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TELECOM REGULATORY AUTHORITY OF INDIA
NEW DELHI

CONSULTATION PAPER ON INTRODUCTION OF INTERNET TELEPHONY

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Preface

1. The TRAI provided its recommendations for opening up of International long distance services wherein use of VOIP Technology for carrying International Traffic has been envisaged. There is a close link between some of the policies relating to VOIP and the issue of Internet Telephony. Regarding Internet Telephony, the New Telecom Policy 1999 stipulates that, " The Internet telephony shall not be permitted at this stage. However, the government will continue to monitor the technological innovations and their impact on national development and review this issue at an appropriate time". The Government has sought TRAI's Recommendations regarding opening up of the Internet telephony in the country and this Consultation paper has been prepared to assist the Authority in that process.

2. This paper presents the global scenario regarding Internet Telephony and gives the background on various policy/regulatory issues relating to it. The paper brings out the distinction between Internet Telephony and VOIP, the two variants of IP Telephony. Each Section of the paper ends with a series of questions that need to be addressed by TRAI before the recommendations to be provided to the Government are finalized. The main objective of this paper is to solicit informed views of the various stakeholders including Service Providers, Consumers, Consumer Organizations and others interested in the subject. The issues will be deliberated upon during the Open House

Consultations planned to be held in the next two months. This paper is also available on TRAI's Web site (www.trai.gov.in).

3. Since the Recommendations to the Government are to be made in a time-bound manner, we would like to have the comments and views on any or all issues raised in this paper on or before 15th December 2001. Submissions in the electronic form would be appreciated. For further clarifications, Shri S.N. Gupta, Adviser (Converged Network Division), TRAI may be contacted on telephone number: 6167914, fax number 6103294 or e-mail trai13@bol.net.in.

M. S. Verma
Chairman

New Delhi
23rd November, 2001

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Glossary of Terms used

Bandwidth: The rate, measured usually in bits per second, at which data can be carried through a transmission circuit.

Best Effort: The service model for the standard public Internet service. In the face of congestion of a network interface, packets are discarded without regard to user or application until traffic is reduced (no guarantee).

BSO: Basic Service Operator

Circuit Switched Connection: A temporary connection that is established on request between two or more stations in order to allow the exclusive use of that connection until it is released.

CMSO (Cellular Mobile Service Operator): Also known as Mobile Telecom Operator.

CPE (Customer Premises equipment): Equipment at the end user's premises; may be provided by the end user or the service provider.

Gateway: A system for providing access from one network to another network. (Like from PSTN to VOIP network and vice versa).

ILDO: International Long Distance Operator

IP: Internet Protocol (A packet switching protocol used in public Internet and private networks).

Internet backbone: The high-speed, high capacity lines or series of connections that form major pathways, to carry aggregated traffic within the Internet.

Internet Service Provider (ISP): ISPs provide Internet access to end users.

Internet Telephony: The transmission of voice over the Public Internet.

IP telephony: A generic term for the transmission of voice over Internet Protocol Networks including Public Internet and Managed Private and Public VOIP networks. (It covers both the voice transmitted over managed IP network & over Public Internet).

Jitter: Time related abrupt, spurious, variation in the duration of any specified related interval. This is also known as Delay variance (random variability of delay).

Latency: The time, expressed in millisecond, taken for a signal element to pass through a device/network.

Leased Line: A leased line is the transmission capacity reserved for the exclusive use of a customer. It is also referred to as a dedicated, private line or non-exchange line.

MOS (Mean Opinion Score): It is a subjective measurement of voice quality. It is derived from an evaluation of various pre-selected voice samples over different transmission media, replayed to a mixed group of men and women, who rate them from 1 (worst) to 5(best). Scores are then weighed to derive a single MOS score rating. An MOS of '4' is considered 'Toll Quality' voice.

Network Access Point (NAP): Point at which the dedicated Internet backbone lines are accessed. (A point at which ISPs connect with one another. NAPs serve as data interchange points for backbone service providers. NAPs and Metropolitan Area Exchanges (MAEs) are generally known as public Internet exchange points (IXPs) in USA.

NLDO: National Long Distance Operator

Packet: An information block identified by a label at layer 3 of the OSI reference model of seven layers (A packet of data bits).

Packet-Switching: The function of handling, routing, supervising and controlling user packet data, as required (by router or a data switch).

Point of Presence (PoPs): A Point of Presence is a node offering users dial-up access to the Internet via a specific access number.

Protocol: A set of formal rules and specifications describing the procedure to transmit data across a network.

PTO:- Public Telecommunication Operator (Facility Based Service Provider)

Quality of Service (QOS): It is the main indicator of the performance of a telephone network and of the degree to which the network conforms to the stipulated norms. The subscriber's perception of the Quality of Service (QOS) is determined by a number of subjective tests such as MOS.

Router: Specialized computers that take incoming packets compare their destination addressed to internal routing tables and depending on routing policy, send the packets out to the appropriate destination. This process is carried out by each router enroute till the datagram packets reach their destination.

Infrastructure Provider: An entity that supplies underlying transmission capacity for sale or lease and either uses it for providing services or offers it to others to provide services.

Throughput: The number of data bits contained in a block which are successfully transferred per unit time in one direction across a network section.

Transmission Control Protocol/Internet Protocol (TCP/IP): The suite of protocols that defines the Internet procedures and enables information to be transmitted from one network to another.

Voice Over IP (VOIP): The transmission of voice over circuits employing Internet Protocol. It denotes a type of IP telephony technique where transmission is primarily over private, managed networks (in contrast to public Internet).

Consultation Paper on Introduction of Internet Telephony

CONTEXT AND STRUCTURE OF THE PAPER:

This paper addresses various issues relating to the introduction of Internet Telephony, which is at present not permitted in India. The Government has referred the issue of opening up of Internet Telephony in India to TRAI, and has sought its recommendations on the subject. (Annexure "A"). A subsequent communication from the Ministry of Communications clarifies that recommendations of the expert committee as in Annexure "A" are not the decisions taken by the Govt.

TRAI has established a process of transparent consultation with stakeholders and others before formulating it's views on such policy issues, brought out in a consultation paper. Accordingly, this paper aims to bring out all major techno-economic as well as regulatory issues relating to Internet telephony. The focus of this paper is to bring out the main regulatory issues relating to the Internet Telephony. It also briefly discusses issues relating to the so called 'Digital Divide'.

Chapter 1 gives the background and the present policy regime. Chapter 2 provides information on the Global Scenario pertaining to Internet telephony. Chapter 3 deals with the Technical issues and Chapter 4 with problems relating to fixing QOS standards for Internet Telephony. Chapter 5 and 6 deal with various licensing, regulatory and economic issue. Chapter 7 deals with the issues relating to 'Digital Divide'.

At the end of each chapter a number of issues have been brought out for discussion and comments from various stakeholders are solicited.

CHAPTER-1

BACKGROUND

1 NTP 99

The New Telecom Policy 1999 (NTP 99) stipulates targets in terms of establishing telecommunication networks with a view to achieve tele-density targets. The NTP 99 also stipulates targets for providing Internet access to all district headquarters by the year 2002. For Internet Telephony, NTP 99 states that this service will not be permitted at this stage, but the Government will continue to monitor the technological innovations and their impact on national development and review this issue at an appropriate time. Since 1995,a number of countries have permitted VOIP as a technology option to the classical PSTN as well as Internet Telephony to provide a cheaper alternative to classical PSTN calls. There is considerable demand for opening up of Internet Telephony in our country also, by the users, who expect to be able to make long distance calls both within the country and internationally at the cost of a local call.

2 Difference between Internet Telephony and VOIP

There appears to be general lack of clarity among many users regarding the difference between Internet Telephony and VOIP. Both Internet Telephony and VOIP are covered by the expression 'IP Telephony'. Internet Telephony is a service and is thus a licensing issue. In other words it would involve giving permission to the Internet Telephony Licensee to offer voice services to its subscribers through the Public Internet. The existing ISPs are providers of data communication and information services. As per the existing terms and conditions of their licence, they do not have carrier rights and are classified as a Value Added Service Provider. On the other hand VOIP is a technology issue. In a number of countries

managed VOIP network are deployed by carriers as an alternative to classical PSTN.

3 Stipulations in the ISP License regarding telephony

The Government has issued around 480 licences to various categories of ISPs out of which 140 have started their operations. According to the ISP licence agreement, “Telephony on the Internet is not permitted. The licence will be liable for termination for any violation of this clause of the licence agreement. The licencee shall also take measures on his own and as and when directed by the Government at his own cost to bar carriage of telephony traffic over Internet.” Thus the existing ISPs are offering pure data service to their 3.5 million subscribers.

4 The existing guidelines for long distance operators

The Government of India has come out with policy guidelines on NLD Operations and the licences are under issue to some of the operators. The licence grants the NLD Operators the long distance rights for carriage of voice traffic. It also stipulates that the technology to be used for carriage of the long distance voice traffic is to be based on a switched bearer service. In case Internet Telephony is permitted as a service, using the public Internet, a review of the current policy and regulatory regime in respect of the NLD Operators would be required since such a relaxation will mean bypass of NLD network through the public Internet. It may have a bearing on the projected revenues of the NLD Operators.

Presently, BSNL (a Govt. PSU) is the only NLDO in the country and two more private operators are likely to be licensed shortly. It can be argued that for the development of transmission infrastructure and facilities in the country, the rights of these operators need to be protected within a consistent policy framework. Also after six years of opening up of Basic Telephony, private operators have started service only in six circles, in a few SDCAs. Licences for the remaining circles are being

issued shortly. This means that basic service liberalization is also in its nascent stage, and will need some more time before it matures. Introduction of Internet Telephony is likely to affect their business case as well.

International Long Distance Telephony is the monopoly of the incumbent operator VSNL and is slated to open up in April 2002. The government have accepted TRAIs recommendations permitting deployment of VOIP in the ILDOs network while opening up of international long-distance Telephony.

Issues for consultation in this context are:

1a) Does the introduction of Internet Telephony help achieve any or some of the policy objectives outlined in the NTP 99? If so, how?

1b) In case Internet Telephony is permitted, whether it should be through the present ISPs? If so, will the ISPs, then be regulated as a Value Added Service provider or as an operator of a Public Telecom Service such as BSOs, MTO, CMSOs etc.?

1c) In case ISPs are permitted to offer Internet Telephony, will it necessitate some modifications in the terms and conditions of the existing operators such as BSOs, CMSOs, NLDOs, because of bypass of their network for voice calls?

CHAPTER-2

GLOBAL SCENARIO

This section provides the status of Internet Telephony in various countries of Asian Region, North America and European Union. It may be seen that Internet Telephony has been opened up mostly in developed countries, having a very high tele-density and high PC penetration. In addition, some of the other countries including developing and under-developed ones, do not regulate Internet Telephony and treat it as an Information service also called Enhanced Service and not a Telecommunication service provided by a Public Telecom Operator (PTO). Enhanced Service Providers (ESPs) do not pay USO contribution for access charges in USA and Europe and are regulated differently than PTOs.

The scenario in various countries in this regard is indicated below:

(i) **Permitted for voice/fax over the Public Internet or managed VOIP network: (25 Countries)**

- Angola, Antigua and Barbuda, Argentina, Bhutan, Congo, Costa Rica, Dominican Republic, Estonia, Gambia, Guatemala, Guyana, Madagascar, Mexico, Mongolia, Nepal, New Zealand, Poland, Slovak Republic, ST Lucia, St Vincent, Tonga, Uganda, United States, Vietnam.

(ii) **Not regulated, if non-real-time (not considered voice telephony) (19 countries)**

- EU Countries, Hungary (if delay >250 ms and packet loss > 1%), Iceland, Norway.

(iii) **Permitted. If real-time, subject to light conditions (notification / registration as for value-added services) (5 countries)**

- Czech Republic, Hong Kong SAR, Japan, Singapore, Switzerland

(iv) **Permitted, if real-time, (regulated similar to telecommunication services or Enhanced Service) (7 countries)**

- Australia, Canada, China, Korea (Rep.), Malaysia, Thailand, Israel.

(v) **ISPs permitted to provide Internet Telephony on public Internet (6 Countries)**

- Hungary, Singapore, Seychelles, Peru, Egypt, Cameroon.

Countries which prohibit the use of Internet for voice/fax services are indicated below: -

(i) Countries that prohibit the use of both the Public Internet and managed VOIP networks for voice or fax services (32 countries)

- Albania, Azerbaijan, Belize, Botswana, Cambodia, Cote d'Ivoire, Croatia, Cuba, Ecuador, Eritrea, Gabon, Indonesia, Jordan, Latvia, Lithuania, Morocco, Mozambique, Myanmar, Nicaragua, Nigeria, Pakistan, Paraguay, Qatar, Romania, Senegal, Seychelles, Swaziland, Togo, Trinidad and Tobago, Tunisia, Turkey.

(ii) Countries that permit voice/fax over managed VOIP based networks but prohibit over Public Internet (6 Countries)

- Cyprus, Ethiopia, Kenya, Peru, Philippines, India.

Internet Telephony regulation in some selected countries are discussed at length in following paras:

A) Asian Region:

i) Malaysia:

The licensing regulations of Malaysia Communication and Multimedia Act 2000 take a converged approach to Public Voice Telephony. In accordance with this, an Applications Service Provider (ASP) individual licence, in contrast to a class licence may be granted to a person/company providing any or all of: (i) PSTN Telephony; (ii) Public Cellular Telephony Services; (iii) IP Telephony; (iv) Public Payphone Service: or (v) Public Switched Data Service. Thus IP Telephony is treated as just another licensable application service, as is PSTN Telephony. PC to PC Voice calls made using the public Internet, which is a service offered by ISPs does not require the kind of license required by PTOs.

(ii) Singapore:

In Singapore, Internet Telephony market was opened in April 2000 when a new Internet-based voice and / or data service licence was created. Any

company can provide Internet telephony provided they have a licence and abide by a minimum specified quality of service (QOS). By mid September 2000, 70 companies had been licenced to provide Internet Telephony in Singapore.

(iii) China:

In 1998, the Ministry of Information and Industry (MII) clarified the regulatory ambiguity regarding IP telephony, which stated that the Ministry had the responsibility for all matters pertaining to Telecommunications in China and that IP Telephony was a Telecom activity. The next action of MII was to grant licences to three carriers under the administrative control of MII to conduct a six-month trial of VOIP services on a managed VOIP network. With this, China's IP Telephony market was formally opened on April 28th 1999 with MII issuing licences to China Telecom, China Unicom and Jitong, to begin with for six months periods of operation in total of 26 cities, which was later extended to two years. This ended the monopoly of China Telecom to carry international and long distance traffic, on a 'Managed VOIP' network. Later on, China Netcom and China Mobile were also permitted to provide IP telephony i.e. to transport voice packet on a managed VOIP network.

In the meantime, China Telecom, the incumbent operator while envisaging fall in revenue due to various operators offering low cost IP telephony services, revised its tariff plans which offered the same price as the IP phone tariffs, and moreover the off peak tariffs were 40% cheaper than for comparable IP calls. It is relevant to note that in China only Facility-based National Carriers are permitted to use 'Managed VOIP' in their network and access is still provided through PSTN, class 5 switches of the access providers.

(iv) Thailand:

Telephone organisation of Thailand (TOT) one of the two state owned Telecom operator has launched its IP telephony service under the name Y-Tel 1234 to provide a cheap long distance call service. To use this service, telephone subscribers dial the prefix '1234' and thereafter dial the long distance destination code. The service is also available from public telephones. However, at present only TOT subscribers are able to use this service. It is learnt that TOT uses VOIP gateways connected to the Public Internet and therefore, it remains a best effort service without any guarantee of QOS. On this service, Fax calls are not supported.

The TOT's domestic IP Telephony service competes with the Domestic Long Distance and International service offered by two major cellular mobile operators. In recent years, the CAT (the monopoly ILD operator) has seen its revenue eroded by competition from International Call back services, substitution of faxes and phone call by e-mail and other Internet based services. The Internet market was classified as an International Telecommunication Service, and thus fell within the monopolistic domain of the CAT. Since 1995, however, the state agency has granted concessions to 18 Internet service providers but voice services are banned for them. Only two state carriers who have PSTN infrastructure are permitted to offer Telephony over public Internet and no QOS is specified or guaranteed. It will thus be seen that ISPs are not permitted to offer Internet Telephony to their subscribers. Only operators (equivalent of NLD/ILD) use the public Internet to offer VOIP based long distance calls with no guarantee of QOS.

B) North America:

(i) USA:

There is currently no explicit regulation of any type on Internet Telephony in the United States, at either the State or the Federal Level. The US Federal Communication Commission (FCC) has ruled that Phone-to-Phone IP Telephony (both Internet Telephony and VOIP) appears to be functionally equivalent to PSTN Voice Telephony. However, these services are not covered by telecommunication regulation. The service providers enjoy the status of Enhanced Service Providers (ESP) (called Value Added Services in Europe), which are exempt from access charges and are not required to contribute towards Universal Service Obligations. There is a school of thought in USA which believes that VOIP on public Internet will not be attractive to ISPs if the FCC removes the ESP status granted to the ISPs. They also believe that the business case of ISPs is mainly based on the concept called “tariff arbitrage” which means bypassing the PTOs toll backbone without paying any access charge. Due to representations of the carriers, FCC plans to determine on case-to-case basis whether certain types of Phone-to-Phone IP Telephony may be classified as Telecommunication service and hence their providers such as ISPs can be considered for USO contribution and subjected to same obligations as a PTO..

However, FCC believes that Internet Telephony serves the public interest by placing significant downward pressure on International settlement rates and consumer prices.

(ii) Canada:

In Canada, IP Telephony was introduced after the liberlisation of long distance telecommunication market. Instead of trying to ban or restrict IP Telephony, Canada simply incorporated certain types of IP Telephony into its

universal service funding regime. Beginning in 1997, CRTC ruled that providers of Phone-to-Phone Voice Telephony where the Internet or VOIP backbone was the underlying transmission facility, should contribute just like providers of any other form of Voice Telephony. CRTC further ruled that PC voice was not subject to Universal Service contribution regime but PSTN voice was. Contributions are required to be paid per minute on any Internet Access lines used for phone-to-phone voice, which allows PSTN voice calls to be originated or terminated. In Canada, therefore, phone-to-phone calls using Internet as backbone (VOIP backbone) are classified as PSTN calls, but PC-to-PC calls using the same backbone are not classified as such calls.

This classification method focuses on where the conversion of calls (either originating or terminating) from traditional signals to IP format takes place. In general, if the conversion process takes place at the caller's premises i.e., in his CPE, the call is considered 'PC voice'. If it happens elsewhere, such as at the media gateway / server of an ISP or at the POP of IP Telephony calling card service provider, the call is treated as 'PSTN voice'. Those offering such services must register with the CRTC as resellers and make contribution payments, even though the facilities used are not the voice circuits, but the Internet access links.

(C) Europe

(i) European Union:

Internet Telephony still continues to fall outside the definition of Voice Telephony because of the following reasons:

1) It does not meet the criteria of reliability and speech quality as normally required for Voice Telephony.

2) It is not offered as a single service or as the main element of range of bundled services marketed as Voice Telephony, as it is technically bundled with data services or is designed to meet demands additional to that of Voice Telephony.

Thus, Member States continue to allow Internet Access Providers to provide VOIP as data transmission service under general authorizations. Also the policy position is that specific licensing conditions for PSTN based voice communications are not justified for VOIP based telephony.

(ii) Hungary:

Hungary has used the QOS of IP Telephony as a regulatory distinction tool. Like many countries that have used inferior speech quality of Internet and IP Telephony as basis for regulatory distinction between Voice Telephony and Internet data, Hungary has made speech quality as the explicit distinction. Accordingly, if a Voice telephony service is provided by means of transmission of speech signals in a non-circuit-switched way in any section of the domestic Public Switched Telephone Network (PSTN) or Public Land Mobile Network (PLMN) (except for leased lines), to qualify as a non-public-voice-telephony connection, the speech signals must meet a certain degradation conditions. It must be distinguishable from customary telephony service and the service provider must ensure a minimum 250 millisecond (ms) of average delay in speech signal transmission between the terminals and should guarantee that the loss of speech packets will not be less than 1%. In addition, users attention should be drawn to the quality parameters that differ from those of public voice telephony when advertising the service.

Services that use a PSTN of PLMN number as an originating gateway to the Internet, are also covered by these requirements (e.g. free phone numbers or

calling card access numbers). Calls originating on leased lines are not governed by this regulation. Since the incumbent operator Matav has exclusive rights (till 31.12.2001) to carry international long distance telephone traffic, it can be bypassed only if the speech connection qualifies as a non-public-Voice Telephony Service.

(iii) Others: -

In some other European countries like Spain and Belgium, the national carriers are making use of VOIP technology in their backbone networks with the objective of achieving economies of scale and scope to provide long distance telephony service, as a substitute to the classical PSTN. In Spain, Telefonica provides PSTN like quality and also provides Fax services on its VOIP backbone. This kind of transparent service is being achieved by avoiding use of compression and also by usage of Echo Cancellation techniques at the input of Media Gateways. With these techniques and use of the same codec as in PSTN it has been possible to achieve PSTN like voice quality, but without any resultant saving in the Bandwidth, and hence the transmission cost. The switching costs (Media Gateway) are higher in case of VOIP network at present. However, they are likely to fall in future.

The summary of regulatory distinctions adopted by various countries regarding IP Telephony is placed at Annexure-'B'. The expression 'IP Telephony' covers both VOIP managed network and voice transmitted over Public Internet.

A survey of various countries show that the status of IP Telephony, which covers both types of transmission of voice using IP protocol on the public Internet by ISPs and on a managed VOIP network by carriers, varies considerably from

one country to another. The considerations on which the introduction of IP Telephony has been permitted have also been different for different countries.

The issues for consultation in this context are:

2a) Whether Internet Telephony i.e., telephony on Public Internet be permitted, considering the fact that it will mean a bypass of the PTOs toll network ?

2b) If the answer to (a) above is yes, who Should be allowed to offer Internet Telephony:

i) ISPs only by a process of migration

ii) All Access providers?

iii) New entrants including existing players under a new operating category called Internet Telephony Service Providers?

2c) If answer to 2(b)(i) is yes, should conditions of the licence of existing Internet service providers (ISPs) remain same in case they are permitted to provide Internet Telephony or they should be modified to reflect the change in the scope of their service.

2d) Should PC to PC voice service be regulated?

CHAPTER-3

TECHNICAL ISSUES RELATED TO INTERNET TELEPHONY

3.1 Definition of Internet Telephony:

Internet Telephony has not been formally defined as yet by ITU, although Study Group-II of ITU is engaged in completing this task at an early date. However, there is a general agreement that there is a need to distinguish between Internet Telephony and VOIP both of which are known as two classes of IP telephony. However, there appears to be a strong case for a clear differentiation between Internet Telephony and VOIP.

The Internet telephony and VOIP can be differentiated as suggested below:

(a) Internet Telephony:

A 'Telephony' service over the public Internet provided either by the existing ISP or by a new category of service provider called Internet Telephony Service Providers (ITSP), based on a new licence. The proposed service to use a separate access code such as '172XXX' so as to bypass the long distance network of the incumbent (BSNL) and NLDOs for long distance calls including International calls. After dialling 172XXX, the dial up call lands on the ISPs node, and the subscribers after getting a second dial tone, proceeds to dial his long distance call by a different dialling scheme. By this process the long distance call is routed on the Internet cloud to the terminating media gateway and through that to the destination PSTN and called phase.

(b) Voice Over Internet Protocol (VOIP)

A purely technology issue. This technology may be permitted to the PTOs as an alternative to the classical PSTN provided a specified QOS is provided to

the customers. Thus VOIP is the transmission of packetized voice over a dedicated or 'Managed VOIP' backbone of the BSO, NLD, ILD etc. Managed VOIP does not use the public Internet, because of QOS problems. VOIP technology can be permitted to be used as a substitute to the TDM Based Circuit Switched Backbone in the PSTN network, for the purpose of saving bandwidth.

3.2. TYPES OF INTERNET TELEPHONY:

Broadly, Internet Telephony can be categorized under the following three types:

a) PC to PC telephony over Internet (Fig 1):

This Telephony makes use of PCs at both the ends. This configuration needs similarly equipped Internet users requiring IP Telephony software and multimedia PC and both the users are required to be logged on simultaneously. The main applications of this technique are 'chat rooms' & 'corporate internal communications' to avoid usage based telephone charges. It is also termed as 'Pure Internet telephony' in many countries. At present it is illegal in our country. It is very difficult to technically prevent such a use by Internet subscribers.

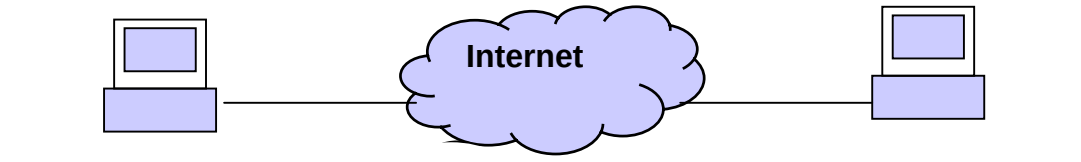

Fig.1

B. PC to Phone Telephony over Internet (Fig 2) :

This is Telephony making use of Multimedia PC at one end to Plain Old Telephone System (POTS) at other end. Internet users with multimedia PC are able to call any phone or fax user and vice versa. The main motivation of providing this service is the reduced long distance charges for Domestic and

International calls with no QOS guarantees. This is at present not permitted in India, as well as abroad in a large number of countries, due to the so called, 'toll bypass'.

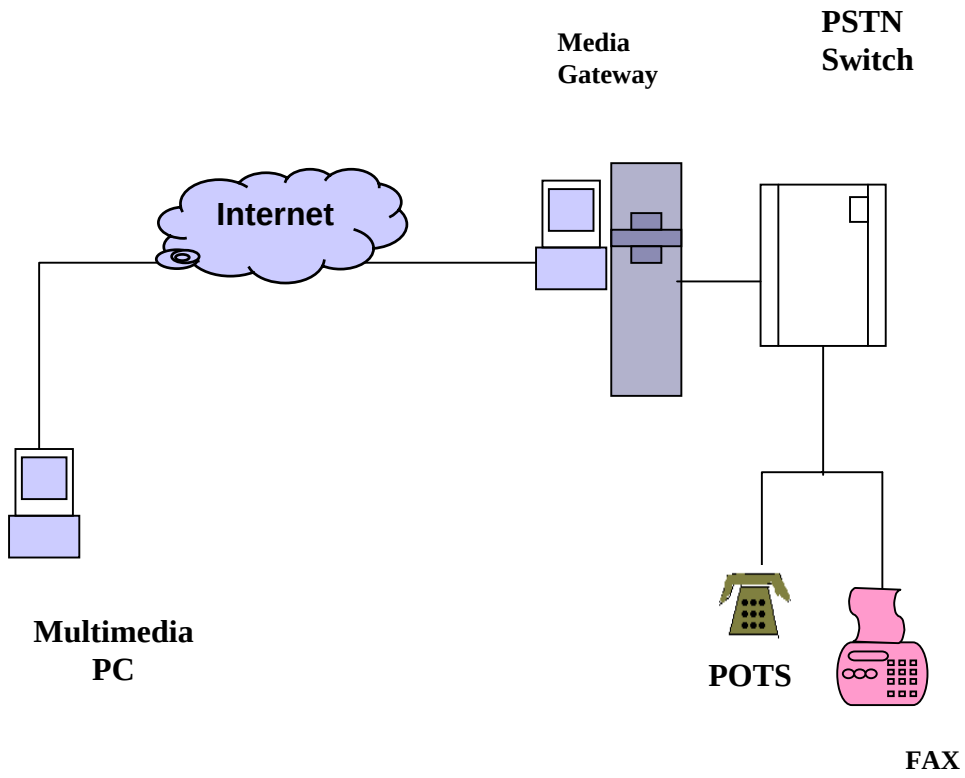

Fig.2

C. Phone-to-Phone Telephony Over Internet:

This service is Internet based Telephony making use of POTS at both the ends. This configuration allows communication between any phone/mobile phone user and any other user. Interworking between IP network and circuit switched PSTN provided by Media Gateway, is the main requirement in this configuration.

It may be difficult to provide Fax service due to compression and other technical constraints of the network.

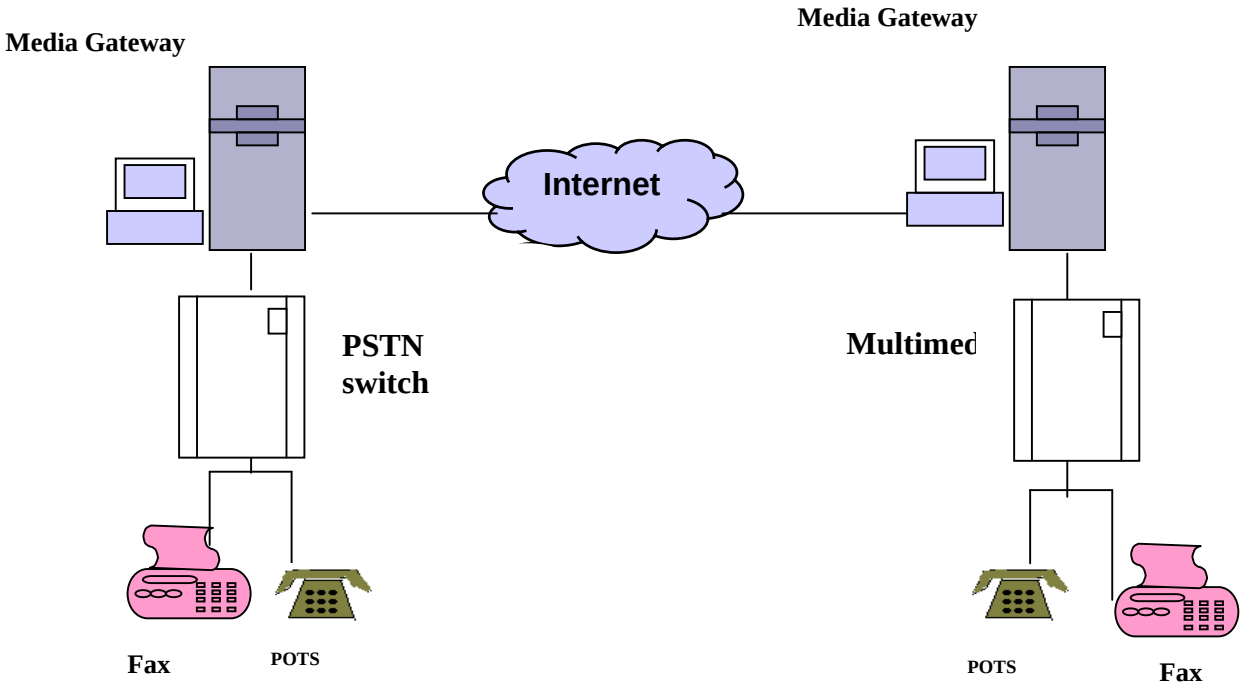

Fig.-3

3.3 Recent Technological Development to enhance the 'IP' protocol for real-time service:

Various international standard setting bodies such as ITU and IETF are in the process of developing standards and protocols for IP Telephony to make it QOS enabled especially for real-time service. Some of this work is being done jointly, so that the problems of interoperability can be addressed. Various vendors such as Alcatel, Siemens, Lucent , Cisco, Juniper, 3COM, etc. have come out with a product range of VOIP enabled Gateways, Gatekeepers, Soft Switches and Routers, which can be deployed to deliver the real time voice services. However, availability of a wide range of protocols and standards is creating problems of interoperability, between two networks. At present, majority of the products are proprietary and do not confirm to open standards. Migration

from the existing circuit switched technology to packet switched technology is also posing a challenge. The main concern is the quality of service (QOS), which is of utmost importance for the consumers and hence the Regulators. The evolving protocols such as Diffserv, MPLS, RSVP, RTP/ RTCP, Megaco, SIP etc are available but these are islands of QOS Domains wherein the quality can be locally guaranteed but not End to End. It may take some time before large scale deployment of QOS enabled products for real time voice services can take place for Telephony on public Internet, to guarantee QOS end to end. This is mainly due to the reasons explained in the following para: -

The Internet protocol (IP) was designed to transport only the data packets over long distances, without any guarantee of its delivery and has been employed for non real-time applications, which do not require stringent Quality Of Service (QOS) guarantees such as those pertaining to end-to-end delays and packet losses. Internet is only a `best effort' service and cannot guarantee the delivery of voice packets on real-time basis particularly during congestion conditions such as those experienced during the `Busy Hour' on a PSTN. On the other hand, the public switched telephone network (PSTN) which has evolved over the last 100 years is dimensioned based on well established teletraffic mathematical models, based on which one can estimate the probability of a call getting blocked at various technical interfaces during the `Busy Hour'. For example, it is possible to engineer a link between two nodes of a PSTN, so that the probability of a call getting blocked on the link will not exceed 1% even during the busy hour. This has been possible because the nature of telephone traffic is `pure chance' or `smooth' and 'non-bursty'. On the other hand, data traffic is essentially `bursty' and it has not been possible to model it mathematically. Existing mathematical models like Erlang's formula apply only to non-bursty

(smooth) traffic such as encountered on a PSTN. As a consequence, precise dimensioning rules are not available for IP based connectionless networks. Therefore, operators are not able to guarantee the specified quality of service (QOS) at various technical interfaces, such as UNI (User Network Interface) and Network Network Interface (NNI).

However, considering the phenomenal growth of IP based networks such as Internet, capable of offering a multiplicity of Information Services (IS), the telecom Industry is actively engaged in developing `QOS guaranteed VOIP' products, which could be deployed by operators to provide QOS based services with optimum investments. Such products have been deployed in Intranets for Corporate Communication and Closed User Groups and for applications such as Call Centres for quite some time. Since such private networks are privately owned and managed, the technical issues relating to Interconnection do not arise and the Quality of Service is manageable. However, if VOIP products are to be deployed for rolling out large public networks of the type being engineered by Basic Service Operators and National Long Distance Operators, a host of technical challenges such as interoperability based on an open network interface (ONI), packet loss, delay and reliability of network elements such as Routers, Servers and Gateways will have to be addressed. The currently available IP products are by and large proprietary in nature and interoperability of various networks based on Open Network Architecture (ONA) is not established. "ONA" appears to be one of the essential technical regulation requirements of all regulators including FCC.

In order to get over these technical issues, standardization bodies like ITU/IETF are working in collaboration to develop and refine standards such as H.323, H.248 (Megaco) and Real Time Protocols such as RTC and RTCP to

support the real time services such as voice over the IP network of the future, also called next generation Internet based on IPv6 Protocol. The current version of IP i.e. IPv4 is incapable of handling the task of supporting real time telephony requirements of a level comparable to that of a PSTN network. Carrier grade products such as Conventional Digital Switches and Transmission Systems are engineered for extremely high reliability, such as a MTBF of 70/80 yrs and an outage of the order of 3 minutes in a year. On the other hand, Routers, Servers and Gateways, which are the main building blocks of VOIP network, are designed for a much lower MTBF. However, these technical challenges are likely to be overcome with the combined efforts of all stakeholders.

3.4 Options to engineer a long distance network by using VOIP techniques: -

In many developed markets, VOIP technology is primarily used by carriers at the backbone level, and only offered as a retail service to large corporate customers. In almost all markets, the PSTN remains the first link in most IP Telephony transmissions, in the sense that most IP calls either terminate or both originate and terminate on the PSTN. This means that IP Telephony will have to remain a part of a hybrid PSTN/IP environment for some time to come and the dial tone to an ordinary telephone set (POTS) will be given by a class 5 switch (local exchange), in the manner explained below:-

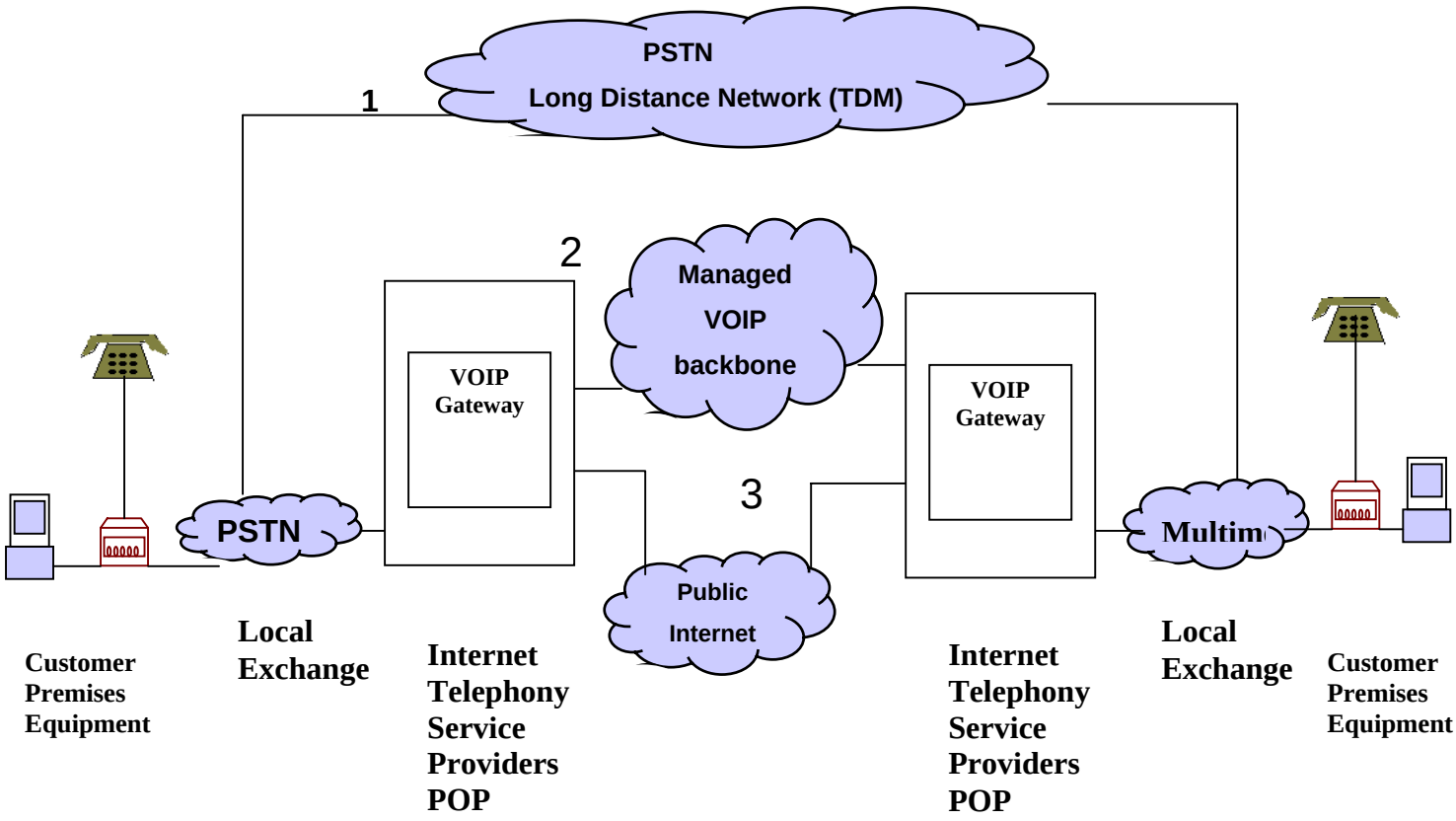

Fig.4

Figure 4 is a typical diagram of a Long distance Telephony Network using IP protocol which is an alternative to the classical PSTN long distance network. At present most of the NLDOs globally engineer their network based on PSTN architecture as shown by the PSTN TDM cloud(1). Increasingly NLDOs and other carriers are deploying a backbone based on managed VOIP network as shown by the VOIP cloud (2). It is also technically feasible to permit NLDOs and other carriers to use the public Internet to transport their voice packets as shown by the public Internet cloud (3). However, in case public Internet is used, as already explained, no QOS can be guaranteed for voice. Whereas, in case of managed VOIP, it is possible to make it fully substitutable to PSTN and also to make it

transparent to Fax and Modem dialled calls, it is not possible to do so in case of the third alternative i.e., public Internet.

Normally in case of Fax transmission, no compression is possible and hence data rate requirement remains same as a normal voice channel (64 Kbps). Public Internet routinely employs compression techniques.

Issues for consultation in this context are:

3a). How do we define Internet Telephony? Should it mean PC to PC voice transmission using public Internet, or also PC to Phone (in other country) as well as Phone to Phone without any restrictions?

3b) Whether 'Internet Telephony' should also include Fax over IP?

3c) Should the new licencees for the Internet Telephony be mandated to use the Access Network of BSOs, or have their own facilities in the last mile including CPEs?

3d) As far as the carriers are concerned, should they be permitted all three options shown in figure 4, or allowed only the managed VOIP option shown as option No. 2 of the diagram, so as to ensure a specified QOS end to end, in the interest of the consumer?

CHAPTER-4

ISSUES RELATING TO QUALITY OF SERVICE

4.1 Quality of Service (QoS) overview:

One of the functions of the Regulator in India is to lay down the standards of “Quality Of Service” (QOS) to be provided by the service providers and ensuring the quality of service by conducting the periodical surveys of such service provided by the service providers so as to protect the interests of the consumers. In case long distance service providers employ VOIP technology to engineer their NLD networks, they must offer the quality of service, which is acceptable to the customers and is comparable to a PSTN based NLD network (Toll Quality). A specification of the Quality of Service by the Regulator is essential, as quality of service has to be linked to the tariff paid by the customer. Even a lower quality of service i.e. non-toll quality has to be specified and guaranteed. The Concepts relating to Quality of Service relating to real-time data networks are still evolving and are yet to be established. Although quality of service norms have been specified by ITU for connection oriented packet technologies such as Frame Relay (FR), Asynchronous Transmission Mode (ATM) and X-25, no such standards are fully established for a connectionless IP network. IP protocol (IPv4) only promises a `best effort service’, which may not be good enough for real-time voice traffic to be carried on a VOIP network. Delay and variability of delay (Jitter) pose major technical challenges for the VOIP network to support real time voice. Maximum one-way delay permissible in a PSTN network is 150 ms for real time voice (as per ITU G.114). Since some standards are becoming available for IP networks, Regulator can specify QOS

norms for a Public Voice Network based on IP for substitutable grade of quality (toll quality).

The ITU-T recommends the following limits for one-way transmission time for connections pertaining to real-time voice services (G.114).

- **0 to 150 ms**: Acceptable for most user applications.
- **150 to 400 ms**: Acceptable provided that the subscribers are aware of the transmission time impact on the transmission quality.
- **Above 400 ms**: Unacceptable for real time voice service.

4.2 STANDARDS FOR QUALITY OF SERVICE (QOS): -

IP – related standardization are currently included in most of the ITU –T and ITU-R Study Groups activities. Study topics include work on differentiated QOS IP Services, Interworking between PSTN and IP networks, Numbering, Naming and Addressing, Support for charging and settlements, Integrated network management of Telecom and IP based networks, Network integrity and reliability.

In addition to ITU-T and ITU-R, standardisation activities in standards setting bodies such as IETF and ETSI are also underway. IETF's SIP (Session Initiation Protocol) for conferencing, telephony, presence detection, events notification and instant messaging is an example of one such effort. SIP can enable developers to create advanced telephony and multimedia applications using familiar Internet Protocols and Web tools. ITU and IETF had joined hands to come out with a joint protocol H.248/Megaco. It defines Master slave protocol to control media gateways that can pass voice, video, fax and data traffic between PSTN and IP- based networks.

Internet Engineering Task Force (IETF) has also proposed many service models and mechanism designed to meet the demands of Internet users for real time services. Important among these are Integrated Services/RSVP, Differentiated

Services (Diff Serv) and Multi Protocol Label Switching (MPLS), Real Time Transport protocol (RTP) which are described as following: -

Integrated Services/RSVP:

This protocol is based on reservation of resources according to the QOS request, within the framework of an overall bandwidth management policy. When a request is made, the protocol sets up the relevant path and reserves the resource required for data transfer in case of real time application.

RSVP can provide the highest level of QOS in terms of service guarantees, with the QOS almost reaching that of circuit switched networks.

Differentiated Services (Diff Serv):

Differentiated services protocol provides a simple method of classifying services for various real time applications. Through this protocol, it is possible to apply different QOS parameters to different classes of data packets so that distinct performance levels of delay and packet drop can be associated with different data packets.

The following categories of services can be configured using Diff Serv: -

Premium Service: - for real-time applications requiring low delay and low jitter;

Assured Services: - for applications requiring reliable but not real-time services;

Best Effort Service: - Unguaranteed just like public Internet service.

Multi-Protocol Label Switching (MPLS):

MPLS (Multi-Protocol Label Switching) is a packet forwarding technique which can work with multiple protocols. Under this technique, packets are assigned a label (denoting the priority assigned to the packet) at the input of an MPLS enabled device and all the subsequent processing for the packets is based on these labels. Being protocol-independent, MPLS enabled devices can be used with various network protocols like ATM, Frame-Relay, IP, or directly at the data-link layer. It

functions as a traffic engineering protocol and can be used to establish “Permanent Virtual Circuits” (PVC) similar to ATM or Frame Relay Virtual Circuits (VC).

Real-time Transport Protocols (RTP)

Real time applications require assurance that a transmitted stream of data can be reconstructed accurately as original at the destination.

One of the problems of Data Transmission is Jitter, i.e. variation in delay experienced by individual packets. Two protocols have been developed to address the problem of Jitter mainly Real-time Transport Protocol (RTP) and Real Time Control Protocol (RTCP). These protocols are designed to work together in complementary mode. Utilising their combined capabilities, it is possible to achieve the goal of end-to-end QOS enabled communication.

4.3 Coding and Mean Opinion Score (MOS) for speech quality:

(i) CODING: -

Coding techniques for telephony and packetized voice are standardized by the ITU-T in its G-series recommendations as follows:

- G.711: Describes the 64-kbps PCM voice coding technique. In G.711 encoded voice exists in the suitable format for digital voice delivery in the TDM based PSTN and the quality achieved is referred to as toll quality, i.e. PSTN like quality. Its variant is Adaptive Differential PCM (ADPCM), which encodes a voice signal into 32kbps stream with quality comparable to toll quality.
- G.729: Describes Code Excited Linear Prediction (CELP) compression where voice is coded into 8-kbps streams. There are two variations of this standard (G.729 and G.729-A) which differ mainly in computational complexity; both provide speech quality inferior to 32-kbps ADPCM.

- The following illustration relates to compression methods suggested by ITU and the resultant data rates:

Compression Method	ITU Standards	Data Rate
PCM	G.711	64 KBPS
ADPCM	7.726	32 KBPS
LD-CELP	G.728	16 KBPS
CS-ACELP	G.729	8 KBPS
CS-ACELP	G.729A	8 KBPS

(ii) MOS (Mean Opinion Score): -

ITU have issued two recommendations for voice quality measurement namely P.800 Mean Opinion Score (MOS) and P.861 Perceptual Speech Quality Measurement (PSQM).

P.800 MOS is a subjective measurement of voice quality. It is derived from an evaluation of various pre-selected voice samples over different transmission media, replayed to a mixed group of men and women, who rate them from 1 (worst) to 5(best). Scores are then weighed to derive a single MOS score rating. An MOS of '4' is considered 'Toll Quality' voice.The MOS ranges for various speech quality are indicated below: -

4-5 Toll Quality

3-4 Communication Quality

<3 Synthetic Quality

P.861 PSQM is an automated scoring process using an algorithm that enables computer-derived scores to correlate to MOS scores. It was originally designed for circuit-switched network and does not take into effect important parameters such as jitter and packet loss which are very relevant to VOIP.

In addition to ITU, British Telecom has designed an intrusive listening speech quality assessment tool where speech quality is computed by injecting a speech like signal at one end and analyzing the degraded signal at other end of the network. This tool is known as PAMS (Perceptual Analysis/ Measurement System).

Scoring and Grading in PAMS are done as follows: -

Signal Parameters:

Parameter	SCORE				
	1	**2**	**3**	**4**	**5**
Latency (ms)	<50	50-75	75-100	100-200	>200
Packet/Loss (%)	0	0-1	1-2	2-3	>3
Jitter (ms)	<5	5-10	10-50	50-100	>100

QoS Grading:

Grading	**Sum of scores**
Excellent	<4
Good	4-6
Acceptable	6-8
Poor	8-10
Unacceptable	>10

The PAMS results show a close correlation with MOS scores.

The issues for consultation in this regard are:

4a) Considering the fact that the present generation Internet protocol (IP V4) and its associated protocols do not provide for QOS guarantees, should Internet Telephony be permitted to the ISPs, without specifying any QOS?

CHAPTER-5

LICENSING AND REGULATORY ISSUES

5.1 Introduction:

Almost all carriers across the globe are planning various strategies for introduction of packet switched technology, such as VOIP, in their carrier networks which were originally designed based on PSTN-architecture. Different countries have adopted different approaches to permit Internet Telephony, taking account of factors such as the degree of competition and the revenues required for meeting the Universal Service Obligation. VOIP promises to provide the capability of offering converged and innovative telecommunication services to end users in a cost effective manner. A number of licensing issues, however, need to be addressed such as:

- Whether the Internet Telephony Service Providers will be subjected to Universal Service Obligations;
- How will the level playing field will be maintained between ITSPs and other competing service providers;
- How to interconnect the existing circuit switched PSTN and VOIP based packet switched network, by open network standards, for seamless inter-working across heterogeneous networks.
- License conditions such as entry fee, revenue sharing etc.
- The Quality of Service parameters applicable.

5.2 Overview of Regulatory Issues:

Although the regulatory regime for IP Telephony is yet to evolve fully, some Regulators clearly distinguish between “VOIP” which is seen as an underlying transmission technology employed by National Long Distance

Operators (NLDOs), to connect two PSTN networks of Basic Service providers, and “Internet Telephony” which is a service offered by making use of the Public Internet and can compete with the service offered by the NLDOs. The introduction of latter is mainly a legal & regulatory issue, since it will mean bypass of the NLDO & ILDO network and also the settlement regime.

5.3 Licensing Issues:- Quality of Service

The main licensing issue relating to the Voice Over IP/Internet Telephony refers to the definition of the public telephone service or Basic service. In most countries including India, the scope of the Basic telephone service covers transmission of voice/fax on the operator’s facilities in real time. Non-real time transmission such as `store and forward' or 'store and retrieve' is generally not covered within the scope of public telephony service. As per the licence conditions for Basic Telephony service, the “Quality of Service” (QOS) for real time services such as voice telephony is required to be evaluated on the basis of measurable parameters such as Grade Of Service, Calls lost due to wrong processing, availability, etc. Therefore, the existing regulation will have to be modified to take into account the latest technological developments in the field of VOIP, and will require the new QOS parameters to be specified. For Internet Telephony too, some QOS may have to be specified.

5.4 Licensing issues : Other factors related to level-playing field:-

Introduction of Internet telephony will raise a number of issues relating to “Level Playing Field”. The existing ISP operators in India have been granted their licences practically without any licence fees and have no roll out obligations. Stringent roll out obligations have been laid down for PSTN operators such as BSOs. They have paid high entry and licence fees to secure their Carrier rights. In addition, the BSOs have made significant investments in their networks based

on Circuit Switched technology and also in installing last mile facilities. It, therefore, needs to be considered carefully whether in case similar Carrier rights are granted to ISPs without the related obligations, the existing terms and conditions of licences for both Basic and NLD operators would be vitiated.

5.5 Licensing issues : Universal Service Obligation (USO):-

Another issue is the contribution towards Universal Service Fund. As per NTP-99, all network operators or carriers are required to contribute a specified percentage of their revenue as a levy towards Universal Service Obligation, for provision of the telecom services in rural/remote areas. The value added service providers particularly ISPs are required not to pay any such levy.

In many countries, the largest or dominant operator has an obligation to provide basic services directly to any customer who reasonably requests for it, or to ensure that all citizens have access to certain services as part of universal service or universal access obligations. Because universal service/access obligations require provision of services to customers in areas which are uneconomical to serve, the universal service/access provider incurs costs as a direct result of the obligation.

In Hong Kong, the operators of external telecommunications services have obligation of sharing the cost of providing universal service of the domestic telephone network in accordance with the volume of traffic handled. This obligation is not dependent on the technology used. Thus operators of external telecommunications service based on the VOIP technology are also required to pay their share of the universal service contribution. Furthermore, where the calls are delivered through the domestic telephone network, a Local Access Charge is payable to cover the cost of transmission over the domestic network. Again this

is not technology dependent and Internet Telephony operators are subject to the same obligation as operators using conventional technologies.

The Universal service funding schemes of Uganda and Nepal have different practice on this issue. In both the countries, ISPs are required to be licensed and to contribute a small portion (1-2 percent) of their revenues to the universal service fund, though, the possible cost advantage enjoyed by ISPs is somewhat lessened because of universal service levy.

5.6 General Structure of Licence fees:

A Licence fee having one or more of the following components is normally prescribed for a telecom service:

i) One time entry fee:

a) Operators to pay a Fixed Entry Fee to obtain a licence.

b) Performance bank guarantee linked to roll-out performance is prescribed

ii) An annual licence fee

An annual licence fee based on a percentage of gross revenue less 'pass-through' revenue is payable (Revenue Share).

iii) USO Levy

USO Levy is also applied. The TRAI has recommended that this be taken from the amount collected as annual licence fee (Revenue Share)

The license fee for Internet Telephony may have to be worked out keeping in mind the type of the Licence. The licencee here will be able to offer services which can bypass/substitute the services offered by PTOs such as NLDO / ILDO.

The issues for consultation in this context are:

5a) Should there be a separate licence for Internet Telephony Service or some of the existing facility based Service Providers should be permitted to provide this service?

5b) In case ISP's are permitted to provide Internet Telephony, what terms and conditions be imposed on them to ensure a Level Playing Field, vis a vis BSOs/NLDOs/ILDOs?

5c) Whether a separate category called Internet Telephony Service Provider be created or only the ISPs be permitted to provide Internet Telephony, with some modification in the terms and conditions of their licence?

CHAPTER-6

ECONOMIC ISSUES

6.1 Introduction:

One of the main motivations for transmitting voice over IP on a dedicated enterprise network (Intranet) is the cost advantage that this technology offers due to integration of data and voice on the same platform. However, this advantage is not evident in case of a carrier grade network for carriage of voice traffic on a backbone network of the type BSOs and NLDOs deploy, as additional investment is required for achieving toll quality QOS. More analysis is needed to assess whether this is a cheaper option in this regard. We may also need to consider the extent of QOS degradation, which can be permitted to make the VOIP based communication cost effective. However, in case of Internet Telephony by making use of existing Public Internet, there is no issue of additional cost though the achievable Quality of Service cannot be specified or guaranteed. The Economic issues, which arise in this context are cost comparison between Circuit Switched and Packet Switched Network, Bypass of Settlement Rate System, Tariff Regulation and Interconnection (Access Charge) which are discussed below:

6.2 Cost comparison between Circuit-Switched Network and Packet Switched Network

IP Telephony is still in the nascent stage of development and ITU and IETF are jointly working towards improving the quality of service and to address the interoperability issues between PSTN and IP network. The cost of VOIP Gateway/Switch at present is higher than that of PSTN switch for a comparable reliability and availability. However, is expected to fall when the volumes pick up.

With VOIP, it is estimated by some that there is a resultant saving of 40 to 60% in transmission cost because of compression of voice traffic on the backbone.

Nonetheless, the capital cost of VOIP gateways at present is higher and may even offset the cost reduction that arises due to compression of voice traffic. Thus, in terms of overall underlying costs of the network elements, the two systems may not be significantly different. The main factor contributing to cost difference would be the settlement rate for PSTN calls and the fact that the tariff of international calls is above-cost in order to provide a cost-subsidy for access network. It should be noted that voice calls on public Internet will bypass the conventional settlement rate system applicable to international calls.

6.3 International Settlement Rate Regime:

The Internet traffic is largely US Centric and most of the ISPs tend to connect to Network Access Points (NAP) in the US, which provide backbone connectivity to the servers located in US. Historically in the case of PSTN circuit switched international calls, there are different accounting rates for different countries based on international traffic volumes sent and received. Under the international settlement system, the operator in the country that originates a call has traditionally made a compensatory payment to the operator in the country which terminates the call. Actual payments are made when traffic in outgoing direction is greater than the traffic in the incoming direction. The level of payment is based on bilaterally negotiated “Accounting Rates”. The net settlement payment is usually made on the basis of excess traffic minutes, multiplied by half the accounting rate. Net settlement payments, primarily from developed countries have grown larger as traffic flows have become less balanced. According to ITU estimates during 1990s net flows of settlement

payments from developed countries to developing ones amounted to some US$ 50 billion.

Operators have an incentive to develop alternative routing procedures to avoid paying the settlement rate. One such alternative is to send the traffic through Internet backbone and pay interconnect fees applicable to the Internet access. This is an important reason as to why there is a trend toward diversion of more and more traffic through Internet backbones instead of PSTN circuits. However, in case of Internet Backbone, full cost of the international leased circuit is borne by the operator of an under-developed country and the developed countries make free use of this for sending traffic from their end.

6.4 Tariff Regulation:

As per the TRAI Act 1997, the Regulator is empowered to fix tariff for various telecom services. The Telecom Regulatory Authority of India, based on extensive public consultation, notified the Telecommunications Tariff Order 1999 in March 1999(TTO-99), fixing interalia, the rental, local call and long distance call charges for Basic Service. The basis of fixing such charges was the underlying cost of the network elements involved in setting up of a local call, a national long distance call and an international call. The national long distance and international call charge cross-subsidised the monthly rental. Since the network elements in case of PSTN are fixed and identifiable as local loop, local exchange (LE), transit exchange (TE), transmission system etc. such an exercise has been possible. The same is not the position in case of VOIP as well as Internet Telephony. In this regard, we need to consider whether the pricing of calls passed through Internet should be done in the same manner as the PSTN calls. Or should some other method of pricing be used, e.g. price based on the

volume of data transfer, or a flat rate charge or a price based on minutes of use only (i.e. not based distance but only on duration of the call).

6.5 Interconnection:

Interconnection is the key to effective regulation. To promote competition based on a level playing field, equitable and non-discriminatory interconnection between service providers is necessary. Interconnection regulation involves unbundling of network elements, definition of technical interfaces, such as user network interface (UNI) and network-to-network interface (NNI). Technical regulation also involves specification of "Quality Of Service" on each of the technical interfaces, such as UNI and NNI, so that end-to-end quality of service could be guaranteed to the customers in a multi-operator environment.

Another major issue relates to the payment of carriage charge based on the usage of resource of one operator by another, in a multi- operator long distance call. These are based on an exact measurement of traffic flowing from one network to another at the NNIs in terms of miles/minutes of use. Sophisticated inter-carrier charge billing systems based on CCS-7 signalling have been implemented under the aegis of the Regulators in some developed countries such as Japan. India is also expected to adopt such a model and the TRAI is working towards this objective. For this, VOIP gateways capable of network management, security and number translation or directory function will be required. They should be capable of production of Call Data Records (CDRs) on real time basis that include information such as Call duration, Dialled number; Number of Packets sent and received destination wise etc. These are required for proper accounting settlement between operators in a multi-operator environment. The end user should preferably receive one bill from his access provider i.e. BSO.

Therefore, it is required to be considered whether the interconnection charges to be settled between different operators can also be based upon the new principles like Volume based charging, Flat Rate charging or can some other alternatives be used.

The issues for consultation in this context are:

6a) Does Internet Telephony really provide a cheaper option to conventional telephone service?

6b) What impact the immediate introduction of Internet Telephony will have on:

i) Tariff rebalancing for domestic and International calls?

ii) Settlement rate system?

iii) Spread of rural telephony

6c) What costing methodology should be used for fixing tariff of Internet telephony service?

CHAPTER-7

DIGITAL DIVIDE ISSUE

There is a large gap in the extent of usage of telecom and Internet services among countries, regions, races and also in the form of disparity between urban and rural inhabitants. This phenomenon is commonly referred to as the “digital divide”.

Internet offers the promise of an information society in which virtually unlimited quantities of information are globally available. But in case the Internet is accessible only by few, it would create a major imbalance regarding access to information and opportunities. The effects of the so called digital divide would be exacerbated by this, undermining to a great extent the achievements of the spread of telephony to rural and remote areas.

There is a considerable disparity between the availability of Basic Telecom Service (POTS) among urban, rural and remote areas. Further, the urban areas tend to have telecom technologies that are more modern based on advanced digital techniques. Also, the high speed information highways which form the backbone for the information society are available mainly in the major cities and metros. This divide created by disparity in availability of telecom services may get further aggrevated by the disparity in availability and affordability of PC, i.e. the basic device for making the data communication and Internet Access possible. At the same time, to the extent that the divide can be reduced, in the potential for linking up various parts of the country to the communication network will increase. Therefore, even though a PC may be much less affordable for individual users, the possibility of providing Internet Telephony through various

means should be considered for widening the scope and affordability of resources available to various parts of the country.

Apart from the policy to promote affordability there is a need to encourage the provision of Internet access to schools, libraries and other institutions like community centres to improve accessibility. In addition, public post and telegraph offices in urban and rural areas which traditionally have telephone booths and long distance calling facilities could be redesigned to include public Internet connectivity and provide Internet surfing facilities. Efforts are required to be made to promote “Sanchar Dhabas” and “Community Internet Centres” (CICs), and also to provide Internet connectivity to the public call offices.

The introduction of Internet Telephony may not help bridge the digital divide unless the key element of affordability can be achieved and the need for a PC is avoided by usage of ordinary phone as the terminal device at customer premises. Also, it is worth considering whether legalising PC-PC telephony over Internet would really serve the objective of reducing the digital divide, if it is not supplemented by a reduction in the price of a basic PC to the affordable level.

Issues for consultation in this context are:

7a) Can Internet Telephony play any role in reducing the so called Digital Divide?

7b) Will infrastructure for Universal Service grow faster as a result of introduction of Internet Telephony?

7c) Can immediate introduction of Internet Telephony have any impact on the rollout plans of facility based operators?

CHAPTER-8

Summary of Issues for consultation

1. Does the introduction of Internet Telephony help achieve any or some of the policy objectives outlined in the NTP 99? If so, how?

2. In case Internet Telephony is permitted, whether it should be through the present ISPs? If so, will the ISPs, then be regulated as a Value Added Service provider or as an operator of a Public Telecom Service such as BSOs, MTO, CMSOs etc.?

3. In case ISPs are permitted to offer Internet Telephony, will it necessitate some modifications in the terms and conditions of the existing operators such as BSOs, CMSOs, NLDOs, because of bypass of their network for voice calls?

4. Whether Internet Telephony i.e., telephony on Public Internet be permitted, considering the fact that it will mean a bypass of the PTOs toll network ?

5. If the answer to (a) above is yes, who Should be allowed to offer Internet Telephony:

   i) ISPs only by a process of migration

   ii) All Access providers?

   iii) New entrants including existing players under a new operating category called Internet Telephony Service Providers?

6. If answer to 2(b)(i) is yes, should conditions of the licence of existing Internet service providers (ISPs) remain same in case they are permitted to provide Internet Telephony or they should be modified to reflect the change in the scope of their service.

7. Should PC to PC voice service be regulated?

8. How do we define Internet Telephony? Should it mean PC to PC voice transmission using public Internet, or also PC to Phone (in other country) as well as Phone to Phone without any restrictions?

9. Whether 'Internet Telephony' should also include Fax over IP?

10. Should the new licencees for the Internet Telephony be mandated to use the Access Network of BSOs, or have their own facilities in the last mile including CPEs?

11. As far as the carriers are concerned, should they be permitted all three options shown in figure 4, or allowed only the managed VOIP option shown as option No. 2 of the diagram, so as to ensure a specified QOS end to end, in the interest of the consumer?

12. Considering the fact that the present generation Internet protocol (IP V4) and its associated protocols do not provide for QOS guarantees, should Internet Telephony be permitted to the ISPs, without specifying any QOS?

13. Should there be a separate licence for Internet Telephony Service or some of the existing facility based Service Providers should be permitted to provide this service?

14. In case ISP's are permitted to provide Internet Telephony, what terms and conditions be imposed on them to ensure a Level Playing Field, vis a vis BSOs/NLDOs/ILDOs?

15. Whether a separate category called Internet Telephony Service Provider be created or only the ISPs be permitted to provide Internet Telephony, with some modification in the terms and conditions of their licence?

16. Does Internet Telephony really provide a cheaper option to conventional telephone service?

17. What impact the immediate introduction of Internet Telephony will have on:

i) Tariff rebalancing for domestic and International calls?

ii) Settlement rate system?

iii) Spread of rural telephony

18. What costing methodology should be used for fixing tariff of Internet telephony service?

19. Can Internet Telephony play any role in reducing the so called Digital Divide?

20. Will infrastructure for Universal Service grow faster as a result of introduction of Internet Telephony?

21. Can immediate introduction of Internet Telephony have any impact on the rollout plans of facility based operators?

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ANNEXURE-"A"

Government of India
Department of Telecommunication
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N. Parameswaran,
Dy. Director General (LR)
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No: 820-1/98-LR (Vol. IV) Dated: 20.7.2001

To

Dr. Harshavardhan Singh,
Secretary,
Telecom Regulatory Authority of India,
A-2/14, Safdarjung Enclave,
New Delhi.

Subject: - Internet Telephony

Sir,

As per NTP'99 regarding introduction of Internet Telephony, the Government is to monitor the technological innovations and their impact on national development and review this issue at an appropriate time. Accordingly Government had set up an Internal Group to review and make recommendations regarding opening up of Internet Telephony. The recommendations of the Committee, as approved by the Government are as follows: -

(i) Introduction of Internet Telephony may be considered after:

(a) Opening up of International Voice Telephony, and
(b) Due process f consultation with TRAI, and
(c) Introduction of cost based tariff.

(ii) All types of Internet Telephony viz. PC to PC, PC to Phone and Phone to Phone should remain illegal till Internet Telephony is permitted.

(iii) Any licenced PSTN/PLMN/NLD/ILD operator, may be permitted to offer Internet Telephony service as per licence conditions of the respective services.

(iv) The Quality of Service may be defined based on International standard/experience.
(v) ISPs should not be permitted to offer Internet Telephony.

2. While approving the above recommendations following observations were noted:

It appears that in China usage of Internet Telephony is permitted only to national carriers. In most developing countries, Internet Telephony is not generally allowed. Our main concern is o provide universal access. Therefore, if infrastructure develops faster with the use of this technology by the national carriers, it could help in providing universal access. Side by side, every effort should be made to promote Sanchar Dhabas and to provide Internet connectivity to the Public Call Offices. Even some of the Post Offices in rural areas could take Internet connectivity and provide Internet surfing facilities. These steps will help in creating an environment where we can avoid any sort of digital divide.

3. TRAI may kindly provide Government with their recommendations regarding opening up of Internet Telephony in the country.

Yours faithfully,

Sd/-

(N. Parameswaran)
Dy. Director General (LR)

ANNEXURE-"B"

Table: Summary of regulatory distinctions adopted in different countries regarding IP Telephony

Nature of distinction	**Meaning**	**Countries in which the distinction is adopted**
Real-time	Can the service provide instantaneous, two-way (or "full-duplex") transmission of speech? If not, the service is often not considered voice telephony, but rather a store-and-forward or messaging service. The latter are often considered "value-added" or "enhanced" services and therefore traditionally subject to little or no government regulation. The difference between real-time and store-and-forward may be measured in milliseconds as a technical matter, but is usually undefined in policies (except Hungary).	*EU* *Hungary* *Switzerland*
Phone-to-Phone	Can an ordinary telephone be used as the originating terminal device? This feature make IP Telephony appear to be a substitute for traditional POTS to the consumer.	*Canada* *EU* *Switzerland*
Where IP/PSTN conversion takes place.	In Phone-to-Phone services, the initial conversion of speech from circuit-switched mode to IP mode takes place on the premises of a service provider of some kind, particularly in the case of calling card services. In PC-to-PC and PC-to-Phone services, the initial conversion takes place at the user's PC, such that there is often not a service provider located in the same country as the user, which is usually a precondition for effective regulation.	*Canada* *Malaysia*
PSTN use	Does a given IP Telephony call ever "touch" the PSTN? If it does not, but goes from a private data network to an IP gateway and then over international Internet links, then the PSTN has not been "used". Regulation relating to basic telephony often focuses on the local access network. If that network is not used, then the service in question may not be considered a basic telecommunication service.	*Canada* *Hungary* *Czech Republic* *EU*
Stand-alone Commercial offer to the public	Are IP Telephony services offered in the originating country for the use of the public, and provided as a standalone commercial service with the intention of making a profit? These criteria eliminate services for closed user groups (such as enterprise networks) and services to which voice transmission	*EU*

	is ancillary, such as video telephony, or other multimedia services, such as networked video games.	
Priced/ Billed	"Free" services, such as Dialpad.com, aim to make a profit from advertising, and from ISPs that promote the service. Thus, it may not collect any revenue in all the jurisdictions where the service is used. This can make domestic regulation of such a service very difficult. Other services can be either pre-paid (e.g. calling cards) or post-paid (e.g. discount access numbers, such as Czech Telecom's "Xcall").	*USA* *Korea (Rep.)* *Singapore* *Hongkong SAR*
True Internet Telephony or VOIP?	Distinction between the Internet and private managed IP networks as the underlying means of transmission for IP Telephony calls. It can make the difference between a service being characterized as an Internet service, or simply another form of resale, provided by means of a different technological platform.	*Canada* *USA*
