INTERNATIONAL TELECOMMUNICATION UNION

WORLD TELECOMMUNICATION POLICY FORUM (WTPF 2001)

31 January 2001

Final report

GENEVA — 7 – 9 MARCH 2001

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 were 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 was prepared according to the following timetable:

> **1 November 2000**: the first draft was circulated with an invitation to comment**,** drawn up on the basis of available material (notably, the Strategic Planning Workshop on IP Telephony[1]);
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> **1 December 2000**: deadline for receipt of membership comments on the first draft;
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> **15 December 2000**: the second draft was circulated, incorporating comments received and with an invitation for further comments;
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> **10 January 2001**: deadline for receipt of membership comments on the second draft.

The Final Report was circulated at the end of January 2001. Written comments from the ITU membership, as well as comments from other entities, have been posted on the website for the Forum at http://www.itu.int/wtpf/.

v) Council Decision 498 also required that the Secretary General convene a balanced, informal group of experts (IEG)—who were active in preparing for the Forum in their own country—to assist in the successive stages of the preparatory process. This group met twice during the consultation process, in November 2000 and January 2001. Invitations to participate in the IEG were sent out by the Secretary-General to those who contributed to the consultation process plus others who could make significant contributions and could assist in achieving the desired balance.

vi) This final 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 in the IEG. The report contains three draft opinions that were drafted by members of the IEG. 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.

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/. They will also appear on the CD-ROM prepared for the Information Session of the Forum, to be held on 6 March 2001.

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

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 network types that have emerged under very different policy and regulatory circumstances:

- the Public Switched Telephone Network (PSTN)[2], based largely 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.

Working definitions

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 purposes of this Report, "IP Telephony" is used as a generic term for the conveyance of voice, fax and related services, partially or wholly over packet-switched IP-based networks. IP Telephony may also include applications that integrate/embed the transmission of voice and fax with other media such as text and images. In this report, the term IP Telephony used interchangeably with VoIP (Voice over Internet Protocol). A third term, Internet Telephony, is also used in the report when referring to IP Telephony or VOIP conveyed partially or wholly over the Internet.

Growth of IP Telephony

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 in combination with and as alternatives to, circuit-switched telephone networks. To some extent they 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.

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[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). The PSTN is mainly based on circuit-switched technology but it can also incorporate packet-switched technology. Generally with convergence, today's telecommunications networks and transport technologies are increasingly complex and difficult to categorize.

Furthermore, the majority of IP Telephony now travels over managed IP-based networks, as opposed to the 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. IP Telephony is already believed to account for more than 3 per cent of international voice traffic. Worldwide, the volume of traffic on IP-based and data networks already exceeds the volume of voice traffic that travels over the PSTN. Consequently, few countries can ignore IP Telephony.

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. Improvements to communications networks may serve as a dynamic stimulus to economic growth. In competitive markets, established PTOs are evolving their networks towards IP not necessarily to provide cheaper voice services (competition has already forced down prices of traditional circuit switched services) but to offer a much wider and diverse range of multimedia services and innovative applications and particularly to be able to compete effectively in future e-commerce markets.

1.7 IP Telephony is an important part of this picture. For consumers, Internet 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 any 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.

Policy approaches to IP Telephony

1.8 Notwithstanding the growth of the Internet, most analysts expect the PSTN to remain robust for the foreseeable future. An important issue for policy-makers will be the co-existence of the two network technologies and, increasingly, combinations of the two. For PTOs, the potential financial implications of IP Telephony are 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 telecommunication networks.

1.9 As IP networks become more widespread, policy-makers also face a challenge in 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 the technological and other differences between IP-based and circuit-based networks. 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 have, up to now, been 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 their 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 telephone calls.

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 has arguably brought about as dramatic a change in personal communications as the telephone did compared to the telegram. 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 PSTN was developed and extended globally with one prime service in mind, public voice telephony. The basic network features of the PSTN (circuit-switching and real-time transmission) are particularly suited to this application. The PSTN supplies voice telephony (voice-grade sound transmission) if suitable terminals (telephones) are attached to the network termination points. Such a network can also support other services (e.g., facsimile and data transmission) through use of appropriate alternative terminals (e.g., fax machines and modems).

2.3 IP-based networks have been developed over the past few decades with a particular set of services in mind, such as e-mail, file transfer, and database searching. 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. The popularity of the Internet grew tremendously in the 1990s with the deployment of World Wide Web technology—allowing users facilitated access to hyperlinked information around the globe.

2.4 Internet technology and its related applications can also be used in private networks based on the Internet Protocol (including "Intranets" or Local Area Networks (LANs). Internet applications or services, including IP Telephony, can be deployed on either the Internet or private IP-based networks—or across a combination of both.

2.5 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. IP Telephony can be viewed as one example of interactive, real time audio between users.

2.6 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. As a working definition, and for the purposes of this Report, "IP Telephony" is used as a generic term for the conveyance of voice, fax and related services, partially or wholly over packet-switched IP-based networks. IP Telephony may also include applications that integrate/embed the transmission of voice and fax with other media such as text and images. In this report, the term IP Telephony can be used interchangeably with "VoIP" (Voice over Internet Protocol). IP Telephony can be of three broad kinds: PC-PC, PC-phone and phone-phone depending on the terminal equipment. Finally, a third term, "Internet Telephony", is used in this report when referring to IP Telephony or VoIP conveyed partially or wholly over the Internet.

2.7 IP Telephony technology, particularly when integrated with data applications, offers the potential for new, multifunctional, end-user portable consumer 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 physical 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

2.8 For most of the last century, voice traffic was the predominant use of telecommunications networks. While voice traffic continues to grow, it represents a decreasing 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.

2.9 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.

2.10 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.

2.11 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 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. These and many other technological innovations made possible by IP Telephony are further eroding the traditional distinction between voice and data services.

2.12 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 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.[3]

IP Telephony Standards Activities

2.13 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.

3 In this regard, draft determined ITU-T Recommendation E.370 from ITU-T Study Group 2, addresses in more detail various scenarios and principles related to interworking between PSTN and IP-based networks. See http://www.itu.int/itudoc/itu-t/com2/reports/r077.html.

2.14 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).

2.15 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 IETF's Session Initiation Protocol (SIP), a protocol for conferencing, telephony, presence detection, events notification and instant messaging. More closely related to web technology, SIP can enable developers to create advanced telephony and multimedia applications using familiar Internet protocols and web tools. 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. Many other industry bodies and consortia are also carrying out important related standards activities.

Quality of service (QoS) and Capacity

2.16 Quality of Service and a related topic, network capacity, is at the core of voice telephony and, as such, is often the focal point of the IP Telephony debate, particularly as it is sometimes used in determining regulatory classifications. There are many aspects to quality, including reliability, throughput and security. Generally, the basic IP network architecture results in variable transmission times, particularly when traffic is intense. As an example, because there is no total control of traffic management on the Internet, end-to-end quality cannot be guaranteed and typically provides only "best effort" packet delivery. For this reason, the Internet is generally not particularly well suited to carry a voice telephony service, which cannot tolerate more than minimal transmission delays. A desire to overcome this limitation has prompted the establishment of separate dedicated managed IP networks of global reach, where the network operator has the possibility of controlling quality over large distances.

2.17 There are, in general, two ways in which this quality can be improved—implementing quality of service support and increasing available capacity. Some argue that the latter may be easier to achieve because it requires less coordinated action across Internet Service Providers (ISPs). However, others argue that simply increasing capacity would still require co-ordinated action across ISPs since calls are likely to be routed across separate provider networks—and if any of these were congested, the end-to-end call quality would still be degraded.

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4 Approved in June 2000.

2.18 Generally, end-to-end call quality is less of an issue when, instead of the Internet, dedicated managed IP networks are used to provide VoIP. In the latter, more capacity, faster transmission, and better voice quality combine to produce better results. Privately operated capacity is therefore typically a key component today in commercially viable IP Telephony, and much more so at present than implementation of QoS.

Numbering and Addressing

2.19 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.

2.20 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 from the PSTN, some sort of global numbering/addressing scheme across both PSTN and IP address-based networks needs to be developed and implemented.

2.21 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[5] defines a Domain Name System (DNS)-based architecture and protocol for mapping an E.164 telephone number[6] to what are known as Uniform Resource Identifiers (URIs)[7]. 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.

2.22 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, including a recent workshop intended to assist Administrations in their consideration of national ENUM operational and administrative issues.[8] Since E.164 numbers may be inserted into the DNS, the ENUM protocol would appear to have important implications for national Administrations responsible for numbering policies under "country codes". Generally, it is accepted that, to be useful, ENUM domain names must accurately reflect the assignment of E.164 resources. If not, ENUM would lose its core advantage, which is the utilization of a widely used numbering system to which the general public is accustomed.

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

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

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

8 http://www.itu.int/infocom/enum/workshopjan01/

2.23 The view of SG2, Working Party 1/2, is that administrative entities, including DNS administrators, should adhere to the applicable tenets of existing pertinent ITU-T Recommendations[9] with regard to the inclusion of E.164 resource information in the DNS. Specifically, in a recent liaison statement[10] to the IETF, Study Group 2, Working Party 1/2, 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.

2.24 At the same time, the appropriate neutral international management of the root of the ENUM DNS structure is of direct relevance to ITU Member States. In order to guarantee an accurate reflection of ENUM domain names with the E.164 numbering plan, it is widely accepted that one guiding principle is that ENUM domain names management strictly reflect the current integrity of international E.164 numbers management. To safeguard this, it has been suggested that the responsibility for the root of the ENUM DNS structure also be assigned to the management body of the E.164 numbering system: the ITU. This would ensure that entry of "country codes" in the ENUM DNS root is performed only at the express instructions of ITU Member States. National regulatory authorities and/or policy makers may wish to consider, their appropriate level of involvement in ENUM related activities taking place in ITU-T SG2.

2.25 IP Telephony may have an impact on IP address management. It could indeed stress the growing lack of IPv4 addresses. Current solutions deployed to minimize IPv4 address allocation could act as a barrier to widespread development of IP Telephony and may encourage more rapid deployment of IPv6. The rules of assignment of the remaining IPv4 addresses and of IPv6 addresses should be determined on a fair basis and not discriminate any operator or country.

Interoperability Considerations

2.26 Interoperability of IP Telephony with the international telephone service currently provided by circuit switched international telecommunication networks, according to text prepared by the Informal Experts Group (IEG), requires consideration of the following principle:

Interoperability should require backward compatibility of IP Telephony with the existing international telephone service and not require burdens to be imposed on existing circuit switched international telecommunication networks. Backward compatibility should include, but not be limited to, aspects of performance metrics, and other aspects as detailed in the relevant ITU Recommendations.

2.27 In considering the aspects of interoperability outlined in the principle outlined above, the appropriate sectors of the ITU will consider that the associated service, operational and technical aspects are reviewed and where appropriate revised, to enable successful interoperability.

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

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

ITU Study Group Activities

2.28 In general, all ITU-T and ITU-R Study Groups have included in their activities IP-related standardization. For example, ITU-related IP Telephony standardization includes, *inter alia*, work on differentiated QoS IP services, interworking between PSTN and IP networks, numbering, 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).

2.29 Specific ITU-T Study Group (SG) activities include ITU-T SG2 (numbering, naming and addressing, routing and interworking, service principles, traffic engineering, network management, quality of service), 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 (VoIP gateways, 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 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[11] and on the ITU-T and ITU-R web pages.[12]

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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 communications networks. There are now more than 300 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;

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

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

- 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 number 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[13]:

- 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. The modifications included provisions that eased and streamlined licensing for IP Telephony Service Providers (IPTSPs);
- 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 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 as, if not higher than, that carried over more conventional circuit-switched networks, especially where bandwidth is plentiful. In most cases, 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 distance sensitive, with profits made on long-distance and international calls being used, in part, to cross-subsidise subscriber access and local call costs. But pricing of traffic on IP-based networks is largely independent of distance.

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13 See www.itu.int/ti/casestudies.

Markets, services and players

3.4 Projections vary widely as to the economic market opportunity that IP Telephony creates. *TeleGeography Inc*. 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. Most studies show that the main use of IP Telephony at present is for international traffic. 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. The main focus of the operations of IPTSPs is global rather than national, and they often work in partnership with incumbent PTOs, bringing training and expertise as well as revenue-generating opportunities, for instance in attracting new traffic and providing value-added services.

3.6 The market can be segmented in several different ways, for instance:

- by 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;
- between wholesale and retail operations;
- 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;
- according to 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 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 applications provide an increasing share of revenue. Value-added applications include, for instance, 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-based content and transactions via auditory commands), and presence management ("find me, follow me"). Operators that begin using IP to carry basic voice may "learn by doing" and go on to develop more sophisticated applications later.

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, that are carried over the Internet and/or which generate advertising revenue. 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, though consumers have reported some quality problems. 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, the perception of the quality of service (e.g., transmission quality, user-friendliness, convenience) as well as the interest of consumers in using some of the more advanced IP Telephony services.

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 that may be affected by a shift to lower-priced IP Telephony. The impact on the PTO will differ according to whether it is a supplier of either an access network or a core network, or both, and whether the network is radio-based or fixed-line. 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. *Matav* itself is now an IPTSP.

3.9 A number of studies have found that the cost of building and using IP networks are significantly lower than those of circuit-based networks However, the precise nature of the cost advantage to PTOs offered by IP networks is still 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 was planned to cover 15 cities and to include some 9'600 kilometres of fibre optic cable by the end of 2000. The use of IP has allowed *China Netcom* an earlier, and lower cost, entry into the market than might otherwise have been 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 (e.g., *T2mail.com*) or the provision of voicemail and fax communication services (e.g., *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.

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, albeit possibly at a lower quality of service. 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.

- 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 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.

3.11 To understand the interplay of these factors better, it could be of assistance to Member States and Sector Members to develop a reliable empirical, analysis of the current price advantage that IP Telephony may enjoy over PSTN services, including an analysis of the cost structure aspects of IP-based and traditional telecommunications networks. There may also be a need for a better understanding of some of the more innovative IP Telephony services.

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. Moreover, new multimedia services using IP Telephony could generate new voice traffic that does not exist for the time being.

Impact on Member States and Sector Members

3.13 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 third-generation mobile networks, like fixed-line networks, are likely to be based on IP technology.

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.

3.15 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 PTOs. 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.

3.16 Net settlement payments grew progressively larger until the mid-1990s, as traffic flows became less balanced. 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.

3.17 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. As retail prices fall and more traffic is routed via least cost routes, 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.

3.18 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. IP Telephony might be better viewed as one of those applications rather than as a service.

3.19 Operators have traditionally used profitable long-distance and international services to cross-subsidise in part 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.

3.20 While IPTSPs may bypass certain parts of an incumbent operator's network, they will not eliminate the need for local networks. Indeed, insofar as Internet Telephony is a new "killer application" and makes access to the Internet even more popular, it may actually increase the volume of local calls. Already, in some Member States, as much as a third of all local calls are to the Internet, though IP Telephony represents only a small proportion of this demand. 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 may be the preferred solution.

3.21 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 will also be IP-based, offer vendors additional opportunities to offer new products including customized and personalised location-based information services that will most likely resemble the Internet client/server model rather than the traditional telecommunications model.

3.22 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 the rest of the Internet—i.e. it was US-centric because of the lack of advanced IP Telephony infrastructure outside of the United States. 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 US-centric and the percentage of IP Telephony traffic that transits through the United States may fall.

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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 subject 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 As a threshold matter, it is useful to set forth possible government policy objectives for IP Telephony that could form the basis for any regulatory approach that is adopted and, in particular, in determining whether to apply legacy telecommunications frameworks. These objectives, which could also form the parameters for a cost/benefit analysis of any policy, may 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.

4.5 To explore these issues, 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.

The general picture

4.6 At present, several broad national policy approaches emerge:

- First, there are countries that include some or all forms of IP Telephony within their regulatory system ;
- Second, there are countries that prohibit IP Telephony;
- Third, there are countries that do not regulate 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 Annex 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 also discussed in sections three and five. In some cases, ISPs have been requested to block access to specific websites, based in other countries, which offer free-of-charge IP Telephony calls. Nevertheless, PTOs in some developing countries are embracing IP Telephony, and bearing the consequences of reduced per-minutes revenue from long-distance and international services, rather than risk missing the opportunity to generate revenues in future IP-related growth areas.[14] 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, nonetheless, 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.[15] Further, reliable, reasonably high-speed access to the Internet is required for tolerable outgoing PC-to-Phone service, and this is often not 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 in a positive manner within their regulatory framework for telecommunications. First, they 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. Secodn, 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. Licensing of third generation (e.g. IMT-2000) wireless systems has generally proceeded on the basis of a voice-centric model. However, IMT-2000 systems will deliver to the subscriber converged voice/data multimedia services using end-to-end IP networks, with “always on” Internet access being a key service feature. As a result, re-evaluation of present licensing regimes may be required, since such systems may have data, rather than voice, as the key defining characteristics.

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[14] Examples include PTOs in Egypt, Gambia, Hungary and Thailand.

[15] 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.

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 as 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 types of services, voice versus data, mode of transmission, facilities-based operators versus resale and quality of service. Because IP Telephony service providers do not need to have their own network facilities, frameworks applied to traditional telephony that is based on network facilities may not be appropriate and new approaches may be called for. These, and other distinctions, are discussed below.

Type of service

4.12 In countries that have IP Telephony policies, some regulators draw distinctions, explicitly or implicitly, between PC-to-PC, PC-to-Phone and Phone-to-Phone services. Most national IP Telephony policies typically refer to Phone-to-Phone services. PC-to-Phone 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. Generally, 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 licenses, or under special authorization. Some PTOs may simply assume that their international franchise allows them to offer IP Telephony, should they decide to pursue it, as a cost-saving measure or as a separate discounted service.[16]

4.13 Another aspect of type of service is the target audience for the service. Some regulators allow IP Telephony 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 believe 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

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[16] 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.

subject to extensive (albeit increasingly targeted) regulation.[17] 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 many applications that can be provided over the Internet, one argument for treating it differently was that it is simply another form of Internet data.

Mode of network transmission

4.16 Policies may also vary depending upon whether IP/PSTN conversion takes place and, if so, where (i.e., whether there is a service provider). 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 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.

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. Another aspect of the quality issue is whether consumer complaints about numbering and addressing errors when using IP Telephony are adequately handled.

4.19 Since Internet Telephony signals, transmitted over the 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 telephony offered over managed IP-based networks may reduce the delay to a point at which

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[17] In the United States, polices generally distinguish between basic and enhanced services. In the Computer II proceeding, the US Federal Communications Commission stated that a basic service consisted of "an offering, on a common carrier basis, of pure transmission capacity for the movement of information." The FCC defined an enhanced service, by contrast, as "offering anything that is more than a basic transmission service, including: services which employ computer processing applications, that act on format, content, code, protocol or similar aspects of subscriber's transmitted information." This distinction between basic and enhanced services has been a key principle underlying non-regulation of Internet services. After the adoption of the 1996 Telecommunications Act, the FCC began using the terms "telecommunication" and "information" services, rather than "basic" and "enhanced" services, respectively. For most purposes, the FCC equates telecommunications services to "basic" services and information services to "enhanced" services.

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 the future, it is the view of some that IP Telephony over the Internet may be offered at equivalent quality levels to the PSTN.

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 used by various 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. Other countries do not share this premise, and thus have chosen not to apply the same requirements to new services based on their view that this would hamper economic growth and the development of innovative services.

4.23 Once clear policy objectives and goals have been clearly delineated and priorities established, in those countries that support the concept of functional equivalence, it may be applied so that functionally equivalent services are subject to similar regulatory requirements. In determining "functional equivalence", policy-makers may look at such criteria as the quality of service, the nature of the service and service provider 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 mobilephone 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. On the other hand, since IMT-2000 wireless systems will likely provide converged services exhibiting

predominantly data/multimedia characteristics rather than voice, it is the view of some that this might suggest under the functional equivalence test that they should be treated mainly as data systems, rather than regulated on the basis of voice functional equivalence.

Technological Neutrality

4.24 Technological neutrality is a principle that is invoked by some policy-makers and regulators when addressing IP Telephony and other emerging communications technologies. This concept can be generally characterized as an effort to apply regulations in an even-handed manner to like services, regardless of the technology used to provide these services. Unless other policy imperatives take precedence, the purpose of this concept is to support competition policy by ensuring that one provider is not given more favorable regulatory treatment than another when providing equivalent services. There is, however, a range of interpretations of this concept and it has been implemented in different ways by various Member States.

4.25 One view of technological neutrality is linked to the concept of functional equivalence of services, irrespective of the technological platform, 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 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 traditional 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.

4.26 A different view is that policy-makers 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.

4.27 Developing a greater understanding of various approaches taken to technology-neutral regulation or treatment within the ITU membership, based on a fuller explanation and analysis of this concept as it applies to the provision of functionally equivalent public voice telephony networks and services, would be a positive step toward fostering a global market environment 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 or regulatory treatment, but would help avoid ineffective or conflicting applications of this principle. A sharing of views could also facilitate a common understanding of these new technologies and services as well as enhance the ability of regulators to stay abreast of this rapidly evolving market.

Convergence and IP Telephony

4.28 Technology analysts have been suggesting for several years that all forms of communications will eventually merge into one platform, and in recent years IP appears to have emerged as a potential 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 around the world are under pressure to adapt. At the same time that the regulatory framework for telecommunications is being streamlined and lightened, convergence raises the issue of whether legacy or new paradigms should be applied to new telecommunications platforms and raises the question of the continued suitability of sector-specific regulation.

4.29 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 is typically layered on top of the PSTN, in the sense that calls are sometimes originated and almost always terminated on the PSTN, while not being 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.[18] 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.

4.30 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. Opening the local loop will likely have the impact of more new players being able to offer broadband data services to customers, including voice over the incumbent unbundled local loop. This opens up the possibility for new competing operators to offer IP Telephony in conjunction with DSL broadband data.

4.31 IP Telephony may also be considered as part of a broader process of deploying IP-based networks around the world and it should be recognized that these networks are not built for transmitting voice traffic alone, but as part of a broader strategy for offering multimedia services. 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. A simplified regulatory structure is considered by some to be an important element in establishing favorable market conditions for investment in IP-based networks.

Impact of IP Telephony on Universal Service/Access

4.32 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 policies.

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[18] 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".

4.33 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.

4.34 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 universal service/access goals due to the fact that most commercial IP Telephony traffic travels over managed IP networks, and not the Internet at all; principally 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 be recognized that the impact of IP Telephony on universal service/access is dependent on how universal service is funded in a country and the type of connectivity used by IPTSPs.

4.35 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 can be good for competition, and benefit consumers, it can render some universal service funding mechanisms increasingly unsustainable. In a few countries, providers of IP Telephony that is equivalent to other forms of telephony are required to contribute to universal service funds.[19] Thus, a basic question is whether calls on one technological platform (e.g., whether IP, Frame Relay or ATM-based) should be treated differently from calls on another when it comes to universal service obligations.

4.36 For some countries, this issue might become more acute if the definition of universal service/access is broadened to include Internet access and applications, which would increase the funding requirements. One option would be to broaden or redefine the category of service providers that must contribute to universal service/access, while another option would be to consider alternative bases to generate financing for universal service. Another possibility is to create incentives for IPTSPs to enter markets if they help build-out the IP infrastructure and offer innovative services that may lower costs. The treatment of IP Telephony with respect to universal service could be based on such considerations as the functional equivalence concept, the condition of the national telecommunications market, the overall deployment of the whole network infrastructure, the extent of dissemination of IP Telephony and its expected future share in the market for voice telephony.

4.37 IP Telephony can also be a helpful tool for attaining universal service/access objectives, especially in the case of markets that have not yet been opened to competition. IP-based networks, depending on the situation and circumstances, may provide lower-priced alternatives to circuit-switched networks, and thus may provide a less costly alternative when expanding or building new capacity. Further studies of the comparative costs of building IP-based networks 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 increases communications resources for

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

underserved populations, it may facilitate and increase the access that lower-income citizens have to basic telephony services.

4.38 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.[20]

Cross-border issues

4.39 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 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.

4.40 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. The development of joint concepts and perhaps a common set of working definitions with respect to IP Telephony would facilitate comparisons of existing experience and, if need be, harmonized considerations at the global level.

4.41 More generally, the issue can be raised as to the extent, if any, to which some forms of IP Telephony are or should be subject to existing international agreements and procedures, such as the global numbering plan or conventions on routing traffic and settling accounts, as well as multilateral trade agreements, that apply to traditional international telephony. On the other hand, some of these issues are increasingly being dealt with by private commercial arrangements. Finally, as discussed in section 2, interoperability of IP-based networks and the development of necessary global technical standards are an important cross-border issue.

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[20] 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>.

5. THE DEVELOPMENT DIMENSION AND HUMAN RESOURCE DEVELOPMENT ISSUES

Human resource development issues

5.1 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 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 incumbent 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.

5.2 Much of the technical development behind IP Telephony makes use of tools, and to some extent skills, from the broader Internet field. Considering the rapid uptake of the Internet in developing countries, there is likely to be a higher number of people in these countries with skills in the field of IP technology than in telecommunications switching techniques. For this reason, developing countries may have greater potential for the local development of IP Telephony technology and services than they have for more traditional telecommunications technology. Partnerships between IP Telephony Service Providers and incumbent carriers and service providers in developing countries can help in meeting training requirements and in determining the effectiveness of IP-based networks as a direction for future network migration.

5.3 Education and training are primary determinants of a country's prospects for economic and human development and international competitiveness. Government action, (i.e., policy-making), is an important factor in creating an environment that aids infrastructure (both human and physical) development. 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. The ITU could provide a "knowledge centre" through which Member States and Sector Members can share knowledge and views of global trends in IP technologies, including the activities of other standardisation bodies, infrastructure development, IP-based services and applications, and regulatory activities and policies.

The digital divide

5.4 IP Telephony 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 applications 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, which is undermining the pricing structure of the incumbent PTO and undercutting 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.

5.5 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.[21] Relatively few developing countries have taken a liberal approach to IP Telephony, though China is a major exception. In China, after a period during which IPTSPs were blocked, 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.

5.6 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 taken a different view of IP Telephony. Consequently, ISPs in these countries may 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.

Draft opinions

5.7 Council Decision 498 asked that the WTPF discuss and exchange views on the theme of IP Telephony and, if possible, draw up opinions for consideration by ITU Member States, Sector Members and relevant ITU meetings. Through the work of the Informal Expert Group, three draft opinions (attached) have been developed which respond to this request by Council:

- Draft opinion A considers 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

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[21] 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".

and economic aspects; and the impact of IP Telephony on the operations of Sector Members, notably in terms of the financial challenges and commercial opportunities it presents;

- Draft opinion B considers 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.

- Draft opinion C 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.

These draft opinions are presented for discussion and appropriate action.

Attachments: Draft opinions A, B and C

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

DRAFT OPINION A

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.

The third World Telecommunication Policy Forum (Geneva, 2001),

considering

that, pursuant to the basic provisions of the ITU Constitution, the purposes of the Union include:

- to maintain and extend international cooperation among all members of the Union for the improvement and rational use of telecommunications of all kinds;

- to promote the development of technical facilities and their most efficient operation with a view to improving the efficiency of telecommunication services, increasing their usefulness and making them, so far as possible, generally available to the public;

- to promote the extension of the benefits of the new telecommunication technologies to all the world's inhabitants,

recognizing ***[broader economic implications for a country]***

a) that the deployment of IP-based networks and applications has the potential to benefit users, industries, and the economy at large, because it fosters technical and market innovation, and diversity and growth in the economy;

b) that these new enhanced communication capabilities may be essential for the development of other service sectors, and for the production and distribution of goods in the global economy as a whole;

c) that IP-based voice applications should become more readily available at cost-effective prices, for the benefit of all users and industries, by being supplied under competitive market conditions in which multiple, alternative sources or means are available to address user and industry needs;

d) that IP Telephony should be viewed as a major opportunity for all countries to respond to the convergence of information and communication technologies and evolve their networks in order to expand the availability and use of a broader range of modern communication capabilities,

noting ***[implications for operators]***

a) the continued expansion of the Internet and IP-based networks as a major medium for communications and commerce;

b) that the flexibility of IP technologies will lead to an integration of voice and data networks, thereby allowing suppliers to take advantage of synergies and cost reductions, which will enable the provision of new innovative services and applications for the benefit of all citizens, and that it has been predicted that revenues from these services could soon exceed those from voice alone;

c) that packet-based networks that can support IP Telephony are being designed with a variety of core network and access technologies and capabilities, including wireless technologies;

d) that mobile wireless systems are expected to migrate towards an IP-based architecture in order to deliver integrated voice, data and multimedia services, as well as access to the Internet;

e) that all Sector Members face both challenges and opportunities during this transition to a market-driven industry;

f) that many service providers in developing countries could benefit from additional resources and expertise in making a smoother and more rapid transition to IP-based networks and applications,

conscious ***[implications for government policies and regulation]***

a) that each Member State has the sovereign right to develop policies related to telecommunications to meet its needs and objectives;

b) that Member States pursue policies that seek to:

(i) attract capital investment so as to fund infrastructure that serves users and society as a whole;

(ii) stimulate innovation in order that applications and products that meet the needs of people can be offered in the marketplace;

(iii) exploit the synergies between capital investment and innovation so as to promote sustainable economic development that can attract further investment and create the environment necessary to promote more innovation;

c) that Member States have legitimate public policy goals in the telecommunication sector, including universal access and service, competitive markets, technology innovation and transfer of technical know-how, and the development of human resources;

d) that although IP Telephony could have a negative impact on voice revenues generated by a number of telecommunication operators, particularly in some developing countries, there could also be a revenue gain for other telecommunication operators and service providers, and a general gain in welfare in the economy as a whole;

e) that the dynamic growth of IP-based networks, applications and services has been due to a combination of private sector investment and innovation and minimal or light government regulation, and that government regulation should aim to foster effective competition;

f) that initiatives and policies dealing with IP-based networks would benefit from input from users (consumers and business organizations),

is of the view

a) that IP Telephony applications are best supplied in a market in which consumers have choices among multiple, alternative sources or means to address their needs, because only then will citizens, businesses and the overall economy reap the benefits of innovation and cost effectiveness;

b) that regulation may be appropriate where there is market failure or when public interests cannot be adequately met by industry (e.g. universal access and service);

c) that Member States should carefully examine the implications of applying existing regulatory regimes to IP-based services and applications,

invites

1 Member States and Sector Members to work on the introduction and deployment of IP technologies and IP applications, including the exchange of information;

2 all Member States to review their current regulatory frameworks with a view to:

i) encouraging investment, spurring innovation and advancing development,

ii) achieving public policy goals in the context of a converged communication services environment;

iii) adopting a competition-oriented approach with respect to IP Telephony in order to achieve clearly defined public policy goals, taking into account, among other things, the concept of technology neutrality;

3 Member States that have not yet decided to open their communication services markets to competition to consider the merits of doing so, in order to be able to take fuller advantage of the benefits of innovative communication services supplied under cost-effective competitive market conditions.

DRAFT OPINION 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

The third World Telecommunication Policy Forum (Geneva, 2001),

considering

that, for several years, technology analysts have observed a tendency for telephony services and other forms of communications to converge and that, in recent years, IP appears to have emerged as the unifying platform,

noting

a) that several global communications operators have announced that they are migrating their traffic to IP-based platforms;

b) that liberalization introduces competition within the telecommunication market, to the benefit of the consumer;

c) that ITU, in its service definitions, has been careful not to imply or specify any particular implementation technology,

conscious

a) that increasing access to the Internet is a policy goal in almost all Member States;

b) that cost-effective voice services can be added to the range of services already available over IP-based networks, taking into account that IP Telephony applications are still developing;

c) that IP technologies offer opportunities for the development of new multimedia applications, including voice,

encourages Member States

to share experiences in developing new methodologies and approaches that recognize the market conditions of advanced technologies, such as IP Telephony, including, but not limited to:

(i) approaches towards making any sector-specific regulation technology-neutral;

(ii) the application of domestic competition laws as part of a pro-competitive policy designed to establish a level playing field;

(iii) establishing sustainable bases to generate financing for universal service,

invites the Secretary-General and the Directors of the Bureaux

1 to promote understanding of the benefits of IP-based technologies and IP applications and of the benefits of a liberalized market and, within existing budgetary resources, to assist Member States and Sector Members, particularly in developing countries:

(i) by updating previous IP Telephony case studies and carrying out further country case studies, as required;

(ii) by carrying out cost studies and establishing a process to assist members in performing cost-benefit analyses in order to plan for investment in converged telecommunication and data networks on IP platforms, on request;

(iii) by helping to attract private sector investment and promoting the use of international lending and donor organization resources;

2 in the pursuit of the above, to conduct regional workshops in partnership with the private sector, complementing existing ITU activities, on the following basis:

- The workshops should provide forums on:

  (i) how telecommunication infrastructure build-out and the evolution of existing networks can be facilitated by deployment of IP-based technologies;

  (ii) technologies that can support IP Telephony;

  (iii) how to create an environment that will attract investment in infrastructure development.

- ITU may call upon voluntary contributions from Sector Members and other industry participants to support such activities.

- The workshops should bring together incumbent and new entrant network operators, Internet Service Providers (ISPs), equipment suppliers, consumers and consumer organizations and government officials responsible for economic development, in addition to those dealing with telecommunication issues.

DRAFT OPINION C

Actions to assist Member States and Sector Members in meeting the human resource development challenges presented by new telecommunications technologies such as IP Telephony, in particular skill shortages and the need for education, and technology transfer

The third ITU World Telecommunication Policy Forum (Geneva, 2001),

considering

a) that the purposes of the Union include promoting the extension of the benefits of new telecommunication technologies, encouraging continued participation by the private sector in telecommunication development, offering technical assistance in the field of telecommunications, and promoting the mobilization of the material, human and financial resources needed for implementation of telecommunication systems;

b) that Council-2000 requested that action be taken to assist Member States and Sector Members in meeting the human resources development challenges presented by new telecommunication technologies such as voice over IP,

recognizing

a) that economic, social, technical and regulatory environments are changing in the context of ongoing telecommunication and information technology developments;

b) that transition to an IP environment places new demands on the management and operation of government agencies and Sector Members;

c) that these new challenges need to be addressed by ITU, and in particular ITU-D/BDT, which plays a crucial role in assisting countries that are developing and building institutional, physical and organizational telecommunication capacity;

further recognizing

a) that the speed with which countries can extend the benefits of telecommunication technologies will depend on their ability to deploy skilled personnel who are able to meet the operational and policy challenges stemming from the new environment;

b) that, in today's environment of globalization, shortages of skilled personnel and the absence of comprehensive human resources policies are impeding the transition to a new IP environment in both developed and developing countries;

c) that technology transfer from Sector Members and Member States may help reduce the knowledge gap, although the problem is exacerbated by the “brain-drain";

encourages Member States and Sector Members to take into account

a) that training and education of a broad range of people benefits individuals, the communications system, communities and the economy as a whole;

b) that many developing countries have experienced great success with small and medium-sized communications enterprises;

c) that the Task Force on Gender Issues established by the Telecommunication Development Advisory Group has developed transferable training modules in various aspects of human resources development,

invites ITU-D

1 to encourage Member States and Sector Members to create integrated human resources transition plans for new technologies, business operations and regulatory and policy activities;

2 to assist Member States and Sector Members in evaluating and identifying new and changing human resources requirements in order to meet the challenges of an evolving communications environment;

3 to draw upon existing BDT research and skilled personnel to identify:

(i) HRD/HRM and training issues related to network evolution;
(ii) HRD/HRM and training issues related to new technologies, including IP;
(iii) skills leading to the creation of a business environment that will attract infrastructure investment,

invites ITU-T and ITU-R

to collaborate with and assist the Director of BDT in creating the technical training components of ITU-D workshops, seminars, training projects, forums and modules,

invites Sector Members

to suggest, initiate, and/or participate in ITU-D human resources development and infrastructure investment programmes,

invites Sector Members and Member States

to work with educational institutions, NGOs and other organizations in order to draw upon resources, studies and expertise and to collaborate in assisting countries with training, resource retention and other HRD/HRM issues,

invites the Secretary-General

1 to disseminate widely information on the urgent need for the United Nations and national leaders to review and develop policies that lead to recognition of the widespread opportunities for people skilled in telecommunications;

2 to encourage Associates and in particular the academic community to become actively involved in knowledge sharing and skills development;

3 to develop virtual capabilities for global knowledge-sharing, training and skills development;

4 to co-ordinate with regional telecommunication entities in identifying and developing programmes to advance regional skills bases.

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 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 **Antigua and Barbuda**[1] **Argentina** **Bhutan** **Congo** **Costa Rica** **Dominican Republic** **Estonia**[2] **Gambia** **Guatemala** **Guyana** **Madagascar** **Malta** **Mexico** **Mongolia**[2] **Nepal** **New Zealand** **Poland** **Slovak Republic** **St Lucia**[1] **St Vincent**[3] **Tonga** **Uganda** **United States**[4] **Viet Nam**	**EU Countries**[5] **Hungary** (if delay =/>250ms and packet loss >1%) **Iceland**	**Czech Republic** **Hongkong SAR** **Japan** **Singapore** **Switzerland**	**Australia** **Canada** **China** **Korea (Rep.)** **Malaysia**

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.

[1] In 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 were prohibited until Dec. 31, 2000. Public IP Telephony was also prohibited until 31 Dec 2000. In Mongolia, international telephone calls over the public Internet were prohibited until Dec. 31, 2000.

[3] In 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.

Source: This table is based on the ITU 2000 Regulatory Survey and ITU case studies. Changes or clarifications to this table that were submitted by Member States in the context of WTPF-01 have been noted.

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

Country	*Use of the Public Internet*	*Use of IP-based networks*
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. Changes or clarifications that were submitted by Member States in the context of WTPF-01 have been noted.

Table B.3: Countries that prohibit the use of <u>both</u> the Public Internet <u>and</u> 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 the public Internet; Telephony and Fax prohibited over IP-based networks
Côte d'Ivoire	Voice prohibited over the public Internet until 2004
Croatia	
Cuba	Telephony prohibited over the public Internet and IP networks Telephony prohibited over IP-based networks, but not fax
Ecuador	Voice prohibited over the public Internet 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 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 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 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. Changes or clarifications that were submitted by Member States in the context of WTPF-01 have been noted.

GLOSSARY OF ACRONYMS

ATM	Asynchronous Transfer Mode
DNS	Domain Name System
DSC	Digital Subscriber Line
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
ITU	International Telecommunication Union
LAN	Local Area Network
PC	Personal Computer
PLMN	Public Land Mobile Networks
PSTN	Public Switched Telephone Networks
PTO	Public Telecommunication Operator
QoS	Quality of Service
SIP	Session Initiation Protocol
SS7	Signalling System Seven
URI	Uniform Resource Identifier
VoIP	Voice over IP
WTO	World Trade Organisation
WTPF	World Telecommunication Policy Forum