

FINAL REPORT  
ITU-D STUDY GROUP 1

# QUESTION 19-2/1

## IMPLEMENTATION OF IP TELECOMMUNICATION SERVICES IN DEVELOPING COUNTRIES



5TH STUDY PERIOD 2010-2014  
Telecommunication Development Sector



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## **QUESTION 19-2/1:**

***Implementation of IP telecommunication services in developing countries***



## **ITU-D Study Groups**

In support of the knowledge sharing and capacity building agenda of the Telecommunication Development Bureau, ITU-D Study Groups support countries in achieving their development goals. By acting as a catalyst by creating, sharing and applying knowledge in ICTs to poverty reduction and economic and social development, ITU-D Study Groups contribute to stimulating the conditions for Member States to utilize knowledge for better achieving their development goals.

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Reports, Guidelines, Best Practices and Recommendations are developed based on input received for review by members of the Groups. Information is gathered through surveys, contributions and case studies and is made available for easy access by the membership using content management and web publication tools.

### **Study Group 1**

For the period 2010-2014, Study Group 1 was entrusted with the study of nine Questions in the areas of enabling environment, cybersecurity, ICT applications and Internet-related issues. The work focused on national telecommunication policies and strategies which best enable countries to benefit from the impetus of telecommunications/ICTs as an engine of sustainable growth, employment creation and economic, social and cultural development, taking into account matters of priority to developing countries. The work included access policies to telecommunications/ICTs, in particular access by persons with disabilities and with special needs, as well as telecommunication/ICT network security. It also focused on tariff policies and tariff models for next-generation networks, convergence issues, universal access to broadband fixed and mobile services, impact analysis and application of cost and accounting principles, taking into account the results of the studies carried out by ITU-T and ITU-R, and the priorities of developing countries.

This report has been prepared by many experts from different administrations and companies. The mention of specific companies or products does not imply any endorsement or recommendation by ITU.

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# QUESTION 19-2/1

## Implementation of IP telecommunication services in developing countries

### 1 Introduction

<sup>1</sup>National telecommunication/ICT policy plays an important role in stimulating innovation and investment in new technologies. It can foster the development of IP-based networks that have the potential to offer to Member States and their citizens a broader range of telecommunication applications. ICT infrastructure plays an important role in social and economic development. Indeed, in growing numbers, telecommunication/ICT network operators are offering converged integrated services and associated applications. Audio, data and video are provided to end users over a single network. This trend toward convergence is changing the way people do business, entertain, and access public services such as health, education and various government services.

Although IP-based networks provide many opportunities and benefits, *e.g.*, new services, applications, low transaction costs, increased productivity, economic development, and innovation, they also raise several potential challenges:

- Investment cost for core and access network,
- Inter-operability between existing telecommunication and IP based networks,
- Need for technical knowledge and skilled human resources,
- Review of the existing regulatory regime,
- Quality of service,
- Trust and security for IP based networks and services,
- Legal interception of communications ,
- Service development for national needs.

Apart from the above, and more importantly for developing countries, limited broadband and basic telephony access, a lack of human resources, limited/scarce financial resources and restrictive regulatory environment are important challenges. To create a regulatory framework capable of attracting the capital investment required for IP based infrastructure, a level-playing field for competitors and new entrants existing regulations need to be established.

#### 1.1 Scope of the Question

The World Telecommunication Development Conference held in Hyderabad on 24 May to 4 June 2010 adopted a set of Questions to be studied by ITU-D Study Groups during the fifth study period. Under Question 19-2/1 “Implementation of IP telecommunication services in developing countries“, the issues to be studied are:

- To describe the potential challenges, benefits and opportunities that developing countries encounter when implementing IP networks, services and associated applications.

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<sup>1</sup> See Documents [1/28](#) and [RGQ 19-2/1/002](#) (Background information concerning Question 19-2/1, March 2011).

- To describe the technical, economic, and regulatory conditions necessary for developing countries to implement IP technologies, services and associated applications.
- To describe the main issues raised by the operation of IP networks and IP services, and associated applications, such as economic impact and possible regulatory frameworks.

In addition, the expected outputs for this Question are:

- 1) An annual progress reports indicating the status of IP applications;
- 2) A detailed final report, at the end of the study period, addressing all the issues raised in the Question as well as lessons learned/success stories/conclusions; and
- 3) Guidelines for overcoming the challenges identified.

## 1.2 Background

The ITU has conducted numerous activities to provide information and guidance on IP based networks, especially for developing countries.

Internet Protocol (IP)-based networks were recognized by the 1998 Plenipotentiary Conference (Minneapolis) in Resolution 101, as an issue of crucial importance to the future, as an important engine for growth in the world economy. The Resolution stressed the need to identify the implications of such networks for ITU Member States.

The Third World Telecommunication Policy Forum held in 2001 (WTPF-2001) discussed and exchanged views on Internet Protocol (IP) Telephony, and adopted, "Opinion D.". This Opinion aimed to address challenges facing developing countries, particularly those encountered by public (or dominant private) telecommunication operators in these countries when "IP telephony" is introduced.

Following the 2001 WTPF , and in accordance with the Opinion D,a) "Group of Experts on IP Telephony" prepared "The Essential Report on IP Telephony" (available at : [http://www.itu.int/ITU-D/e-strategy/publications-articles/pdf/IP-tel\\_report.pdf](http://www.itu.int/ITU-D/e-strategy/publications-articles/pdf/IP-tel_report.pdf)) This 2003 report, analysed the technical, policy, regulatory, and economic aspects and provided a checklist for national regulators and policymakers to consider when introducing IP telephony.

The 2003 session of the ITU Council (5 to 16 May) decided to prepare an IP policy handbook for ITU Members, especially for developing countries. Accordingly, the 2005 ITU Council approved "A Handbook on Internet Protocol (IP)-Based Networks and Related Topic and Issues" (available at: <http://www.itu.int/ITU-T/special-projects/ip-policy/final/IPPolicyHandbook-E.pdf>). The purpose of the report is to inform ITU Member States, especially developing countries on the issues related to IP-based networks. The report underlines the key policy questions associated with the general use of IP-based networks, and provides information on technical management and coordination of relevant resources, convergence issues, and IP-enabled applications. It also underlines the main issues raised by IP networks, services and applications and gives the web address for many online resources for further, detailed information.

During the third study period (2002-2006), ITU-D Study Group 1 prepared a report for Question 19-1/1 "Implementation of IP telephony in developing countries" (available at : [http://www.itu.int/ITU-D/study\\_groups/SGP\\_2002-2006/SG1/index.html](http://www.itu.int/ITU-D/study_groups/SGP_2002-2006/SG1/index.html) ) In this report, existing broadband access technologies such as DSL, fiber, satellite, fixed, mobile wireless are described, benefits from broadband networks and related applications (telemedicine, teleworking, e-government, distance learning, e-commerce, entertainment etc.) are outlined. Also, technical, economic and regulatory challenges are addressed in the report through the inputs received from Member States. Finally, ways to overcome the regulatory challenges are discussed.

In the fourth Study Period (2006-2010), Question 19-1/1 focused on broadband access and other IP-based technologies in more detail. The final report (available at: <http://www.itu.int/publ/D-STG-SG01.19.1-2010>) emphasized the trend towards the convergence of voice, data and video telecommunications and

underlined that converged applications are moving to IP transport infrastructure. Accordingly, an overview of possible network migration strategies, regulatory trends focusing on competition and convergence, and service provision scenarios are mentioned. Two country case studies are also included.

### 1.3 Method used to study Question 19-2/1

In order to compile the latest information about the status of IP telecommunication networks, services and applications in various countries, to understand associated technical, regulatory, economic and social challenges, and to get views/opinions on the issues addressed by Question 19-2/1, a questionnaire was prepared. After discussion, it was adopted by the Rapporteur Group at its May 2011 meeting and submitted to ITU Member States, Sector Members, Associates and Academia.

41 countries (9 developed countries, 6 transition countries, 21 developing countries and 5 least developed countries) replied to the questionnaire given in **Annex 1**. Answers received were carefully analyzed and incorporated into this report. **Annex 2** provides the overall statistics prepared by BDT based on the answers received. In addition the main issues raised by the various contributions received during the meeting are also taken into account in this report.

## 2 IP Telecommunication Services

### 2.1 Definition and scope

Internet Protocol (IP) based technologies are increasingly being used in information and communication technologies. IP is defined as the dominant network layer protocol used with the TCP/IP protocol suite.<sup>2</sup> The term "telecommunication" is defined in the ITU's Constitution and Convention as "*any transmission, emission or reception of signs, signals, writing, images and sounds or intelligence of any nature by wire, radio, optical or other electromagnetic systems.*" From these definitions, for the work of this report, "IP Telecommunications Service" can be defined as the service comprising any transmission, emission or reception of signs, signals, writing, images and sounds or intelligence of any nature by wire, radio, optical or other electromagnetic systems based on mainly IP.

In the survey conducted, regarding the question asking whether a definition of the terms "IP telecommunication (IPT) network", "IP services" and/or "IP applications" had been adopted, developed countries generally stated that specific definitions were not available as they have technologically neutral legislation which covers all kinds of technology including those that are IP based. On the other hand, one third of developing countries and least developed countries who provided answers stated that they have defined these terms in their legislation.

For instance, in **Bulgaria**, there is no particular definition for the above-mentioned terms. However, they define "electronic communications networks" and "electronic communications services" which also include "IP telecommunication network" and "IP services". According to their Law on Electronic Communications: "Electronic communications network" shall mean a totality of transmission facilities and, where necessary, switching and routing equipment, and other resources, which serve to transmit signals over wires, radio, optic or other electromagnetic means, including satellite networks, fixed (with channel or package switching, including Internet) and mobile land networks, electricity distribution networks, when they are used to transmit signals, networks used for radio and television broadcasting, and cable electronic communications networks for broadcasting of radio and television programs, irrespective of the type of transmitted information. 'Electronic communications service' shall mean a service, usually

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<sup>2</sup> ITU, A Handbook on Internet Protocol (IP)-Based Networks and Related Topics and Issues 2005. <http://www.itu.int/pub/D-HDB-IP-2005>

provided against remuneration, which consists wholly or mainly in conveyance of signals over electronic communications networks, including transmission services, provided through broadcasting networks, excluding services, related to content and/or the control over it. It does not include information society services, which do not consist wholly or mainly in the conveyance of signals over electronic communications networks.

For **Czech Republic**, networks, services or associated applications using the IP protocol are included in the general term "the electronic communications infrastructure and services. In **Austria**, the Austrian Telecommunications Act (TKG, <http://www.rtr.at/en/tk/Recht>) follows the principle of technology neutrality and therefore does not make an explicit distinction between, e.g. a circuit or packet switched network or service, and includes both in the definition of a communication network and service. However, specific rules for providers of VoIP services have been published by the national regulatory authority (See <http://www.rtr.at/en/tk/RichtlinienVoIP/VoIP%20RL%201.0.pdf>).

Similarly in **Nepal**, the Telecommunication Act of 1997 does not specify the use of any particular technology to provide telecommunication services. It adopts the principal of technology neutrality and defines the terms as follows:

- IP Telecommunication Network: The telecommunication network that utilizes Internet Protocol for exchange of information.
- IP Services: The services that require Internet Protocol (IP) for its delivery or which is based on IP.
- IP Applications: The applications that require IP for its operation.

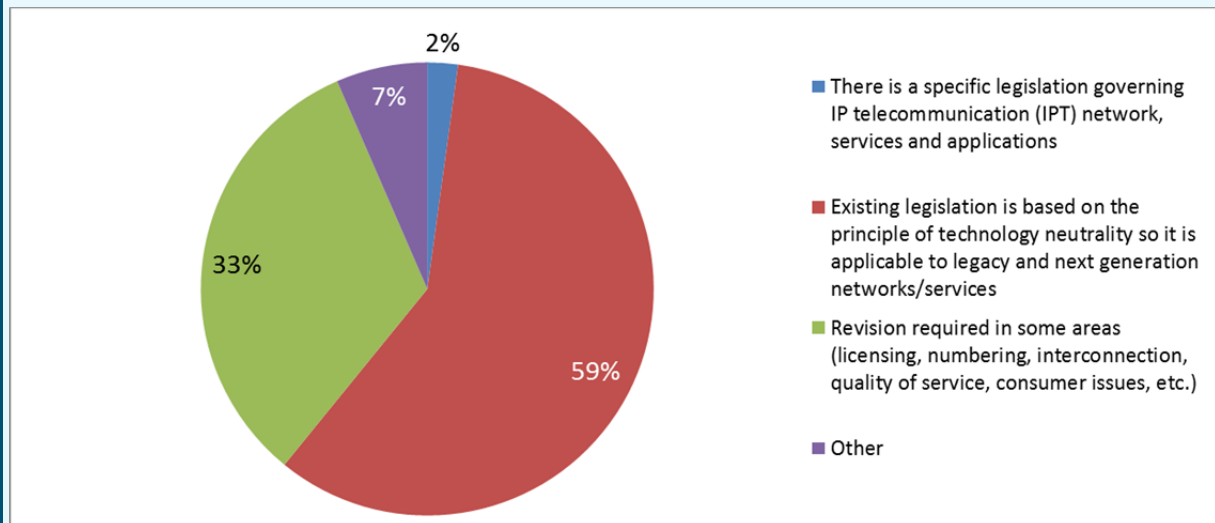
In **Peru**, telecommunication regulation is based on services rather than technologies. IP telephony providers that use E.164 numbering and have a licence to provide service assume the rights and obligations pertaining to fixed telephony operators.

In **Portugal**, although no specific legislation exists on VoIP, some determinations have been made by ANACOM to accommodate nomadic VoIP services. For example ANACOM opened a specific numbering range in the National Numbering Plan (NNP) fo nomadic VoIP services, and to assure VoIP calls would be routed to emergency services, included this range in the portability and other obligations of nomadic VoIP services' providers with NNP numbers when on national territory, . (See link <http://www.anacom.pt/render.jspcategoryId=169402&languageId=1>)

In general, the perception and understanding of most countries on these terms is very similar. For instance the International Telecommunications Users Group (INTUG) defines an "IP telecommunication network as one using Internet Protocol (IP) and IP addressing for communication. "IP service" is one that is available using an IP telecommunications network. "IP Application" is one that is accessible via an IP telecommunications network. The majority of the countries who responded to the questionnaire stated that their existing legislation is based on the principle of technology neutrality and so is applicable to legacy and next generation networks/services. On the other hand, some of the countries stated that a revision is required in some areas (e.g., licensing, numbering, interconnection, quality of service, consumer issues etc.) see **Figure 1**.<sup>3</sup>

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<sup>3</sup> Document 1/109, Preliminary Analysis of the Results of the Survey on Question 19-2/1, 5 September 2011.

**Figure 1: Status of legislation with respect to IP telecommunication networks/services**

Examples of IP telecommunication services.

### 2.1.1 VoIP

“Voice over the Internet Protocol” (VoIP) is a generic term used to convey voice, fax and related services, delivered partially or wholly over packet-based, IP networks. It is often used interchangeably with the terms Internet Telephony (IPT) and IP Telephony. VoIP allows network operators, service providers, and consumers to realize significant savings by:

- Reducing the underlying costs of a telephone call. VoIP uses network resources much more efficiently than conventional telephone service, reducing the costs of providing a call, and
- Creating opportunities for regulatory arbitrage that enable service providers and consumers to reduce or avoid call charges and/or regulatory fees<sup>4</sup>.

In addition to VoIP services over fixed lines, mobile VoIP is also emerging especially, in developing countries where a rapid expansion of mobile networks has increased the availability of services in areas not previously reached by the PSTN. Although an understanding of VoIP service and its definition may depend on the regulatory system of a country, there appear to be three broad categories – IP telephony via computer, Internet telephony that is partially accessible from and to the PSTN, and Internet telephony that is fully accessible from and to the PSTN.<sup>5</sup>

#### 2.1.1.1 Internet telephony via computer

Computer-to-computer Internet telephony services require users to download software in order to set up free voice conversations with other subscribers through the Internet. Calls are routed using a peer-to-peer arrangement that uses the computer of any logged on subscriber as an intermediary for routing traffic on to the intended call recipient. Although it is widely accepted and used, Internet telephony via personal computer arguably has several drawbacks for the incumbent telecommunications operators:

<sup>4</sup> ICT Regulatory Toolkit, <http://www.ictregulationtoolkit.org>

<sup>5</sup> ICT Regulatory Toolkit, <http://www.ictregulationtoolkit.org>

- Typically, calls do not access the PSTN (unless one of the computers accesses the Internet via a modem and conventional dial-up telephone line),
- Subscribers must log onto the service in order to make and receive calls,
- The service does not provide caller identification and location information needed in emergencies,

For these reasons, most countries treat Internet telephony via computer as an unregulated information service, largely free of traditional telephone carrier responsibilities.

### 2.1.1.2 Internet telephony that is partially accessible from and to the PSTN

This category of VoIP calls includes:

- Long distance telephone calls originated by subscribers of incumbent carriers, and by users of calling cards who call from payphones and mobile phones. In both cases calls originate and terminate over the PSTN, but transit the Internet for all or a portion of the long haul;
- Internal corporate VoIP traffic that originates and terminates over an enterprise network. Some enterprise networks can route traffic into the PSTN;
- VoIP services that enable customers to make calls over the Internet. Such calls typically originate over a broadband Internet link and terminate at the call recipient's end without ever traversing the PSTN. These services can also deliver traffic to non-subscribers over the PSTN and a normal telephone handset.

### 2.1.1.3 Internet telephony that is fully accessible from and to the PSTN

Many telephone companies already use Internet carriage to handle long distance calls. The customer making the call may not even be aware of this.

Most current VoIP services do not use the PSTN for both call origination and termination. In the future, almost all VoIP services will require a broadband, digital Internet access link. Telephone companies and cable television companies are replacing copper networks with optical fibre. This enables voice services to ride over a ubiquitous broadband digital network as a software application.

From a regulatory point of view, a broad range of definitions are used for VoIP. Common regulatory criteria to define VoIP include:

- **Degree of transmission over the PSTN** – This is one of the most commonly used criteria to define VoIP. That is, definitions may vary according to whether the service is a phone-to-phone, PC-to-phone (or vice versa), or PC-to-PC offering. This can also be expressed as a service that is either “on-net,” “inbound,” “outbound” or bi-directional.
- **VoIP as a voice or data service** – Some countries view VoIP as a voice service, while others view it as a data, “value-added” or “information” service.
- **Nomadic or non-nomadic services** – This establishes whether the service can be accessed in more than one fixed location. This definition implicates geographic numbering allocation and is applied in some European countries.
- **“Technology” or “Service”**-- Whether VoIP is viewed as a technology or service has implications for technology-neutral licensing and regulatory frameworks.
- **“Telephone” or “electronic communication” service** – In Europe, where regulatory frameworks for VoIP are well advanced, countries have widely differed in their classification of VoIP with significant consequences for regulation.

In **Ecuador**, Voice over Internet is recognized as a technological application available on the Internet. An operator providing telephone service using IP is subject to the applicable legal framework, regulatory standards and control. Any natural or legal person may commercialize equipment and plans to use the application. No natural or legal person may use switching devices within the territory of **Ecuador** to

connect voice-over-Internet or call-over-Internet communications to Ecuador's public telecommunication networks. This restriction does not apply to duly authorized telecommunication operators. In **Nepal**, IP telephony has been defined as the transmission of voice signals over packet switched IP-based networks and has been categorized into two groups (a) VoIP and (b) Internet Telephony.

- (a) VoIP: The transmission of voice signals over managed IP based networks; only ILD operators are allowed to provide such service by publishing the access code of the VoIP gateway to make international outgoing calls.
- (b) Internet telephony: Voice Communication over the unmanaged or public Internet and which uses the IANA addressing scheme, but not E.164 numbering.

In **China**, VoIP service is classified as basic telecom services, so the operator has to get a basic license to offer VoIP services.

### **2.1.2 Triple/Quadruple play services**

Traditional services such as voice and video are increasingly delivered over IP networks, and converged services like "triple play" and "quadruple play" provide data, television, fixed and mobile services are appearing on the market. Bundling various services is very attractive to end-users for the convenience of a single invoice and possibly a better price compared to receiving those services separately. Users are demanding innovative and interactive services as most user devices today include a microprocessor, screen, storage, input device, and network connection, which enable multiple communication functions and applications. The trend is towards user-created content and sharing, so now download and upload speed are very important in broadband access. Digitalisation of content, current trends towards IP-based networks and services, and availability of multimedia communication and computing devices require the end user to have high-speed broadband access.

### **2.1.3 IPTV**

IPTV is basically television delivered over an IP-based network which provides very flexible service provisioning compared to traditional broadcasting. Viewers can determine their own viewing schedules, receive the program they want to watch at a time and place of their choice and over a range of different devices, from an ordinary TV set to a desktop or laptop computer, web-enabled PDA, or even a General Packet Radio Service (GPRS) or Third Generation (3G) mobile phone.<sup>6</sup>

Regarding content services, mobile operators provide content through mobile phones, wireless, cable and satellite access. These operators provide also video, music or other content using IP based technologies. Content services have great potential in the future as many users are creating and exchanging their own content through various media.

### **2.1.4 Everything over IP (EoIP)**

*"The Internet of Things" is defined as the technological revolution that represents the future of computing and communications by means of IP protocol, RFID technologies,[etc.] Its development depends on dynamic technical innovation in a number of important fields, from wireless sensors to nanotechnology. Real-time communications will be possible not only by humans but also by things at anytime and from anywhere. In a 2005 report, the ITU noted that "The advent of the Internet of Things will create a plethora of innovative applications and services, which will enhance quality of life and reduce inequalities whilst providing new revenue opportunities for a host of enterprising businesses"*<sup>7</sup>.

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<sup>6</sup> WTPF-2009 Background documents and online resources, <http://www.itu.int/osg/csd/wtpf/wtpf2009/>

<sup>7</sup> ITU Internet Reports 2005: The Internet of Things, <http://www.itu.int/osg/spu/publications/internetofthings/>



EoIP raises a number of regulatory issues however, such as consumer privacy and data protection that will have to be addressed to build confidence in the use of the Internet of Things.

### 2.1.5 IP Applications

IP applications such as e-health, e-government, e-commerce, e-learning etc. are important components in social and business life. For instance, e-government can contribute to the effective provision of government services to citizens and therefore may lead to good governance in the public sector. It is widely accepted that e-government applications provide more transparency and efficiency in delivering public services. Many countries are reforming and modernizing their public-sector system.<sup>8</sup> To this end, governments play a leading role in stimulating the use of Internet by e-government applications.

### 2.1.6 IP infrastructure development

IP infrastructure is necessary to provide VoIP services. The development of IP infrastructure is both a market and a regulatory challenge. An efficient regulatory regime can help develop IP infrastructure and extend it to unserved areas. New wireless technologies play an important role in rural and unserved areas where a combination of wireless infrastructures and VoIP service can enable more efficient development of all communications services, including basic voice.<sup>9</sup>

In **Spain**, the main operators have completed migration of their core network to IP technologies, allowing them to use a single platform to offer a variety of services both to the residential market (nPlay offerings) and to the business segment. Some operators have extended IP technologies to access interfaces, especially to provide service for the business segment, with alternative operators basing their offerings on naked-DSL wholesale services offered by the historical operator. Interconnection between operators at IP level remains incipient.

In **Pakistan**, most operators are switching to IP based networks as it is considered more cost effective. Current networks are a hybrid of legacy networks and IP. Reportedly, operators prefer IP based interconnection.

In **Austria**, the majority of mobile operators are migrating towards Next Generation Network (NGN) (which is an IP-based network); the smallest operator has already finished the transition. The incumbent – also the largest fixed network operator – is currently in the migration phase towards an NGN.

In **Cameroon**, the migration process of existing telecommunications networks towards Next Generation Networks (NGN) is on-going. The mobile operators have completed the evolution of their core networks to IP based technologies and now are focusing their efforts on implementing Next Generation Access (NGA). The incumbent telecommunications operator's core network has been partially migrated to NGN. In addition, the main ISPs provide their services over IP based infrastructure.

In **Costa Rica**, until 2007, telecommunication services were provided by the Instituto Costarricense de Electricidad (ICE) as the only provider. Approval of the Dominican Republic-Central America-United States Free Trade Agreement (CAFTA-DR) altered that structure, allowing free competition in various telecommunication services. This led to the entry of two new mobile telephone operators, along with numerous telecommunication service operators and providers. Currently, **Costa Rica's** telecommunication regulator, SUTEL, has authorized 102 companies to provide IP network services including: IP telephony, Internet access, point-to-point channels, virtual private networks, videoconferencing, cable TV, GPS.

In **Turkey** operators prefer to use IP based facilities to provide service where it is feasible and cost effective. For instance, the incumbent fixed operator is upgrading its network and announced a plan to

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<sup>8</sup> WDTR 2010: Monitoring the WSIS target

<sup>9</sup> ICT Regulation Toolkit



deploy IP based network in five years. Alternative fixed operators mainly use IP-based infrastructure. ISPs and mobile operators are also using IP based facilities in their network.

In **Vietnam** facility-based operators have been engineering and building their networks based on technology integration trends on an NGN technology/platform.

In **France** all operators have deployed IP networks including the historical operator. The main alternative operators no longer use the PSTN (except for reasons of inheritance) to serve the residential segment, with the exception of SFR. The PSTN is still used by operators targeting the business market and by the historical operator (the migration of all subscribers to IP takes time), and for some specific voice services that are not available on an IP network.

In **China** every operator has launched IP based networks; they are testing the IPv6 network. Through implementing the CNGI project supported by the government of China, large-scale Next Generation Internet demonstration networks have been established, including 6 backbone networks, 2 international switching centers and 273 premise networks. China Telecom has launched a pilot IPv6 network for "Shanghai Expo" and "Shenzhen Universiade." The introduction of IP-based exchanges was initiated by China Mobile in 2005 and the transformation of its mobile core networks was completed in 2008. China Telecom had a very clear purpose in mind when introducing IP technology: to adapt to the rapidly growing mobile Internet services and to save cost. China Telecom introduced IP-based RAN interfaces at all levels of its core networks and gradually broadened their coverage. After its founding through merger, China Unicom is still providing services through two networks, accelerating IP technology introduction in its metropolitan area networks.

Moreover, according to Thales Communications (France)<sup>10</sup>, the implementation of all-IP overlay solutions could also be envisioned in order to foster IP infrastructures development. Indeed, this lower-cost IP solution allows rapid deployment of IP-based services in response to user demand in developing countries, as was done in the developed countries. Regarding these all-IP overlay solutions, the impacts on network architecture, the different phases of the overlay migration strategy as well as the example of installing an "I2P" security network (Invisible Internet Project) are also described.

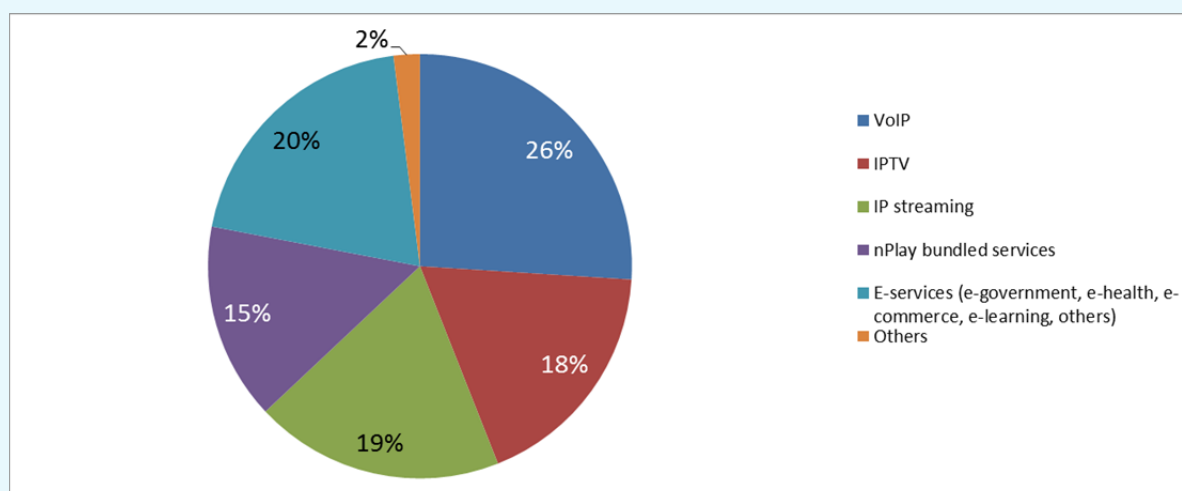
## 2.2 IPT Services: Country Examples

Responses to the survey indicate that the main services provided in the countries are VoIP, e-services such as e-Government, e-Health, e-Commerce, e-Learning, IP streaming, IPTV and nPlay bundled services (see **Figure 2**).

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<sup>10</sup> [Document RGQ19-2/1/22](#)

Figure 2: IPT services provided in the countries



In **Bangladesh**, IP-based telecommunications services are provided by ISPs (Internet Service Providers), IPTSPs (Internet Protocol (IP) Telephony Service Providers) and BWA (Broadband Wireless Access) Service Providers. There are in total 412 ISPs out of which 112 are Nationwide ISPs, 87 are Central Zone ISPs, 58 are Zonal ISPs and 119 are Category A ISPs (for Dhaka Metropolitan Area), 26 are Category B ISPs (for Chittagong, Rajshahi, Khulna, Barisal and Sylhet Metropolitan Area) and 10 are Category C ISP (Other than Metropolitan Area). There are in total 41 IPTSPs out of which 30 are Nationwide licensees, 8 are Central Zone licensees and 3 are Zonal licensees. There are in total 2 (two) BWA licensees. Recently the Government has decided to issue VSP (VoIP Service Provider) and 3G (3rd Generation) licenses which is currently under process. The Government has also decided to issue ITC (International Terrestrial Cable) and alternate submarine cable licenses which will meet the national bandwidth requirement and enable us to provide future IP-based services more efficiently. IP telecommunication services have huge impact on the social conditions of **Bangladesh**. Almost all public offices have their own websites; so, any kind of information regarding Government offices can be obtained through website. E-education, tele-medicine / e-health, video conferencing, e-agriculture, e-tendering etc. systems have been introduced in both the urban and rural areas and this is helping people develop their socio-economic conditions. Huge awareness is increased in each and every sector, especially in agriculture and health. Tele-density is more than 53 per cent, internet penetration is more than 15 per cent, the number of telecom subscribers is over 78 million, the number of internet users is more than 22 million and annual the internet users increase by 70 per cent.

In **Turkey**, alternative fixed telephony operators are authorized to provide services using any kind of technology. Therefore, they can use IP technology for voice services. IPTV service can be offered under a wired broadcasting service authorization. IP streaming is not regarded as a telecommunication service in the legal framework. Generally internet and VoIP are offered as bundled service but some operators offer triple play services; internet, VoIP and IPTV.

In **Portugal**, there are several nomadic VoIP operators with a limited market share. There are several medium to large VoIP operators, namely Cable TV operators and FTTH/B operators, which account for a significant part of the market. The second largest PSTN operator in the country is a cable TV operator which offers VoIP services. The incumbent offers nomadic VoIP and VoB. IPTV accounts for about 25 per cent of the subscription TV market. Multiple play bundles are offered widely; about 40 per cent of households subscribe.

In **Ecuador**, VoIP and IP streaming are technological applications available on the Internet; an operator providing VoIP service is subject to the applicable legal framework, regulatory standards and control.

nPlay bundled services are provided by authorized operators, and include: Internet, fixed and mobile telephony, TV. E-services are being developed for e-government, e-health, e-learning.

In **China**, VoIP is provided by basic operators in the whole country. IPTV and nPlay bundled services are currently on trial in 12 cities. IP streaming and E-services is provide by many companies across the country.

## 2.3 Legislation

Concerning the survey question that asked whether there were specific laws/legislation in place which allow VoIP services, from the 39 answers received, 16 generally stated that VoIP is allowed by legislation. In some countries, like **Tonga**, although it is not explicitly stated in the law, VoIP services are provided by the operators. Regarding laws/legislation which govern access to IPT services by persons with disabilities, from the 39 answers received, only 5 stated that their legislation contained such provisions. .

Out of the 40 countries who responded to the questionnaire, 12 stated that the national regulatory authority encourages telecom operators to roll-out these networks, and that most operators are deploying or planning to deploy IP based networks. In **Latvia**, the government has decided to co-finance the deployment of optical backhaul in rural areas.

In view of these responses, , the following issues are raised: : what kind of legal framework is needed and what its specific characteristics? In evaluating individual country responses to this question, we notethe importance of considering t the specific circumstances in each country as this will determine what the best step forward could be.

### National plans to deploy all-IP networks

Survey results show that of the 40 countries that replied, 12 have national plans or strategies to develop all-IP networks. Twenty-six countries have no plans in this regard.

In **France**, the draft decision on analysis of the fixed market encourages the deployment of all-IP networks, basing itself on the definition of demand/conditions of access that are reasonable and taking account of the fact that the most efficient technology for providing these services is IP. In particular:

- The ceilings for tariffs for service terminations are to be cost-oriented based on the incremental cost that would be proposed by an efficient NGN operator (PSTN costs will not be considered);
- The number of interconnection points for voice will gradually decrease regardless of the technology used. For this market analysis cycle (2011-2014), the decrease will concern only VoB traffic, but should also be reflected on the PSTNs in the course of the next cycle (2014-2017);
- The Regulatory Authority for Electronic Communications and Posts (ARCEP) holds regular discussions with the French operators' association, FFT, with a view to standardizing IP interconnection. If it proves necessary, ARCEP will defend the right for an operator to interconnect using this type of new interface;
- Following work undertaken in collaboration with the operators, ARCEP should publish an evaluation of the percentage of access to telephone services that would be more efficient over IP rather than PSTN. Thus the historical operator should no longer be authorized to cover the costs of its inefficient PSTNs on the wholesale market.

In **China**, "The State Informatization Strategy, 2006-2020" issued by the General Office of Chinese Communist Party Central Committee and the General Office of the State Council of the People's Republic of China declares the following:

- Move towards the next-generation network by promoting network convergence.
- Optimize network structure and improve network performance to put in place an integrated basic information platform.

- Speed up the transformation and promote "triple play" at the levels of service, network, terminal, etc.
- Diversify broadband access and strive to increase Internet adoption.
- Boost the development of wireline, terrestrial, satellite and all other types of digital radio and television and accomplish the analogue-to-digital transition in radio and television.
- Increase network functionalities with photoelectric sensing, radio-frequency identification and other technologies, build and improve the integrated information infrastructure and effect a steady transition to NGN.

In addition, China's 5-year plan, describes some projects and initiatives to promote the development of next generation internet.

**Austria** stated that generally, the NRA considers the development of the national market in its regulatory decisions. As the Austrian telecoms market is a competitive environment, the decision to roll-out new networks and services is made by the carriers in consideration of market dynamics and is not regulated by authorities. For regulated markets, the imperative of efficiency for both networks and technology is always considered in the course of the regulatory decisions. An all-IP based network satisfies this imperative.

In **Peru**, a temporary multi-sectoral commission was established to prepare the national plan to develop broadband in Peru and to analyse the environment, identify obstacles, and propose policy recommendations. In addition, in **Peru**, there is a national policy for the obligation to deploy optical fibre and/or ducts and chambers, and set up the Optical Fibre Backbone Commission, bringing the efforts of other sectors to bear on this task.

Moreover, given the importance of the convergence phenomenon, OSIPTEL gradually began to develop proposals for a framework of policies to promote convergence in the country. A key part of that process was the work carried out in 2009 by OSIPTEL, in collaboration with three internationally recognized consulting agencies, which produced three reports with proposals for convergence in the sector. One report entitled NGN Network Interconnection, established the basis for the regulatory modifications required to promote IP-based networks and services.

In **Nepal**, operators have developed IP-based technologies in their backbone and core networks.

In **Bulgaria** there are limited legislative incentives to promote investment in IP-based networks. A 2009 analysis of revenues allocated according to the retail services provided shows that the largest market share belonged to uncircuited Internet access - 76 per cent - followed by virtual networks and services for data transmission. Revenues from complementary services such as IP TV transmission allowed by VoIP, web hosting and dialup access were insignificant in total - 1 per cent. At the end of 2009, 36 companies had declared that they provide VoIP; 18 provide IP TV. In addition, 12 more planned to start providing VoIP service in 2010, and 36 had plans to offer IP TV. In general, fixed providers realize savings in operational and infrastructure costs by introducing new IP-based services. Many incumbents prefer to initially introduce IP-based services through an overlay network. This approach allows businesses to avoid replacing the switching elements of the former network where there is no return on investment. So the new network architecture enables providers/operators to maintain their previous investment and reduce risk while exploring and introducing new services.

In **Turkey**, the new regulatory framework encourages operators to enter the market and provide new and innovative services. The reduction in mobile termination rates may also encourage operators to deploy all-IP networks in light of the cost savings that can be made in management, operation, and services.

In **Bangladesh**, the Regulator does not directly encourage the roll-out of full IP-based networks. This is rather market driven. But the last license issued was technology specific and was rolled out with NGN technology, indirectly encourages the roll-out of IP-based network.

## Cloud Computing

During the work of Question 19/2-1, ITU Members expressed great interest in cloud computing. Below is the information excerpted from the recommendation prepared NIST (National Institute of Standards and Technology, U.S. Department of Commerce)<sup>11</sup>.

Cloud computing is a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction. This cloud model is composed of five essential characteristics, three service models, and four deployment models.

### Essential Characteristics:

*On-demand self-service.* A consumer can unilaterally provision computing capabilities, such as server time and network storage, as needed automatically without requiring human interaction with each service provider.

*Broad network access.* Capabilities are available over the network and accessed through standard mechanisms that promote use by heterogeneous “thin” or “thick” client platforms (e.g., mobile phones, tablets, laptops, and workstations).

*Resource pooling.* The provider’s computing resources are pooled to serve multiple consumers using a multi-tenant model, with different physical and virtual resources dynamically assigned and reassigned according to consumer demand. There is a sense of location independence in that the customer generally has no control or knowledge over the exact location of the provided resources but may be able to specify location at a higher level of abstraction (e.g., country, state, or datacenter). Examples of resources include storage, processing, memory, and network bandwidth.

*Rapid elasticity.* Capabilities can be elastically provisioned and released, in some cases automatically, to scale rapidly outward and inward commensurate with demand. To the consumer, the capabilities available for provisioning often appear to be unlimited and can be appropriated in any quantity at any time.

*Measured service.* Cloud systems automatically control and optimize resource use by leveraging a metering capability<sup>1</sup> at some level of abstraction appropriate to the type of service (e.g., storage, processing, bandwidth, and active user accounts). Resource usage can be monitored, controlled, and reported, providing transparency for both the provider and consumer of the utilized service.

### Service Models:

*Software as a Service (SaaS).* The capability provided to the consumer is to use the provider’s applications running on a cloud infrastructure. The applications are accessible from various client devices through either a thin client interface, such as a web browser (e.g., web-based email), or a program interface. The consumer does not manage or control the underlying cloud infrastructure including network, servers, operating systems, storage, or even individual application capabilities, with the possible exception of limited user-specific application configuration settings.

*Platform as a Service (PaaS).* The capability provided to the consumer is to deploy onto the cloud infrastructure consumer-created or acquired applications created using programming. The consumer does not manage or control the underlying cloud infrastructure including network, servers, operating systems, or storage, but has control over the deployed applications and possibly configuration settings for the application-hosting environment.

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<sup>11</sup> NIST Definition on Cloud Computing, Peter Mell & Timothy Grance, <http://csrc.nist.gov/publications/nistpubs/800-145/SP800-145.pdf>

*Infrastructure as a Service (IaaS).* The capability provided to the consumer is to provision processing, storage, networks, and other fundamental computing resources where the consumer is able to deploy and run arbitrary software, which can include operating systems and applications. The consumer does not manage or control the underlying cloud infrastructure but has control over operating systems, storage, and deployed applications; and possibly limited control of select networking components (e.g., host firewalls).

#### **Deployment Models:**

*Private cloud.* The cloud infrastructure is provisioned for exclusive use by a single organization comprising multiple consumers (e.g., business units). It may be owned, managed, and operated by the organization, a third party, or some combination of them, and it may exist on or off premises.

*Community cloud.* The cloud infrastructure is provisioned for exclusive use by a specific community of consumers from organizations that have shared concerns (e.g., mission, security requirements, policy, and compliance considerations). It may be owned, managed, and operated by one or more of the organizations in the community, a third party, or some combination of them, and it may exist on or off premises.

*Public cloud.* The cloud infrastructure is provisioned for open use by the general public. It may be owned, managed, and operated by a business, academic, or government organization, or some combination of them. It exists on the premises of the cloud provider.

*Hybrid cloud.* The cloud infrastructure is a composition of two or more distinct cloud infrastructures (private, community, or public) that remain unique entities, but are bound together by standardized or proprietary technology that enables data and application portability (e.g., cloud bursting for load balancing between clouds).

## **2.4 National strategies to transition from IPv4 to IPv6**

### **2.4.1 National strategies to migrate to IPv6**

Thirty-eight responses were received on this issue in the survey; 13 stated that they have a plan to transition to IPv6. For instance, the **Czech Republic** stated that the deadline for transition was 01/01/2011, **Viet Nam** stated that its deadline is 31/12/2020, and **Turkey** stated 31/08/2013 as their transition deadline.

**In Turkey** the E-Transformation Turkey Executive Board which is responsible for making important decisions about Turkey's transformation to the information society, directed the Information and Communication Technologies Authority (ICTA) of Turkey to raise awareness, prepare a roadmap and develop measures and policy proposals for the transition to IPv6. They were asked to collaborate with all related stakeholders in this process. Consequently, since 2006, ICTA has communicated with ISPs and other related parties to raise awareness about IPv6. Additionally, the "National IPv6 Infrastructure Design and Transition Project" funded by the government took place from February 2009 - February 2011. (<http://www.ipv6.net.tr>) In collaboration with the National Academic Network Center and two national universities, ICTA actively participated in this Project which provided an IPv6 test bed for ISPs; estimated the total IPv6 transition cost in Turkey, drew a roadmap for IPv6 transition in Turkey and researched the security aspects of transition. At the end of the project, "KOVAN," a security software and "Fi6en," an IPv6-enabled videoconference software were produced to be distributed by ICTA free of charge to interested parties. During the project, an IPv6 workshop was organized in May 2010 and conference on this topic was organized in January 2011. Both were widely attended.

The National IPv6 Infrastructure Design and Transition Project help to build IPv6 know-how in the collaborators of the Project, the public and private sector which are indirectly involved in the project by organizing activities, conducting surveys, etc.

Additionally, a Prime Ministry circular, "Plan for Public Sector's transition to IPv6", was published in the Official Gazette dated 12.08.2010 (Number 27779) with the collaboration of ICTA and the Ministry of Transformation and Communications. According to this circular, government agencies must meet certain predefined levels of IPv6 support. The elements of the Roadmap prepared for the IPv6 transition in government agencies are:

Phase 1 (January 1st, 2011-August 31st, 2012)

- Government agencies shall perform an inventory analysis to assess IPv6 support of their hardware and software. By considering the lifecycles of the software and hardware that are not IPv6-compatible, a plan shall be prepared to renew these items and the costs shall be considered in the annual budget studies.
- Government agencies shall obtain IPv6 connections until August 31st, 2012 at latest. No investment for network software and hardware which is not IPv6-compatible shall be made after August 31st, 2012.
- Government agencies shall assess their staff's training needs on IPv6 transition and IPv6-enabled services. Necessary training shall be completed until March 1st, 2012 at latest.
- Government agencies will be trained at the "IPv6 transition Training Centre" which will be formed under the Turkish Academic and Technological Research Council of Turkey- Turkish Academic Network and Information Centre (ULAKBIM). The scope of the training program will be determined and announced by ULAKBIM. This training may also be provided by "personnel licensing institutes" that are accredited according to standards TS EN ISO/IEC 17024 or ISO/IEC 17024.

Phase 2 (September 1st, 2012-December 31st, 2012):

- Governmental agencies shall make at least one of their Internet-based services IPv6-compatible as a pilot application until December 31st, 2012 at latest.

Phase 3 (January 1st, 2013-August 31st, 2013):

- Governmental agencies shall make their all Internet-based services open to public access IPv6-compatible until August 31st, 2013 at latest.

## **2.4.2 Overview of ITU activities to facilitate the transition from IPv4 to IPv6**

### **2.4.2.1 Overview**

The Plenipotentiary Conference adopted Resolution 180 (Guadalajara, 2010) on facilitating the transition from IPv4 to IPv6, after the adoption of WTSA Resolution 64 (Johannesburg, 2008): IP address allocation and encouraging the deployment of IPv6, and WTDC Resolution 63 (Hyderabad, 2010): IP address allocation and encouraging the deployment of IPv6 in the developing countries

Resolution 180 (Guadalajara, 2010) instructs the Director of the Telecommunication Development Bureau (BDT), in coordination with the Director of Telecommunication Standardization Bureau (TSB):

- 1) to undertake and facilitate activities (under *resolves*) in order that the relevant study group of the ITU Telecommunication Standardization Sector (ITU-T) can carry out the work;
- 2) while assisting those Member States that require support in the management and allocation of IPv6 resources, to monitor the current allocation mechanisms (including the equitable distribution of addresses) for ITU Member States or Sector Members, and to identify and point out any underlying flaws in the current allocation mechanisms;
- 3) to communicate proposals for changes to existing policies, if identified under the studies above, in accordance with the existing policy development process;
- 4) to develop statistics on progress made with the transition, based on information that may be compiled regionally through collaboration with regional organizations.



### 2.4.2.2 Activities

- The IPv6 Group, established by ITU-D and ITU-T to conduct further activities toward the implementation of WTS-08 Resolution 64, WTDC-10 Resolution 63 and subsequently Resolution 180 (Guadalajara, 2010), met on 12 June 2012.
- Work is being progressed through a correspondence mailing list to facilitate collaboration, sharing information and experiences related to IPv6 deployment, as well as to contribute to the further development of the initiative presented in Council 2011 (document [C11/32](#)). Sharing information is vital for further encouragement of IPv6 deployment initiatives.
- The following ITU training and workshops on IPv6 were organized:
  - Online Training: Migration to IPv6 for Asia, 28 November – 25 December 2011
  - Training Course on Certified Network Engineer in IPv6 (Penang, Malaysia), June 2012
  - Seminar on “Migration from IPv4 to IPv6 : Regulatory and Technical aspects” for CIS countries in Chisinau, Moldova in June 2012
- The following activities to assist ITU membership are planned in the 3rd Quarter of 2012:
  - Implementation of IPv6 deployment test beds for Africa
  - Migration plans to support Arab States with deployment/migration to IPv6-based networks and applications
  - Guidelines and best practices on IP address allocation and encouraging the deployment of IPv6 for Developing Countries
- ITU-T Study Group 13 continued its work on the impact of IPv6 on NGN in [Q7/13](#), covering identification/location split, migration, object mapping, network access and interworking aspects of IPv6. Two new Recommendations were completed since the SG13 meeting in October 2011
- ITU-T Study Group 17 continued to work on two work items titled “Technical security guideline on deploying IPv6” and on “Security management guideline for implementation of IPv6 environment in telecommunications organizations”.
- ITU-T Study Groups are taking into consideration the impact of IPv4 exhaustion and the deployment of IPv6 in their relevant standardization work. Many ITU-T Recommendations, such as Y.1901 ‘Requirements for the support of IPTV services Requirement’, Y.1902 ‘Framework for multicast based IPTV content delivery’, H.720 ‘Overview of IPTV terminal devices and end systems’, H.721 ‘IPTV terminal devices: Basic model’, and newly approved ITU-T Y.1565 ‘Home network performance parameters’, have both IPv4 and IPv6 in their scope as applicable.

## 3 Impact of IP Networks, Services, and Associated Applications

### 3.1 Economic impact

In accordance with the ITU Telecom Regulatory Report 2011, broadband technologies have the following impact on an economy<sup>12</sup>:

- Positive contribution of broadband to GDP growth
- Positive impact on productivity

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<sup>12</sup> ITU Telecom Regulatory Report 2011



- Contribute to employment growth, both as a result of network construction programs and spill-over effects on the rest of the economy. While the deployment programs are, as expected, concentrated in the construction and telecommunications sectors, the impact of externalities are greater in sectors with high transaction costs (e.g., financial services, education, and health care).
- In addition to economic growth and job creation, broadband has a positive effect on consumer surplus in terms of benefits to the end users that are not captured in the GDP statistics. These benefits include efficient access to information, savings in transportation, and benefits in health. The results of the analyses also validate the positive contribution of broadband on employment creation for less developed countries and regions. In this case, all prior research, as well as the results of this study, indicates that broadband has a positive impact on job creation.

### 3.2 Impact on market and regulation

Traditionally, telecommunications, information technology and broadcasting operated in separate, independent networks. With the advent of IP technology and the increasing use of packet switched digital communications, today, it is possible for one operator to provide telephony, Internet, and broadcast services through one license. Market related convergence is also driven by consumer expectations, as they demand one-stop shop service, bundling of services and flat price packages. Increasingly, many operators organize their tariff plans based on the volume of data transferred. While cable TV operators are providing Internet services, news, and entertainment videos are being made available by mobile operators using 3G capability. IPTV is seen as a new revenue opportunity for many telecom operators. Convergence is leading to increased competition in the markets as the same service is delivered through different infrastructure.<sup>13</sup>

### 3.3 Impact on Consumers

As various new services are provided by one operator, the cost of providing services will be reduced compared to the provision of services separately. Therefore, consumers benefit from reduced prices.

As recognized by **Peru**, for example, in its contribution to these studies, the transition to IP networks presupposes considerable investment on the part of telecommunication operators, which explains why in most cases the transition takes place slowly. While the traditional regulatory framework has to be adapted to an IP network environment, regulatory policies must promote investment for the deployment of new networks.

### 3.4 Benefits and Opportunities

Driven by promises of reduced network infrastructure costs and increased productivity through converged applications, many organizations are deploying or evaluating the feasibility of IP communications. Managers are evolving their data networking infrastructure (Res 101, 102 PPO6) to adopt IP telecommunications for four primary reasons<sup>14</sup>:

- **Measurable ICT Network Cost Savings:** ICT Network cost savings can be measured in different ways. Efficient IP packet switching reduces voice transmission costs in a multi-site network. Management of IP Telephony is made more efficient when combined with data network management. Savings can also be achieved because management of the data network can incorporate IPT-based moves, additions, and changes. Additionally, as IPT does not depend on a co-

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<sup>13</sup> Telecom Regulatory Authority of India (TRAI), Consultation Paper on Issues relating to Convergence and Competition in Broadcasting and Telecommunications, January 2006 (WTPF 2009 Background paper)

<sup>14</sup> Document [1/009](#), Contribution from BDT Focal Point on Question 19-2/1, 20 September 2010

located switch or PBX, IPT network resources can be located and managed independently of the users' locations.

- **Improved Productivity** Today's second-generation IPT systems include tools such as integrated email, voicemail, and fax messaging. These features allow users to save time by managing different message types through a single graphical user interface. IP Telecommunication can also employ a "follow-me/find-me" feature that gives users control of who may reach them, providing the network with call routing instructions that are specific to user profiles and caller identities.
- **Improved Customer Care Management:** Customer relationship management can also benefit from IP Telecommunications in several ways. Analysis of detailed reports that are integral to a call management system can be used to reduce hold time and the number of dropped calls for future callers. Interactive voice response systems (IVRs) are often provided with or easily integrated into second generation IPT, and calls can be routed across a wide geography when one location or caller is busy. Callers who choose to "call" with email or Web chat can have their calls routed using the same network used by voice callers.
- **Application Convergence:** Although network cost savings, improved productivity, and better customer management are all reasons enough to move to IPT, perhaps the biggest draw is application convergence. Adopting IPT today lays the foundation for integrating data and applications with voice communications in the future. Users can already employ SIP and IP Telephony for "click to call," turning an instant message session into a voice call.

Various IP telecommunication services touch not only the telecommunication sector but involve others, including equipment manufacturers, software developers, media content providers, and ISPs. Traditional operators need to co-operate with these new market participants.

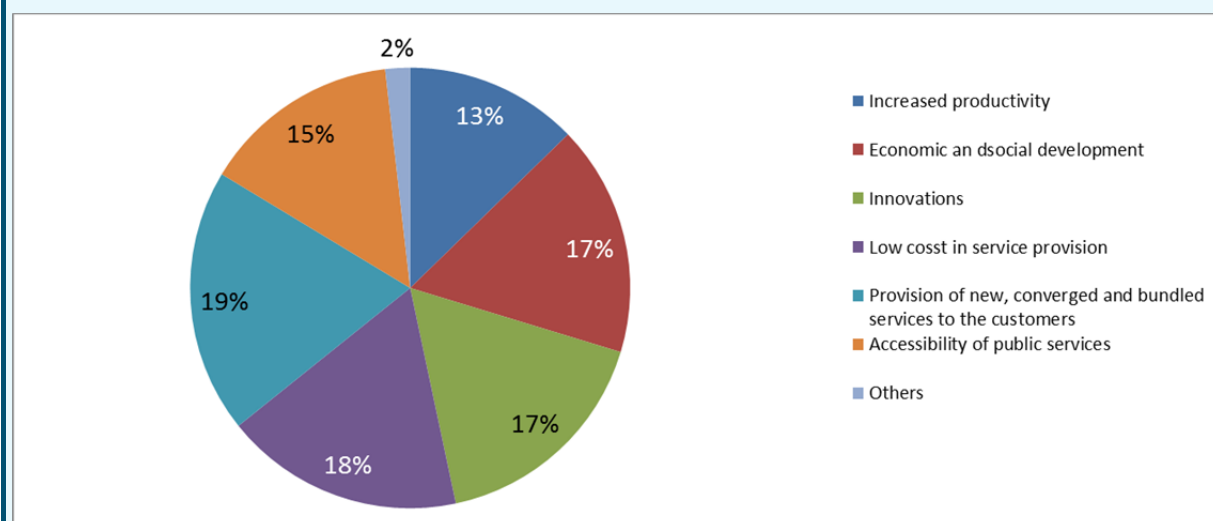
Regarding the most significant benefits for countries when implementing IP networks the following , listed in order of significance, were mentioned:<sup>15</sup> .

1. Provision of new, converged and bundled services to the customers
2. Innovation
3. Economic and social development
4. Low cost service provision
5. Accessibility of public services
6. Increased productivity

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<sup>15</sup> Further details can be found in **Figure 3**.

**Figure 3: Benefits of implementing IP networks**



Countries responding to the survey identified the following opportunities to be realized from implementing IP networks, services, and associated applications:

- Employment opportunities
- Infrastructure development
- Innovation
- Increased productivity
- Ease of expansion and upgrading of the network
- Greater availability of advanced services
- Lower costs of network development, lower service cost
- Faster access and collection of information

### **Accessibility<sup>16</sup>**

Developing countries often have higher rates of disability than developed countries. The use of IP networks can provide assistance to people with disabilities, their families and communities in very effective ways. For example, reliable, high-speed broadband access can support the use of video communications, which is very useful to deaf people as it provides more effective communication than conventional telephony. This is especially true if relay services can be provided to act as intermediaries between deaf and hearing people. Relay services may also be configured as remote interpretation services where a remote sign language interpreter could assist with local communication. This could be useful to educate the deaf.

People in remote areas should not be disadvantaged and should have access to services with sufficient speed and adequate quality of service, depending on the applications.

<sup>16</sup> Document [RGQ 19-2/1/009](#)

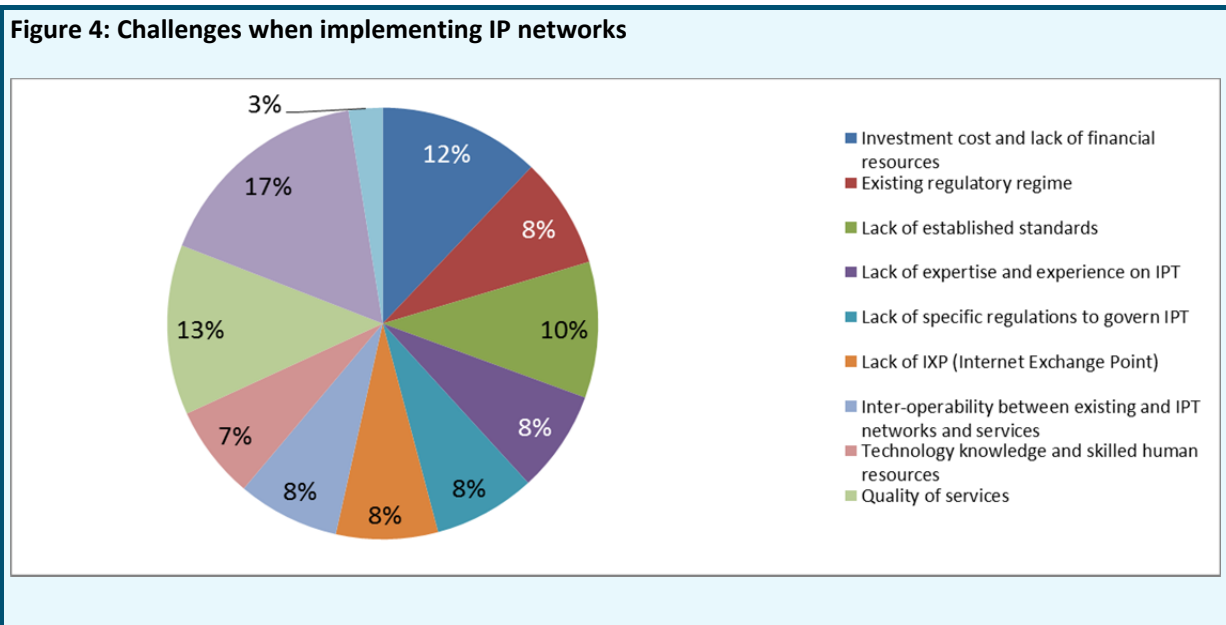
## 4 Potential Challenges

### 4.1 Potential challenges

The survey showed that the following challenges are the most significant countries face when implementing IP networks (listed in order of importance):

1. Trust and security of IPT networks and services
2. Investment cost and lack of financial resources
3. Quality of service
4. Lack of established standards
5. Existing regulatory regime
6. Inter-operability between existing and IPT networks and services
7. Lack of expertise and experience in IPT
8. Lack of specific regulations to govern IPT
9. Lack of IXP (Internet Exchange Point)
10. Technology knowledge and skilled human resources

Further details can be found in **Figure 4**:



### **4.1.1 Regulatory challenges**

Policy makers must review and reassess existing regulations to ensure that policies applicable to legacy networks do not hamper convergence, investment and choice in the market.<sup>17</sup> Below are some of the important challenges.

#### **4.1.1.1 Licensing**

Convergence of service capabilities on common technical platforms makes it difficult to issue licenses according to specific technologies or types of services provided. To support the development of IP services, many countries have simplified their licensing regimes, adopting technology neutral, unified licensing schemes with simplified administrative procedures for market entry

#### **4.1.1.2 Interconnection<sup>18</sup>**

The interconnection of IP networks is a crucial issue for network development and competition. The shift to IP networks, that is, from single to multi-platform service provision, implies a need for new types of interconnection products. These include interconnection between existing telecommunication and IP based networks, and between different types of network and new types of unbundled network components from voice-centric to multiservice centric networks.

#### **4.1.1.3 Universal service**

As a whole, the purpose of a universal service obligation is to promote the availability, affordability and accessibility to telecommunication services<sup>19</sup>. New network technologies should be reflected in universal service obligations. New wireless services including WiMAX, Wi-Fi and 3G offer new opportunities for improving universal access. Therefore, it is necessary to allow operators other than the fixed incumbent operators to provide universal service.

#### **4.1.1.4 Bundling of services and competition**

Bundling services together can make it difficult for regulators to define markets, assess market power, and therefore determine whether or not dominance exists in a given market. In addition it is more difficult to determine the extent to which prices are cost-oriented as services are cross-subsidized.

Many incumbent PSTN operators transitioning to an IP based network employ fiber optics in the access and core network. Fibre optic networks deployed by an incumbent operator may raise competition issues and create new barriers for entry however, and regulators need to evaluate the market carefully.

#### **4.1.1.5 Infrastructure sharing**

As the deploying fibre network is costly especially for new entrants, infrastructure sharing is very crucial to lower the cost of deploying broadband network. It is also important for affordable access to ICT and its widespread usage. Especially for developed countries, infrastructure sharing plays important role in the transition to IP networks via deployment of FTTx.

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<sup>17</sup> Convergence and Next Generation Networks, OECD Ministerial Background Report, 2008, <http://www.oecd.org/dataoecd/25/11/40761101.pdf>

<sup>18</sup> Excerpt from New Technologies and Their Impacts on Regulation, Module 7 of ICT Regulation Toolkit, March 2007, Author: Technical University of Denmark

<sup>19</sup> Convergence and Next Generation Networks, OECD Ministerial Background Report, 2008, <http://www.oecd.org/dataoecd/25/11/40761101.pdf>

#### 4.1.1.6 Management of resources

##### Spectrum management

To provide various IP telecommunication services to users, high speed broadband access is essential. As wireless broadband services grow, demand for frequencies increases. Therefore, to maximize efficient use and availability of spectrum, many countries are reassessing their allocation and assignment procedures and considering the use of competitive mechanisms *as well as the future demand*. As HDTV, mobile TV, 4G services or LTE are also growing rapidly, many countries are considering ways to flexibly *reallocate and* reassign unused and underused spectrum. Spectrum trading and in-band migration are examples of market-based approaches to spectrum management used in some countries<sup>20</sup>.

##### Numbering

IP telecommunication services affect the management of numbering resources. Nomadic use of numbering resources in various IP services particularly challenges geographic numbering plans. For example, tracing the geographic origination of a call to an emergency services facility becomes very complicated as the traffic flows through various networks. It also raises a question of the reliability of calling line identity (CLI) information as this can be changed easily by the users or network operator as the traffic goes through various IP networks.

##### Internet Resources

Management of critical internet resources, and in particular the management of Internet top-level domains, the allocation of Internet protocol addresses, and management of security in the Domain Name System become much more important in an all-IP world. Some developing countries state that they are under-represented in the current governance mechanisms, and there is a need for an improved global framework to bring a multilateral approach to manage this increasingly vital resource. Without a model that extends the principles of democracy to the online world and rewrites the rules of globalization so that its benefits are more equitably distributed, some argue that we risk a meltdown in cyberspace<sup>21</sup>.

#### 4.1.1.7 Quality of service

The world knowledge-based economy is perceived as having a global dimension evolving towards integration of economies in all-IP-based multiservice networks. Quality of service (QoS) is an important element that must be considered as part of a complex feature set and is the ultimate test of the benefit of those features. Before deploying an IP telecommunications solution, organizations must plan for and resolve the issues that will impact QoS; otherwise, basic voice call quality will suffer. As video, voice, radio and TV services are provided through IP-based networks, data flowing across networks become indistinguishable. Therefore, prioritization of traffic to ensure quality of services becomes an urgent and complex issue.<sup>22</sup> In managed VoIP services, it is possible to provide measurable QoS. But this is more difficult in best effort services.

Multiple-play quality of service will become an increasingly important issue for service providers since degradation tends to increase as more services are included on the network. Technical solutions such as packet prioritisation are available for time-sensitive services but they could also raise anti-competitive

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<sup>20</sup> ICT Regulatory News, May 2010

<sup>21</sup> WTPF-2009 Backgrounder, "Convergence, including Internet-related Public Policy matters", <http://www.itu.int/wtpf2009>

<sup>22</sup> Excerpt from WTPF2009 Online Resources, <http://www.itu.int/osg/csd/wtpf/wtpf2009/resources/convergence.html>

issues if their implementation creates an unfair competitive advantage for the services of the infrastructure provider.<sup>23</sup>

Moreover, in order to be more effective for QoS and for the protection of customers, additional considerations are necessary, such as criteria of QoS and compensation rules in case of not meeting the criteria.

#### 4.1.1.8 Data protection and consumer privacy

Given the inherent security risks to IP protocol and to the Internet more generally, the issue of data protection and consumer privacy must be addressed when implementing IPT applications and services. As a result, Policy-makers, National Regulatory Authority (NRA), telecommunications operators and end users have to play their respective roles in order to set and apply the guidelines relating to this issue.

#### 4.1.2 Economic challenges

##### 4.1.2.1 Investment cost and lack of financial resources

Broadband is necessary to provide IP telecommunication services to end users, however deploying fiber optics, especially in access networks, is costly. A large part of the cost of deploying fibre networks is in civil engineering, appropriate policies should be in place to ensure fair and non-discriminatory access to ducts, poles and rights of way for market players. Policy makers also need to examine how to ensure better access by new entrants to existing resources to promote facilities-based competition.

Regarding e-services, in general, funding constitutes an important barrier to the spread of services like e-health services in developing countries. Therefore, governments can look at alternative funding sources such as donor or private funds, as well as public-private partnerships to complement public funding.<sup>24</sup>

##### 4.1.2.2 Tariffs

<sup>25</sup>Affordable, high-speed internet access is central to the development of IP telecommunication services. One of the barriers for developing countries is the price for Internet access. Taking Africa as an example, review of Internet connectivity on this Continent yields the following findings:

- According to the ITU-D publication, *Measuring the Information Society* (2010), overall, people in developed countries have to spend relatively less of their income (1.5 per cent) on ICT services than people in developing countries (17.5 per cent). This shows that, with a few exceptions, ICT services tend to be more affordable in developed countries and less affordable in developing countries, especially the least developed countries (LDCs).
- At the same time, the international bandwidth needed to access content on remote servers remains limited and costly. Not enough interconnected broadband networks: the absence of interconnected networks in developing countries means that States often use international Internet bandwidth, even in order to consult a database hosted in a neighbouring country.
- Insufficient number, or absence, in the Africa region of Internet exchange points (IXP), which could also help develop Internet connectivity while contributing to reduce the access costs to local contents.

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<sup>23</sup> Multiple Play: Pricing and Policy Trends, Working Party on Telecommunication and Information Services Policies, DSTI/ICCP/TISP(2005)12/FINAL, Organisation for Economic Co-operation and Development, 07-Apr-2006, <http://www.oecd.org/dataoecd/47/32/36546318.pdf>

<sup>24</sup> WDTR 2010 : Monitoring the WSIS target

<sup>25</sup> Contribution from Senegal on Cloud Computing (Document [RGQ19-2/1/6](#))

- The use of cloud computing, which requires constant upgrades to Internet bandwidth. This mode of transit to access the services on offer entails substantial costs for the end user.
- While the remote storage service phenomenon generally referred to as "cloud computing" clearly has advantages for the user (pooling and optimization of computer resources, savings on investments in computer equipment, etc.), for the developing countries it also means having to bear the cost of the international bandwidth needed to have access to this new service.

Apart from above, the government needs to pursue policies that will have significant impact on internet usage, including an enhanced effort to deploy broadband infrastructure and to include broadband in universal service plans.

In order to better understand the impact that the existence of IXPs (Internet Exchange Points) have on demand and on internet prices, countries were asked in the survey about these issues. From the 38 answers received, 23 stated that they have IXPs in their countries. In **Pakistan** for instance, there is no IXP, however operators and ISP's interconnect with each other so local traffic can be routed locally, without the need to go to internet cloud and back and in this way increase costs.

### 4.1.3 Technical challenges

Below are some of the technical challenges developing countries face when implementating IP telecommunication service.. Some of the challenges described below are not only in technical nature, but also have social, political, financial and other implications.

#### 4.1.3.1 Power Supply

For developing countries, lack of electricity especially in the rural areas and the high price of computers and internet are the major barriers to internet access. Therefore, in order to have internet services for the people, community access points are critical.<sup>26</sup>

#### 4.1.3.2 Emergency calling

VoIP provided by the operators is usually considered to be a replacement for fixed line services. In almost every country routing such emergency calls to the appropriate emergency authority -is a core element of publicly available telephony services.

In addition, location information is becoming an important requirement for fixed as well as mobile telephony. Due to its nomadic nature of VoIP in general terms, localization of the call for emergency services is one of the major problems. In nomadic use at the current level of technological development, the position information cannot be connected to the emergency call. This is a challenge both to the market players and to the regulatory framework.<sup>27</sup> In addition, a service cut due to power failure is also an important problem for emergency services and for continuous access for users. Therefore, service user needs to be well informed about the restriction of the services they will receive especially before the subscription.

#### 4.1.3.3 Lawful interception

Network operators, application service providers and manufacturers of telecommunication equipment are required to modify and design their equipment, facilities and services to ensure that law enforcement

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<sup>26</sup> WDTR 2010 : Monitoring the WSIS target

<sup>27</sup> ICT Regulatory Toolkit



agencies can conduct electronic surveillance.<sup>28</sup> Cross-border enforcement becomes important as the servers are sometimes located outside a country.

#### **4.1.3.4 Trust and security**

Security in an IP world is not only technical but also an economic and social issue. Consumers are becoming increasingly dependent on information systems and as a result, convergence of networks and services is expanding based on the consumer needs. Therefore, countries should elaborate their needs for security of their networks and implement projects for increasing trust and security in their country.

#### **4.1.3.5 Lack of local content**

Lack of local content is one of the major barriers to Internet access in developing countries. Digitizing book, documents, exhibits and collections available in local libraries can increase the availability of online content in local languages.<sup>29</sup> Building human capacity to create and distribute software in local languages must be supported. Policy makers and others should make such capacity building a priority and encourage service providers to facilitate delivery of local content for TV and the Internet.

#### **4.1.3.6 Interoperability between existing and IPT networks and services**

Interconnection between existing telecommunications and IP based networks may impact the count modalities of interconnection traffic. Also, in order to facilitate interconnection between such networks, some technical steps relating to standardization have to be taken.

#### **4.1.4 Lack of expertise and experience with IPT**

In developing countries, a lack of human resources is a very important constraint to increasing access to the internet and deployment of IPT services, as is obtaining and maintaining an adequate supply of trained teachers. It is essential to create initiatives for digital skills and literacy, particularly for teachers.

Countries responding to the survey voiced a number of training needs. Some include:

- Regulation of IPT services
- Implementation, administration and management of all-IP networks.
- Legal implications and policy issues of IPT.
- Transition from IPv4 to IPv6
- Allocation of IPv6 resources
- IP Interconnection
- IP QoS
- IP service licensing
- IP network security
- Billing for IP based voice services
- Internet regulatory policy

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<sup>28</sup> Convergence and Next Generation Networks, OECD Ministerial Background Report, 2008, <http://www.oecd.org/dataoecd/25/11/40761101.pdf>

<sup>29</sup> WDTR 2010:Monitoring the WSIS target

## 5 Technical, Economic, and Regulatory Conditions Necessary to Implement IP Technologies, Services and Applications

Countries responding to the survey question on this issue stated that the regulatory frameworks to govern the implementation of IP networks, services and associated applications have to be put in place, including the issue of interoperability between the legacy network and the all IP network. They also stated that human resource development and capacity building issues must be addressed.

Concerning the main issues experienced in a country with the introduction and operation of IP networks, services and associated applications, various issues have been stated by countries. For instance, the main issues raised in **Tonga** were the lack of a regulatory framework and the quality of services provided to the general public. **Montenegro's** main issue is the shared use of underground ducts and global Internet access. For **Eritrea**, noted the high prices and the latency of the existing IP network, as well as inadequate capability and experience of the young engineers. They further noted the need for longer training on high-end software.

The International Telecommunications Users Group (INTUG)<sup>30</sup> stated that the major challenges affecting most regions/countries are the following:

- Cost models used for determining regulated prices for significant market power (SMP) operators;
- Progressive elimination of fixed and mobile termination rates;
- Transparent traffic management rules to prevent discriminatory network prioritization;
- Spectrum allocation processes (avoiding stealth taxation through auction fees); and
- Establishing and sustaining open competition in wholesale and retail markets.

In **Peru**, the deployment of IP networks on a large scale has certain implications at the technical, regulatory and socio-economic levels. At the technical level, specialized technical staffs are required for the deployment, operation and maintenance of this type of network. At the regulatory level, the regulatory framework has to be appropriate and contribute to promoting the development of IP networks. At the socio-economic level, demand for converging services has to be generated so that there is adequate use of the IP networks. Regarding the regulatory framework, OSIPTEL is participating in the commission mandated to prepare the National Broadband Plan, which has identified the obstacles to the development of this type of network in Peru and is defining policies aimed at eliminating or reducing the effects of those obstacles. As a result of the work of the commission, a permanent commission has been set up to monitor the deployment of an optical fiber backbone at national level. In addition, a Convergence Commission was set up within OSIPTEL to identify the regulatory challenges within an environment of telecommunications convergence, thus allowing the regulator to tackle future challenges.

### 5.1 Technical conditions

Regarding the technical aspects, in the case of an emergency call from an IP network, steps must be taken to ensure the accuracy of the positioning information and its correct transmission to the regional PSAP. In the case of a nomad VoIP (use of geographical numbers outside the geographical zone designated by the number), it is more complex to transmit the emergency call to the correct PSAP than for traditional networks, as the traditional transmission focuses on geographical knowledge of the network termination point as a result of the E.164 geographical numbers used.

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<sup>30</sup> INTUG is an international association of business users of telecommunications, bringing together national and multinational user associations throughout the world. They have members and contacts in all five continents.

## 5.2 Economic conditions

By default, developing countries are countries of economic opportunities. Most have huge untapped potential that could enable them to achieve a great leap ahead towards sustainable economic growth. In order to create the economical conditions necessary to implement IP applications and services, developing countries have, amongst other, to put in place an enabling policy and regulatory framework that attracts both local and foreign investments and ensure their return on investment, and to identify and mobilize many funding sources in order to invest massively in the rolling-out of IP infrastructures, applications and services, with benefits such as an increase of the national GDP and job creation.

## 5.3 Regulatory conditions

Most developing countries started the telecom reform process much later than most developed countries, and have not yet fully completed the transition to an effective structure of liberalized market participation and independent regulation. Virtually all developing countries face the daunting task of not just upgrading the national network for broadband access to internet services but also the more difficult task of extending the national telecom network by several orders of magnitude to unserved rural areas and majority of the population that has poor or no access to telecom services. Policy makers and regulators in developing countries must confront challenges in adapting the new VoIP environment<sup>31</sup>.

The policy and regulatory environment has an heavy influence on both technical and economic opportunities. That environment can foster new opportunities or restrict, delay and sometimes even prevent them from being realized. Proactive regulation can foster the development and application of new technologies.

The primary challenge is to adopt appropriate policies and regulations that will facilitate the transition and growth of national telecom infrastructures that will support the development of e-economies and information societies.<sup>32</sup> Many established policies and regulations could become obsolete in a converged environment. Artificial distinctions among technologies, services and markets prevent implementation of new services and applications in ICT environment. Therefore, flexible regulatory regimes which observe market dynamics are important. Also, National competition authorities may play a crucial role.

**China** stated that the following operational issues need to be addressed:

- 1) Policies aimed at service innovation and promotion;
- 2) The tariff regulation policy in the wake of the bundling of multiple new services;
- 3) The regulatory policy concept governing market competition for the new services;
- 4) Internet interconnection settlement for new services, namely, whether instant messaging is included and if there should be any settlement;
- 5) How to carry out coordinated regulation of IPTV and other new services involving content regulation?

For **France**, the main issues are:

- Gradual transition of the historical operator from PSTN to IP network;
- Implementation of IP interconnection for voice, which today should be standardized (this should make it possible to satisfy the doubts concerning the quality and security of the service provided);

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<sup>31</sup> Convergence, IP Telephony and Telecom Regulation: Challenges & Opportunities for Network Development, with particular reference to India, Linne.Net, 2005

<sup>32</sup> Convergence, IP Telephony and Telecom Regulation : Challenges & Opportunities for Network Development, with particular reference to India, Linne.Net, 2005

- The replicability of a certain number of services such as fax on IP networks has not yet been confirmed and standardized.

**Venezuela** stated that there are no regulations for IP interconnection. The main issues to be addressed are:

- Definition of an economic model for interconnection charges using IP.
- Definition of the quality of service variables and thresholds for new services

## 6 Lessons Learned and Success Stories

### 6.1 Internet Telephony in the Republic of Korea

<sup>33</sup>The convergence of telecommunications networks through digital technology has blurred the line between voice and data communication. The core of the telecommunications sector is shifting from the public switched telephone network (PSTN)-based telephony to internet telephony. The evolution toward an all-IP network, fierce competition in telecommunications market, and convergence among services leads to the diffusion of internet telephony.

In general, Internet telephony, or voice over internet protocol (VoIP), is defined as a protocol for transmitting voice signals through the Internet or other packet-switched networks. It also refers to the voice service using the protocol. In the **Republic of Korea**, Internet telephony is defined as “telecommunication services which enables users to transmit and receive voice signals through the Internet without limits of calling areas by utilizing telecommunications facilities.” Internet telephony is classified as common telecommunication services.

Since the Internet telephony guideline was announced in Korea, the number of internet telephony service users has increased to ten million in seven years. This figure is over one third of the total fixed telephony users. The Korean example is a successful model of Internet telephony for developing countries.

#### 6.1.1 Market Development of Internet Telephony in Korea

The first Internet telephony service was launched in **Korea** in 1999. Saerom technology provided free dial-pad service based on soft-phone. Before the launch of the service, Saerom technology had a license of the type 2 specialized telecommunication service providers from the Korean Government.

Until the guideline on Internet telephony was announced in 2004, internet telephony was considered to be a free phone service; many companies provided it for free. As a result, the services were recognized as free but regarded as low quality telephony services.

Recognizing that future network evolution is internet-based and that even telephony would evolve into an internet-based service, The Korean government reconsidered the market position and strategic implications of Internet telephony. The Government prepared a guideline on Internet telephony to promote it as a core telecommunications service. A draft of the guideline was prepared by a task force of experts. Through an open hearing, the Korean Government reached consensus on the policy, and in October 2004, released a public announcement on Internet telephony. Enforcement regulations were released in October 2005.

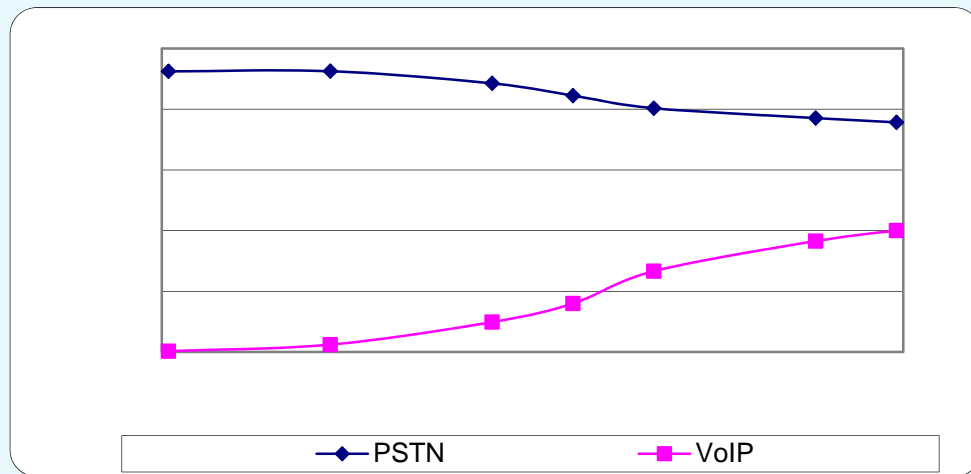
A boost in services started in 2008 with 2.47 million users by the end of the year. In June 2009 there were 4 million users, with 6.66 million at the end of 2009. There were 9.14 million users in 2010, and 10 million

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<sup>33</sup> Document [1/INF/32](#)

in June 2011 which is 34.6 per cent of the total number of fixed telephony services. The compound annual growth rate (CAGR) between 2008 to June 2011 is 49.15 per cent.

**Figure 5: Number of internet telephony subscription in Korea**



### 6.1.2 Korean Guideline on Internet Telephony (May 2004)

The “Basic Direction on Internet telephony” was announced in May 2004. The motivation for the guideline was to prepare for the evolution of the telecommunications network, estimating that due to the transition to all-IP the market power of Internet telephony would grow to be popular around the year of 2010. The second motivation was to stimulate the telecommunications market, by using Internet telephony to give opportunities for new telecommunications carriers to enter the market with new services, and to allow incumbent carriers to develop new services and lead the network upgrade. The Internet telephony guideline also promotes fair competition among carriers and service upgrade through improving the competitive policy for market-entry, numbering plan, and service quality.

The Korean Government initiated the Internet telephony working group consisting of telecommunication operators, academicians and researchers. The working group assigned Internet telephony to common carriers services, examined the numbering scheme, “0N0,” and prepared quality criteria for internet telephone numbers by forming the “association for improving internet telephony quality.” The working group also discussed interconnection, guarantee of call quality, and consumer protection.

When the Korean Government initiated a national ICT master plan, “IT839” in 2004, internet telephony was selected as one of eight new services. With this initiative, the work to revise the policy on internet telephony was accelerated. From the first half of 2005, internet telephony users with “070” numbers could also receive calls.

Throughout this progress, policies on Internet telephony were revised and improved. For entry regulation, internet telephony service providers are classified as common carriers or specialized carriers. Common carrier Internet telephony providers are those having an internet subscribers’ network, backbone network, and internet telephony facilities, such as servers, routers, a gateway or gatekeeper. They must be approved by “the common carriers licensing guideline and evaluation criteria.” Specialized carrier internet telephony providers are those that do not have an internet network but have internet telephony facilities.

In the number assigning scheme, the “070” identification number is assigned to internet telephony. Based on the type of service providers, both direct assignment from the government and indirect assignment through common carriers are possible. Only the carriers who meet the call quality criteria can have

receiving numbers. Specialized carriers can have the "070" identification number if they meet the quality criteria or they are reassigned the numbers from common carriers.

**Table 1: Classifications and descriptions of internet telephony service providers in Korea**

Classification		Description
<b>Common carriers</b>		Carriers who have internet network facilities (backbone network, subscribers network and so on) and internet telephony facilities (servers, routers, gateways, gatekeepers and so on)
<b>Specialized carriers</b>	<b>Type 1</b>	Carriers who provide internet telephony common services, having switching machines and utilizing circuit facilities from common carriers Carriers who have call processing switching machines such as gateway, gatekeeper, proxy server, soft-switch in order to access or cooperate with PSTN
	<b>Type 2</b>	Carriers who provide internet telephony services, utilizing switching machines as well as circuit facilities from common carriers

The Korean Government was very interested in the quality of internet telephony service, and required Common internet telephony providers to meet certain criteria. Specifically, for voice quality, the rating value should be over 70, and the one-to-one delay should be less than 150ms. For access quality, the call success rate should be over 95 per cent. Operators must be certified by the Telecommunications Technology Association (TTA) in **Korea**. The evaluation of quality is conducted annually.

Regarding the interconnection policy, Internet telephony service providers must pay the network usage charge, especially for the subscribers' network. In the case of a terminating PSTN or mobile network, a common internet telephony providers pay interconnection charges; specialized internet telephony service providers pay charges on the linkage by the usage contract. For a PSTN to IP network, PSTN operators must pay relevant charges to internet telephony providers.

For customer protection, protective efforts such as emergency access, callers' location tracking, security, etc., are not enough. As the internet telephony services are popular, more concerns over customer protection are expected to rise.

### **6.1.3 Number portability between Internet telephony and PSTN (October 2008)**

On October 1, 2008, the Korea Communication Commission (KCC) passed a revision on number portability of local, internet telephony, and 080 toll-free services at the 32<sup>nd</sup> meeting. The biggest revision is the decision to include internet telephony services into the area of number portability. Under the section 38-4 of Telecommunication Business Law, number portability between local and internet telephony is introduced to promote competition in voice service and improve user welfare through internet telephony. By the end of October 2008, number portability between local and internet telephony was in effect.

The details of this revision are:

- Expansion of the number portability scope from local telephone to internet telephony
- Operators must provide necessary information, such as emergency call, registration of local information in the case of location change, black-out, etc., to customers.
- Operators should keep calling areas in the case of number portability

### **6.1.4 Operators' Strategies for Internet Telephony**

#### **MYLG070**

LG Dacom launched 'MYLG070' of internet telephony in 2007, which leads the internet telephony market in **Korea**. MYLG070 provides free service to subscribers who feel bill burden, and makes its customers replace their home phones with internet telephony. It targets strategies based on traffic patterns of

telephone users in Korea. In particular, Korean users make calls mostly to specific numbers on their list. So, free service between in-network subscribers gives customers large benefits in terms of telephone bill saving. MYLG070 can be utilized at any place where a wireless access point (AP) is allowed because it can access Wi-Fi service. It provides i-HUB service which is informative internet service of a walled garden type. i-HUB services provide news, weather, and stock information for free interconnection charges only with access to internet through Wi-Fi.

### **KT QOOK internet telephony**

KT launched its internet telephony services in 2008. It provides a new customer premise equipment (CPE) which has camera and liquid crystal display (LCD) function. Through a 4.3 inch display, traffic, stock, news, and home-banking services are provided. In 2009 KT launched a Style phone which is designed by Iriver. This telephone has multimedia features of picture frame, video playing, MP3 playing, radio, and so on. It also has a widget function which provides news, weather, and stock information easily.

### **6.1.5 Implications of the Case of Internet Telephony in Korea**

The success factors of Internet telephony in Korea are two-fold. First, a proper guideline by the Korean Government let users recognize internet telephony as a plausible option for telephony service. Improved quality of service came from the relatively high requirement by the Government obtained users' attention. Second, expanding number portability to internet telephony removed a barrier to approval of internet telephony by the Korean Government. Third, operators' activity in the market supported internet telephony to be positioned at the center of the telecommunications market.

## **6.2 IP based telecommunication in Bangladesh**

### **6.2.1 Introduction**

<sup>34</sup> In **Bangladesh** IP-based telecommunications services are provided by ISPs, IPTSPs (Internet Protocol Telephony Service Providers) and BWA (Broadband Wireless Access Providers). There are 412 ISPs out of which 112 are Nationwide ISP, 87 are Central Zone ISP, 58 are Zonal ISP and 119 are Category A ISP (for Dhaka Metropolitan Area), 26 are Category B ISP (for Chittagong, Rajshahi, Khulna, Barisal and Sylhet Metropolitan Area) and 10 are Category C ISP (Other than Metropolitan Area). There are in total 41 IPTSPs out of which 30 are Nationwide licensees, 8 are Central Zone licensees and 3 are Zonal licensees. There are in total 2 BWA licensees. The Government is issuing VSP (VoIP Service Provider) and 3G (3rd Generation) licenses. The Government has also decided to issue ITC (International Terrestrial Cable) and alternate submarine cable licenses, which will meet the national bandwidth requirement and enable more efficient provision of future IP-based services.

IP-based telecommunications services are also provided by Cellular Mobile Phone Operators. There are 6 Cellular Mobile Phone licensees. The Bangladesh Telecommunication Regulatory Commission (Commission) issued 6 ITC (International Terrestrial Cable) licenses. In addition, the Government is issuing 3G/4G/LTE and VSP (VoIP Service Provider) licenses, and has also decided to issue alternate submarine cable licenses. So far the alternate submarine cable licenses are not issued, the ITC will be used as its redundant.

All IP based telecom infrastructures in **Bangladesh** are routing their data through IIG (International Internet Gateway). IIG is the authorized licensee for providing IP bandwidth to the IP based ANS Operators. Initially there were two IIGs in Bangladesh; 36 more were later approved. Now, it is expected that there will be more IP based facilities available to the public at large resulting in more data penetration; simultaneously a highly competitive market will be ensured.

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<sup>34</sup> Document [1/INF/41](#)



ISPs and IPTSPs obtain bandwidth from IIG. Per the IPTSP Guidelines, the pre-condition for obtaining an IPTSP license is to have an ISP license.

The BWA licensees were awarded spectrum by the Commission to provide WiMAX services in the 2.3 GHz and 2.5 GHz spectrum bands. The licensee is authorized to develop and operate a broadband network to provide nationwide BWA services based on IEEE802.16e standards. The operators and end users are allowed to use their equipment in fixed locations with full mobility function at their choice. BWA licensees do not require a separate ISP license. BWA operators are connected to IIGs to handle data traffic.

ISPs are allowed to provide fixed WiMAX services by using IEEE802.16e standard equipment provided that, among other things, the Mobility License Key of the equipment shall be disabled and the Foreign Agent (FA) and the Handover Agent (HA) shall not be established in the core network. Additionally, Cellular Mobile Phone Operators provide mobile Internet services using Enhanced Data Rates for GSM Evolution (EDGE) and Global Packet Radio Service (GPRS) technologies.

There are Licensing Procedure Regulations issued in 2004 for IPTSP and BWA licenses. There are no guidelines for ISP licenses. Other regulatory mechanisms are renewal and amendment of license. For violation of any provision of the **Bangladesh** Telecommunication Regulation Act, 2001 (Act, 2001), any Regulations promulgated under the Act, 2001, license, permit, direction or directive of the Commission by any licensee, the Commission has the authority to suspend or cancel the license with the approval of the Government. The Commission also retains power to issue an injunctive or enforcement order. For recovering outstanding dues, if any, the Commission may initiate certificate cases. To prevent crimes in relation to telecommunication the Commission may lodge criminal cases in the Courts of law.

Contribution to the national economy of **Bangladesh** from IP based telecommunication service, is remarkable. For the period of July, 2011 to 04 April, 2012 the IP telecommunication service providers paid in total BDT 9,13,82,626.40 (=USD 1,124,847.69) to the Government. Out of this amount BDT 1,77,58,730.00 (=USD 377,886.8928) was paid by the ISPs, BDT approximately 1,20,20,000.00 (=USD 147,956.6715) was paid by the IPTSPs and BDT 6,16,03,896.40 (=USD 758,295.1304) was paid by the BWA licensees. (USD 1 = BDT 81.24)

IP telecommunication services have had a huge impact on the social conditions of **Bangladesh**. Almost all public offices have their own websites; so, any kind of information regarding government offices can be obtained through a website. Bangladesh has introduced e-education, tele-medicine / e-health, video conferencing, e-agriculture, e-tendering etc. systems both in the urban and rural areas and it helps people to develop their socio-economic conditions. Huge awareness is increased in each and every sector especially in agriculture and health.

Tele-density is more than 60.9 per cent, internet penetration is more than 18 per cent, the number of telecom subscribers is over 86 million, number of internet users is more than 26.44 million and the per year internet user increase rate is 70 per cent. In 2009–10 data penetration was approximately 12 per cent; in 2010–11 it was approximately 14 per cent, and in 2011–12 it was roughly 18 per cent. As per the Millennium Development Goal (MDG) at the end of 2015 it is expected to be 30 per cent.

## 6.2.2 Conclusion

Because of decrease of the bandwidth price, data penetration and the rate of internet users is increasing rapidly. IP service providers are trying to maintain quality of service (QoS) as directed by the Commission, however due to the lack of expected data penetration and rate of users, the quality of service (QoS) cannot be ensured by the IP service providers. For the same reasons, the Commission cannot force such service providers to ensure QoS. Nevertheless, as has been noted in this document and discussion above, the socio- economic impacts of IP-based communications are very positive in **Bangladesh**. The country is now ready to accept any kind of next generation IP-based technology.



## 6.3 IP telecommunication networks, services and applications in Cameroon

### 6.3.1 Overview

The telecommunication/ICT landscape in **Cameroon** is dominated by three main franchise operators, the incumbent telecommunications operator CAMTEL, and the mobile operators MTN Cameroon and Orange Cameroun. More than 60 registered Internet access and service providers (ISPs/ASPs), including the incumbent operator CAMTEL and the Internet subsidiaries of the mobile telephone operators, are also present in Cameroon's telecommunication/ICT market.

CAMTEL has a monopoly on the fixed telephony segment of the market and since its establishment in 1998 has provided basic telephone services (fixed line telephony, fax, telex, and so on). In 2005, with the roll-out of the new "CTphone" network, CAMTEL also started to offer a new telephone service based on the CDMA standard, in addition to its basic telephone services and as part of the deployment of local telephony.

From the time the wireless telephony operators entered the Cameroonian market (in 1999 in the case of Orange, 2000 in the case of MTN) until 2005, they operated mobile networks based on the GSM standard to provide mainly voice and SMS services. In 2006, they upgraded their GSM core networks to GPRS in order to develop new services such as multimedia messages (MMS) and Internet. During 2008, 2009 and 2010 they progressively incorporated gateway media and MSC servers in their core networks with a view to the migration of their telecommunication networks to IP-based networks.

The Internet market segment has experienced fairly consistent growth since the liberalization of the telecommunication sector in 1998. The most commonly used Internet services are the web, site hosting, message services, forums and IP telephony. User access is affected via the public switched telephone network (PSTN) for low-speed connections, or by radio links (CDMA, WiMAX), specialized wired links (ADSL, ISDN), optical fibre and VSAT, for high-speed connections. All these services are made available to the public by the ISPs/ASPs operating the networks, mostly using IP-based equipment.

In 2010, the process of revising Law No. 98/014 of 14 July 1998 governing telecommunications in Cameroon and its implementing legislation, under way since 2007, was completed with the enactment on 21 December of three new pieces of legislation: Law No. 2010/013 governing electronic communications in **Cameroon**; Law No. 2010/012 governing cybersecurity and cybercrime in **Cameroon**; and Law No. 2010/021 governing electronic commerce in Cameroon. Work is under way to draw up the principle implementing texts. This first Law, which was drafted with due respect for the principle of technological neutrality, will be conducive to the emergence of new markets based on IP technology.

Since 2011, a study has also been under way to draw up a national strategy to migrate existing telecommunication networks to new-generation networks (NGNs). The study aims to encourage the principal players in the telecommunication/ICT sector to upgrade their networks to entirely IP-based networks.

Furthermore, in view to open the telecommunication/ICT sector to competition, the Government in 2011 decided to bring new players into the mobile telephony segment and to provide a technology partner for the incumbent operator CAMTEL. So far, the implementation of the government's decision led to the granting of a 3G license to a new operator in the mobile telephony marketplace called VIETTEL Cameroon.

### 6.3.2 IP telecommunication networks and associated services and applications in Cameroon

The architecture of telecommunication/ICT operators' networks in **Cameroon** incorporates, at the level of the core networks and transport elements, active IP-based systems. The main services and applications offered by these networks are voice communications, SMS, voice and multimedia messaging, and Internet browsing. In addition to these, value-added services (location services, prognostics, games, interactive kiosks) are also under development.

### 6.3.2.1 The incumbent telecommunication operator

The telecommunication network of the incumbent operator CAMTEL comprises the wired access network (copper cable and optical fibre), the wireless access network (satellite and terrestrial radio), the switching system, fibre optic links, and the international access system.

The copper cable network with a connection capacity of 173 002 pairs serves more than 93 towns and cities. It also provides ADSL in 27 localities and rural telephony in another 31 localities. Modernization is planned and will involve the regeneration and expansion of the copper cable access networks in potentially profitable areas (major towns), the introduction of optical fibre in the transport sections (splitters and subsplitters) of the access network, and the expansion of the ADSL network in other locations. The fibre optic access network comprises two fibre-optic metropolitan loops in Yaoundé and Douala which ensure interconnection of digital exchanges and high-speed connections for subscribers in those locations.

The satellite network comprises three earth stations at Yaoundé, Douala and Garoua. The wireless access network comprises one wireless (Internet connection) network covering urban centres, one CDMA network covering the country's ten regions, one VSAT network serving mainly rural areas, and one WiMAX network.

In order to provide telephone services, CAMTEL network's switching system uses local telephone exchanges -- both old- and new-generation digital technology. As regards the new-generation digital equipment, the core network comprises, for the CDMA network, two softswitches and three media gateways (MGWs) with a 500 000 line capacity that can be upgraded to 800 000; and, for the wired network, one softswitch, two media gateways and MSAN access units with a capacity of 10 000 subscribers. Two softswitches with MGWs and MSAN access units with a total capacity of 70,000 subscribers are being deployed in Yaoundé, 60 000 in Douala, and 20 000 ADSL lines, are being deployed to upgrade the core wired network.

As regards Internet services, the CAMTEL switching system has two access nodes to connect Cameroon's network to the international network, each one with international passbands of 155 Mbit/s, points of presence (PoP) and ADSL access multiplexers (DSLAM), two Internet access points for the CTphone network (CDMA), and one VSAT hub serving digitally enclaved areas.

At the national level, fibre-optic links include the trunk lines and optical loops established in urban areas. This wired backbone provides an STM16 capacity and comprises more than 5 000 km of optical fibre. Deployment of an additional 3 000 km of optical fibre is planned and will extend the national backbone network to all the administrative centres in the country's ten regions.

At the international level, CAMTEL has access to the SAT3 submarine cable which lies along the African coast and extends as far as Europe and Asia. CAMTEL is also a partner in the ACE (Africa Coast to Europe) project, a submarine cable system off the west coast of Africa which will connect the countries of Africa from South Africa to Morocco and beyond to Europe. In addition, the construction of new landing points for submarine cables (WACS, ACE, MAIN ONE) on the Atlantic coast is also planned as a means of boosting the country's capacity for access to global information highways.

A number of projects are also planned to improve the existing access network which does not currently allow broadband access, and to pursue migration of the core network to IP-based networks. These include the MORA (Access Network Modernization), CBN (Cameroon Broadband Network), and OBN (Optical Backbone Network) projects. Implementation of these projects will involve inter alia:

- migration of older-generation telephone exchanges to NGN hardware in order to allow deconcentration of backhaul nodes through greater proximity to areas of customer concentration;
- replacement of the two international transit centres with softswitches in order to respond more effectively to requests from national and foreign partners for signalling and new services;
- acquisition of platforms for VoIP and IPTV services, creation of several high-capacity points of presence (PoPs) for provision of Internet access and IP-VPN service to interconnect enterprises and administrative authorities;

development of an IP-MPLS network based on fibre-optic trunk transmission links and on the Douala and Yaoundé fibre-optic loops.

### 6.3.2.2 Mobile telephony operators

The mobile telephone operators' networks comprise switching, transmission, radio, operating and maintenance subsystems. They rely on IP-based equipment in the core and transport networks. The main services and a number of optional or complementary services offered to subscribers by these wireless telephony operators are listed below:

- basic telephony, fax, data, roaming, GPRS;
- web browsing, WAP browsing and downloading;
- MMS mobile-to-mobile, MMS to e-mail;
- monitoring, loading and transferring call credit using USSD codes;
- ISDN functions (CLIP, CLIR, CUG, CCF, CW, call holding, and so on);
- alert messages, voice messaging, SMS, voice SMS and voice servers;
- backup/restore subscribers' contacts.

The Orange Cameroun network's core and transport networks migrated to NGN architecture during the period 2008, 2009 and 2010. The core network level incorporates the following IP-based components:

- 3 MSC-Ss (mobile services switching centres-servers, NGN version), comprising two active MSC-Ss and one backup capable of taking over from either of the other two;
- 9 MGWs (media gateways);
- 2 ngHLR (new generation home location registries).

Between 2009 and 2010, the main developments in the core network were the upgrading of the ngHLR software and the expansion of the core network's capacity to 7 million subscribers.

The transport level comprises an IP-MPLS backbone linking the country's two biggest cities (Yaoundé and Douala) via Bafoussam and the northern part of the country via Garoua and Maroua. This IP-MPLS backbone is based on radio relay transmission links and level P (provider) and PE (provider edge) IP routers for routing and quality of service management. In 2010 the main developments in the backbone were the upgrading of the IP-MPLS backbone to SDH(1+1) on certain trunk transmission links, migration of voice streams, signalling, data and maintenance to IP-MPLS, and the creation of a VSAT backup for the IP-MPLS backbone.

Orange Cameroun's radio subsystem comprises 31 BSCs (base station controllers), 1 041 BSTs (base transceiver stations) and 11 127 TRXs. The operating and maintenance subsystem is organized around control exchanges which include N2000 components to control the IP backbone routers.

The MTN Cameroon core network and transport network partially migrated to NGN architecture during 2009. The active elements in the core include the following IP systems:

- 4 MSC-S (mobile services switching centres – servers, NGN version), which coexist with the older generation non-NGN MSCs;
- 6 MGWs (media gateways);
- 2 SGSN/GGSNs (serving GPRS support nodes/gateway GPRS support nodes).

The transport level consists of an IP-MPLS backbone based on radio-relay transmission links and level P (provider) and PE (provider edge) IP routers for routing and quality of service management.

The radio subsystem consists of 14 BSCs (base station controllers), 1 064 BTSs (base transceiver stations) and 25 140 TRUs. The operating and maintenance subsystem is organized around control exchanges which include M2000 components to control the IP backbone routers.

### 6.3.2.3 Internet access and service providers

The networks of the Internet access and service providers comprise the WiMAX wireless local loops (WLLs), a number of point-to-point links established in areas not covered by the WLLs, VSAT stations and links leased from the incumbent operator CAMTEL for their urban and trunk traffic. These networks incorporate a number of systems based on IP (routers, Internet PoP, servers, and so on). The main IP telecommunications services and applications offered by these Internet access providers include VoIP, IPTV, IP-VPN, WebSMS and Faxmail.

### 6.3.3 Implementing IP telecommunication networks in Cameroon

In economic terms, there are a number of factors (including potentially reduced investment and operating costs, a wider range of services, and the convergence of technologies and services) that encourage operators based in **Cameroon** to upgrade their core and transport networks to IP-based networks. For these operators, moving to IP is also an opportunity to satisfy consumers' demands for services and to improve their own productivity. In technical terms, the major concerns in relation to the move to IP telecommunication networks and services are:

- quality of service (QoS) and security of communications, in particular the risks inherent in packet switching technologies based on IP (transport in connectionless mode for voice communications, unreliable packet delivery, loss of packets, security not guaranteed, etc.);
- reorganization of the current dialling plan in order to include IP numbers and, where appropriate, take account of these resources in addressing the question of number portability;
- interconnectivity of existing networks, which is affected by the transition from circuit mode to packet mode and may be subject to changes in the interconnection interfaces (physical interfaces and protocols) and procedures for metering and units used (call termination? Bill and keep?);
- licences, which under current regulations are service-based and technologically neutral.

The major challenges include the implementation of the high-speed governmental Intranet (GOVNET), e-services (e-government, e-health, e-commerce, e-learning, etc.), migration of IPv4 to IPv6, and the introduction of an Internet exchange point (IXP). Where this latter project is concerned, a feasibility study is under way in **Cameroon**. The implementation of this IXP will facilitate traffic routing between local operators and providers and help to reduce charges for communications and services that rely on IP.

## 6.4 Challenges in Sierra Leone

### 6.4.1 Overview

<sup>35</sup> **Sierra Leone** is a developing country situated in West Africa. Since the turn of the century there has been massive growth in telecommunication services in the country. Voice telephony services with special reference to mobile telephony have rapidly grown while fixed line services continue to decline. Data services also continue to grow though not at a similar rate. Access to the world wide web is exclusively via VSAT as **Sierra Leone** is not yet connected to a submarine fiber cable. Consequently, Sierra Leoneans endure slow speeds while surfing the internet. This is also seen to have a direct effect on foreign investment. However through a World Bank sponsored project the ACE (Africa Coast to Europe) fiber cable was expected to become operational in the second half of 2012.

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<sup>35</sup> Document [1/INF/24](#)

### 6.4.2 Ongoing Activities

In order to build growth in the **Sierra Leone** networks and link them robustly to the internet, the entire ICT infrastructure of the country has to collectively run IPV4 and IPV6 networks and also register the different networks with AFRINIC and use their ASN number.

To facilitate this, a week long workshop on IPV4 and IPV6 training was organized by ISOC, AFRINIC, and others. The following was highlighted:

- The network operators lacked technical persons in this area and most of the attendees were learning about the practical use of IPV4, IPV6 and BGP protocols for the first time. The demonstration network used helped fast track the introduction, but their respective networks/environment where running basic networking and the opportunity to further this was limited.
- All the networks then commenced the process of applying for their ASN numbers via AFRINIC.
- To bridge this gap, more training for network operator technicians is needed. A discussion forum of the participants of this training was established with the hope of nursing this embryo opportunity until the next training.

With training of the personnel, it is incumbent on the regulator to put adequate regulations in place. To this end an ICT policy was developed and launched in February 2011. This policy framed the discussion for technical, economic and regulatory conditions.

### 6.4.3 Main Issues

The main issues for the introduction and operation of IP networks in **Sierra Leone** are as follows:

- Investment in these areas is still largely foreign-direct investment that must recoup investment in time before a technology expires. Therefore the lines of development (spatially, in-terms of service and applications) are narrow.
- Leadership in the ICT sector is lacking. The vision to build on one project after another is missing. Networks are really about maintaining legacy ones and integrating new ones.
- Regulations have to be put in place. The focus should be on how it can secure new entrants with new technologies into the ICT arena against the urge for entrenched and legacy networks to keep the services and applications limited to only what they can offer. VoIP is becoming topical and thus the regulator has to manage this properly in order to maximize the benefits that can be gained from it.
- The monopolization of the international gateway. Fortunately, with the advent of the fiber cable the gateway will no longer be monopolized. The government will soon authorize a company to manage the fiber landing station. At the same time investors will be encouraged to invest in the company and buy shares. This will truly bridge the digital divide between **Sierra Leone** and the rest of the developed world.

### 6.4.4 Conclusion

Two networks in **Sierra Leone** launched 3G networks and a third operator is expected. One thing that is common to all these operators is the lack of trained local personnel working on these networks. There is an abundance of personnel for the legacy/GSM 2 and 2.5G networks. This highlights a point raised earlier about adequately trained personnel to work on them. This also of course bears directly on the costs of running such networks as expatriates would have to be brought in or money will have to be spent on training.

## 6.5 Broadband wireless connectivity project in Djibouti

ITU has engaged to support Djibouti to develop a broadband wireless network. The objective of this project is the establishment of broadband wireless connectivity and ICT applications that provide digital access to schools and hospitals and to underserved populations in rural and remote areas. More specifically, it plans to provide free or low-cost broadband to schools and hospitals in Djibouti and to develop ICT applications and services such as telemedicine and tele-education. If necessary, the network could also be used to provide applications such as IP telephony and IPTV (TV over the Internet using the Internet Protocol).

## 7 Conclusion

This final Report on ITU-D Question 19-2/1, adopted by the CMDT-10 for the fifth study period, deals with the implementation of IP telecommunications services in developing countries. It also examines the work carried out by the Rapporteur's Group for Question 19-2/1 during the study period 2010-2014.

The report highlighted the stakes, the challenges and associated opportunities, as well as important technical, socio-economic and policy issues that need to be addressed by developing countries in order to implement IP telecommunications services. In addition, the report provides the guidelines in order to answer these challenges and issues facing developing countries, including funding issues to invest in IP-based networks, numbering and addressing issues, the migration from IPv4 to IPv6, interoperability issues between IP-based networks and other telecommunication networks as well as how to provide the quality of service required by the users and to effectively protect the consumer's rights.

Moreover, given the fact that the year 2012 saw the implementation of IPv6 at the global level, it would be advisable that developing countries focus on the elaboration and implementation of their migration strategy from IPv4 to IPv6 and its consequences on regulatory and technological aspects.

## 8 Guidelines for Overcoming the Challenges

The following *Guidelines*, for overcoming the challenges and the issues identified within the framework of the study of Question 19-2/1, suggest a range of options that may be applied in diverse circumstances to assist ITU Member efforts to Implement IP Telecommunications services in developing countries. Members and others are encouraged to review these *Guidelines* and select those which will be useful in their domestic circumstances. Concepts of regulation that are inapplicable, or practices or solutions that are not suitable in one country may work well in another. We trust that this menu of choices will assist ITU Members and others to deliver a robust communications sector that is capable of providing benefits to all.

1. Political will and support are one of the critical points for countries to remove barriers and ease the implementation of IP telecommunication services. Therefore, countries should consider political will and support for creating an enabling environment for the development of IP services.
2. Existing regulatory regimes may be appropriate for traditional telecommunication networks/services but insufficient for new services. For this reason, review of the legal and regulatory regimes to identify the elements which may affect how IP networks and services develop in a country would be very important, especially for developing countries. Simplification of procedures and the requirements for licensing can also be considered. Moreover, regulatory certainty is another point which needs to be considered as it is very important to encourage long term plans and to provide a trusted environment for investing in IP telecommunication services. Therefore relevant authorities in developing countries need to make sure that they have rules and procedures that are technologically neutral, clear and open and guarantee a secure environment for investors, operators, consumers, etc.
3. Developing countries may encourage public/private partnerships to aid in funding to deploy IP network and services. Indeed, given the fact that funding constitutes an important barrier to access



to broadband and to the spread of e-services, like e-commerce, e-health, e-learning and e-government, public/private partnerships are one of the most important means for developing countries to secure adequate funding to deploy networks and services. In addition, developing countries should take incentive measures, especially in their legal framework, to attract more investment from abroad. To this end, governments can look to alternative funding sources such as donor or private investment funds to complement public funding.

4. Conditions in a country may vary. Therefore, countries should analyse the actual needs of the operators and consumers in implementing IP telecommunications services. For instance, countries may consider whether to promote unbundling of core and access networks or infrastructure sharing.
5. Deployment of IP networks and services requires IP addresses. Considering the fact that IPV4 addressing schemes are rapidly being exhausted, countries should facilitate the migration from IPV4 to IPV6 and prepare concrete plans and timelines in coordination with all stakeholders.
6. One of the weak points in IP telecommunication networks and services is the issue of quality of service. Therefore, countries should consider this issue and draw clear guidelines and set the minimum of quality of service parameters for operators and they should also inform consumers of these requirements. Specifically, it is recommended that administrations should include the QoS obligations in their IP communication policies and related licenses for the benefit of consumers. It is also noted that network efficiency and cost should also be taken into consideration.
7. IP telecommunications services require E.164 numbering resources. Therefore, countries need to evaluate their national numbering plans and usage of various numbering resources, particularly geographic numbering resources, for IP services and scarcity of the resources needs to be evaluated for future use. Assigning numbers similar to the current PSTN numbers and to require number portability may be advisable.
8. The Q19-2/1 survey shows that developing countries need know-how and skilled human resources. Therefore, in order to increase human capacity in the relevant fields, various information sharing and training opportunities (international resources, experiences of developed countries etc.) should be sought.
9. Countries should set clear guidelines and rules to protect consumer rights and also raise consumer awareness about new IP services. These guidelines should take into consideration all UN guiding principles and rules related to the consumers protection especially for children, youth, disabled people, etc.
10. Privacy and security of communication in IP environment are very hot points and people usually do not trust the IP medium when it comes to data protection and privacy of communications. Therefore, relevant measures (both technical and regulatory) should be taken.
11. As deploying of critical infrastructures is costly especially for new entrants, infrastructure sharing is very crucial to lower the cost of deploying broadband network. Therefore, clear rules should be defined for infrastructure sharing and proper implementation (especially by the incumbent) should be observed by the NRAs in a country.
12. New IP-based wireless services including WiMAX, Wi-Fi and 3G offer new opportunities for improving universal access. Therefore, it is necessary that developing countries take some steps in order to allow operators other than the fixed incumbent operators to participate in the task of providing universal service. But it should be carefully analysed so that this should not threaten the economic viability of relevant services and negative impact on network expansion.
13. To foster social and economic development, developing countries should create strategies and policies to encourage the use of IP applications and services by all their citizens and with affordable costs, notably E-government, E-commerce, E-learning, E-health, etc.
14. Interconnection between existing and IP networks has to be dealt properly by the National Regulatory Agencies (NRAs) of Developing countries given the fact that the transition from the

circuit-switched mode to the packet-switched mode impacts the interconnection's count modalities (Call termination, Bill and Keep) and interfaces (physical interfaces and protocols). As a result, within the framework of regulation, the NRAs have to continue with the analysis of different aspects of Interconnection between the existing PSTN /TDM and IP-based networks.

15. Developing countries are encouraged to implement Internet Exchange Points (IXP) to facilitate routing of local traffic amongst operators and ISP/ASP, and to reduce the rates of IP-based communications services.



## **I. Annexes**

**Annex 1: Questionnaire on ITU-D Question 19-2/1: Implementation of IP Telecommunication Services in Developing Countries**

**Annex 2: Results of the Survey**

**Annex 3: Composition the Rapporteur Group for Question 19-2/1**

**Annex 4: Reports of the Rapporteur Group Meetings for the study period 2010-2014**

## **II. Glossary**

## **III. References**



## **Annex 1: Questionnaire on ITU-D Question 19-2/1: Implementation of IP Telecommunication Services in Developing Countries**

Question 19-2/1 (Implementation of IP telecommunication services in developing countries) is expected to describe:

- The potential challenges, benefits and opportunities that developing countries encounter when implementing IP networks, services and associated applications;
- The technical, economic, and regulatory conditions necessary for developing countries to implement IP technologies, services and associated applications; and
- The main issues raised by the operation of IP networks and IP services, and associated applications, such as economic impact and possible regulatory frameworks.

Expected outputs for this question are:

- 1) Annual progress reports indicating the status of IP applications;
- 2) At the end of the study period, a detailed final report addressing all the issues raised in the Question as well as lessons learned/success stories/conclusions; and
- 3) Guidelines for overcoming the challenges identified.

During the first meeting of ITU-D Study Group 1 for the fifth study period, held from 20 to 23 September 2010, the Rapporteur's Group on Question 19-2/1 recognized the need to compile the latest information about the status of IP telecommunication networks, services and applications from various aspects (technical, regulatory, economic, social etc.) and to get views/opinions on the issues addressed by Question 19-2/1 through a questionnaire to be sent to ITU Members.

Please read the guidelines below before answering the questionnaire. As your contributions are very important for the success of this study, please answer the questions in detail as much as you can.

### **GUIDELINES IN ANSWERING THE QUESTIONNAIRE**

The questionnaire has 3 parts:

In Part I, the main purpose of the questions is to get the latest information about the current status of IP telecommunications (IPT) networks, services and applications in a country along with the national strategies, policies, existing regulatory regime and approaches to IPT networks, services and applications. It is expected that the questions in this part will be answered by the Administrations.

In Part II, the aim is to learn the potential challenges, benefits and opportunities encountered when implementing IPT networks, services and associated applications along with the technical, economic and regulatory conditions necessary for developing countries to implement IP technologies, services and associated applications. Also, in the questions, it is intended to get views and opinions on the main issues raised by the operation of IPT networks, services, and associated applications, such as economic impact and possible regulatory framework. In Part II, questions are also intended to get information about the main issues raised by the operation of IPT services, such as economic impact and possible regulatory framework. These parts of the questions are addressed to the Administrations and Sector Members where relevant.

In Part III, it is expected from the countries to provide specific needs for training and expertise and also it is expected that the countries to share their experiences (country case studies) on IPT network, services and applications which could be useful for developing countries. Administrations and Sector Members are welcomed to provide their contributions for this part.

For each part, it is appreciated if you can provide the relevant documents (legislation, law, web site address, project description, etc.) or links to reach the documents if available online.

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**QUESTIONNAIRE**

**Name of your Administration:** .....

**Country:** .....

**Contact person:** .....

**Tel:** .....

**Fax:** .....

**Email:** .....

Please answer the following questions in detail as much as you can. You may attach a separate document in answering the questions.

**PART-I**

***(This part of the questionnaire is to be completed by Administrations only)***

**1) Do you have in your legislation the definition and scope of "IP telecommunication network", "IP services and/or applications".**

Yes

No

If yes, please provide the web site address where the relevant document can be found. If your answer is "no", please provide your perception and understanding on the given terms.

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**2) Which of the following describe your legislation best in terms of addressing the issues raised by IP telecommunication (IPT) network, services and applications? Please choose the most appropriate one for your country.**

There is a specific legislation governing IP telecommunication (IPT) network, services and applications

Existing legislation is based on the principle of technology neutrality so it is applicable to legacy and next generation networks/services.

Revision required in some areas (licensing, numbering, interconnection, quality of service, consumer issues etc.)

Other (Please specify below)

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**3) Do you have law/legislation which governs the access to IPT services by disabled people?**

Yes

No

If yes, please provide brief information and the link if the relevant document available online.

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**4) Do you have specific law/legislation which allow for providing VoIP services (please refer to the definition of VoIP made by ITU-T SG17)?**

Yes

No

If yes, please provide brief information and the link if the relevant document available online.

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**5) Do you have national plan and/or strategy for deployment of all-IP networks (overlay or replacement)?**

Yes

No

If yes, please provide the main points and the link for the document where it can be found.

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**6) Does your national regulatory authority encourage telecom operators to roll-out full IP-based network?**

Yes

No

If yes, please describe briefly how?

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**7) Do you have national strategy and/or plan for transition from IPV4 to IPV6? If yes, please provide the planned deadline for such transition.**

Yes (Deadline for transition :.....)

No

If yes, please describe the main point of the strategy and provide the link for documents available on the subject.

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**8) Do you have any survey conducted in your country which measures the market demand for IPT networks, services and applications and their availability in your country?**

Yes

No

If yes, please explain briefly the main results below and provide the document or the link if available online.

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**9) Do the operators in your country deploy or planning to deploy IP based networks?**

Yes

No

Please provide brief information on the status of IP based network deployment in your country.

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**10) Which of the following IPT services are provided in your country? Please provide brief information about the range of services provided.**

VoIP

IPTV

IP streaming

nPlay bundled services

E-services (e-government, e-health, e-commerce, e-learning others)

Others (please specify.....)

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**PART-II**

*(This part of the questionnaire is to be completed by Administrations and ITU-D Sector Members if relevant)*

**11) Which of the following challenges are the most significant for your country when implementing IP networks, services and associated applications?**

- Investment cost and lack of financial resources
  - Existing regulatory regime
  - Lack of established standards
  - Lack of expertise and experience on IPT
  - Lack of specific regulations to govern IPT
  - Lack of IXP (Internet Exchange Point)
  - Inter-operability between existing and IPT networks and services
  - Technology knowledge and skilled human resources
  - Quality of service
  - Trust and security for IPT networks and services
  - Others (please specify.....)
- 

**12) Which of the following benefits are the most significant for your country when implementing IP networks, services and associated applications? Please explain briefly.**

- Increased productivity
- Economic and social development
- Innovations
- Low cost in service provision
- Provision of new, converged and bundled services to the customers
- Accessibility of public services
- Economic and social development
- Others (Please specify...)

**13) Please describe the opportunities to be encountered when implementing IP networks, services and associated applications in your country.**

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**14) What are the technical, regulatory, socio-economic and policy issues that need to be addressed in your country in order to introduce/deploy IP networks, services and associated applications?**

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**15) What are the main issues raised in your country by the operation of IP networks, services and associated applications, such as economic impact and possible regulatory frameworks?**

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**16) Is there any IXP (Internet Exchange Point) in your country?**

Yes

No

If yes, please provide brief information about the success factors particularly impact on internet prices and the link if the relevant document available online.

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If no, is there any plan to establish it? what is the effect of unavailability of IXP on Internet prices? And what are the conditions necessary to implement an IXP in your country?

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**PART-III**

*(To be answered by both Administration and Sector members, if relevant)*

- 17) Could you share your countries' experiences (best practices, success stories, lessons learned) on IPT network, services and applications which could be useful for especially developing countries?**

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- 18) Training needs: Please list the 5 most critical areas where your country needs trainings (seminars, workshops, etc.) in order to introduce or to foster the use of IPT services. Being as specific as possible will help ITU to seek ways to provide the required trainings**

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- 19) Expertise needs: Please list the 5 most critical areas where your country needs expertise. Being as specific as possible will help ITU to seek ways to provide the required expertise**

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- 20) Other comments**

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Thank you.

## Annex 2: Results of the Survey

### 1. Introduction

In order to compile the latest information about the status of IP telecommunication networks, services and applications in various countries and to understand associated technical, regulatory, economic and social challenges as well as to get views/opinions on the issues addressed by the Question 19-2/1, a draft questionnaire was prepared by the Rapporteur and Vice-Rapporteur for Question 19-2/1. After discussion, it was adopted by the Rapporteur's Group in its meeting in 9 May 2011. Subject questionnaire was sent to relevant ITU members. Answers to the survey received from 9 developed countries, 6 transition countries, 22 developing countries and 4 least developed countries (31 July 2011). Preliminary analysis of the survey is provided below.

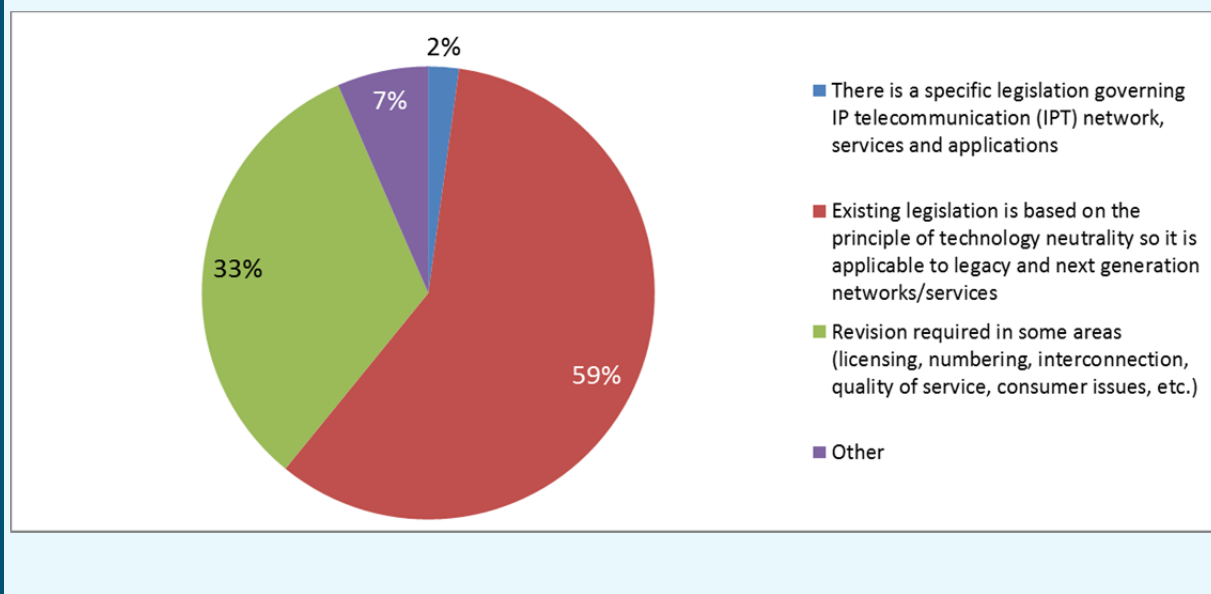
### 2. Preliminary analysis of the answers to the survey

Responses to the questionnaire on Question 19-2/1, attached as **Annex 1**, were received by 41 countries: 9 developed countries, 6 transition countries, 22 developing countries and 4 least developed countries. **Annex 2** provides the overall statistics prepared by BDT based on the answers received. In order to provide some insight into the answers received, below is a summary of some of the main points of the survey result.

#### 2.1 Definition and scope of "IP telecommunication (IPT) network", "IP services" and/or "IP applications"

Regarding the question on definition and scope of "IP telecommunication (IPT) network", "IP services" and/or "IP applications", developed countries stated that specific definitions of the given terms are not available as they have technologically neutral legislation which covers all kinds of technology including IP based technologies. On the other hand, one third of developing countries and least developed countries provided their answer as "yes" giving some reference to their legal documents on the issue.

In general, the perception and understanding of the countries on the given terms are very similar. For instance International Telecommunications Users Group (INTUG) provided its understanding as *"IP telecommunication network means a network using the Internet Protocol (IP) and IP addressing for communication. "IP service" means a service available using an IP telecommunications network. "IP Application" means an application accessible via an IP telecommunications network.* The majority of the countries who responded to questionnaire stated that their existing legislation is based on the principle of technology neutrality so it is applicable to legacy and next generation networks/services. On the other hand, some of the countries stated that a revision is required in some areas (licensing, numbering, interconnection, quality of service, consumer issues etc.) on the issue (see **Figure 1**).

**Figure 1: Status of legislation with respect to IP telecommunication networks/services**

## 2.2 Laws/legislation on access to IPT services and VoIP

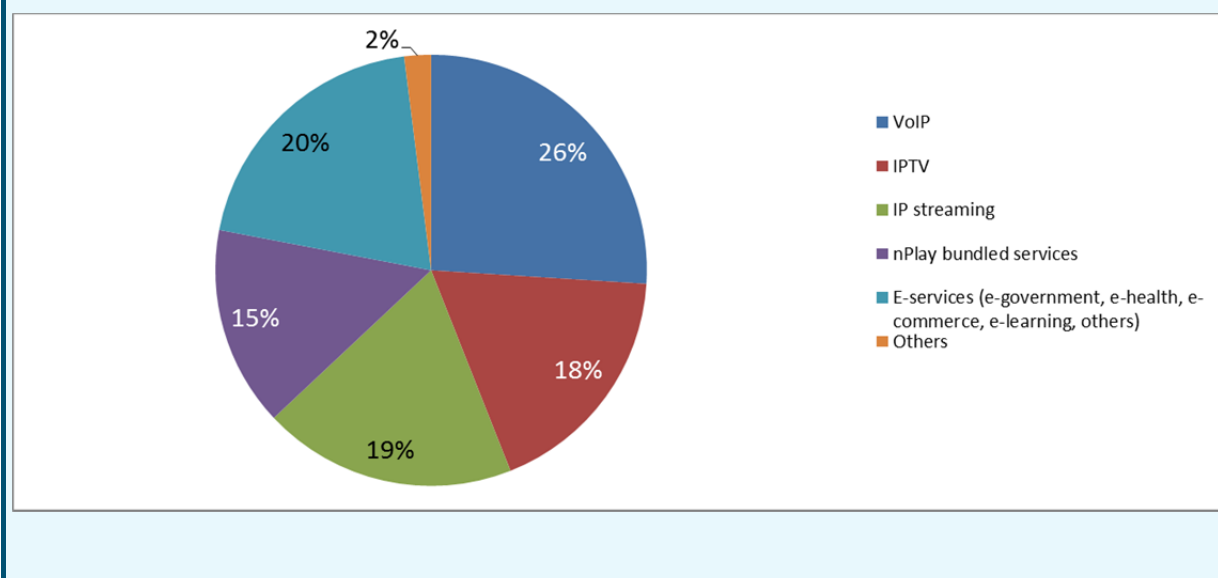
Regarding the existence of the laws/legislation in the different countries who responded to the survey which govern the access to IPT services by disabled people, from the 39 answers received, only 5 of them stated that their legislation has provisions regarding access to IPT services by disabled people. Concerning the question which sought to understand if there were specific laws/legislation in place which allow for providing VoIP services, from the 39 answers received, 16 of them generally stated that VoIP is allowed by legislation. In some countries, like Tonga, although it is not explicitly stated in the law, VoIP services are provided by the operators. The majority of countries who responded to the questionnaire stated that they have a national plan and/or strategy for the deployment of all-IP networks and that the national regulatory authority encourages telecom operators to roll-out full IP-based networks. For instance, in Latvia, the government has decided to co-finance the deployment of optical backhaul in rural areas. Furthermore, most of the countries stated that the operators are deploying or planning to deploy IP based networks.

## 2.3 National strategy and/or plan for the transition from IPV4 to IPV6

Concerning the national strategy and/or plan for the transition from IPV4 to IPV6, from the 38 answers received for this question, 13 of them stated that they have a plan to guide them in the transition to IPV6. For instance, the Czech Republic stated that the deadline for transition is 01/01/2011, Viet Nam stated that their deadline is 31/12/2020 and Turkey stated 31/08/2013 as their transition deadline.

## 2.4 Types of IPT services provided

With regards to the broad range of IPT services provided in the countries, in accordance with received responses, the main services provided in the countries are VoIP, e-services such as e-Government, e-Health, e-Commerce, e-Learning, IP streaming, IPTV and nPlay bundled services (see **Figure 2**).

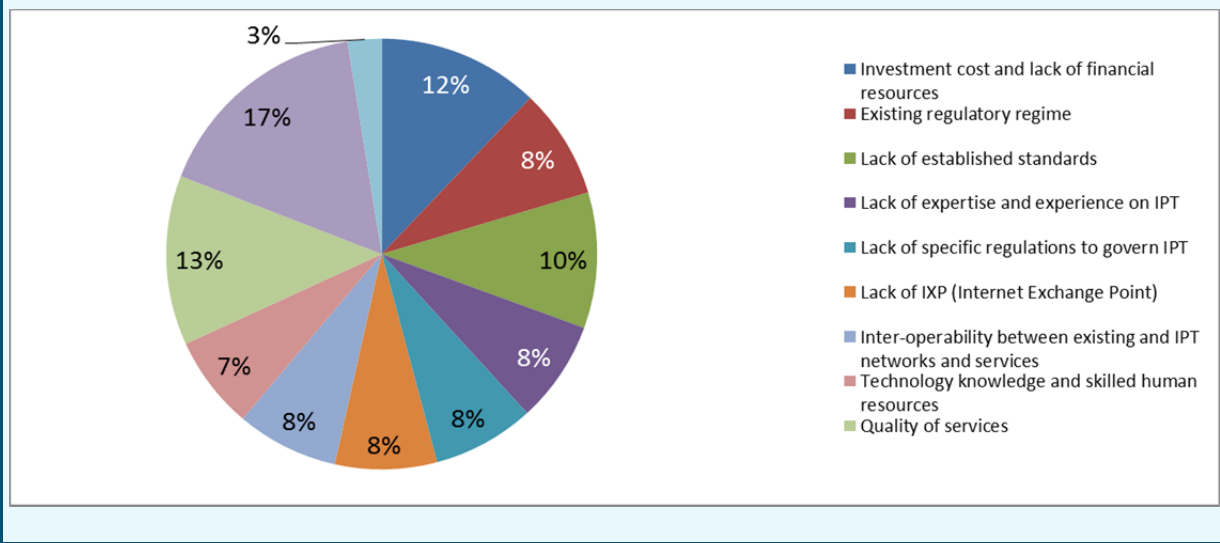
**Figure 2: IPT services provided in the countries**

## 2.5 Challenges faced by the countries in rolling out IP networks

The survey further showed that the challenges which are most significant for countries when implementing IP networks are the following. Note that these are listed with the most significant challenges first and the less significant challenges last in the list:

1. Trust and security for IPT networks and services
2. Investment cost and lack of financial resources
3. Quality of service
4. Lack of established standards
5. Existing regulatory regime
6. Inter-operability between existing and IPT networks and services
7. Lack of expertise and experience on IPT
8. Lack of specific regulations to govern IPT
9. Lack of IXP (Internet Exchange Point)
10. Technology knowledge and skilled human resources
11. Further details can be found in **Figure 3**.

**Figure 3: Challenges when implementing IP networks**

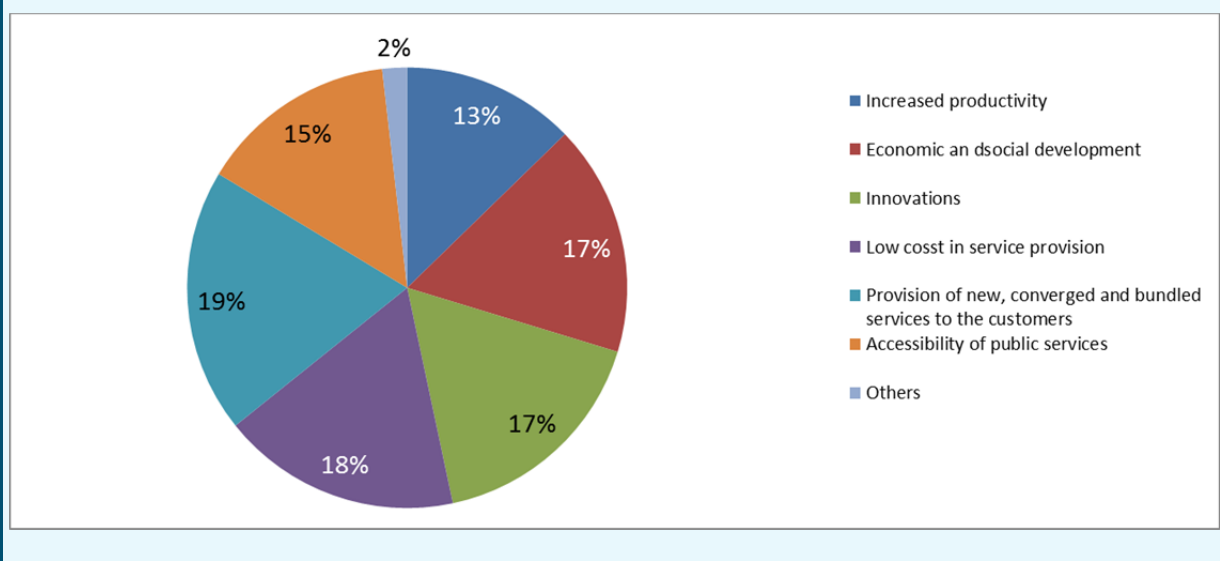


## 2.6 Benefits and opportunities related to the implementation of IP networks

Regarding the benefits which are most significant for the countries when implementing IP networks the following benefits were mentioned (further details can be found in Figure 4). Note that these are listed in order of significance.

1. Provision of new, converged and bundled services to the customers
2. Innovations
3. Economic and social development
4. Low cost in service provision
5. Accessibility of public services
6. Increased productivity

**Figure 4: Benefits of implementing IP networks**



As for the opportunities to be encountered when implementing IP networks, services and associated applications in the countries, various issues are mentioned by the countries as opportunities. They include the following:

- Employment opportunities
- Infrastructure development
- Innovation
- Increased productivity
- Ease of expansion and upgrading of the network
- Greater availability of advanced services
- Lower costs of network development, lower service cost
- Faster access and collection of information

## **2.7 Issues to be addressed in order to successfully introduce IP networks, services, and applications**

Regarding question on the technical, regulatory, socio-economic and policy issues that need to be addressed in a country in order to introduce/deploy IP networks, services and associated applications, some of the countries stated that the regulatory frameworks to govern the implementation of IP networks, services and associated applications have to be put in place, including the issue of interoperability between the legacy network and the all IP network. In addition to these, human resource development and capacity building are stated as the issues to be addressed.

Concerning the main issues experienced in a country with the introduction and operation of IP networks, services and associated applications, various issues have been stated by countries. For instance, the main issues raised in Tonga were noted as being the unavailability of a regulatory framework and the quality of services provided to the general public. Montenegro stated that the main issue in the country is the shared use of underground ducts and global Internet access. For Eritrea, the main issues noted are the high prices and the latency of the existing IP network, as well as inadequate capability and experience of the young engineers. They further noted the need for longer training on high-end software.

The International Telecommunications Users Group (INTUG)<sup>1</sup> stated that the major challenges affecting most regions/countries are the following:

- Cost models used for determining regulated prices for significant market power (SMP) operators;
- Progressive elimination of fixed and mobile termination rates;
- Transparent traffic management rules to prevent discriminatory network prioritization;
- Spectrum allocation processes (avoiding stealth taxation through auction fees); and
- Establishing and sustaining open competition in wholesale and retail markets.

## **2.8 Impact of Internet Exchange Points on internet prices**

In order to better understand the impact that the existence of IXP (Internet Exchange Point) have on demand and on internet prices, countries are asked whether they have an IXP in their country and if this

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<sup>1</sup> INTUG is an international association of business users of telecommunications, bringing together national and multinational user associations throughout the world. They have members and contacts in all five continents.

has an effect on internet prices. From the 38 answers received, 23 of them stated that they have IXP in their countries. In Pakistan for instance, there is no IXP, however operators and ISP's have established interconnects with each other so local traffic can be routed locally, without the need to go to internet cloud and back and in this way increase costs.

## **2.9 Training needs in the countries**

Concerning the training needs of the countries in order to introduce or to foster the use of IPT services various areas are depicted by the countries. Some of them are as follows:

- Regulation of IPT services
- Implementation, administration and management of all-IP networks.
- Legal implications and policy issues of IPT.
- Transition from IPv4 to IPv6
- Allocation of IPv6 resources
- IP Interconnection
- IP QoS
- IP service licensing
- IP network security
- Billing for IP based voice services
- Internet regulatory policy



### **Annex 3: Composition of the Rapporteur Group for Question 19-2/1 — Implementation of IP telecommunication services in developing countries**

<b>Function</b>	<b>Name / Country</b>
Rapporteur	Mr Fabrice James Djoumessi Dontsa (Cameroon) from 2012 Ms Aysel Kandemir (Turkey)
Vice-Rapporteur	Mr Youcef Bouzar (Algérie Télécom SPA, Algeria)
Vice-Rapporteur	Mr Seyni Malan Faty (Senegal)
Vice-Rapporteur	Mr Rachid Outemzabet (Algeria)
Vice-Rapporteur	Mr Patrick Zeboua (Côte d'Ivoire)
BDT Focal Point	Mr Desire Karyabwite

## **Annex 4: Reports of the Rapporteurs Group Meetings for the study period 2010-2014**

The reports of the Q19-2/1 Rapporteurs Group meetings for the fifth study period are available at the link <http://www.itu.int/md/D10-RGQ19.2.1-R/>.

The reports of the Study Group 1 Q19-2/1 meetings are available at the link <http://www.itu.int/md/meetingdoc.asp?lang=en&parent=D10-SG01-R&question=Q19-2/1>

## II. Glossary

<b>3G</b>	Third Generation
<b>BWA</b>	Broaband Wireless Access
<b>CDMA</b>	Code Division Multiple Access
<b>DSL</b>	Digital Subscriber Line
<b>EoIP</b>	Everything over IP
<b>FTTH</b>	Fiber To The Home
<b>GPRS</b>	General Packet Radio Service
<b>GDP</b>	Gross Domestic Product
<b>HDTV</b>	High Definition Television
<b>ISP</b>	Internet Service Provider
<b>IP</b>	Internet Protocol
<b>IPT</b>	IP Telecommunications
<b>IPTV</b>	IP Television
<b>IXP</b>	Internet Exchange Point
<b>MMS</b>	Multimedia Messaging Service
<b>NGN</b>	Next Generation Network
<b>NRA</b>	National Regulatory Authority
<b>PSTN</b>	Public Switched Telecommunication Network
<b>QoS</b>	Quality of Service
<b>RFID</b>	Radio Frequence Identification
<b>SMP</b>	Significant Market Power
<b>TDM</b>	Time Division Multiplexing
<b>VoB</b>	Voice over Broadband
<b>VoIP</b>	Voice over IP
<b>WTDC</b>	World Telecommunication Development Conference
<b>WTSA</b>	World Telecommunication Standardization Assembly

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