Generation Network (NGN), and has been migrating sections of its users onto the advanced network. The timeline for completion of migration is the end of 2007⁷⁸. By establishing its NGN, Etisalat aims to offer voice, video and data over a single network in true Triple-Play functionality. It aims to introduce cost effective telephony solutions for small businesses and large residential customers. In July 2006, Etisalat signed two Memoranda of Understanding with Mitel Networks, a UK supplier of IP communications solutions. Under the terms of the first MoU, Mitel will provide Etisalat an IP-based voice platform MN 3300 Integrated Communication Platform (ICP) to be installed at Etisalat head office in Abu Dhabi⁷⁹. The second MoU covers the provisioning of a Hosted Key System application- Mitel 3600.</p>
Uzbekistan	
Viet Nam	<p>VoIP is legal and provided by the Vietnam Post & Telecommunications Corp., including from public payphone facilities. VoIP is subject to price regulation and included in the price decisions of the Ministry of Posts and Telematics. International VoIP calls made using prepaid calling cards are cheaper (Maximum charge rate: US\$0.50/minute) than international Voice-over-IP (VoIP) services (maximum US\$0.50/minute)⁸⁰. International IP telephone calls can be made from public service points. The Ministry issued a decision on the charges of international telephone calls using the Internet protocol (IP) using the public switched telephone network (PSTN) in March 2003⁸¹. For international IP telephone calls can be made from public service points, there are communications charges as well as another surcharge regulated to be collected by the service provider.</p>
Yemen	<p>There are a few ISPs providing VoIP, but this does not necessarily mean that it is legal. The Yemen Public Telecommunications Company signed a contract in September 2006 with Mitel for its IP communications.</p>

7.3 Europe

Country	VoIP Status
Austria	VoIP is permitted, with no need for a license for the provision of VoIP services over the Internet. PTS over VoIP is subject to voice telephony licensing requirements, if managed VoIP traffic forms part of the core network of a PTS operator. The Austrian regulator RTR

	conducted a consultation on the numbering for VoIP services. VoIP service providers are subject to loose regulations. These services have only to be notified, according to the Telecommunications Act. The incumbent announced its cooperation with a US-based VoIP carrier establishing an IP interconnection.
Belgium	VoIP is considered as a simple voice service, separate and distinct from traditional telephony. VoIP providers have only to declare when they start offering services. The Belgian regulator BIPT is planning to undertake a consultation on VoIP.
Bulgaria	No official licensing/authorization regime for VoIP, as long as minimum QoS requirements for voice telephony are met. There is no official position as to whether VoIP services should meet the QoS parameters for fixed voice telephony service.
Croatia	VoIP is legal and governed by the 2003 Telecommunications Act 122/03. VoIP providers must first notify the regulator in order to gain the right to provide VoIP telecommunication services. Operators wishing to provide Internet services, VoIP, video-conferencing and other value-added services must apply to the regulator, the Croatian Telecommunication Agency, for a license under Article 23 of the Telecommunications Act 122/03 ⁸² . The CTA maintains a list of all licensed VoIP providers ⁸³ .
Cyprus	Geographic number ranges are not open to VoIP services in Cyprus ⁸⁴ . The Cypriot regulator OCECPR is planning to undertake a consultation on VoIP.
Czech Rep.	VoIP services, including prices, remain unregulated as a data service. VoIP providers do not have to be an owner of a telecommunications license for provision of PSTN services. A number of operators offer VoIP services and the Czech regulator Český Telekomunikační Úrad assigned the service number 910 in the Numbering plan to VoIP services ⁸⁵ . Operators and service providers need to sign interconnection agreements with other operators, with a "model" agreement on interconnection has been developed by the APVTS Economic Committee ⁸⁶ .
Denmark	No specific regulations apply to VoIP providers. VoIP services were not officially offered on the market, until as recently as mid-2003. IP telephony over the Internet is not covered by the Danish Telecom regulation, with IP telephony considered as content. Other forms of IP telephony which do constitute telecom services can be provided under Danish telecom regulation without any license requirements. The Danish regulator NTA conducted a consultation on the numbering for VoIP services. Consumer protection rules are an obligation for all telecom service providers.
Estonia	VoIP is legal in Estonia, but there are no special regulations, standards etc. The Estonian National Communications Board (ENCB, Sideamet) considers that rights, obligations and conditions for VoIP services should be based on technologically neutral and transparent regulatory principles. There are thus no specific obligations relating to VoIP as a separate technology. VoIP is regarded as a telephone service and all the general requirements from telecom law and decrees extend to VoIP. There were 31 registered VoIP providers in mid-2003. Geographic number ranges are not open to VoIP services in Estonia ⁸⁷ . ENCB treats VoIP services as telephone service if it fulfills three parts of the PATS definition (publicly available, enables originating and receiving inter/national call through an E.164 number), otherwise it is a data communication service. Rights and obligations for communications undertakings and communications services are regulated in Electronic Communications Act and its sub-acts ⁸⁸ .
Faroe Isls.	See Denmark – same regulations apply.
European Union (EU)	Under the EU regulatory framework of July 2003, players (including VoIP providers) are free to enter the market for electronic communications services without prior authorization, provided they abide by the conditions of the general authorization applicable in each Member State. VoIP providers will face obligations under the EU framework depending on the service, rather than the technology used to provide it. The EU aims to adopt a light regulatory

	touch, taking into account the emerging nature of the technology, whilst preserving consumer interests (e.g. access to emergency services). The EU issued an Information and Consultation Document on the Treatment of VoIP under the EU Regulatory Framework in June 2004 ⁸⁹ .
Finland	In October 2003, the regulator imposed regulations on VoIP service providers using broadband networks similar to those imposed on PSTN operators. VoIP services are classified as enhanced services, which are not regulated provided the service provider does not make any subscription agreement with the user. The rights and obligations of VoIP providers depend on the type of service ⁹⁰ , with VoIP services and networks subject to the regulations for services and networks. The Finnish regulator (FICORA) must be notified, with an annual fee chargeable. Interconnection and numbering regulations will apply.
France	France published one of the earliest public consultations, with a public call for comments on VoIP in 1999. VoIP operators are subject to the general authorization framework from 25 July 2004, along with other telecom providers. Operators have to notify the regulator, ART. The French regulator has conducted a consultation on the numbering for VoIP services. It is also one of the first regulators to publish official statistics for the number of VoIP subscribers, which amounted to 1.5 million at the end of March 2005, accounting for 1.5 billion minutes or 6% of total traffic ⁹¹ .
Germany ⁹²	VoIP is not regarded as a voice telephony service as defined in the Telecommunication Act (or by the EU). Therefore, VoIP providers are not subject to a license and they must only be notified. Previously, the Regulatory Authority for Telecommunications and Post (RegTP) has not regulated VoIP services due to the real-time problem. However, in April 2004, RegTP opened a public consultation on VoIP. The regulator will formulate its formal regulatory position on VoIP in light of comments received ⁹³ .
Greece	A general authorization from the government is required to offer VoIP services. Otherwise, VoIP providers are subject to minimal regulatory oversight.
Greenland	See Denmark.
Hungary	VoIP became legal in July 1999. At that stage, VoIP providers required a license and, in a novel approach, providers had to ensure that the quality of their services was less than that of traditional PSTN service (until the end of Matav's exclusive license in 2002). These voice quality restrictions (requiring a minimum 250 ms average delay in speech signal transmission and loss of speech packets under 1% ⁹⁴) lasted between 1998-2002, but were lifted with the start of the liberalization of the voice market. Now, VoIP providers no longer need a license, and no registration is required. In its effort to promote the Internet and spread its benefits, the Hungarian Ministry has used arguments of regulatory deficiency to allow VoIP services and to avoid prosecuting VoIP service providers.
Iceland	VoIP providers are subject to the same requirements as traditional PSTN operators, including license requirements. VoIP providers are not distinguished from other voice telephony operators. Iceland is reviewing whether geographic number ranges should be open to VoIP services ⁹⁵ . Iceland Telecom is working to establish a portfolio of corporate VoIP services and carried out tests on VoIP services in 2005 for future commercialization ⁹⁶ . Its corporate suite of VoIP services is called IP Centrex, an IP-based virtual PBX service suited to businesses with geographically remote operations.
Ireland	VoIP is legal. VoIP providers are free to operate subject to General Authorisation, once they have notified the regulator. VoIP is unregulated, insofar as the service is provided by an operator other than the incumbent. Obligations on the incumbent include network requirements (e.g. the provision of access to its own network via interconnection agreements with other operators and service-level agreements for provision of facilities/services to customers), as well as service obligations (relating to consumer protection, price publication and itemized billing for the call). The framework for VoIP in Ireland consists of the following directions by the regulator ComReg: <ul style="list-style-type: none"> • a Consultation on "Numbering for VoIP services"⁹⁷ in June 2004 and ComReg's response "VoIP Services in Ireland" in October 2004⁹⁸; • A range of geographic and non-geographic numbers was made available to VoIP

	<p>service providers (PATS and ECS), with a single retail price point established⁹⁹. Full number portability rights/obligations attach to the new VoIP numbers (staged implementation to avoid burdening new operators)¹⁰⁰.</p> <ul style="list-style-type: none"> • In 2005, it published “Guidelines for VoIP service providers on the treatment of consumers” to address consumer protection issues¹⁰¹. Although emergency services and call location are not mandatory, they are strongly encouraged. <p>ComReg published its “Review of the VoIP regulatory framework” in 2006¹⁰².</p>
Italy	<p>The Italian communications regulatory authority, AGCOM, held a public consultation on regulatory interventions for VoIP-enabled services that concluded on 26 August 2005. VoIP is allowed according to the EU Communication 98/C6/04 (Voice communication over Internet). AGCOM distinguishes three main types of VoIP-enabled services that are currently available on the Italian market¹⁰³. VoIP services are treated as equivalent to data transmission services and subject to general authorisation. Self-provided consumer VoIP and corporate internal VoIP use on a business LAN/WAN are not subject to the requirement for general authorisation, in accordance with the guidance provided by the European Commission¹⁰⁴.</p>
Luxembourg	<p>Following the recommendations of the EC on VoIP issues, no differential treatment for VoIP services is planned, except for the incumbent. A license will be necessary for interconnection with PSTN networks. Luxembourg is planning to create a sub-category of geographic VoIP numbers, in order to allow portability between VoIP and other services¹⁰⁵.</p>
Malta	<p>Malta is reviewing whether geographic number ranges should be open to VoIP services as part of a consultation exercise in 2004¹⁰⁶.</p>
Montenegro	<p>The Agency for Telecommunications of Montenegro has decided to regulate VoIP. Some parties have expressed interest in the provision of VoIP services, but there have also been cases of VoIP abuse. In 2003, the Agency began its work to revise existing licenses and prepare for new licenses for international services, VoIP, “call-back” and leased lines, etc¹⁰⁷. In mid-2005, the Agency formed a Working Group to make a close analysis of the regulation of VoIP in Europe. The Agency plans to complete its work on VoIP in 2006, so that providers of VoIP services can start work in Montenegro by the end of 2006.</p>
Netherlands	<p>VoIP services are not so far qualified as public telephone services. The Dutch regulator OPTA is planning to undertake a consultation on VoIP.</p>
Norway	<p>VoIP providers are regulated in the same way as telecom operators on the basis that ‘voice is voice’, regardless of the technologies used. The Norwegian regulator PT conducted a consultation on VoIP in 2004.</p>
Poland	<p>Provision of VoIP is currently unregulated. VoIP services are not covered by separate regulation from traditional telecommunications services. Under the Telecommunications Law, international telephone services including VoIP may not be provided by entities other than public telecom operators.</p> <p>The Polish regulator is currently holding a public consultation on its regulatory position, as a result of which, it should finalise its position¹⁰⁸. Geographic number ranges are not open to VoIP services in Poland¹⁰⁹.</p>
Portugal	<p>The licensing regime identifies ‘Voice on the Internet’ and VoIP (both can qualify as Fixed Telephone Service). VoIP service providers are subject to license, where they are also classified as fixed telephone service providers, whereas pure VoIP service providers (using the public Internet to carry IP traffic) are subject to registration.</p>
Romania	<p>VoIP networks do not constitute a separate category of networks, with no dedicated regulation of VoIP networks. Providers of electronic communication networks or services (including VoIP) must notify ANRC. VoIP providers are providers of “other electronic communications services” (i.e. data transmission services) and must comply with the general authorization regime. VoIP providers are distinct from companies that run services only for their own internal use using their own networks (private enterprise network), that do not need ANRC authorisation¹¹⁰. The Romanian regulator ANRC has plans to undertake a consultation on VoIP (as stated to ERG).</p>
Russia	<p>VoIP is not specifically prohibited in Russia, although neither has it yet been legalized.</p>

	<p>The main document currently relating to VoIP is "The Directive on the Telematic service"¹¹¹ that permissively refers to VoIP-like services, defining them as "sending voice over data networks". The interpretation of the regulatory framework for VoIP in Russia is a very complex issue and still the subject of heated debate in the community. To provide this 'telematic' service, a telematic license with the possibility of sending voice over data is required.</p> <p>The interconnection regulations of the PSTN network (whereby two local operators in neighbouring regions are prohibited from direct interconnection and are required to connect to the long-distance operator) do not apply to data networks, nor to the traffic exchange between PSTN and data networks. This means that to access VoIP-like telematic services, users can simply purchase an IP Telephony prepaid card and dial the B-sub international number, preceded by the network access code.</p>
Slovak Rep.	<p>VoIP is legal, with no specific regulations for the provision of VoIP services – only a general license is required. The regulator, the Telecommunications Office of the Slovak Republic, originally dealt with Internet access under the ISP Dial-up Access Act. From 2001 – 2004, 2 general licenses were available:</p> <ol style="list-style-type: none"> 1. General license VPT-1/2001 - to operate public telecom networks for unidirectional transmission of radio and TV signal in circuits and for providing public telecom services of retransmission of radio and TV by cable. 2. General license VPT-2/2001 to provide telecom services mediating access to the Internet and data services of voice transmission over the Internet (VoIP). <p>However, these licenses were replaced by a general license in March 2004¹¹², and the ISP Dial-up Access Act was replaced by the Voice Plus Provision Act in mid-2004¹¹³. The regulatory authority modified ISP Dial-up Access Act in order to regulate Voice Plus, which is necessary for the legal provision of internet data transfer services (VoIP). In February, March and April 2004 respectively, three operators (GlobalTel, Nextra & TelSlovensko) requested an upgrade of their license from ISP Dial-up Access to Voice Plus. TU SR also amended the rights and obligations for the license of Nextra, which had to stop providing VoIP through the separate 019xy (code) one month after the new regulation came into force in 2004. Slovak Telecom offers VoIP services for businesses, while Slovak Telecom is marketing Voice over Internet (VoI) based on DSL access¹¹⁴.</p>
Slovenia	Geographic number ranges are not open to VoIP services in Slovenia ¹¹⁵ .
Spain	<p>VoIP providers need authorization depending on their technology and network. An individual license is required where communication is made between two telephone terminals. A general authorization is required where communication is between two data terminals. A provisional authorization is needed where communication is between the two types of terminals.</p> <p>The General Telecommunication Act was published in November 2003 to transpose the new European regulatory framework, adopting a policy of technological neutrality. The Spanish regulator CMT conducted a consultation on VoIP during 2004. Telefonica's VoIP network is closely monitored by a real-time Network Management System. The regulator CMT has specified that for 95% of calls, the delay should be <125 µs (microseconds) and not exceed 150 µs.</p>
Sweden	VoIP is legal (also referred to as broadband telephony by the regulator, Post & Telestyrelsen ¹¹⁶). The same regulations apply to VoIP service providers as for PSTN providers ¹¹⁷ . VoIP services are subject to the terms and conditions of the subscription contract. Users should check with VoIP service providers whether emergency services are available ¹¹⁸ .
Switzerland – info on VoIP ¹¹⁹	VoIP is legal in Switzerland. The goal of VoIP regulation is to retain interoperability of real-time voice transmission using E.164 numbers in compliance with the telecommunications law, for uniformity of the public telephone service ¹²⁰ . Swiss

	legislation does not include specific definitions relating to VoIP and the regulation of VoIP is based on the existing telecommunication legislation ¹²¹ . All telecom service providers independently operating a large part of the telecommunications network need a license. VoIP is regarded as a public telephone service (for providers with real-time voice transmission, using E.164 numbers and connected to the PSTN) and is subject to traditional regulations including interoperability and emergency calls. The same requirements apply to VoIP providers offering services over broadband connections or other means. However, VoIP is not subject to universal service obligations. The regulator, the Federal Office of Communications (OFCOM), established an OFCOM-Industry Working Group on VoIP that in November 2002 to examine QoS criteria, legal obligations for the provision of public telephony and IP interconnection ¹²² . The VoIP Working Group has published functional standards for VoIP ¹²³ .
Turkey	There are no particular regulations on the provision of VoIP services, and no specific position. The provision of VoIP services does require a long-distance telephony service license.
Ukraine	
UK	OFCOM concluded a public consultation in September 2004 that issued interim guidance, including an interim forbearance policy (allowing VoIP providers to offer emergency services, without other regulatory requirements for PATS) ¹²⁴ . OFCOM initiated a consultation in February 2006 ¹²⁵ . Providers offering VoIP services to the public have to comply with the requirements applicable to any voice service ¹²⁶ . The most recent consultation ends the policy of interim forbearance policy and introduces a mandatory code of practice for consumer information, to be observed by VoIP providers ¹²⁷ .

7.4 Africa

Country	VoIP Status
Algeria	<p>VoIP is legal. Algeria has been allowing VoIP (PC-to-phone) by ISPs on an experimental basis since January 2003. Licensed PTOs are authorized to provide all VoIP services, while competition from VSAT operators is permitted in PC to PC VoIP services. The Algerian regulator, the Autorité Algérienne de Régulations de la Poste et des Télécommunications (ARPT), conducted a consultation on VoIP. VoIP operators are subject to authorisation, avoiding the difficulties of qualifying for a license. The first VoIP operator, EEPAD, won its authorization to provide VoIP services in April 2005.</p> <p>In order to qualify for an authorisation, candidate VoIP operators must prove that they have capital of 40 million dinars (around 500,000 USD), pay 30 million dinars for the authorisation (about 400,000 USD) and remit 10% of their annual revenue to the regulator (in contrast to the 2% that fixed and mobile operators pay). Six applications for VoIP services had been approved by April 2006, including EEPAD, Smart Link Communications (SLC), WEBCOM, WebPhone Network and 2 others. As of April 2006, Balancing-Act Africa estimated that there were 100,000 VoIP clients, a number that is growing constantly¹²⁸.</p> <p>Under the terms of their authorisation, VoIP operators are obliged to provide VoIP services in at least 5 wilayas (areas) of their choice within the first year of operation, to encourage operators to cover not only the main urban zones, but also areas of sparse telephone coverage. 0820 and 0822 number series have been allocated to VoIP operators.</p>
Angola	Mundo Sartel has announced that it will introduce an IP-based network.
Benin	VoIP was prohibited as recently as 2004.
Botswana	VoIP was prohibited in Botswana as recently as 2004.
Burkina Faso	
Burundi	

Cameroon	VoIP was prohibited as recently as 2004.
Cape Verde	
Central African Rep.	
Chad	Chad's incumbent Société des Télécommunications Internationales du Tchad (SotelTchad) signed an agreement to originate and terminate international long distance traffic with the VoIP carrier ITXC.net in Chad in 2001 ¹²⁹ .
Comoros	VoIP was prohibited as recently as 2004.
Congo	
Cote d'Ivoire	Up until 2002, international VoIP calling was not specifically covered by the regulatory framework, and the grey market flourished. However, the regulator closed this loophole, and a number of equipment seizures by police followed. VoIP was prohibited as recently as 2004, with initiatives against grey market operators.
DRC Congo	VoIP can be provided by the licensed telecom provider over the public Internet only.
Djibouti	
Egypt	In Egypt, data and voice services are treated separately. Voice, including VoIP, is offered by incumbents and subject to regulatory treatment by the NTRA, while data services are offered by ISPs ¹³⁰ . The licensing of VOIP in Egypt is under new consideration: currently, a license is required for all voice services, except PC to PC. VoIP is licensed only for VPN within the same enterprise, and cannot be used to communicate with bodies external to the same enterprise. However, the government and regulator uphold principles of technology-neutral regulation, and it is intended that Egypt will allow the private sector and other operators to use VoIP for international calls. Telecom Egypt recently announced a project with Zhone Technologies and is installing access concentrators in its network, using a Nortel CS2K Softswitch along with Zhone's Broadband Loop Carrier MALC. TE considers that this will allow TE to provide its customers with voice services including both POTS and VoIP Services ¹³¹ .
Eq. Guinea	
Eritrea	VoIP was prohibited as recently as 2004.
Ethiopia	VoIP was prohibited as recently as 2004, with some initiatives noted against grey market operators.
Gabon	VoIP was prohibited as recently as 2004.
Gambia	
Ghana	Ghana has yet to legalise VoIP services. VoIP was not covered explicitly in the regulatory framework and the grey market flourished, with Ghana Telecom estimating that the parallel market amounted to approximately US\$15-25 million in 2003 (depending on estimated rate and volumes applied). Ghana Telecom took steps against ISPs to suppress VoIP, restricting ISPs so they could only download traffic in early 2003. However, it recognized that this was not a very efficient approach, and in due course, service resumed. The Director General of the National Communications Authority, the regulator, and the Minister of Communications have reportedly both publicly stated their readiness to license VoIP operators ¹³² .
Guinea	VoIP was prohibited as recently as 2004.
Guinea-Bissau	ISPs can lease international data gateways.
Kenya	VoIP is legal and operators are allowed to carry VoIP. Prior to its legalization, there was a large and growing grey market in Kenya. The incumbent itself tried to negotiate agreements with ISPs and cyber-cafés – unsuccessfully, as the ISPs felt that it was not Telkom Kenya's role to legalise VoIP through the back door and that the regulator should set the terms. Following one offer to ISPs that was rejected, Telkom Kenya prioritized web, email and FTP traffic, and downgraded multimedia and VPN traffic. Telkom Kenya used 'packet sniffers' to detect voice traffic being carried over the

	<p>Internet and closed one set of ports. This resulted in large numbers of websites becoming unavailable and chaos for Internet users and MNCs. Eventually, the regulator CCK wrote to Telkom Kenya asking it to remove the filtering and traffic management measures.</p> <p>The Kenyan regulator, the Communications Commission of Kenya (CCK), has now issued guidelines legalizing various categories of VoIP, following public consultation. The main challenges identified by the regulator are regulatory intercept, interconnection, VoIP cost models, consumer protection and the impact on existing operators¹³³. As a result, most operators are carrying VoIP traffic, including telecentres connected to licensed operators. Telkom Kenya has been investing in VoIP since 2004¹³⁴, and is about to offer a VoIP-based international service.</p>
Lesotho	ISPs can lease domestic data gateways.
Liberia	VoIP was prohibited as recently as 2004.
Libya	ADSL is in the process of being introduced over Libya Telecom and Technology's ATM network in early 2006 ¹³⁵ . This means that in practice, VoIP is still very much a future prospective, rather than current reality.
Madagascar	
Malawi	ISPs can lease international data gateways.
Mali	VoIP is in practice legal and on offer - it has been endorsed by the incumbent operator, Sotelma, but is not explicitly addressed in the regulatory framework. Sotelma aims to exploit new ICTs and Value-Added Services, including ADSL, BLR and VoIP ¹³⁶ . It has concluded agreements with four local enterprises which designate these firms as specialized retailers of VoIP telephony, applying to Sotelma to obtain their bandwidth at pre-negotiated rates ¹³⁷ . The agreements in effect make the four companies retail VoIP sellers, obtaining their bandwidth from Sotelma at an agreed rate. However, there was no clear selection process for these four companies, and local companies that were excluded have complained.
Mauritania	
Mauritius	VoIP is legal in Mauritius. Operators that wish to provide VoIP services to the public need a license from the ICT Authority under the ICT Act 2001. Two types of license are available: 1) International Long Distance (ILD) license (where calls can be terminated on a PSTN/PLMN telephone) and 2) Internet Telephony Service (where calls cannot be terminated on a PSTN/PLMN telephone in Mauritius). The VoIP licensing and regulatory framework is currently under review by government as part of the National ICT Strategic Plan (NICTSP) ¹³⁸ . The NICTSP will be completed in November 2006 to chart the way for the next five years for the development of the ICT Sector.
Morocco	VoIP is legal. A license is required for the provision of any VoIP service. Only the licensed PTO can provide VoIP services. The National Telecom Regulatory Agency (ANRT) carried out a public consultation in November 2005 to discuss its vision on the definition of certain markets, operators' market power and obligations ¹³⁹ . VoIP is not included in the list of Value-Added Services ¹⁴⁰ .
Mozambique	VoIP was prohibited as recently as 2004.
Namibia	VoIP was prohibited as recently as 2004. However, Telecom Namibia has announced that it will introduce an IP-based network.
Niger	
Nigeria	VoIP is legal, with a license required to provide VoIP services ¹⁴¹ . All telecom operators (including Nitel) carry international traffic over IP ¹⁴² . Nitel offers VoIP services for international calling. Providers wishing to offer international VoIP calling have to connect to the backbone of Nitel or the SNO, Globacom. Mobile operators also all have IP gateways (e.g. MTN operates IP gateways in Lagos and Abuja). As a result, prices have fallen significantly and the grey market has been radically undercut. Most small-scale operators (e.g. cyber-cafes or ISPs) buy from international minutes aggregators

	<p>and sell on. However, telephony prices have now fallen to the point where there is little or no margin left for these small operators to make a living.</p> <p>The Nigerian Communications Commission announced its intention to move towards a unified licensing regime in February 2005¹⁴³, and published a Consultation Document on 30 January 2006. The Unified Service License covers: Fixed Telephony (wired or wireless); Digital Mobile Services; International Gateway Services; National Long Distance Services; and Regional Long Distance Services. Unified Licensees are allowed to provide ISP, VAS and Payphone services¹⁴⁴. Digital Mobile licensees are allowed to provide fixed and data services. International Gateways are allowed for own use and third party use. FWA and PNL licensees (Fixed Telephony and LEO) can also provide mobile services (subject to frequency and geographical limitations).</p>
Rwanda	
Sao Tome&P	
Senegal	<p>Senegal liberalised its telecom sector one year ago, but has not yet defined any specific regulation of VoIP, according to the monopoly incumbent, Sonatel. According to Balancing Act Africa, Sonatel initiated what was probably the first VoIP wholesale arrangement in Africa¹⁴⁵. Sonatel discovered it was losing traffic to grey market operators. Knowing who most of them were, Sonatel offered them continued trading at agreed rates. This has resulted in strong market growth – Sonatel claimed that about 25% of its international traffic was VoIP in 2004¹⁴⁶. However, it did not actually stop the growth in the grey market – new operators stepped in to offer voice services at even lower prices. There are many Internet users using Internet telephony over "Skype"¹⁴⁷. Individuals can use "Skype" for their personal communications, but businesses and firms cannot. The Senegalese incumbent Sonatel has started to offer 'triple play' services with voice, Internet access and television.</p>
Seychelles	VoIP was prohibited as recently as 2004.
Sierra Leone	
Somalia	
South Africa	<p>Prior to 1 February 2005, all value-added network service (VANS) providers were prohibited by legislation from carrying voice. This restriction was objected to by Telkom, the incumbent, during its exclusivity period. As of 1 February 2005, any holder of a value-added network service or enhanced service license is allowed to carry voice on their networks. VANS are still required to obtain facilities from any licensed telecom operator, including mobile operators, but cannot self-provide such facilities. ISPs and VANS operators have begun to offer VoIP services on a retail basis and have initiated marketing campaigns. VANS providers can now apply for numbering resources, spectrum and interconnection with any operator. There is no regulation of rates or tariffs for VoIP services, but the regulator is considering QoS issues and access to emergency services. By 2004, Telkom South Africa had built a regional VoIP gateway that it was offering across the continent, and has attracted a significant number of African countries to use it.</p> <p>The regulator also sees VoIP as part of the solution to under-served areas. Under-served area licenses were introduced by a 2001 amendment to the Telecommunications Act. Licensees in these areas are mandated to provide any telecommunication services, including VoIP, fixed, mobile and public telephone services in the licensing area. By 2004, four such licenses had been granted, but providers had not yet started operations, so it was too early to say whether VoIP services would form part of their offerings¹⁴⁸.</p>
Sudan	
Swaziland	VoIP was prohibited as recently as 2004.
Tanzania	<p>The Tanzania Communication Regulatory Authority (TCRA) has issued new licenses to four national service providers (Clear line Communications Tanzania Ltd, Hotspot Business Solutions Ltd, Wavetek Communication Tanzania Ltd & Benson Informatics Limited). The new type of license permits licensees to provide a range of electronic</p>

	communication services to end-users, including payphone services, Internet, video conference, voice, data, VoIP, multi-media services and calling cards.
Togo	VoIP is legal in Togo, which established the first VoIP calling centre in Africa, to serve many North American clients using VoIP ¹⁴⁹ . ISPs can lease international data gateways.
Tunisia	VoIP is permitted for business use by companies and firms, for which an authorisation is needed from the Tunisian Ministry of Communication Technologies. Tunisie Telecom does not allow VoIP for residential customers. The Ministry is revising the regulatory framework in order to promote the development of VoIP, in the context of a Strategic Plan for Telecommunications (with funding from the World Bank). On 19 April 2004, the Ministry issued a Decree No.2004-979 on the conditions and procedures for the allocation of licenses for the installation and exploitation of a public network for data transfer ¹⁵⁰ , part of which addressed the framework for VoIP.
Uganda	Licensed telecom providers are permitted to provide IP telephony on the basis that it is a voice service (for which, to date, incumbent operators have held exclusive licenses). ISPs can lease international data gateways. Up until 2004, no Ugandan ISP had openly admitted using Internet telephony and the Ugandan Communications Commission (UCC) had not taken an active stance against VoIP services and IP telephony. In late 2006, however, the Ugandan regulator UCC granted a telecoms services license to the local operator TalkTelecom to become a VoIP services provider and provide services to both residential and corporate customers, which Balancing Act Africa calls “the first legal opening for a VoIP service provider in the country that does not operate its own network” ¹⁵¹ . UCC is working with ITU on a project to extend Multi-Purpose Community Telecentres to remote and rural areas testing the use of packet-based wireless IP technology. UCC is testing the use of VoIP as a precursor to possible regulatory reform, leading to more cost-effective telephone services. UTL has announced that it will introduce an IP-based network.
Zambia	Zambia’s license framework is service-specific and technology-neutral. Licenses are awarded for the provision of specific services (for example, Mobile Cellular service, public payphone services, basic voice and internet services among others). The regulator views VoIP as a technology, rather than a service, so it is therefore not licensable as a service. VoIP cannot be exploited as a service in isolation by itself, because there is no specific provision for VoIP in Zambia’s regulatory framework. To the extent that a licensee is authorised to provide any particular service or operate a private network, they can use VoIP as their technology of choice in exploiting the commercial opportunities permitted by their license. In practice, an international gateway license is necessary to fully exploit VoIP, and despite recent moves to extend these to mobile operators, there is currently only one holder of an international gateway license: the incumbent Zamtel. The framework is currently under review, with the aim of developing a unified licensing framework, as well as reducing barriers to entry.
Zimbabwe	

NOTES

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- 2) Nomadic PATS VoIP services and PATS VoIP-enabled services that have characteristics that are different from the traditional PSTN service. (A new category of numbers should be created for these).
- 3) VoIP-enabled services accessible to the public that do not require resources from the national numbering plan (but may use numbering/addressing resources that are different from E.164 numbers). These require general authorisation under Italian law as electronic communications services (ECS).

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