RESPONSE from Mr. RAKESH KUMAR BHATNAGAR, Retd. Advisor(Technology), DoT on TRAI Consultation Paper No. 13/2014 dated 19 November 2014 on Interconnection Usage Charges

Q1: Which of the following approaches would be the most appropriate for Mobile Termination Charge and Fixed Termination Charge:

(i) Cost oriented or cost based;

(ii) Bill and Keep

Please provide justification in support of your response.

TRAI Consultation Paper has not captured NGN based Interconnection architecture. Most of the Service Providers across the world including India have migrated to NGN or are in various stages of moving towards NGN. It is important that some issues are brought out in public domain through Response to this Consultation Paper.

1. **An Article from 'The Economic Times" on 20th June 2014 is reproduced below"**

"DoT working on policy to treat broadband as basic need

PTI Jun 19, 2014, 03.44PM IST

NEW DELHI: The Department of Telecom is expected to finalise a National Broadband Policy within 100 days that would treat high-speed Internet access a basic right like education and health.

"A new broadband policy is being prepared and will be finalised within 100 days," an official source said.

Under the new policy the government has plans to include broadband among basic necessities like education and health and work towards new legislation of 'Right to Broadband', sources said.

They said it is expected to look at ways of increasing broadband penetration as well as convergence of various technologies and platforms like cable TV, optical fibre, wireless connection through spectrum, VSAT and satellite .

At present there are different departments that govern various technologies. For instance, Cable TV comes under the Ministry of Information and Broadcasting and Satellite related issues are majorly governed by the Department of Space.

The policy is proposed to look at provisions for providing affordable broadband equipments and devices for end consumer use.

The National Telecom Policy 2012 has set a target of 175 million broadband connections by 2017, and 600 million 2020 at minimum 2 Mbps download speed and making available higher speeds of at least 100 Mbps on demand.

There were about 61 million broadband subscribers at the end of March, 2014. Of these, 14.86 million subscribed broadband through fixed line and 46 million used wireless connection like dongles, mobile phone and other devices."

2. Another news item quoting inputs from PTI on Sep 25, 2014 is also reproduced and it clearly captures issues raised in NTP 2012 and DoT's intentions of establishing a National Broadband Policy. The news item is also based on TRAI's Consultation Paper on Broadband Services.

"In order to boost availability of broadband services, telecom regulator TRAI today sought views from the public on ways to accelerate proliferation and use of high speed internet services in the country.

"The objective…is to discuss issues contributing to the poor broadband penetration in India and solicit stakeholders' views on actions required to be taken both by the Government and the service providers to accelerate the proliferation and use of broadband in the country," TRAI said in a consultation paper. The Telecom Regulatory Authority of India has also invited views on timeline to auction 700 megahertz band, most premium spectrum available for telecom services.

In the consultation paper, the regulator has sought views on the way cost of deploying various broadband technologies can be reduced, measures required to encourage content service providers to host content in the data center situated within India,issues in laying optical fibre, freeing spectrum bands for Wi-Fi technology etc. The paper has been floated to meet objectives of National Telecom Policy 2012.

The policy has set a target to "provide affordable and reliable broadband-on-demand by the year 2015 and to achieve 175 million broadband connections by the year 2017 and 600 million by the year 2020 at minimum 2 Mbps download speed and making available higher speeds of at least 100 Mbps on demand".

Against a target of achieving 175 million broadband connections by 2017, 60.87 million have been achieved while total internet connections in the country now stands at about 252 million."

3. The Consultation Paper on IUC from TRAI has however, has not captured the targeted scenario of 2017 and 2020 as IUC also will have to be aligned in line with the changing Network Scenario and for sure, it is going to be data centric. In India, we are having in general about 10 Licensed Operators in each Licensing Area. Most of the Licensees are already having their architecture on NGN Platform though the existing Regulatory regime is yet to move forward on NGN connectivity for Multi-Operator Multi-Service interconnection scenario but NGN interconnection will have to be in place and that too much before 2017 if broadband centric networks have to develop very fast and IUC Regime based on NGN Architecture will be required to be developed by TRAI and time is already running out.

As TRAI Consultation Paper has not captured NGN based Interconnection architecture, I try to bring some issues in public domain to invite some counter comments on NGN based interconnection which I strongly feel should have been captured in TRAI's IUC Consultation Paper. The Response below covers International Traffic delivery and termination rate issues also which are captured in the last group of Questions.

The WORLD BANK has recently published Broadband Strategies Handbook and the same addresses most of the issues raised in the TRAI's IUC Consultation paper.

The **Broadband Strategies Handbook** is a guide for policy-makers, regulators, and other relevant stakeholders as they **address issues related to broadband development**. It aims to help readers, particularly those in developing countries, by identifying issues and challenges in broadband development, analyzing potential solutions to consider, and providing practical examples from countries that have addressed broadband-related matters. The Link below provides the complete Handbook.
http://broadbandtoolkit.org/Custom/Core/Documents/Broadband%20Strategies%20Handbook.pdf

Section 3.4 is most relevant for the Consultation Paper issues and extracts from the same are reproduced below along with the Web Link reference.
http://broadbandtoolkit.org/3.4

"Interconnection for Internet traffic over IP networks operates according to a different set of rules from telephony. However an increasing proportion of telephone traffic is carried over IP-enabled carrier networks. There are now many different operators offering network capacity to send, transit and terminate traffic, ranging from traditional telecom carriers to third party vendors, from Internet Access Providers (retail) to Internet Backbone Access (wholesale) carriers, from content distribution networks (CDNs) to utilities with spare capacity to wholesale.

The commercial terms and ways in which interconnection is offered varies considerable. For example, carriers traditionally interconnect at network Points of Interconnection (POIs) whereas CDNs and cloud computing service companies interconnect in data centres, and Internet Access Providers at Internet Exchanges. Nevertheless, despite its origins and the fact that Internet traffic was never subject to the same regulatory regime as telecoms, certain common practices have emerged.

Interconnection at the international level was mandated, and under ITU guidelines an accounting rate and a settlement rate system between international carriers was established. With market liberalization came competing networks and the need for interconnection. Often regulators required the incumbent to register a ROI (Reference Interconnection Offer) to ensure equal treatment among carriers. No such system has ever existed for Internet traffic.

The Internet had become big business, posing ever growing demands for network capacity on the telecom industry. This posed both a threat and an opportunity for carriers, and most of the dominant ISPs that emerged from the competition were subsidiaries of the carriers. Often by charging high wholesale prices to all ISPs, telecom companies could squeeze the profit margins of independent ISPs without breaking any equal access regulations. The market power of the carriers lies in their ownership of the backbone networks over which IP packets have to travel irrespective of the route they take, and although the use of least-cost routing will save some money, that only works if there is a competitive wholesale market.

ICAIS (International Charging Arrangements for Internet Services)

It is slightly ironic that the big dispute over IP interconnection that arose in the 1990s, and which still echoes to this day, for example, it resurfaced at the 2012 ITU WCIT-12 in Dubai, was not between ISPs and telecom companies as such but largely between the telecom companies that own most of the ISPs. Academia peering arrangements are not difficult to agree, but for commercial service providers peering arrangements are all about market power. The basic rule is that smaller ISPs either cannot peer with larger ISPs in which case they have to find ways to aggregate their traffic to reach critical mass, or reach special agreements with carriers, or pay premium rates for interconnection.

Internationally the same rules apply, but the larger ISPs have for historical reasons been in the USA, and later to a lesser extent in Europe. There is no accounting rate or settlement rate procedure for ISPs and the *de facto* position is that the major US carriers have always been free to charge the full cost of the international links to ISPs outside the US. In the 1990s there were intense arguments between carriers and even between states over this apparent inequality. In reality the issue is an old one: regulated rates versus market rates.

The way markets work is that imbalances between supply and demand will be reflected in prices, and high prices should act as an incentive to remove the supply bottlenecks. In this case the bottleneck was outside the USA where domestic IP traffic, in the absence of a local Internet Exchange Point (IXP), had no option but to route through the US. To justify the expense of a local IXP there needs be a critical volume of IP traffic. All markets thrive on liquidity, and in this case the liquidity in the Internet market means traffic volume. Unless there are structural impediments to the growth of local Internet traffic, such as a monopoly provider, the market mechanism should result in more local IXPs. This should result in more balanced flows of international traffic which in turn should allow more ISPs to enter into peering arrangements with their US and European corresponding networks.

3.4.1 Internet Interconnection and IXPs in Developing Countries

To be cost-effective, interconnection between circuit-switched TDM (Time-Division Multiplexing) telecom networks requires points of interconnection (POI) that minimise route distances. For price arbitrage reasons service providers may choose a more round-about routing of traffic, but technically the more direct the routing the more efficient it is and the less latency

involved. In a packet-switched world of Internet Protocol (IP), a different set of principles operate. Because different packets of the same transmission are routed over different networks there is no single POI. ISPs do not always own their own networks and there is no guarantee of the quality of the networks over which the packets will route. So unless the network was 'managed' and its quality assured, Internet traffic from its earliest days was only 'best effort'. Investment in broadband in recent years means network quality has generally improved and with more sophisticated routing algorithms 'best effort' is now often of very high quality. For example, over-the-top (OTT) voice and video services like Skype and Yahoo Messenger, Facebook and Google that are transmitted internationally over broadband networks can be crystal clear with minimal latency. In addition, a range of specialist managed Internet networks have arisen such as CDNs that guarantee quality of delivery.

ISPs come in three tiers: Tier One ISPs are usually affiliated with a licensed carrier having direct access to an international network, although some of the larger Internet-based companies have begun to build their own networks. For example, Google is ranked third in the carriage of global traffic behind Level 3 and Global Crossing. Tier Two ISPs own or have direct access to local networks and may serve a regional market but require IP transit for international routing. Tier Three carriers have to lease lines and peer with larger ISPs, in some cases as paid peering, to achieve end-to-end delivery of traffic or IP transit. The larger ISPs also provide the connecting networks for IP transit which are known as Autonomous Systems (AS) and are assigned an Autonomous System Number (ASN). The ASN identifies them as using the appropriate routing protocol for IP transit traffic, also known as the Border Gateway Protocol (BGP). When using IP transit, ISPs provide and receive from each other routings to facilitate traffic to and from the customers of the ISPs involved.

Unless the ISP is affiliated to a licenced carrier there is no guarantee of interconnection. Large carriers such as incumbents may reject interconnection with smaller providers for commercial reasons, not technical or regulatory reasons. Alternatively they may impose draconian interconnection charges or high prices for leased lines resulting in profits squeeze of independent ISPs. The lack of domestic interconnection forces ISPs to route their domestic traffic through Internet Exchange Points (IXPs) or to pay for peering to send traffic overseas. Their traffic becomes transit IP traffic which they have to 'trombone', that is send over several different networks before it reaches its destination.

In the 1990s, IXPs were typically in the US and it is still the case that many countries route much of their domestic traffic through the US. According to Packet Clearing House (PCH), as of May 2013, about half of the world's 199 countries are without IXPs'. By contrast, only four European countries are without IXPs, while in Asia Pacific the countries without IXPs are largely Pacific Islands.

3.4.2 The Economics of IXPs and Wholesale Charging

Since the collapse of the dot.com bubble in 2000, international circuit costs in submarine cables have dropped to a fraction of their former price, a trend that was reinforced as cable capacity soared following the recovery in financial markets in the mid-2000s. Reduced international prices have had a major impact upon the cost of Internet traffic. An OECD assessment of the voice-equivalent cost of Internet transit traffic in 2013 is "USD 0.0000008 per minute – five orders of magnitude lower than typical voice rates." However, as the report also points out,

local access charges levied by telecom companies consistently seem to account for between 30%-40% of total international transit costs.

At the same time, Internet businesses have undergone a complete transformation to create a digital economy, everything from search to e-commerce, from social media to e-Government, from online video content to online gaming. In 2011, it was estimated that the Internet-based digital economy contributed 3-4% GDP to the G-8 nations plus Brazil, China, India, South Korea and Sweden.

If a flourishing local Internet can generate so much local economic activity and contribute so much to social welfare, for policy-makers and regulators these statistics are just too important to be ignored. The danger is that smaller ISPs can be easily hindered from reinvesting in their business due to high wholesale prices and profits squeeze and the local Internet economy will suffer. There may be a need for regulatory intervention if wholesale charges are clearly discriminatory against ISPs not affiliated to the telco. However, this can be a difficult policy to pursue because a telco may also squeeze its own ISP so that downstream margins are sacrificed to maintain upstream margins and market dominance. In fact most IXPs have not come about through regulatory intervention but by voluntarily market agreements.

In some cases the state itself establishes an IXP, which can be motivated by the need to address market failure, but the motives could be more political. Much more often IXPs are established either as non-profit entities, sometimes by universities or NGOs or associations of ISPs, or as commercial businesses. Most IXPs in the US are commercial, most in Europe, Latin America and Africa are non-profit and there is more of a mix in Asia. For example most commercial IXPs are in Australia, China (including Hong Kong), Japan and Singapore and non-profit IXPs are mostly in India, Nepal and the Philippines.

The commercial IXPs usually co-locate ISPs in data centres, with various charging schemes including charging for ports or capacity usage, rack space, connection fees and/or a range of management and security services. They can be carrier-related or carrier-neutral, co-location neutral or ISP-specific. The non-profit IXPs are usually dedicated operations which only charge cost-recovery fees and facilitate peering between members, likely to be at no charge between ISPs, although in some cases it can be paid peering if the balance of traffic is too one-sided.

3.4.3 Future Charging Arrangements and Developments of IXPs

When Internet companies such as Yahoo! and Google and major content distribution networks (CDNs) such as Akamai, Amazon and Limelight invest in a local server to cache content from overseas the stimulus to the local IXPs is immediate.

Charging in an NGN Internet World

More of all of these services are being accessed by mobile wireless devices such as smart phones and tablet computers over PLMNS and WiFi networks. These trends have important implications for the business models of the traditional telecom providers; their pricing models in particular are being redesigned. The idea of charging by-the-second or by-the-minute of usage does not work in an Internet world. Charging by capacity makes more sense and as voice traffic declines as a revenue earner, and as OTT substitutes such as social media chat services and texting become ever more popular, telecom companies are moving towards bundled voice and

data services. Bundles are frequently offered at flat rate charges, sometimes with tiered flat rates: each tier with its own capacity ceiling.

The old model of charging termination fees to networks for the delivery of their traffic also comes into question in an Internet environment, for two reasons. First, because there are now many ways for users to access the Internet. Second, as networks upgrade to broadband, telecom companies may be tempted to charge both sides of the market—the providers of services over the Internet and the users—in what is called a 'two-sided market'. This goes the nub of the net neutrality issue.

In practice most carriers, fixed line and mobile wireless, will make the transition cautiously, not wanting to cannibalise their existing lines of business, such as call services, too early as long as they continue to generate revenues.

But as they invest more in all-IP NGNs their billing arrangements are likely to come closer to the charging mechanisms between ISPs, which are mostly Sender-Keeps-All (SKA) – also called Bill-and-Keep (BAK).

Where interconnection charges are levied, for example where the balance of traffic is very uneven, it is likely to be capacity-based charging as the marginal costs of sending a packet are very close to zero."

NGN Interconnection Architecture based on Bill and Keep arrangement will have to be introduced for the Multi-Operator Multi-Service scenario in the country in the near future.

However, in the interim, the existing Cost Based Termination Rate Architecture will have to continue till NGN based Interconnection gets introduced. The changeover is desirable to be undertaken at the earliest.

Q2: In case cost-oriented or cost-based approach is used for determining Mobile Termination Charge and Fixed Termination Charge, is there a need to give a glide path towards Bill and Keep and what will be the appropriate time frame to migrate to Bill and Keep regime?

Earlier we introduce, Bill and Keep NGN Interconnection Regime, it will be better for the country.

Q3: Which method of depreciation for the network elements should be used and what should be the average life of various network elements?

Bill and Keep NGN Interconnection Regime will have different Network Elements and different type of issues to be addressed and existing discussions on depreciation as in Consultation Paper will have not much relevance.

Q4: Should TRAI continue with a pre-tax WACC of 15% as used in framing other regulations, tariff orders, and regulatory exercises? If not, please state what pre-tax WACC would be appropriate for the present exercise, along with justification and computations.

Bill and Keep NGN Interconnection Regime will have different treatment on pre-TAX WACC issues and existing discussions on WACC as in Consultation Paper will have not much relevance.

Q5: In case a cost-oriented or cost-based approach is used for prescribing Mobile Termination Charge and Fixed Termination Charge, which method would be the most appropriate for estimating these costs?

Existing LRIC Modelling can continue till NGN Interconnection Regime is implemented.

Q6: In case your response to the Q5 is fully allocated cost (FAC) method, would it be appropriate to calculate IUC using historical cost data submitted by the service providers in Accounting Separation Reports (ASRs), Annual Reports/published documents or other reports submitted to TRAI?

Reliability of data?

It would have been desirable, if the Consultation Paper had included data that is proposed to be used or is referenced for IUC calculations.

Q8: Should CAPEX be included in calculating termination cost? If yes, what items of fixed assets from the ASRs ought to be considered relevant for termination cost? How should costs incurred by service providers for acquiring usage rights for spectrum be treated?

Existing LRIC Modelling can continue till NGN Interconnection Regime is implemented.

Q9: Would it be appropriate to take an average life of 10 years for all network elements without any salvage value for the purpose of depreciation in the FAC method? If not, please suggest an alternative method keeping in view the categorization of network elements prescribed in Accounting Separation Regulations, 2012, along with justification.

NGN Interconnection Modelling will not be same. However, Technology Changes are so fast that average life of Network Elements deployed in Telecom Networks will be on the lower side. Further, all Network Elements cannot have same life period.

Q11: Do you agree with the methodologies explained for various variants of LRIC, including the detailed description of computation of the termination cost using LRIC model in the Annexure? If not, please give your answer with justification.

NGN Interconnection Modelling is not discussed in the Consultation Paper.
In the interim, existing Model can continue as NGN architecture will be desirable to be implemented in a years time. We need to have close look of Network Architecture of Licensees. It would be observed that most of them internally make use of NGN architecture for their National traffic.

Q12: In case it is decided to go for an LRIC model for determining termination cost, which is the most suitable variant of LRIC for the telecom service sector in the country in the present circumstances and why?

(i) LRIC
(ii) LRIC+
(iii) Pure LRIC

NGN Interconnection Modelling is not discussed in the Consultation Paper.
In the interim, existing LRIC Model can continue though NGN architecture will be desirable in a years time.

Q14: In case there is a significant difference in the mobile termination cost and fixed termination cost, will it be appropriate to prescribe different mobile termination charge and fixed termination charge?

The issue will not be relevant for NGN Interconnection and no change is suggested for intervening short interval before new Interconnection architecture.

Q15: The Authority has already prescribed access charges to facilitate the introduction of calling cards. Is there any other issue which needs to be addressed so that the consumer gets the most competitive tariff for ISD calls?

No.

Q16: Do you feel that the Authority's intervention is necessary in the matter of International Settlement Rates? If so, what should be the basis to determine International Settlement Rates?

No.

For Q17 to Q22, ITU-T Recommendations of SERIES D that cover GENERAL TARIFF PRINCIPLES should be applicable.

When NGN based International interconnection is established, General tariff principles – Charging and accounting principles for next generation networks (NGN) based on ITU-T Recommendation D.271 'Charging and accounting principles for NGN' should be applicable. For conventional International voice traffic, ITU-T Recommendation D.150 shall be applicable along with D.150 Supplement 1 of January 2012 'Checklist for bilateral complex agreements' should be applicable.

D.150 : New system for accounting in international telephony

Recommendation D.150

In force components		
Number	**Title**	**Status**
D.150 (06/99)	New system for accounting in international telephony	In force
D.150 (1999) Amendment 1 (09/05)	Optional transit share arrangement	In force
D.150 (1999) Supplement 1 (01/12)	Checklist for bilateral complex agreements	In force

Para 2.5 of ITU-T Recommendation D.150 on Termination Charge Procedure is reproduced below:

"2.5 Termination charge procedure
2.5.1 Under this procedure, the Administrations of destination receive a payment on the basis of a cost-orientated termination charge which they set by reference to a mutually acceptable costing methodology or, when available, a costing formula/methodology contained in ITU-T Recommendations, for traffic received from Administrations with which the application of this procedure has been bilaterally agreed.

2.5.2 The termination charge should comprise:
a) the use of its international exchange.
b) the national extension.
Components a) and b) should normally be separately identified.
In addition,

c) Where it is bilaterally agreed to use an international circuit provided by the Administration of destination, to terminate an international call, then the costs associated with the use of that international circuit section should be added to the call termination charge.

This charge should be cost orientated, separately identified and bilaterally negotiated. Where the administration of origin does not use the international circuit section offered by the Administration of destination, no charge would be applied.

d) Any additional costs that are imposed on a carrier by national regulation and that are a condition of operating its domestic network and providing termination of international traffic."

The Administration should make available to its international correspondents concerned a detailed list of any additional cost elements, as described in d) above, together with associated national laws."

Indian Service Providers should be free to enter into any Bilateral Agreements that they may like to finalise, provided parameters listed in a) to d) are respected. TRAI can play a role on some of these parameters including through IUC Regulation.