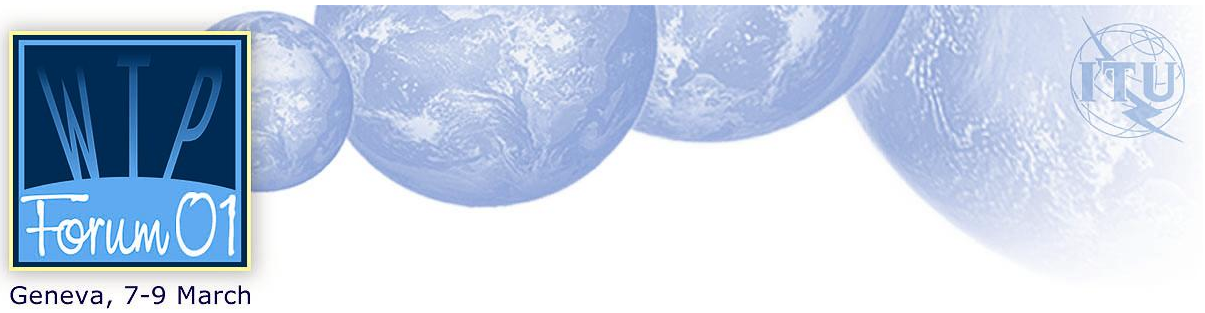


IEG/COMMENTS/

**January, 10, 2001**

# iBasis

## COMMENTS

## ON THE SECOND DRAFT REPORT OF THE SECRETARY-GENERAL ON IP TELEPHONY FOR THE WTPF 2001

iBasis, Inc., a leading wholesale provider of IP Telephony services and an invitee to the WTPF's informal experts group (IEG), congratulates the ITU Secretariat General for the second Draft Report of the Secretary-General on IP Telephony. We commend the ITU for being responsive to many of the comments iBasis and others submitted to the ITU regarding the First Draft Report.

Please find below suggested line-by-line edits and comments regarding the Second Draft Report. Most of our comments are aimed at providing additional information on new services and technologies that IP Telephony companies are bringing to the market that are helping traditional carriers prosper in an increasingly competitive global market and that may help reduce the "digital divide" by transforming the way people communicate and retrieve information. We understand there is an ongoing discussion within the WTPF's IEG on the use of the terms "IP Telephony," "Internet Telephony," and "VoIP Telephony" Consistent with the definitions used in section 1.2 of the current draft, our edits use the more generic term "IP Telephony." Once the WTPF's IEG reaches a consensus on the use and definition of these terms, we encourage that the report be reviewed to ensure more consistency in the use of these terms in the final report.

We look forward to continuing to assist the ITU Secretariat General and the IEG on future drafts of the Report as well as with other efforts to help make the WTPF meeting a success.

INTERNATIONAL TELECOMMUNICATION UNION

**WORLD TELECOMMUNICATION POLICY FORUM (WTPF 2001)**

GENEVA — 7 – 9 MARCH 2001

**15 December 2000**
**Version 2**

# Draft Report of the Secretary-General on IP Telephony

## PREAMBLE

i) The ITU World Telecommunication Policy Forum (WTPF) was established by Resolution 2 of the 1994 Kyoto Plenipotentiary Conference and was confirmed by Resolution 2 of the 1998 Minneapolis Plenipotentiary Conference. The purpose is to provide a forum where ITU Member States and Sector Members can discuss and exchange views and information on emerging telecommunication policy and regulatory matters arising from the changing telecommunication environment. Although the WTPF shall not produce prescriptive regulatory outcomes or outputs with binding force, it shall prepare reports and, where appropriate, opinions for consideration by Member States, Sector Members and relevant ITU meetings.

ii) By Decision 498 (attached as Annex A), the 2000 session of the ITU Council decided to convene the third World Telecommunication Policy Forum (WTPF-01) in Geneva, from 7 to 9 March 2001, in order to discuss and exchange views on the theme of Internet Protocol (IP) Telephony, with the following agenda:

- *the general implications of IP Telephony for the ITU membership with respect to: (a) the telecommunications policies and regulations of ITU Member States; (b) the implications of IP Telephony for developing countries, particularly with respect to policies and regulatory frameworks, as well as technical and economic aspects; (c) the impact of IP Telephony on the operations of Sector Members, notably in terms of the financial challenges and commercial opportunities it presents;*

- *actions to assist Member States and Sector Members in adapting to the changes in the telecommunication environment due to the emergence of IP Telephony, including analysing the current situation (e.g., by case studies) and formulating possible cooperative actions involving ITU Member States and Sector Members to facilitate adaptation to the new environment;*

- *actions to assist Member States and Sector Members in meeting the human resource development challenges presented by new telecommunication technologies such as IP Telephony, in particular, skills shortages and the need for education, and technology transfer.*

iii) In accordance with Decision 498 of the Council, and in keeping with past practice, discussions at WTPF-01 shall be based on a report from the Secretary-General, incorporating the contributions of ITU Member States and Sector Members, which will serve as the sole working document of the Forum, and which shall focus on key issues on which it would be desirable to reach conclusions.

iv) Pursuant to the Council's Decision, the arrangements for the third Forum will be similar to those for the first two. To give the Membership as much opportunity as possible for contributing to the preparations for this important event, and pursuant to Decision 498 of the Council, the Report of the Secretary-General shall be prepared according to the following timetable:

**1 November 2000**: the first draft shall be circulated with an invitation to comment**,** drawn up on the basis of available material (notably, the Strategic Planning Workshop on IP Telephony[1]);

**1 December 2000**: deadline for receipt of membership comments on the first draft;

**15 December 2000**: the second draft shall be circulated, incorporating comments received and with an invitation for further comments;

**10 January 2001**: deadline for receipt of membership comments on the second draft.

The **Final Report** shall be circulated by the **end of January 2001.**

In order to strengthen this iterative process, we would welcome the designation of a focal point in your office to follow up this matter.

The first draft of the Report of the Sectary-General was distributed to the ITU Membership on 1 November 2000. It was intended that the first draft would serve to trigger written comments from Member States and Sector Members. In response, the secretariat received 18 written comments from the ITU membership, as well as comments from other entities. These comments have been posted on the website for the Forum at **http://www.itu.int/wtpf/**.

Council Decision 498 also requires that the Secretary General shall convene a balanced, informal group of experts—who are active in preparing for the Forum in their own country—to assist in the successive stages of the preparatory process. This group will meet twice during the consultation process. Invitations to participate in the informal group of experts (IEG) were sent out by the Secretary-General to those who contribute to the consultation process plus others who can make significant contributions and can assist in achieving the desired balance.

The first meeting of the Informal Experts Groups (IEG) was held on 16-17 November 2000 in Geneva. The Group discussed and offered a number of suggestions to revise the first draft of the Report of the Secretary-General and also established a procedure to develop the draft Opinions for the Policy Forum. Those draft Opinions will be attached to the final Report of the Secretary-General. A second meeting of the Experts Group is scheduled for **18-19 January 2001** in Geneva.

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1 The workshop took place in June 2000. See: http://www.itu.int/iptel/

v) This second draft of the report has been revised to incorporate the views expressed by the Membership in written comments. In addition, this draft reflects the discussions that took place at the first meeting of the Informal Experts Group. The Report is designed as well to address the issues raised in Council Decision 498. Annex B contains tables and information on the regulatory status of IP Telephony in some ITU Member States.

vi) If WTPF-01 is to prove a success, it will be because the final Report of the Secretary-General reflects the opinions and contributions of the ITU membership as a whole. For that reason, you are encouraged to submit your comments on this second draft by **10 January 2001**, by email to the address: **IEG-wtpf@itu.int.** They will then be posted on the website so that they can be viewed by others involved in the process.

Alternatively, your comments can be sent by post, enclosing an electronic copy on diskette, to:

**International Telecommunication Union**
**Strategies and Policy Unit**
**Office T.1314**
**Place des Nations**
**CH-1211 Geneva 20**
**Switzerland**

vii) In addition to this Report, other background information relating to WTPF-01, as well as the case studies which have been commissioned and materials on the general topic of IP Telephony, are being posted on the ITU website, also at: http://www.itu.int/wtpf/.

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# 1. SUMMARY

1.1 The increasing use of Internet Protocol (IP) networks for communication services, including applications such as telephony, has become a pivotal issue for the telecommunications industry worldwide. The possibility of transmitting voice over IP-based networks, with all its challenges and associated opportunities, such as voice and data integration, constitutes a milestone in the convergence of the communications sector. It also reflects a convergence between two technologies that have emerged under very different policy and regulatory circumstances:

- the Public Switched Telephone Network (PSTN)[2], based on circuit-switched technology, which has been fairly extensively regulated by most countries (until recently);

- the Internet, which is based on packet-switched technology, and which has evolved as a data network subject to few, if any, controls.

1.2 ~~1.2~~ The term "IP Telephony" can mean different things to an engineer or policy-maker and there is no consensus at this point on its exact definition. However, for purposes of discussion, it is necessary to provide some delineation of the various forms that IP Telephony can take. Accordingly, as a working definition and for the

[2] The term PSTN (public switched telephone network) is used in this document as a synonym for traditional circuit-switched telephone networks offered by Public Telecommunication Operators (PTOs), as well as Integrated Services Digital Networks (ISDN), and Public Land Mobile Networks (PLMN). Generally with convergence, today's telecommunications networks and transport technologies are increasingly complex and difficult to categorize.

purposes of this Report, "IP Telephony" is used as a generic term for the different ways of transmitting voice, fax and related services over packet-switched IP-based networks. IP Telephony services may also include services that integrate/imbed the transmission of voice and faxes with other media such as text and images. The transmission of voice over IP-based networks can be subdivided into two major subsets: VoIP (Voice over IP) and Internet Telephony. The difference lies in the nature of the underlying IP network: VoIP utilizes managed, private IP-based networks, while Internet Telephony primarily uses the ~~public~~ Internet. Since IP Telephony is a broad term, throughout the Report an effort has been made to clearly identify the specific type of network or service that is being described and discussed.

1.3 [**EDITORIAL NOTE:** We suggest inserting a short paragraph here that further explains the technological/routing differences that exist between a call routed over an PSTN network – point-to-point channel – versus an IP call. The paragraph should briefly point out that IP technology and routing is seen as more efficient and affordable and that these technical differences pose a challenge to traditional telecom regulatory regimes that were designed around circuit-based-networks. The paragraph should draw on a more detailed discussion of the technological issues related to this from the technology- and the regulatory sections of the report.]

1.3 One key issue that has gained the attention of policy-makers, regulators, and industry alike is the fact that the Internet, and other IP-based networks, are increasingly being used as alternatives to the circuit-switched telephone networks and to some extent are becoming the technology of choice as new infrastructure is deployed.

1.4 Several major international Public Telecommunication Operators (PTOs) have announced that they will migrate all their international traffic onto IP platforms and have committed substantial investment sums to make that transition. One reason for this transition is the apparently lower cost of moving traffic over IP-based networks; one company estimates that this technology will allow it to carry traffic at a quarter of the cost of doing so over a conventional, circuit-switched network. Liberalization of markets is also contributing to this migration to IP-based networks. As of late 2000, more than three-quarters of all international traffic originated in countries in which the provision of IP Telephony is liberalised. Furthermore, the majority of IP Telephony now travels over managed, private IP-based networks as opposed to the ~~public~~ Internet.

~~1.5~~ While there are a range of views as to the pace at which IP Telephony will grow in the coming years, it is commonly believed that it will increase fairly rapidly. Some market forecasters project that, within five years, IP Telephony will account for between 25 and 40 per cent of all international voice traffic~~ie~~. Worldwide, the volume of traffic on IP-based and other data networks already far exceeds the voice traffic that travels over the public switched telephone network. Consequently, few countries can ignore IP Telephony. Nonetheless, most predict that the PSTN will remain robust for the foreseeable future, and an important issue for policy-makers will be ~~the need to oversee~~ the co-existence of the two network technologies and, increasingly, combinations of the two. As IP networks become more widespread, policymakers also face a challenge of determining whether the regulatory frameworks they have in place and which were developed initially for circuit-based networks are relevant and appropriate for IP-based networks given technological and other differences between IP- and circuit-based networks.

1.4 1.6 The growth of IP-based networks around the globe has profound and broad implications for societies, including consumers, industry, and national administrations. In part, this is because telecommunications infrastructure is

increasingly being viewed as a fundamental element of national competitiveness in the age of the Information Society and improvements to communications networks may serve as a dynamic stimulus to economic growth.

1.7 IP Telephony is an important part of this picture. For consumers, IP Telephony offers potentially much cheaper long-distance and international telephone calls compared with the alternative of using a circuit-switched, fixed-line or mobile network. These cost savings may, at least partially, offset the possible loss of quality. IP Telephony also offers consumers advanced services, integrating voice and data, such as merged World Wide Web and voice services (e.g., "click-to-talk") or integrated messaging. Adding voice to traffic on IP-based networks further raises issues of substitution for circuit-switched services and strategies for network transition.

1.8 For PTOs, the potential cost advantages of IP Telephony are more complex to calculate. That is because incumbent PTOs have existing revenue streams and technologies that may be adversely affected if customers shift to other services or other companies that offer lower-priced IP Telephony. However, such concerns may be viewed in the context of national policy objectives designed to improve the performance, cost and range of services offered by telecommunications networks.

1.9 The regulatory approach to IP Telephony varies significantly among ITU Member States and reflects the different interests involved. In some countries, governments have defined IP Telephony services in such a way as to permit the delivery of this service to the public, despite the existence of market exclusivity of the incumbent over basic voice telephony. In others, the service is prohibited, while in others it is licensed and promoted. In some countries, IP is treated as just another technology that can be adopted by PTOs, or is not regulated at all.

1.10 Given that IP Telephony calls are mainly carried outside of the PSTN—and hence outside the regulatory and financial structures which have grown up around the PSTN—it is the view of some that, for incumbent PTOs in developing countries, IP Telephony may undermine not only current revenue streams but also existing universal service programmes aimed at extending networks and services in unserved or underserved areas. In other countries, IP Telephony, and particularly the roll-out of IP networks, is viewed as a means to offer and encourage new and cheaper services, and thus to exert downward pressure on the price of circuit-switched telephony.

1.11 This Report seeks to provide background for the key issues that are posed by IP telephony. Section 2 of the Report looks at technical and operational aspects of IP Telephony. Section 3 deals with the economic aspects of IP Telephony and its impact on Member States and Sector Members. Section 4 discusses the different policy and regulatory approaches that Member States have taken to IP Telephony, and its significance for universal service schemes and convergence. Section 5 examines the relationship between IP Telephony and Human Resource Development and also discusses the particular concerns of developing countries.

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# 2. TECHNICAL AND OPERATIONAL ASPECTS OF IP NETWORKS

## Introduction

2.1 A fundamental paradigm shift has been underway in the telecommunications industry—a shift that is arguably as important as that from the telegraph to the telephone or

from the mainframe to the personal computer. That change is a shift from traditional PSTN *circuit-switched* voice networks to *packet-switched* data networks, using Internet Protocol (IP) technology. This Section discusses the technical and operational aspects of IP Telephony. Since transmitting voice over IP networks is just one of many possible IP-based applications, the discussion is framed within the broader context of IP networking technologies.

2.2 The largest (and most well known) IP network in the world is "the Internet"; referred to by many as the "public Internet". There are many definitions for the Internet but simply put, it is a globally connected set of computer networks, using the Internet Protocol, sharing a common IP address space. Computers connected to the Internet use software that "serves" or provides interchange of information using widely available standard applications (e.g., email, file transfer). The popularity of the Internet grew tremendously in the 1990's with the deployment of World Wide Web technology—allowing users easy access to hyperlinked information around the globe.

2.3 The Internet Protocol and related applications can also be used in private networks based on Internet technology (e.g., "Intranets" or LANs). Therefore, applications or services such as IP Telephony can be deployed on either the public Internet or private IP-based networks—or across a combination of both.

2.4 Technological innovation means that IP-based networks will continue to evolve and provide increasingly sophisticated services and applications on top of basic Internet data communications. Despite being originally designed for not real-time, *asynchronous* communications, extensions to the Internet Protocol are currently under development to support application services that require "real time" transport such as audio and video streams. VoIP can be viewed as one specific example of interactive, real time audio between users.

2.5 VoIP technology, integrated with data applications, offers the potential for new, multifunctional end-user portable devices which may be much more user-friendly, interactive, and personal than traditional telephones or personal computers. For example, such devices may include services linked to a user's current location. These new modes of access and related services will spawn new applications, which in turn will drive further evolution of global telecommunication network infrastructures.

**Evolution in Network Infrastructures**

2.6 For most of the last century, voice traffic was the predominant use of telecommunications networks. While voice traffic continues to grow, it represents an ever-diminishing percentage of overall telecommunications traffic when compared to data. The result is that support for IP-related technologies is now a strategic element in the design, development and use of telecommunication networks.

2.7 Architectural differences between circuit-switched and IP-based networks are rooted in their origins. IP networks were originally designed for two-way, not real-time, or *asynchronous* communication, typically referred to as "connectionless" or "stateless". In other words, no unique end-to-end circuit is created and held for the duration of a particular session. On the other hand, telephone networks have been engineered to provide real-time or *synchronous*, two-way voice conversations possible between almost any two points on earth, using circuits created as necessary and held for the duration of the call.

2.8 ~~2.8~~ IP technology chops up electronic transmissions into packets of varying numbers of bytes. Each packet is given a "header" or address label, and forwarded from one *router* to another, armed at each "hop" with enough information to get it to

the next, where the process is repeated. As a result, each "voice packet" of an IP Telephony call does not completely tie up any given circuit and may travel very different routes between callers before being re-packaged. By contrast, on circuit-switched networks, using protocols such as Signalling System 7 (SS7), a call is typically routed through a hierarchy of local, inter-urban and international switches to establish an end-to-end circuit between caller and called party.

2.9

~~2.9~~ In general, telecommunication vendors and operators are transforming themselves from voice-centric, circuit-switched providers to data-centric, IP-based solution providers. Therefore, deployment of core networks solely for the delivery of voice services is increasingly uncommon. As a consequence, there are enormous efforts underway to support real-time applications and carrier grade quality with IP technologies. Many operators, both wireline and wireless, have begun investing in upgrading their entire networks towards a more flexible "all IP" architecture. For~~As one~~ example, 3rd generation (i.e., IMT-2000) mobile network vendors and operators plan to migrate core networks to IP technologies, thus improving integration of mobile telephony and Internet services. Operators are also using the increased flexibility of IP Telephony and IP networks to integrate and embed voice services with other media such as text and images to produce new IP Telephony services such as click-to-talk (placing a call by clicking on an icon in a web page), unified communications (making voicemail, email, and fax messages accessible from any device), speech-enabled access to Internet content (giving telephone users access to web content via auditory commands), and turnkey hosting solutions so that companies can to provide all of these new services on a world-wide basis through the Internet. These and many other technological innovations introduced by IP Telephony companies are further eroding the traditional distinction between voice and data services.

2.10 ~~2.10~~ It should be recognized that there are several technological scenarios under which voice is carried on IP networks—often involving different treatment from a policy or regulatory perspective. One scenario is where IP Telephony is carried solely across the public Internet between computers. Another scenario is where IP is just used as an underlying transport technology for networks that provide PSTN services. In this scheme, signalling and network intelligence still use the Signalling System Seven (SS7) protocol widely used on the PSTN and users may also access a service by using a traditional telephone or some other IP device. A third scenario is where IP Telephony is based on full end-to-end IP technology (e.g., on private IP networks or next generation "greenfield" mobile networks). This scenario does not use SS7 signalling but may use new "soft switch" technology to manage network call control and provide intelligent network management—including well-known telephony network features such as busy tone, call forwarding, call data records for billing, etc. Finally, there may also be use of gateways or interconnection between the Internet or private IP networks and the PSTN. In this regard, ITU-T Recommendation E.370, proposed for final approval by ITU-T Study Group 2 in January 2001, addresses in more detail various scenarios and principles related to interworking between PSTN and IP-based networks.[3]

2.11 It is also important to consider the impact IP Telephony is having on build-out of the global Internet infrastructure and on traffic patterns, issues that are of great interest to ITU members. Initially, when most of the IP Telephony gateways were deployed in

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[3] http://www.itu.int/itudoc/itu-t/com2/reports/r077.html

the United States, the IP Telephony traffic patterns probably mirrored in some ways the traffic patterns of traditional telephony – i.e. it was U.S.-centric -- because of the lack of advanced IP Telephony infrastructure outside of the United States. For example, an IP telephony call between two developing -countries would often have to be routed thrrough one or more U.S.-based gateways for billing, administrative, other technical considerations. As a growing number of –IP Telephony gateways, and especially more advanced gateways, are deployed outside of the United States, the traffic patterns are likely to become less U.S.-centric and reduce the amount of IP Telephony traffic that transits through the United States. The deployment of these gateways and IP Telephony infrastructure is also increasing the demand for higher quality and lower cost IP connectivity in many countries. As this demand increases, IP backbone operators and carriers have greater incentives to further invest and improve IP networks around the world. It is also important to recognize that the deployment of the IP Telephony gateways and infrastructure were initially largely done by the smaller, pioneering IP Telephony operators and not the larger traditional carriers. These deployments have now further accelerated as a result of larger carriers embracing IP Telephony. [**EDITORIAL NOTE:** Similar text to this is suggested for the economic section. It is relevant here because the discussion touches on evolution of infrastructures and networks as well as who has been driving this evolution.]

**IP Telephony Standards Activities**

2.11 Of course, most telephones are—and for several years to come will continue to be—connected to traditional circuit-switched telephone networks. IP Telephony services must be able therefore to accept calls originating on the PSTN, to terminate calls on the PSTN, and to do it all seamlessly. The first generation IP Telephony services that linked to the PSTN via gateways were not capable of Intelligent Network (IN) functionality, such as calling party identification, nor could they interface with PSTN signalling systems such as Signalling System 7. In order to address these requirements, the latest standardization activities have focused on the distributed architecture of *gateways* linking PSTN and IP networks. These gateways convert and forward calls in one direction or another as well as provide call management functionality.

2.12 Technical standardization for IP Telephony is underway in many industry and regional entities, as well as in standardization bodies such as the ITU Telecommunication Standardization Sector (ITU-T), the ITU Radiocommunication Sector (ITU-R), the European Telecommunications Standards Institute (ETSI), and the Internet Engineering Task Force (IETF). Other entities and consortia that are carrying out important standards related work include the International Multimedia Teleconferencing Consortium, the Internet & Telecoms Convergence Consortium, Interoperability Now!, the IP Call Detail Record Initiative and Voice on the Network.

2.13 One example of ITU standardization is the H.323 series of Recommendations from ITU-T Study Group 16. The scope of the H.323 series is very broad and supports both audio and video multimedia conferencing, call setup and control, bandwidth management, as well as interfaces between different network architectures. Also notable is the IETFnternet Engineering Task Force's Session Initiation Protocol (SIP), a protocol for conferencing, telephony, presence detection, events notification and instant messaging that enables web developers to create advanced telephony and multimedia applications, using familiar Internet protocols and web tools. SIP is an open-source technology that will link speech recognition-based services together, much the way hypertext links link various websites on the Web that will allow consumers to 'speech-surf' through a variety of speech-activated content simply by using spoken commands through a traditional telephone, a mobile phone or other IP deviceand the nearest phone."– In some circumstances, the IETF and ITU-T have cooperated

directly on IP telephony standardization—producing the joint protocol called H.248 (ITU-T name)[4] and Megaco (IETF name). H.248/Megaco defines a master/slave protocol to control media gateways that can pass voice, video, facsimile and data traffic between PSTN and IP-based networks. The ITU-R is also involved in standardization related to fixed and mobile wireless access using IP networks. In other circumstances, standardization work is effectively being carried out entirely in private sector standards consortia because these better facilitate and speed adoption of standards in an industry driven by constant innovation. In addition, much of the testing of new IP Telephony standards and innovative applications are being tested in a cooperative manner on the networks of IP Telephony companies. [5]

2.14 Currently, many of the deployed IP Telephony solutions, even when based on standards, are from single vendors and encounter interoperability issues with other systems. For IP Telephony to further advance, common standards work still needs progressing.

**Quality of service (QoS) and Capacity**

2.15 Quality of Service and its related topic, network capacity, is at the core of voice telephony and, as such, is often the focal point of the IP Telephony debate, especially in determining regulatory classifications. There are many aspects to quality, including reliability, throughput and security. However, it is the perceived poor transmission quality of voice delivered over the public Internet that explains why Internet Telephony is often not considered as a carrier-grade service. There are, in general, two ways in which this quality can be improved—implementing quality of service support and increasing available capacity. The latter may be easier to achieve because it does not require coordinated action across Internet service providers.[6]

2.16 Generally, there is less of an issue when, instead of the ~~public~~ Internet, dedicated~~privately managed~~ IP networks are used to provide VoIP. In the latter, more capacity, faster transmission, and better voice quality combine to produce more satisfied customers. Privately operated capacity is therefore typically a key component today in commercially viable IP Telephony, and much more so at present than QoS. **Numbering and Addressing**

2.17 One of the technical challenges raised by the ever-closer integration between circuit-switched and packet-switched networks is how to address calls that pass from one network service to another. Generally, it is assumed to be desirable that an integrated global subscriber access plan exists. For example, the same ITU-T E.164 telephone number would reach a subscriber regardless of whether IP-based or PSTN network technologies are used.

2.18 It is now widely possible to originate calls from IP address-based networks to other networks, but it is uncommon to terminate calls from other networks to IP address-based networks. Rather, calls are generally terminated on the PSTN, so the called party can only use a terminal device connected to those networks. In order to access a subscriber on an IP address-based network, some sort of global numbering/addressing scheme across both PSTN and IP address-based networks needs to be developed and implemented.

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[4] Approved in June 2000.

[5] For example, see "iBasis Launches SIP Test Network For Internet Developers; Pingtel and Speechworks To Trial New Internet Devices and Technologies," September 11, 2000 (http://www.ibasis.net/news/pr09112000.htm).

[6] See Odlyzko, A.M., "The current state and likely evolution of the Internet," presented at IEEE Globecomm '99, http://www.research.att.com/~amo/doc/globecom99.pdf; and Huston, G., "Quality of Service: Fact or Fiction?" The Internet Protocol Journal (Cisco) (March 2000), http://www.cisco.com/warp/public/759/ipj_3-1/ipj_3-1_qos.html.

2.19 ITU-T Study Group 2 (SG2) is currently studying a number of possible options whereby users in IP address-based networks can be accessed from/to PSTN users. One option is the assignment of E.164 numbering resources to IP devices. Another approach is to support service interworking between different subscriber addressing systems in the PSTN and IP networks; for example, using the IETF's ENUM protocol. ENUM[7] defines a Domain Name System (DNS)-based architecture and protocol for mapping an E.164 telephone number[8] to what are known as Uniform Resource Identifiers (URIs)[9]. URIs are strings of characters that identify resources such as documents, images, files, databases, and email addresses. For example, http://www.itu.int/infocom/enum/ is the URI for the ITU website providing an overview of ENUM activities.

2.20 During the last year, SG2, responsible for E.164, and the IETF, have held discussions and collaborative activities related to the deployment of ENUM services. Since E.164 numbers may be synchronized with the DNS, the ENUM protocol would appear to have important implications for national Administrations responsible for numbering policies under "country codes". The view of SG2 is that administrative entities, including DNS administrators, should adhere to the applicable tenets of existing pertinent ITU-T Recommendations[10] with regard to the inclusion of E.164 resource information in the DNS. Specifically, in a recent liaison statement[11] to the IETF, Study Group 2 has noted that since most E.164 resources are utilized nationally, ENUM service and administrative decisions are primarily national issues within the purview of ITU Member States.

2.21 National regulatory authorities may wish to consider, their appropriate level of involvement in ENUM related activities in ITU-T SG2. One method of involvement is by providing contributions to SG2 in developing Recommendations that recognize and/or safeguard current national approaches and standards. Another issue of interest to Administrations is the appropriate international management of the root of the ENUM DNS structure, on which Administrations would be dependent for services.

**ITU Study Group Activities**

2.22 In general, all ITU-T and ITU-R Study Groups have refocused their activities on IP-related standardization. Relevant IP Telephony standardization includes, *inter alia*, work on differentiated QoS IP services, interworking between PSTN and IP networks, naming and addressing, support for charging and settlements, integrated network management of telecom and IP-based networks, IP signalling, routing principles, traffic management, network integrity and reliability (e.g., important for emergency services), optical networks, and fixed and mobile wireless systems (e.g., IMT-2000).

2.23 Specific ITU-T Study Group activities include ITU-T Study Group (SG) 2 (naming and addressing), SG3 (charging and settlements), SG4 (network management), SG7 (Frame Relay Interworking with IP), SG9 (cable network services including IP Telephony support), SG11 (signalling), SG12 (end-to-end performance), SG13 (ITU-T lead SG on IP), SG15 (optical networks), SG16 (H.323, H.248 and related Recommendations), and the recently established Special Study Group on "IMT-2000 and beyond". Concerning ITU-R, relevant

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7 http://www.ietf.org/rfc/rfc2916.txt

8 http://www.itu.int/itudoc/itu-t/rec/e/e164.html

9 http://www.ietf.org/rfc/rfc2396.txt

10 For example, ITU-T Recommendations E.164, E.164.1, E.190, and E.195.

11 http://www.itu.int/infocom/enum/wp1-39_rev1.htm

Study Groups include SG6 (broadcasting, terrestrial and satellite), SG8 (mobile, terrestrial and satellite, IMT-2000 included) and SG9 (terrestrial fixed service), all dealing with wireless access to IP networks. More detailed information on specific ITU Study Group IP activities can be found in a report to the 2000 ITU Council[12] and on the ITU-T and ITU-R web pages.[13]

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[12] http://www.itu.int/itudoc/gs/council/c00/docs/27a.html

[13] http://www.itu.int/ITU-T/ and http://www.itu.int/ITU-R/, respectively.

# 3. ECONOMIC ASPECTS OF IP TELEPHONY AND ITS IMPACT ON MEMBER STATES AND SECTOR MEMBERS

**The IP opportunity**

3.1 Throughout the world, enormous sums are being invested to establish IP-based networks, both for creating new capacity and for enabling existing narrowband networks and future broadband ones to run IP-based services. It is in this broader context that any consideration of the economic aspects of IP Telephony should be rooted. The initial driving force behind this investment has been the desire to widen and improve access to the Internet. There are now more than 350 million Internet users worldwide. While for many, the Internet is primarily a source for information and entertainment; it also brings significant opportunities for economic and social development:

- By using IP-based networks for electronic commerce, firms can widen their potential customer base and reduce transaction costs, while national economies can benefit from new trade opportunities;

- By using IP-based networks to retrieve information, health care professionals can keep up-to-date with developments in specialist areas and can pass on their own knowledge to others;

- By using IP-based networks as research media, schools and universities can greatly expand the range of information services available to their students and ensure that teachers remain abreast of the latest developments in their field;

- By using IP-based networks as communications tools, governments can make their services more accessible to their citizens and can establish websites to promote events or provide information.

These are just a few of the endless possibilities opened up by IP-based technologies for both fixed-line and mobile networks. Even though the Internet is still at the start of its growth cycle, already the number of emails sent each year exceeds the volume of fax messages and the volume of data and text transmitted exceeds the volume of international telephone calls

3.2 Most countries have adopted a supportive attitude to the Internet, and are taking steps so that all citizens have access to the possibilities it brings for commerce, communication, education and entertainment. ITU research carried out for the 2001 edition of the World Telecommunication Development Report shows how governments in different countries have adopted policies to promote the development of the Internet[14]:

- In Egypt, the Government's Information and Decision Support Centre played a critical role in introducing the Internet into the country by investing in international connectivity and establishing websites for the tourism and healthcare sectors;

- In Hungary, the Hungarnet academic network provides free Internet access to 400'000 or so of the nation's higher education students and professors;

- In Singapore, the government modified its telecommunications licensing regime in April 2000, to foster more investment in telecommunications and the Internet -

[14] See www.itu.int/ti/casestudies.

modifications that included provisions that eased and streamlined licensing for IP Telephony service providers~~s~~;

- In Nepal, a government task force is examining ways to promote electronic commerce to market the nation's handicrafts, tourist potential and software expertise.

3.3 ~~3.3~~ But IP-based networks can be used for much more than just text messaging and data communications. As capacity expands, new and innovative multimedia applications become possible. One of these is the facility for carrying voice, both in real-time and stored form, over IP-based networks. Packetised voice communications can attain levels of quality that are as high, if not higher, as that carried over more conventional circuit-switched networks, especially where bandwidth is plentiful. In most cases, this service of IP Telephony can be offered to customers at prices that are significantly below those offered over circuit-switched networks. This is partly because call origination and termination costs may be lower, but mainly because of savings in the long-distance transmission component of the call. Traditionally, pricing of calls on circuit-switched networks has been highly distance sensitive, with profits made on long-distance and international calls being used in part to cross-subsidise subscriber access and local call costs. These cross-subsidies have become increasingly less sustainable as competition emerged, international accounting rates are reduced and as a growing number of regulators put in place costing methodologies such as long-run incremental cost methodologies. Further downward pressure on traditional prices regimes emerged as new technologies and networks such as IP-based networks emerged with pricing structures ~~-~~that are ~~is But pricing of traffic on IP-based networks~~ is largely independent of distance.

**Markets, services and players**

3.4 Projections vary widely as to the economic market opportunity that IP Telephony creates. TeleGeography estimates that some 3.7 billion minutes of international traffic were carried over IP-based networks in 2000, or just over 3 per cent of the global total, but the market is growing fast. Market analysts forecast that, by 2004, IP Telephony will account for between 25 per cent (Analysys) and 40 per cent (Tarifica) of the global total. Most studies show that the main use of IP Telephony at present is for international traffic rather than for domestic long-distance or local traffic. The United States is currently the main source of IP Telephony traffic. TeleGeography estimates that all of the top 20 IP Telephony routes worldwide by traffic volume are between the United States and other countries (though some of this traffic may simply be being switched via the United States). In the longer term, there is a market opportunity for IP Telephony also in long-distance and local networks, especially if the transition of prices towards costs is delayed.

3.5 The IP Telephony marketplace, its products and players, differs considerably from the traditional PSTN telephony market which, even today, is dominated by incumbent national operators. Although the majority of IP Telephony Service Providers (IPTSPs) are US-owned, the main focus of their operations is global rather than national, and they often work in partnership with incumbent PTOs, bringing training and expertise as well as revenue-generating opportunities. The market can be segmented into several different types of applications, including (in the approximate order in which they have appeared): PC-to-PC; PC-to-Phone; Phone-to-Phone and value-added services.

~~3.6~~ The market can also be segmented between wholesale and retail operations; or between those IPTSPs that offer priced services and those which offer applications which are free-of-charge to the end-user, funded by advertising revenue. It is also useful to distinguish between the ways in which IP is used to carry voice, for

instance: in the networks of incumbent carriers migrating to IP; in the networks of newer PTOs without direct connection to customers; in managed IP-based networks offering multimedia services; or via ISPs (Internet Service Providers) which interconnect the public Internet with the PSTN. The mainstay of the business, for the moment at least, is price arbitrage, but this is evolving over time as value-added services—such as click-to-talk (placing a call by clicking on an icon in a web page), unified communications (making voicemail, email, and fax messages accessible from any device), speech-enabled access to Internet content (giving telephone users access to web content and trade via auditory commands), ~~integrated messaging, presence management~~ ("find me, follow me"), ~~click-to-talk website functions~~ etc.,—provide an increasing share of revenue. Operators often learn to use IP technologies by using them to initially carry voice traffic and as they learn to run and manage these technologies they begin to offer more advanced IP Telephony services.

**Costs and prices**

3.7 While the long-term potential for IP Telephony lies in the new functions and applications it makes available, the short-term advantage lies in cost-savings compared with conventional circuit-switched telephony. For **consumers,** IP Telephony is invariably *cheaper* than a circuit-switched call, especially for calls originating in non-liberalised markets or that are carried over the public Internet. For instance, in Hungary, where consumers have had a choice of using IP Telephony since 1999, the price advantage over standard PSTN calls ranges between 20 and 50 per cent per minute. If all other factors—quality, convenience, reliability, etc.—are equal, the choice to use IP Telephony is an economically rational one. But current IP Telephony offerings do not always match up to consumer expectations. At present, consumers must generally make a trade-off between price and quality. Willingness to make that trade off will generally depend on price sensitivity as well as the interest of consumers in using some of the more advanced IP Telephony services:

- Consumers in low income countries, low income families or cost-conscious consumers in developed countries, will be more inclined than other less-price-sensitive consumers to choose IP Telephony, where it is available;

- Residential consumers may be more inclined to use IP Telephony than business users, for whom transmission quality and reliability are more important.

- Consumers who cannot afford to pay for a phone and a computer may use unified communications or other IP Telephony services to place voice calls as well as to generate and retrieve e-mail or obtain information from the Internet though voice-enabled web sites that they access via payphones or via debit mobile phones.

3.8 For **Public Telecommunication Operators**, the potential cost advantages of IP Telephony are more complex to calculate. That is because incumbent PTOs have existing revenue streams, which may be affected by a shift to lower-priced IP Telephony. In the case of Hungary quoted above, the initial pressure to offer IP Telephony came from mobile service providers that saw the opportunity to bypass *Matav's* monopoly on carrying international calls, although *Matav* itself is now an IPTSP.

3.9 ~~3.9~~ Numerous studies have found that the cost of building and using IP networks are significantly lower than those of circuit-based networks. For example, one study

found that the average cost of a circuit-based class 5 switch is estimated at $20 million, while a packet-based gateway with comparable functionality costs between $3-$5 million.[15] Another study found that the cost of switching a bit on a circuit-based network is $0.00125 per bit versus $0.00002 per bit.[16] Despite the lower costs of IP-based networks, PTOs have other considerations they must take into account when determining when and how transition to IP-based networks. ~~The precise nature of the cost advantage to PTOs offered by IP networks is the subject of much debate.~~ It will depend, for instance, on:

- Whether a particular investment in IP is as a new-build network, or as an upgrade or overlay to an existing network. The incentive to choose IP will be greater for new, or substantially new, networks. For instance, in Senegal, where existing networks serve only just over 1 per cent of the population, *Sonatel* plans to migrate its existing core network to an IP backbone by 2004 and to offer both voice and data services over the same integrated IP network.

- Whether a particular carrier is an incumbent or a new market entrant. New market entrants, with no legacy network to defend, are likely to be the first movers towards IP Telephony. In China, for instance, *China Netcom*, a new market entrant which is based upon the Ministry of Railway's network, is building a voice over IP network which will cover 15 cities and include some 9'600 kilometres of fibre optic cable by the end of 2000. The use of IP has allowed *China Netcom* an earlier entry at a lower cost into the market than might otherwise be the case.

- The extent to which value-added services are being offered. In economies such as Hongkong SAR and Singapore, where local call charges are free (bundled into the access charge), new market entrants are offering value added services that allow, for instance, voice users to retrieve their email (*T2mail.com*) or the provisoin of voicemail and fax communication services (*2Bsure.com*) over an IP platform.

- The costs of international IP connectivity. Some countries have argued that the costs of international leased lines used to establish IP connectivity are too high and the costs are unequally shared. This issue is current being discussed within ITU-T Study Group 3 (see ITU-T Recommendation D.50).

3.10 In reviewing these factors, it seems likely that the pressures and incentives to shift towards IP Telephony will vary among economies at different states of development and with differing degrees of market competition.

- In countries where **prices for international traffic are high**, the main opportunity for IP Telephony will be for price arbitrage of simple voice transmission. In many of these countries, however, outgoing IP Telephony is banned. Thus, the main form of IP Telephony is for incoming traffic. Even though the use of IP Telephony for incoming traffic may be no more legal than for outgoing traffic, it is harder to detect and block. Countries that ban IP Telephony are also creating significant disincentives for the deployment of other IP Telephony service such as click-to-talk, unified communications

[15] "Latin American Telecom Odyssey: From dial tone to IP services." Hector Hernandez. IDC. III PCCI CITEL/OAS Forum. Isla Margarita, Venezuela. June 2000.

[16] Peter J. Sevcik, "Why Circuit-Switching is Doomed," Business Communications Review. (September 1999).

and speech-enabled access to Internet content that could be important sources for new revenues and for new ways of reducing the digital divide.

- In countries where **prices for international traffic are falling**—for both retail (consumer) and wholesale (settlement) rates—IP Telephony traffic may already be playing a role in promoting price competition (as, for instance, in Hungary or Thailand) or in providing an alternative to the services of the fixed-line incumbent (as, for instance, in Colombia). However, a critical factor is how easy it is for subscribers to use the service. In Peru, for instance, the success of IP Telephony was partly based on the availability of a telephone-like device (Aplio) that could use either IP-based networks or the PSTN for establishing calls. In these countries, operators, especially incumbents, may also attempt to offer IP Telephony services such as click-to-talk, unified communications and speech-enabled access to Internet content in order to generate new revenues sources in the face of increased competition.

- In countries where **prices for international traffic are already low**, due to the effects of competition, IP Telephony is likely to be important for reasons other than price arbitrage. The market opportunity for IP Telephony is likely to lie, on the one hand, in the prospects of value-added integrated services for users and, on the other hand, cost reductions for PTOs. As an example of the former, in the United Kingdom, *yac.com* offers a service for personalised numbers and automated call forwarding via the Internet. As an example of the latter, the *BT/AT&T* joint venture, *Concert*, is building a new managed IP-based global network to deliver services, such as electronic commerce and global call centres, to link some 90 cities worldwide. Even though the required investment is of the order of US$1 billion per year, an integrated IP network is considered to offer the most cost-effective solution for handling multiple traffic streams.

3.11 To better evaluate the interplay of these factors, it would be of assistance to Member States and Sector Members to further develop the following:

1. a reliable empirical analysis of the current price advantage that Internet Telephony enjoys over PSTN services

2. a comparison between the cost structure aspects of IP-based networks and Internet Telephony and their individual components, and traditional telecommunications networks.

3. a better understanding of some of the more innovative IP Telephony services, how they can assist operators prosper in the face of increased competition, how they impact Internet infrastructure build-out and how to create incentives so that these innovative services may be used to increase access, foster network build-out and reduce the digital divide.

**Substitutability and traffic migration**

3.12 A further economic issue raised by IP Telephony is that of substitutability between services. Clearly, much of the traffic carried over PC-to-PC Internet Telephony will be "new" traffic, which would not otherwise have existed on the PSTN. Much of the discount traffic generated over PC-to-Phone services is also likely to be new traffic, especially that which is offered "free of charge", for instance by companies such as *DialPad.com* or *phonefree.com*. But some of this traffic, and the majority of calls carried over Phone-to-Phone services, might otherwise have been made over the PSTN, and could therefore be regarded as substitute traffic. The cheaper prices generally available for IP Telephony may spur higher growth rates in traffic, where demand is elastic. IP Telephony will also spur additional traffic on local and

long-distance networks. In the longer-term, as PTOs move their backbone networks to an IP-based platform, the issue will become one of traffic migration, rather than substitution. Thus, some countries consider that the development of common strategies for migration from circuit-switched to IP-based networks would be of assistance to Member States and Sector members, especially for developing countries.

**Impact on Member States and Sector Members**

3.13 IP-based networks arguably represent the future for the telecommunications industry. Therefore, investment in IP-based networks may be regarded as an investment in the future, irrespective of the state of economic development of a particular Member State. The business case for investment in IP would rarely be based on the potential of IP Telephony alone, but rather on the wider potential of IP-based networks to carry data, text and video traffic as well as voice. Future mobile networks, like fixed-line networks, are likely to be based on IP technology. Thus those Member States that choose to ban the use of IP technology for carrying voice may be blocking the technological migration path of national operators and new entrants.

3.14 Some Member States have chosen to promote the Internet for text and data services, but not for voice. Their objective may be to protect the incumbent operators from potential competition. The risk in such an approach however, lies in the fact that those operators may be ill-prepared for operating in the future global environment. The PTO of the future may "own" the customer, in terms of providing billing and customer care support, and may "own" the local network, in terms of providing origination and termination of calls. However, it is unlikely to be able to "own" or control the types of application that the customer chooses, and IP Telephony might be better viewed as an application rather than a service.

3.15 Operators have traditionally used profitable long-distance and international services to cross-subsidise the functions of network access and local calling. In increasingly competitive markets, such hidden cross-subsidies can no longer be sustained. In the future, operators will need, instead, to address new challenges that may require substantial tariff rebalancing and a greater reliance on locally generated revenues.

3.16 While IP Telephony may bypass certain parts of an operator's network, it will not take away the need for local networks. Indeed, insofar as IP Telephony is a new "killer application" and makes access to the Internet even more popular, it will actually increase the volume of local calls and the demand for second lines. Already, in some Member States, as much as a third of all local calls are to the Internet and around 15 per cent of all local lines are used primarily for Internet access. Furthermore, dial-up Internet access is on a steeply rising curve while international traffic growth is slowing down. Competition will drive prices closer to costs and, where IP Telephony offers the lowest cost alternative, it will be the preferred solution.

3.17 ~~3.17~~ For Sector Members that are equipment vendors, the development of new IP-based product lines is likely to be essential to future growth and profitability. In developed country markets, demand for circuit-switched network technology has declined steeply and although demand in developing countries remains strong, this cannot be expected to continue indefinitely. Third generation mobile networks (IMT-2000), which are ~~-~~also IP-based networks, offer vendors additional opportunities to offer new products.

3.18 It is also important to consider the impact IP Telephony is having on build out of the global Internet infrastructure and on traffic patterns, issues that are of great interest to ITU members. Initially, when most of the IP Telephony gateways were deployed in

the United States, the IP Telephony traffic patterns probably mirrored in some ways the traffic patterns of traditional telephony – i.e. it was U.S.-centric because of the lack of advanced IP Telephony infrastructure outside of the United States. For example, an IP telephony call between two developing countries would often have to be routed through one or more U.S.-based gateways for billing, administrative, other technical considerations. As a growing number of IP Telephony gateways, and especially more advanced gateways, are deployed outside of the United States, the traffic patterns are likely to become less U.S.-centric and reduce the amount of IP Telephony traffic that transits through the United States. The deployment of these gateways and IP Telephony infrastructure is also increasing the demand for higher quality and lower cost IP connectivity in many countries. As this demand increases, IP backbone operators and carriers have greater incentives to further invest and improve IP networks around the world. It is also important to recognize that the deployment of the IP Telephony gateways and infrastructure were initially largely done by the smaller, pioneering IP Telephony operators and not the larger traditional carriers. These deployments have now further accelerated as a result of larger carriers embracing Internet and IP Telephony. –[**EDITORIAL NOTE:** Similar text to this is suggested for the technology section. It is relevant here because the discussion touches on the impact of IP telephony on network build-out, members and sector members.]

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# 4. POLICY AND REGULATORY ISSUES FOR IP TELEPHONY

## Introduction

4.1 This section discusses the different policy and regulatory approaches that Member States have taken to IP Telephony, and the methods used to categorize it within those frameworks. The significance of IP Telephony for convergence, universal service schemes, and cross-border issues is also considered.

4.2 IP Telephony is treated in a range of different ways within ITU Member States. Some allow or do not regulate it, others prohibit it, while some apply a range of controls and restrictions, either through licensing or other regulatory tools. It should be noted as well that this issue arises within the context of a period when many Member States are lightening their regulatory regimes for telecommunications and moving to a greater reliance on competition policy to ensure a level playing field in telecommunications markets, as opposed to sector-specific regulation.

4.3 Within these broad policy frameworks, IP Telephony raises a number of specific questions for policymakers and regulators, that require a careful and informed balancing of different and sometimes competing interests. Where does IP Telephony "fit" within telecommunication regulatory regimes, if at all? How should the rights and obligations of IPTSPs compare with those of traditional telephony providers, many of whom are subjected to common carriage regulations and universal service commitments? Should Internet Telephony, VoIP, and PSTN voice-traffic be treated the same way, or differently? Should IPTSPs be required to hold a license as most traditional voice telephony carriers do? Or should IP Telephony be viewed as an emerging technology offering new services and applications that could best develop with minimal or no governmental regulation?

4.4 To explore these questions, this section attempts an approximate categorization of the different ways in which IP Telephony is presently treated in many Member States and the factors that have been considered by national policy-makers. It provides illustrative examples

of some of the different national approaches. As background, the tables in Annex B classify the approach to IP Telephony taken by certain Member States, based on their responses to a recent ITU regulatory questionnaire.

**Policy objectives**

4.5 As a threshold matter, it is useful to set forth possible government policy objectives for IP Telephony that could or should form the basis for any regulatory approach that is adopted. These objectives, which could also form the parameters for a cost/benefit analysis of any policy, would include:

- Universal Service/Universal Access
- Affordable telecommunications services
- Tariff re-balancing
- Ensuring a level-playing field for competitors and new entrants
- Promotion of new technologies and services
- Stimulating investment in network build-out and new services
- Impact on revenue streams of incumbent operators
- Technology transfer
- Human resource development
- Economic growth as a whole and in particular in the communications sector.

**The general picture**

4.6 At present, three broad national policy approaches emerge:

- First, there are countries that include IP Telephony within their regulatory system or which do not regulate IP Telephony;

- Second, there are countries that prohibit IP Telephony;

- Lastly, there are countries where the situation is uncertain or the issue remains to be formally addressed.

4.7 This latter group of countries, where there is no specific policy on IP Telephony, constitutes the majority of ITU Member States. As can be seen from Table B, countries have taken widely differing regulatory approaches, which may be related to different prevailing market conditions or degrees of liberalization. It is important to note that it is the service component, i.e., voice telephony *service* delivered by means of the Internet or IP-based networks, which is most frequently the subject of policy, not the use of IP *technology* itself.

4.8 Prohibitions on IP Telephony are mostly found in developing countries and this may be linked to concerns that this service or application can divert revenues from the incumbent operator, as discussed in sections three and five. Many countries that have retained telecommunication monopolies do not specifically prohibit IP Telephony. However, it is likely that they would not allow any company other than the incumbent PTO to provide it. It is possible, however, as a practical matter, that IP Telephony (or at least PC-to-Phone services) may be permitted in these countries because it is not considered voice telephony at all, and therefore not a competing service.[17] However, reliable, reasonably high-speed access to the Internet is required for tolerable outgoing PC-to-Phone service, and this is often not

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17 Hungary is an example of a country where IP Telephony has been defined by the regulatory authorities in such a way as to fall outside the legal monopoly of the fixed-line voice incumbent.

widely available in developing countries. Consequently the issue of termination of incoming international calls is the more significant aspect of IP Telephony for many developing countries.

4.9 There are different rationales underlying the policies of those countries that either do not regulate IP Telephony or have chosen to include it within the regulatory framework for telecommunications. This approach may be motivated by a desire to encourage and stimulate emerging technologies linked to concerns about imposing regulations on technologies that are not fully mature. IP Telephony may be viewed as exerting downward competitive pressures on telephone tariffs and thus consistent with consumer welfare. Limitations placed on IP Telephony may also be seen as inconsistent with approaches designed to stimulate the deployment and migration to IP-based networks. Lastly, regulators in these countries may be hesitant to intervene in new markets unless there is evidence of a market failure.

**License restrictions**

4.10 Licensing is one of the principal means by which telecommunications authorities address the question of IP Telephony. Terms and conditions in existing licenses can be interpreted as either prohibiting or permitting such service offerings by new market entrants. Indeed, in non-competitive markets, the license of the incumbent operator may be viewed as precluding new market entrants from offering IP Telephony. On the other hand, a few countries expressly license PTOs to provide IP Telephony.

**Regulatory distinctions**

4.11 In countries that have policies on IP Telephony, it is possible to identify a number of factors which are used to distinguish IP Telephony from other, usually reserved or licensed, telecommunication services. In making the determination as to whether a particular service constitutes, or should be classified with, traditional voice telephony, a number of different regulatory distinctions are employed, alone or in combination, by many countries. Among the most commonly-used distinctions are type of service, voice versus data, mode of transmission, facilities-based operators versus resale and quality of service. These, and other distinctions, are discussed below.

***Type of service***

4.12~~4.12~~In countries that have IP Telephony policies, some regulators are explicitly or implicitly drawing distinctions between PC-to-PC, PC-to-Phone and ~~Most national IP Telephony policies specifically refer to~~ Phone-to-Phone services~~.~~ PC-to-Phone and PC-to-PC services tend to be prohibited in those countries that prohibit IP Telephony generally, while they tend to be permitted without condition in countries that permit some or all forms of IP Telephony. A significant number of countries, such as the United States, most members of the European Union, and Singapore allow all forms of IP Telephony services to be provided with minimal or no regulation and or licensing requirements. Calling-card services are rarely treated separately in policies. Rather, they are rolled in with other forms of Phone-to-Phone service, since the difference is largely one of marketing and billing, rather than technology. It should also be noted that, for many countries, information simply is not available as to whether or not incumbent PTOs are employing IP Telephony and if so, whether by right of their existing licences, or under special authorization. Some PTOs may simply assume that their international

franchise allows them to use IP Telephony, should they decide to pursue it, as a cost-saving measure or to offer a discounted service.[18]

4.13 Another aspect of type of service is the target audience for the service. Some regulators allow VoIP providers to be treated differently depending on whether or not they provide their service directly to end users, or just to other service providers.

***Voice or data***

4.14 Another, and perhaps the most important regulatory distinction in many countries, is whether IP Telephony constitutes voice or data. IP Telephony services can, in some cases, achieve a level of functional equivalence to traditional telephony services, making the means of transmission irrelevant to the user. Still, the voice/data distinction is often used as a definitional tool to implement policy even though some argue that this distinction is becoming less sustainable as IP Telephony technology and operators are creating new services that integrate voice with the Internet, data services and other media.~~.~~

4.15 The Internet, which started as a text and data network, has been treated in most countries as something other than traditional telecommunications. The trend has been in favour of little or no regulation of Internet services, even while traditional voice services are subject to extensive (albeit increasingly targeted) regulation. The reason is that Internet traffic is considered in many Member States, for regulatory purposes, as data traffic, even though in some forms (e.g., dial-up Internet sessions), the bits actually pass over PSTN circuits. Once voice became one of the applications that can be provided over the Internet, one argument for treating it differently was that it is simply another form of Internet data. Hence the regulatory advantage of Internet Telephony over VoIP—being treated as something other than voice, even though voice is the actual functionality being offered.

***Mode of network transmission***

4.16 Policies may also vary depending upon whether IP/PSTN conversion takes place (i.e., whether there is a service provider) and, if so, where. In Phone-to-Phone services, the initial conversion of speech from circuit-switched mode to IP mode generally takes place on the premises of a service provider, particularly in the case of calling-card services. In PC-to-PC and PC-to-Phone services, the initial conversion takes place at the user's PC, such that there is often no requirement for a service provider to be located in the same country as the user. The location of the ISP can be important, since commercial presence is usually a precondition for regulation in many particular countries.

4.17 Another case is where a given call does not use the domestic PSTN, but goes from a private data network to an IP gateway and then over international Internet links. Thus the local PSTN has not been "used." Regulation relating to basic telephony often focuses on the local access network. If that network is not used, then the service in question may not in fact be considered a basic telecommunication service at all.[19]

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[18] For instance, Telecom Egypt concluded exclusive agreements to offer IP Telephony within Egypt in 1999 without seeking clarification as to whether this was covered by its license.

[19] In the United States, policies generally distinguish between the Internet and other IP-based networks as the underlying means of transmission for IP Telephony calls. This can make the difference between a service being characterized as an Internet service, or simply another form of resale provided by means of a different technological platform.

***Quality of service***

4.18 Another means to distinguish IP Telephony is the question of whether or not it provides "real time" communications similar to traditional telephony. This is a technical measurement of whether the service provides instantaneous, two-way transmission of speech. If not, the service is often not considered voice telephony, but rather a store-and-forward or messaging service. The latter is often considered to be a "value-added" or "enhanced" service, which have traditionally been subject to little or no regulation. The difference between real-time and store-and-forward may be measured in milliseconds as a technical matter, but is usually left undefined as a legal matter. From the consumers' perspective, there may be a benefit in having an increased choice of different prices for different quality of calls.

4.19 Since Internet Telephony signals, transmitted over the public Internet, generally involve several conversion steps and face unpredictable traffic conditions, and as a result suffer levels of delay not generally experienced with circuit-switched telephony, they might not be considered to meet the criteria of "real time" communications. However, improvements in VoIP over private, managed IP-based networks may reduce the delay to a point at which such communications could reasonably be considered to be "real time". Furthermore the delays involved in IP Telephony might typically be the same or shorter than those experienced in satellite telephony, and the sound quality may be comparable with mobile telephony. Thus, technical quality of service measurements that are defined to exclude IP Telephony may also unintentionally exclude other types of voice telephony from regulation. In addition, as other media such as radio and other IP Telephony services use the Internet as a way to transmit voice– and as Internet QoS improve, the use of the "real time" criteria may not be sustainable as a long-term regulatory criteria to distinguish between circuit-based and IP Telephony. Critics of the using the "real time" criteria argue that there are significant additional technological and cost differences between circuit-based telephony and IP Telephony that justify treating IP Telephony differently, especially when it is provided by non-incumbents.

4.20 ITU-T Recommendation G.114 (2.96 revision) (One-way Transmission Time) establishes the following technical parameters for satisfactory telephony (footnotes omitted):

"[T]he ITU-T *recommends* the following limits for one-way transmission time for connections with echo adequately controlled, according to Recommendation G.131 (*Stability and Echo*):

- **0 to 150 ms**: Acceptable for most user applications.
- **150 to 400 ms**: Acceptable provided that Administrations are aware of the transmission time impact on the transmission quality of user applications.
- **above 400 ms:** Unacceptable for general network planning purposes; however, it is recognized that in some exceptional cases this limit will be exceeded.**"**

***Special categories***

4.21 In some countries, mobile operators are given special rights to use IP Telephony to route international calls, allowing them to bypass the incumbent's international gateway for incoming or outgoing calls, or both. Other countries restrict the right of mobile operators to offer or provide IP Telephony.

***Functional equivalence***

4.22 Functional equivalence is a regulatory concept that is implicitly used by some countries to link some or all of the above criteria in developing a policy as to whether some forms of IP Telephony should be treated on the same basis as conventional switched telephony. The premise for this approach is that similar or equivalent services should be treated in a similar way.

4.23 On this basis, functionally equivalent services should be subject to similar regulatory requirements, unless other policy imperatives take precedence. In determining "functional equivalence", policy-makers look at such criteria as the quality of service, the nature of the service and service provider, the transmission networks used and such other factors as whether the service is offered to the public. Where the type of IP Telephony service under review is such that an ordinary telephone or mobile phone can be used as the originating or terminating terminal device, the service is offered to the public, the PSTN is involved at some point and there is an acceptable technical level of call quality, then there is a reasonable basis for concluding that it is functionally equivalent to traditional telephony.

4.24 Accordingly, a possible decision path for establishing or assessing functional equivalence, and to determine whether or not regulation is advisable, would look at the following factors:

1. Is speech transmitted with significant average delays –which render conversation difficult?

2. What is the originating and/or terminating terminal device?

3. Is the PSTN used on the originating end, other than in the course of a dial-up Internet sessions?

4. Is the service available for use by the public?

**Technological Neutrality**

4.25 Technological neutrality is a principle that is often invoked by policy-makers and regulators when addressing IP Telephony and other emerging communications technologies. However, there are a range of understandings of this concept and it has been implemented in different ways in Member States. The concept is particularly pertinent with respect to the difference between VoIP and Internet Telephony, since the former is more likely to approximate conventional voice telephony than the latter.

4.26 One view of technological neutrality is linked to the concept of functional equivalence and provides that a basic public telephone service, even if provided over an IP-based network, should not escape from justified regulation. The definition of the voice telephony service must be based on functional criteria (e.g. transport and switching) that can be evaluated independently of the technologies used. Applying equal regulatory treatment to roughly equal services is seen as a means to neither favour nor disadvantage new or legacy technologies. As a result, appropriate telecommunication regulations might be applied to services such as IP Telephony that approximate traditional telephony. For example, regulations on emergency number services would be applied to all operators providing voice services, regardless of the technology used.

4.27 Another view is that policymakers and regulators should not be indifferent to technology. Emerging technologies might benefit from a "window", i.e. a form of regulatory

asymmetry during a transitional phase, which would allow them to develop and grow outside traditional obligations. This approach may enable small and medium-sized enterprises, offering new technologies and services, to provide competition for traditional industry operators and foster market-based results. If or when market failures arise, competition policy could be employed to reduce bottlenecks or curb abusive practices, without the need for sector-specific regulation or definitions and classifications that may quickly become outdated.

4.28 Efforts to develop a common approach to technology-neutral regulation or treatment within the ITU membership, based on a fuller explanation and understanding of this concept as it applies to the provision of functionally equivalent public voice telephony services, would seem to be a positive step toward fostering a global climate conducive to the use of IP-based networks and applications. This would not mean that all communication services should be subject to the same level of regulation, but would help avoid ineffective or conflicting applications of this principle. Efforts could be made to determine those circumstances under which technological neutrality is viable (e.g., where there is a high degree of product or service substitutability), and to examine whether 'identical' as compared to 'similar' approaches are required.

**Convergence and IP Telephony**

4.29 Technology analysts have been suggesting for several years that all forms of communications will eventually merge onto one platform, and in recent years IP appears to have emerged as the unifying platform. With PTOs and broadcasters entering each others' markets in many countries, and mobile operators shifting to IP platforms as they develop third generation systems, regulatory structures the world over are being pressured to adapt. At the same time that the regulatory framework for telecommunications is being streamlined and lightened, convergence raises the issue of whether existing or new paradigms should be applied to new telecommunications platforms and the continued suitability of sector-specific regulation.

4.30 One of the key issues in telecommunication markets that have been opened to competition has been the terms for interconnection among all local service providers. It is conceivable that some IPTSPs may seek the benefits of licensed local provider status, such as interconnection rights, numbering resources, and access to essential facilities such as directory listings. This is already the case, for instance, in the United Kingdom. IP Telephony rides on top of the PSTN, in the sense that calls are sometimes originated and almost always terminated on the PSTN, but are not fully integrated with it. The question of whether the public interest *requires* that ISPs (and IPTSPs) interconnect with each other may also arise in the near future.[20] Another approach to this issue is to apply domestic competition laws, and relevant doctrines developed under such laws concerning essential facilities, as part of a pro-competitive policy designed to establish a level playing field.

4.31 An important aspect of this issue is access to unbundled elements of the "local loop". In many ways, local competition has proven to be the most complex regulatory undertaking in liberalized telecommunication markets. The integration of Internet and IP-based services with incumbent and new entrant circuit-switched networks will make the local environment even more complex. The inherently international nature of the Internet, in turn, will make international cooperation on such matters essential.

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[20] In Chile, for instance, IPTSPs are required to offer interconnection. It is to be noted that the WTO Agreement on basic telecommunications and the Reference Paper on telecommunications only place the obligation for interconnection upon "major suppliers".

4.32 IP Telephony may also be considered as part of a broader process of deploying IP-based networks around the world. It is unlikely to be cost effective to develop IP-based networks solely for the carriage of voice, but rather as part of a strategy to develop a full-range of multimedia services. For countries that would seek partners to build such networks, developing best practices for creating favourable market conditions for investment and installation of IP-based networks need to be addressed.

**Impact of IP Telephony on Universal Service schemes**

4.33 It is widely perceived that market solutions will not ensure the expansion of networks to economically less viable regions and areas and thus universal service/access obligations and funding are a common element of national telecommunications polices.

4.34 The asymmetric regulation of voice and data services naturally creates an incentive for arbitrageurs to develop the capability to bypass the PSTN, and thereby avoid the costly regulatory obligations that are associated with voice traffic, in particular contributions towards implicit cross-subsidies or explicit universal service funds, or both. This can make offering international services profitable for small PTOs, or give larger PTOs crucial cost savings in extremely competitive markets. This incentive is particularly high where outgoing traffic exceeds incoming traffic and/or where universal service obligations are significant.

~~4.35~~ A positive policy towards IP Telephony may be designed to encourage the development of the Internet and the growth of small and medium-sized companies in a particular country. However, such a policy may not be entirely consistent with traditional universal service/access funding mechanisms~~goals~~ due to the fact that most commercial IP Telephony traffic travels over private IP networks, and not the public Internet at all, for quality reasons. Thus, such a policy might do little to increase Internet access, while facilitating the bypass of universal service funding schemes designed to increase the accessibility of the very telephone lines most often required to access the Internet in the first place. However, it should also be recognized that the impact of IP Telephony on universal service is highly dependent on how universal service is funded in each country. For example, some IP Telephony carriers lease PSTN and IP connectivity from carriers which in countries that have transparent and pro-competitive universal service funding mechanisms based on carrier revenues means that IP Telephony companies are indirectly increasing universal service funding by increasing the revenues of companies directly subject to universal service funding requirements.4.36 IP Telephony is being used more and more to offer functionally equivalent services without the regulatory burdens associated with providing traditional voice telephony. While this is good for competition, and therefore good for consumers, it can render some universal service funding mechanisms~~schemes~~ increasingly unsustainable and subject to challenge. A~~In a~~ few countries have responded to this challenge by subjecting~~,~~ providers of IP Telephony that is equivalent to other forms of telephony ~~are required~~ to contribute, on a non-discriminatory basis, to universal service funds.[21] Thus, two~~a~~ basic questions are ~~is~~ whether calls on one technological platform (e.g., IP, Frame Relay or ATM-based) should be treated differently from calls on another when it comes to universal service obligations and whether imposing universal service obligations on IP Telephony may undermine innovations introduced by IP Telephony that may help increase access to communications and information.~~-~~

4.37 For some developed countries, this issue might become more acute if the definition of universal service is broadened to include Internet access and applications, which would increase the funding requirements. One~~One~~ option would be to broaden or redefine the category of providers that must contribute to universal service, ~~while~~ another option would be

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[21] This is the situation in Canada, where a test of functional equivalence is applied and it is a policy objective in Nepal..

to consider alternative bases to generate financing for universal service, and a final option would be create incentives for IP Telephony providers to enter their markets if they help build out the IP infrastructure and offer innovative IP Telephony services that may help operators lower costs and/or benefit underserved areas or communities.

4.38 IP Telephony can also be a helpful tool for attaining universal service/access objectives. IP-based networks, depending on the situation and circumstances, can provide lower-priced alternatives to circuit-switched networks, and thus may provide a less costly alternative when expanding or building new capacity. In addition, IP Telephony services/applications such as unified communications and voice-enabled Internet access (previously described) may also create new, easier and more affordable ways for underserved populations to communicate and obtain information– especially those who cannot afford to pay for a phone and a computer to access the Internet (–e.g. people living in high cost areas, people with disabilities and/or people who are not computer--literate or have lower literacy levels). Further studies of the comparative costs of building IP-based networks and of these new services that may increase access would serve to develop this point and could provide a helpful checklist for policy-makers when making decisions on expanding national networks. In addition, to the extent that IP Telephony offers lower cost calls and increase communications resources and options to underserved populations, this may facilitate and increase the access that lower-income citizens have to basic telephony services.

4.39 Increasing access to the Internet is a policy goal in most countries, and low-cost long distance and international voice services can be easily added to the range of Internet services already available at community telecentres. Such services would not necessarily compete with an incumbent's existing business, and could be used as an interim strategy to provide easy and affordable access to those without a telephone in their home.[22]

**Cross-border issues**

4.40 The treatment of Phone-to-Phone IP Telephony may have implications for the international telephony market. IP Telephony may serve the public interest in the originating country by placing significant downward pressure on international settlement rates and consumer prices. In the terminating country, it may serve to introduce an alternative calling option, even though policy-makers have otherwise decided to restrict or prohibit competition. In addition, IPTSPs may benefit from a lighter regulatory approach than that imposed on incumbent PSTN operators. Where a liberalised approach in the originating country conflicts with clear and restrictive policies in foreign markets in which the services are terminated, it might be useful to have a means to address such difficulties, while respecting the sovereign rights of Member States.

4.41 Different approaches to the concept of technological neutrality and its implementation may create uncertainties among investors as to the regulatory climate and can impede the global expansion of IP-based networks and IP Telephony. For that reason, the principle of comity and attempts to develop common understandings of these concepts can serve to foster the development of seamless global networks. By ensuring that competing technologies are neither advantaged nor disadvantaged at the global level, opportunities for diversity, flexibility and innovation in the supply of services would be encouraged.

4.42 More generally, an assessment could be made as to the extent, if any, to which some forms of IP Telephony are or should be subject to international agreements and procedures, such as the numbering plan or conventions on routing traffic and settling accounts, that apply

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22 See the information on public Internet access centres in Peru in the ITU-commissioned case study available at <http://www.itu.int/osg/sec/spu/ni/iptel/countries/peru/index.html>.

to traditional international telephony. Finally, as discussed in section 2, interoperability of IP-based networks and the development of necessary global technical standards are an important cross-border concern.

# 5. THE DEVELOPMENT DIMENSION AND HUMAN RESOURCE DEVELOPMENT ISSUES

## The digital divide and bypass

5.1 Of those developing countries that have adopted a specific policy towards IP Telephony, many have chosen either to ban it outright, or to restrict its provision to the incumbent PTO.[23] Relatively few developing countries that have monopolistic telecommunication structures have taken a liberal approach to IP Telephony, though China is a major exception. In China, after a period during which IPTSPs were blocked and even jailed, IP Telephony has now been adopted by each of the major licensed international operators and they have been permitted to provide nationwide and international IP Telephony services. In China, IP Telephony has permitted the earlier introduction of competition than might otherwise have occurred and this has prompted a significant reduction in prices for international calls.

5.2 The position of those developing countries that ban or limit the provision of IP Telephony may benefit from a period of reassessment, if it is concluded that IP Telephony promises to bring lower call prices and make services more accessible, both of which are goals in the battle to narrow the digital divide. While most developing country governments have been supportive of IP-based networks in general, and the Internet in particular, they have often been hostile to IP Telephony. Consequently, ISPs in these countries have been deprived of a potentially valuable revenue source, and this may slow Internet development. In some cases, ISPs have been requested to block access to specific websites, based in foreign countries, which offer free-of-charge IP Telephony calls. As more websites integrate voice applications, such bans will become more difficult to enforce and the result may be that application service providers and website developers in developing countries are less able to compete with those in countries where IP Telephony is liberalised.

5.3 While some developing countries have chosen to limit outgoing IP Telephony calls, and the advertising of those services, they have often been unable to limit incoming IP Telephony calls. One of the main motivations for PTOs to route traffic via IP-based networks is to reduce the level of settlements that are due to partner countries. Under the international settlements system, the PTO(s) in the country where a call is originated make a compensatory payment to the PTO(s) in the country where the call is terminated. Payments are made when traffic in one direction is greater than traffic in the return direction. The level of payment is based on bilaterally negotiated "accounting rates". A net settlement payment is usually made on the basis of excess traffic minutes, multiplied by half the accounting rate (the accounting rate share, or settlement rate). The accounting rate system is undergoing reform, and new systems for the settlement of traffic accounts are being developed. Nevertheless, accounting rate traffic still accounts for a considerable proportion of the 20 per cent or so of international traffic that either originates or terminates in a country that retains a monopoly.

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23 In India, for example, the 1999 National Telecom Policy states "Internet telephony shall not be permitted at this stage. However, Government will continue to monitor the technological innovations and their impact on national development and review this issue at an appropriate time".

5.4 Net settlement payments, primarily from developed countries, have grown larger as traffic flows have become less balanced[24]. PTOs that send more traffic than they receive have an incentive to develop alternative routing procedures. They do this to avoid having to make settlements based on above-cost accounting rates and instead pay interconnection fees, based on local call rates. Some developing countries fear that, if an increasing share of their incoming traffic is routed over IP-based networks, then settlement payments will be reduced. They are concerned that reduced settlement revenues will endanger their ability to roll-out the basic telecommunications infrastructure, and hence to narrow the digital divide.

5.5 Net settlement payments have been declining worldwide since the mid-1990s, and arguably this would have happened even without IP Telephony. This trend is principally the result of increased competition and pressure from countries that make net settlements. Markets for international calling are shrinking in value as, on the one hand, prices fall sharply and, on the other hand, traffic is routed via least cost routes and settlement rates are forced downwards. This market change is particularly affecting those PTOs that have traditionally relied upon revenues from international service to cross-subsidise their local access networks. It is forcing the pace of tariff rebalancing. Nevertheless, many PTOs in developing countries are embracing IP Telephony, and bearing the consequences of reduced per-minute revenues from long-distance and international services, rather than risk missing the opportunity to generate revenues in future IP-related growth areas[25].

5.6 IP Telephony thus presents a dilemma for developing countries, especially for their incumbent PTOs:

- On the one hand, it promises to reduce the price of international telephone calls, for instance, enabling residential customers to make calls to relatives living abroad that might otherwise be too expensive, and enabling business customers to participate more effectively in the global marketplace. IP Telephony may also result in increases in traffic and network usage and provide another means for PTOs to tap into in new markets outside their country. IP Telephony may also reduce the cost of deploying domestic infrastructure and may introduce innovative technologies and services that will increase the ability of underserved communities to communicate and access information.

- On the other hand, IP Telephony could be viewed as a threat to undermine the pricing structure of the incumbent PTO and undercut its profitable business in originating and terminating international calls. IP Telephony might also reduce the revenues available to the PTO to invest in extending the domestic network or in meeting its universal service obligations.

**Human resource development issues**

5.7 ~~5.7~~ Over the last two decades, PTOs around the world have shifted from analogue to digital networks. This has required the development of a new set of skills among their staff. ITU Member States and Sector Members have frequently worked together to facilitate the transfer of technology, human resources development and network maintenance, to the benefit of developing countries. The shift from circuit-switched to IP-based networks is equally as fundamental as the shift from analogue to digital and requires similar co-operative arrangements among ITU

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24 ITU estimates that, during the 1990s, net flows of settlement payments from developed to developing countries, amounted to some US$50 billion . See, for instance, the analysis in ITU/TeleGeography Inc. "Direction of Traffic: Trading Telecom Minutes", ITU, Geneva, October 1999, 347 pp, available at: <http://www.itu.int/ti/publications/DOT99/index.htm>.

25 These PTOs include *Telecom Egypt*, *GamTel* (Gambia), *Matav* (Hungary) and *CAT* (Thailand).

Members. Because the change coincides with the advent of more competitive markets, and because IP skills are frequently in short supply, many developing country PTOs fear that they will be left behind. As developing country PTOs are often major employers and revenue generators in their respective countries, this makes the need for assistance in human resources development even more critical.

5.8 [**EDITORIAL NOTE:** We suggest inserting a paragraph describing how IP Telephony and other companies that enter in agreements with foreign partners are training a significant number of their partners staffers on IP Telephony technology, management, etc. These de-facto and on-the-job training programs are transferring a significant amount of knowledge and expertise to developing countries. In some cases, incumbent carriers and service providers in developing countries enter into agreements with IP Telephony companies in large measure in order to determine the effectiveness of IP Telephony and to develop in an affordable manner initial expertise before fully committing to developing their own IP Telephony networks. Private sector companies have also established in-country and remote training programs that use video and audio conferences as well as web-based training tools. Furthermore, a significant number of the highly-valued core technical staff of IP Telephony companies are from many countries – staffers that often return to their home countries to establish or manage IP Telephony networks and companies. In sum, while there remains a significant need for more human resource development in developing countries, the report should recognize the importance of these private sector initiatives and perhaps foster more of these initiatives.]

5.8 Education and training are primary determinants of a country's prospect for economic and human development and international competitiveness. As well as a need for IP-based skills among a country's service providers and manufacturers, there is also a need for training for those involved in regulatory and policy functions, and awareness-raising among the user community.

5.9 Council Decision 498 asked that the WTPF consider actions to assist Member States and Sector Members to adapt to changes in the telecommunication environment due to the emergence of IP Telephony, including analysing the current situation (e.g., by case studies) and formulating possible cooperative actions involving ITU Member States and Sector Members to facilitate adaptation to the new environment. The Decision also invites the WTPF to consider actions to assist Member States and Sector Members in meeting the human resource development challenges presented by new telecommunication technologies such as IP Telephony, in particular, skills shortages and the need for education, and technology transfer.

5.10 Possible elements for an action plan for meeting the human resource development challenges raised by IP Telephony are:

- Upgrading of technical skills for staff through training, seminars, workshops and tutorials amongst Member States and Sector Members.
- Identify, publicize and foster private-sector led technical training opportunities and initiatives
- Sharing of pilot project and developmental activities amongst Member States and Sector Members.
- Exchange of skilled manpower amongst Member States and Sector Members.
- Setting up of a separate fund for HRD development.
- Encouraging the sharing of knowledge and skills among Member States, industry players and policy makers and regulators.

Annexes: Annex A Council Decision 498.
Annex B Status of IP Telephony in ITU Member States.
Glossary of Acronyms

**Annex A**

# DECISION 498

## Third World Telecommunication Policy Forum

The Council,

*considering*

Resolution 2 of the Plenipotentiary Conference (Minneapolis, 1998), on the maintaining of the Policy Forum in order to discuss and exchange views and information on telecommunication policy and regulatory matters, especially on global and cross-sectoral issues,

*noting*

a) the Report of the Secretary-General, as contained in Council Document C2000/3;

b) the experiences gained from the previous Policy Fora, on Global Mobile Personal Communications by Satellite (1996) and on Trade in Telecommunications (1998),

*considering further*

a) that Internet Protocol (IP) Telephony is one of the topics of high-current interest to ITU Member States and Sector Members;

b) that the development of IP Telephony also has significant implications for several domains, particularly for human resource development, especially in developing countries,

*decides*

1 to convene the third World Telecommunication Policy Forum in Geneva from 7-9 March 2001 in order to discuss and exchange views on the theme of Internet Protocol (IP) Telephony, with the following draft agenda:

a) the general implications of IP Telephony for the ITU membership with respect to:

- the telecommunications policies and regulations of ITU Member States;
- the implications of IP Telephony for developing countries, particularly with respect to policies and regulatory frameworks, as well as technical and economic aspects;
- the impact of IP Telephony on the operations of Sector Members, notably in terms of the financial challenges and commercial opportunities it presents;

b) actions to assist Member States and Sector Members in adapting to the changes in the telecommunication environment due to the emergence of IP Telephony, including analysing the current situation (e.g. by case studies) and formulating possible cooperative actions involving ITU Member States and Sector Members to facilitate adaptation to the new environment;

c) actions to assist Member States and Sector Members in meeting the human resource development challenges presented by new telecommunication technologies such as IP Telephony, in particular, skills shortages and the need for education, and technology transfer;

2 that the Forum shall draw up a report and, if possible, opinions for consideration by ITU Members and relevant ITU meetings;

3 that arrangements for the third WTPF shall be similar to those of the previous Fora. In particular:

a) discussions shall be based on a report from the Secretary-General, incorporating the contributions of ITU Member States and Sector Members, which will serve as the sole working document of the Forum, and shall focus on key issues on which it would be desirable to reach conclusions;

b) the final report of the Secretary-General shall be circulated at least six weeks before the opening of the Policy Forum;

c) the report of the Secretary-General shall be developed in the following manner:

i) the Secretary-General shall convene a balanced, informal group of experts, each of whom is active in preparing for the Policy Forum in his/her own country, to assist in this process;

ii) a first draft of the report shall be circulated, based on available material, with an invitation to comment, not later than four months before the opening of the Forum;

iii) a second draft, incorporating comment from the membership, with an invitation to comment, shall be circulated ten weeks before the opening of the Forum;

d) participation in the Forum shall be open to Member States, Sector Members and small and medium-sized enterprises with attendance, as observers, by the public;

e) the Secretary-General shall encourage ITU Member States, Sector Members and other interested parties, to make voluntary contributions to help defray the costs of the Policy Forum and facilitate the attendance of the LDCs;

f) Forum Meetings should be conducted in line with the Rules of Procedure used at the previous two Fora.

# Annex B

## STATUS OF IP TELEPHONY IN ITU MEMBER STATES

Tables B.1, B.2, and B.3 are based on available data and show the current regulatory status of IP Telephony in a range of ITU Member States. However, the Tables do not include all Member States, because many of them simply *do not have* specific IP Telephony policies or have not responded to the ITU survey. Member States are invited to provide additional data or clarifications so that the tables can be kept up-to-date.

### Table B.1: Countries that include IP Telephony (i.e. voice and fax over <u>both</u> the public Internet and IP-based networks) within their Regulatory System or that do not specifically regulate IP Telephony

| ***No specific prohibition for voice/fax over the Public Internet or over IP-based networks*** | ***Permitted or not regulated, if not real-time*** *(not considered voice telephony)* | ***Permitted. If real-time, subject to light conditions*** *(notification/registration may be required, other basic provisions of voice regulation)* | ***Permitted. If real-time, treated similarly to other voice telecommunications services*** *(licensable, subject to more extensive provisions of voice regulation)* |
|---|---|---|---|
| **Angola**<br>**Antigua and Barbuda**[1]<br>**Bhutan**<br>**Congo**<br>**Costa Rica**<br>**Dominican Republic**<br>**Estonia**[2]<br>**Gambia**<br>**Guatemala**<br>**Madagascar**<br>**Malta**<br>**Mexico**<br>**Mongolia**[2]<br>**New Zealand**<br>**Poland**<br>**Slovak Republic**<br>**St Lucia**[1]<br>**St Vincent**[3]<br>**Tonga**<br>**Uganda**<br>**United States**[4]<br>**Viet Nam** | **EU Countries**[5]<br>**Hungary**<br>(if delay =/>250ms and packet loss >1%)<br>**Iceland** | **Czech Republic**<br>(except Phone-to-Phone by other than incumbent)<br>**Hong Kong SAR**<br>**JapanSingapore**<br>**Switzerland** | **Australia**<br>**Canada**<br>**China**<br>**Korea (Rep.)**<br>**Malaysia** |
| | | | |

[1] Antigua & Barbuda and St Lucia: the use of the public Internet is not prohibited for voice and fax, but no data is available on the use of IP-based networks for these services.
[2] In Estonia, both domestic and international phone calls over IP-based networks are prohibited until Dec. 31, 2000. Public IP telephony is also prohibited until 31 Dec 2000. In Mongolia, international telephone calls over the public Internet are prohibited until Dec. 31, 2000.
[3] St Vincent: the use of IP-based networks is not prohibited, but no data is available regarding the use of the public Internet for voice and fax services
[4] The United States permits IP Telephony unconditionally, i.e. it is exempt from the international settlements regime.
[5] The 15 countries of the European Union are Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal, Spain, Sweden, and the United Kingdom.
*Notes:* Depending on whether or not speech transmission is "real-time", normal voice regulation may apply to varying degrees. Regulatory information on the real-time nature of the service is not available for all countries.
*Source:* This table is based on the ITU 2000 Regulatory Survey and ITU case studies. No changes or clarifications to this table have been submitted by Member States in the context of WTPF-01.

## Table B.2: Countries that permit voice/fax services over either the Public Internet or IP-based networks (but not both)

| *Country* | *Use of Public Internet* | *Use of IP-based networks* |
|---|---|---|
| **Argentina** | **Prohibited** | **Not prohibited** |
| **Cyprus** | **Prohibited** | **Not prohibited** |
| **Ethiopia** | **Prohibited** | **Not prohibited** |
| **Kenya** | **Prohibited** (voice services; includes call back and refile) | **Not prohibited** |
| **Kyrgyzstan** | **Not prohibited** | **Prohibited** (IP telephony until 2003) |
| **Moldova** | **Not prohibited** | **Prohibited** (IP telephony until 2003) |
| **Peru** | **Prohibited** (voice services in real-time are prohibited as they are considered voice telephony) | **Not prohibited** |
| **Philippines** | **Prohibited** | **Not prohibited** |
| **Sri Lanka** | **Not prohibited** | **Prohibited** (voice services) |

*Source:* This table is based on the ITU 2000 Regulatory Survey and no changes or clarifications have been submitted by Member States in the context of WTPF-01.

*Table B.3: Countries that prohibit the use of both the Public Internet and IP-based networks for voice or fax services*

| *Countries* | *Specifics given* |
|---|---|
| **Albania** | Voice services over IP-based networks prohibited until 2003 |
| **Azerbaijan** | |
| **Belize** | All services prohibited |
| **Botswana** | Voice prohibited over the public Internet |
| **Cambodia** | Voice prohibited indefinitely |
| **Cameroon** | Telephony prohibited over public Internet;<br>Telephony and Fax prohibited over IP-based networks |
| **Côte d'Ivoire** | Voice prohibited over public Internet until 2004 |
| **Croatia** | |
| **Cuba** | Telephony prohibited over the public Internet and IP networks<br>Telephony prohibited over IP-based networks, but not fax |
| **Ecuador** | Voice prohibited over public Internet<br>Voice temporarily prohibited over IP-based networks |
| **Eritrea** | Voice is prohibited for some years to come (both over the public Internet and IP-based networks) |
| **Gabon** | Telephony prohibited (both over the public Internet and IP-based networks) |
| **Indonesia** | Telephony prohibited over the public Internet. Regulation now under preparation to allow voice over IP-based networks |
| **India** | India prohibits the use of voice services over the public Internet, but did not respond to the question relating to IP-based networks |
| **Israel** | Telephony prohibited over the public Internet<br>Both voice and fax prohibited over IP-based networks |
| **Jordan** | Voice prohibited over the public Internet. Voice and fax services prohibited over IP-based networks until the end of 2004 |
| **Latvia** | |
| **Lithuania** | Voice prohibited over both the public Internet and IP-based networks until Dec. 31, 2002 |
| **Morocco** | |
| **Mozambique** | Voice and Fax services prohibited over both the public Internet and IP-based networks |
| **Myanmar** | |
| **Nicaragua** | Voice services prohibited over both the public Internet and IP-based networks |
| **Nigeria** | Voice and fax prohibited over IP-based networks at this time |
| **Pakistan** | Voice termination services prohibited over the public Internet<br>Voice prohibited over IP-based networks |
| **Paraguay** | Voice services prohibited over both the public Internet and IP-based networks |
| **Qatar** | Telephony and Fax prohibited over both the public Internet and IP-based networks, subject to review |
| **Romania** | Voice services prohibited over the public Internet<br>Voice services prohibited until at least Jan. 1, 2003 |
| **Senegal** | Telephony prohibited over the public Internet |
| **Seychelles** | Voice and fax over the public Internet are prohibited, but Internet telephony which is an Internet application rather than a telecommunication service provided by an ISP is permitted. All services over IP-based networks are prohibited. |
| **Swaziland** | |
| **Thailand** | Voice and fax services prohibited over both the public Internet and IP-based networks |
| **Togo** | |
| **Trinidad and Tobago** | Voice services prohibited over IP-based networks |
| **Tunisia** | |
| **Turkey** | Voice prohibited over both the public Internet and IP-based networks |

*Source:* This table is based on the ITU 2000 Regulatory Survey and no changes or clarifications have been submitted by Member States in the context of WTPF-01.

# GLOSSARY OF ACRONYMS

| | |
|---|---|
| **ATM** | Asynchronous Transfer Mode |
| **DNS** | Domain Name System |
| **ETSI** | European Telecommunications Standards Institute |
| **IETF** | Internet Engineering Task Force |
| **IN** | Intelligent Network |
| **IP** | Internet Protocol |
| **IPTSP** | IP Telephony Service Provider |
| **ISDN** | Integrated Services Digital Networks |
| **ISP** | Internet Service Provider |
| **LAN** | Local Area Network |
| **PLMN** | Public Land Mobile Networks |
| **PSTN** | Public Switched Telephone Networks |
| **PTO** | Public Telecommunication Operators |
| **QoS** | Quality of Service |
| **SIP** | Session Initiation Protocol |
| **SS7** | Signalling System Seven |
| **VoIP** | Voice over IP |