Project Report

On

Interconnection Issues In Telecom Sector

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1. Background

Telecom is the means of communication of the future and shall form a vital component of India’s infrastructure. The pace of technological evolution coupled with the presence of a monopoly player and multiple regulators has led to a situation where the regulatory issues need a thorough examination. In this project we aim to look at Indian telecom sector, specifically the interconnection issues, in light of reforms that have been occurring across the globe and try to come up with certain recommendations. The perspective of the project is primarily from that of the TRAI1.

2. Scope of the project

This report aims:

?? To examine the current trends in regulation of interconnection especially fixed mobile, mobile to fixed and implementation calling party regime and implications for the incumbents and the private operators.

?? To understand steps taken the TRAI, analyse the proposals and judgements delivered by TRAI regarding the interconnection issues.

?? To understand the present framework existing for dispute resolution and comment upon the same.

?? To make recommendations for regulatory authorities while converting from 2G to 3G technologies.

?? To examine the current pricing mechanisms prevalent across the globe, understand the advantages and disadvantages of the various methods and comment on the actions taken by TRAI for the above.

After discussions with the faculty, it was decided that the project would not cover the calling party pays regime as referred to in the original mandate because the topic shall be dealt with in detail by another group.

1 TRAI: Telecom and Regulatory Authority of India
3. Introduction To Interconnection

All over the globe the introduction of competition in telecommunications has brought tremendous benefits to both consumers and operators. Competition provides consumers with greater choice of service operators, wider variety of services, significantly improved service quality, and more cost reflective tariffs. For developing countries, added benefits include the attraction of badly needed investment, faster network deployment, and wider consumer coverage. In addition, incumbents and other operators are given incentives to make improvements in their efficiency and to exploit opportunities for growth and innovation.

Interconnection, the linking together of interoperable systems or the linkage used to join two or more communications units, such as systems, networks, links, nodes, equipment, circuits, and devices, is a necessary condition for effective competition since it enables consumers of one network to be able to successfully complete a call to another consumer or service irrespective of whose network the originator of the call is using or to whose network the call recipient or service provider is connected to. This is referred to as the any-to-any principle of interconnection.

*Interconnection is simple:* Public interest is maximised by minimising the barriers to the flow of communication and information (implies seamlessness) and by having as many people connected to the network as possible (externality issues)

In multi-operator environments: In multi-operator environments, this implies interconnection to ensure any customer of one network can call any customer of another network
If any to any calling is not maximised through regulatory intervention then economic efficiency is not guaranteed and competitive networks are not in the public interest (duplication of resources argument).

4. Importance Of Interconnection

?? Interconnection is essential for the inter-operability of networks to enable customers of different networks to communicate with one another

?? Interconnection is the critical item in providing efficient investment and effective competition

?? Interconnection accounts for between 20%- 70% of operating costs, depending on the particular product.

?? The structure and level of interconnection are critical in defining where and how ventures can be competitive

?? It defines the nature of networks and, in some cases, businesses

?? If regulators fail to understand interconnection, they can distort market entry signals, invalidate investments and allow/ encourage the abuse of dominant positions to the detriment of customers

5. Interconnection Services

?? Call termination is the essential interconnect service - it cannot be feasibly replicated - there is no ‘make or buy’ decision.

?? Call origination (which encompasses carrier select, carrier pre-select and equal access) is also treated as an interconnection service to enable resellers to access customers of local networks in order to sell them other services such as long distance and international. But it is possible to replicate call origination by building your own access network - so there is a ‘make or buy’ decision.

?? Inter-operability of services means that interconnection should cover all types of services and not be confined to basic voice telephony calls (pstn).
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?? Isdn, data, mobile calls, premium rate services, shared revenue services plus interconnection links.

?? Arrangements should also be made for access to emergency services and directory enquiries - not ‘interconnect’ strictly speaking.

?? The key issue is not what ‘label’ is given to any particular service but the price paid by the ‘interconnecting operator’.

The following sections discuss a host of interconnection issues in telecom, analyses the judgements delivered by the TRAI, critiques some of the proposals of the TRAI consultative papers and gives suggestions for the Indian context.
6. Issues In Interconnection While Pricing Interconnect

6.1 Introduction

The aim liberalisation of the telecom sector in the Indian context is to ensure that service is provided to greater number of people at low, affordable costs.

Effective competition is the most appropriate way of achieving these goals. Therefore the new entrants should not be unreasonably hampered through a lack of network infrastructure of their own. Hence, care must be taken to ensure that interconnection charges encourage efficiency, effective competition, and improvements in product and service quality. In summary, interconnection charges should be at a level commensurate with the true economic cost of providing the service, including an adequate return on investment.

Regulators may be called in to set prices where prices cannot or should not be set in the market. In the case of interconnection, dominant network operators have incentives to overcharge not merely to earn an excessive profit on interconnection itself, but also to reduce competition in downstream retail markets.

The general policy guiding the governments is that prices, including interconnection charges, be cost oriented. There is no universal definition of what constitutes cost orientation. In fact there are various definitions of cost orientation, depending on the costs that are included, how assets are valued, and how costs are apportioned across services. For an approach to be cost oriented, the principle of cost causation must be respected. This has two important implications:

?? Charges should include the costs incurred by the incumbent in providing interconnection services to the interconnecting operators. On occasion, there may be a case for diverting from this aspect of cost causation or modifying its effect, because of the implications of some of the other principles.

?? Costs that are unrelated to the provision of interconnection services should be excluded. Examples of such costs are retail costs and the costs of providing exchange lines (the access network). The latter are not relevant to the basic
interconnection charge, because the costs of lines do not vary with the amount of traffic, but depend on the number of lines.

6.2 The Alternatives

There are three broad methodologies, which have been employed worldwide in order to determine the charges applicable to any network. All have been implemented in different parts of the world with varying degrees of success. These approaches are:

1) Fully Distributed Cost (FDC)
   The total costs of the operator are split or distributed among the various services that it provides. Precisely how the distribution of costs is done depends upon the accounting attribution and allocation methods adopted. Some types of cost can be attributed to particular services on a causal basis.

2) Total Service Long Run Incremental Cost (TSLRIC)
   It is the cost that the operator would incur to provide the given service in question, given that its other services are already provided and, as such, includes only costs causally related to the service in question. An appropriate mark-up may be provided in the initial years for reasons of aiding entry. The size of the mark-up is set to allow the common costs just to be recovered.

3) Efficient Component Pricing Rule (ECPR)
   The price of the interconnection service is the sum of the TSLRIC of providing interconnection and the net revenue foregone by the incumbent (or its 'opportunity cost') by providing interconnection. The entrant uses the interconnection purchased from the incumbent to provide a retail service or value-added service, which may be in competition with a retail service provided by the incumbent. The net revenue foregone is the
margin of the retail price over the incremental cost of its retail service that the incumbent loses by providing the interconnection service to the entrant.

6.3 The Different Sides Of The Coin

Each of the three methods has its advantages and disadvantages, which are briefly summarised below:

6.3.1 FDC

**Pros**

?? It would ensure that sufficient revenue was generated in aggregate to cover the total costs of the company, because (by definition) the sum of the FDCs of the services equals total cost.

?? As FDC is derived from the operators’ accounting records, various types of verification can be obtained for the cost information: in particular, the FDCs can be audited.

**Cons**

?? One of the most important criticisms is the use of historical cost; as being a poor measure of the economic costs.

?? FDCs are strongly influenced by the accounting conventions used, such as the use of historical cost or replacement cost for asset valuation

?? The cost allocation process is complex and notoriously arbitrary. There is no single correct answer to the question of how costs should be allocated

?? It can be extremely difficult for the regulator to prevent companies from acting on the incentive to allocate costs unduly towards non-competitive services and away from competitive services

?? FDC does not measure the cost to the firm of providing additional units of the service (marginal cost), or the amount the operator would save by ceasing to provide the service (total service incremental cost). Thus, comparing FDC to the service’s average revenue does not really indicate whether or not it is really profitable, in the sense that its continued provision at existing prices
makes a net contribution to the operator’s profitability, or whether instead it is a burden on the users of other services.

6.3.2 TSLRIC

**Pros**

?? It is a measure of the economic cost incurred. This eases the use of methods for asset valuation such as the Modern Equivalent Asset.

?? It appropriately satisfies both aspects of cost causation, since it includes all costs that are casually related to the provision of the service, and it excludes all irrelevant costs. Therefore it can provide a sound price signal to allow interconnecting operators to make appropriate investment decisions.

?? TSLRIC can be used to set the minimum price and the maximum price for the service. TSLRIC sets the floor and the stand-alone cost (SAC)² sets the ceiling price. SAC sets the maximum price, because a price above SAC would not be sustainable in a competitive market. A price above SAC could be undercut by new entrants, even those that did not benefit from the incumbent's economies of scope.

**Cons**

?? The mark-up rule lacks sound conceptual justification; can be arbitrary and is not sustainable in the long run. Hence it shall require the regulator to step in at a date in the future to resolve the pricing as and when the markets mature.

?? Costs are based on a hypothetical network, not the incumbent’s actual network. This may be an unrepresentative estimate and hence does not capture accurately the opportunity costs that society foregoes when elements/services are consumed.

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² SAC is the cost that would be incurred if the operator were to provide a single service itself. SAC is the sum of TSLRIC of the service and all the common costs, because the operator would continue to incur these costs even if it withdrew all other services.
6.3.3 EPCR

**Pros**

?? It encourages efficient entry while deterring inefficient entry. If an entrant's cost of providing the retail service were lower than the incumbent's, then there would be a profitable entry opportunity. But if the entrant has higher costs than the incumbent, entry at interconnection charges determined according to the ECPR would not be profitable.

**Cons**

?? It is problematic to implement in that a distinction has to be made between generated and diverted traffic and this might not be feasible (because revenue foregone is zero for generated traffic).

?? As the method necessitates that the incumbent’s net revenue foregone to be included, ECPR tends to result in relatively high interconnection charges.

?? The argument that ECPR only deters inefficient entry is derived from a static model that does not take account of the dynamic benefits of competition. These include increased choice for customers, enhanced incentives for cost reduction, improved customer service and greater innovation.

### 6.4 The Global Status

TSLRIC interconnection charges are now in place in the USA, UK, Netherlands and Hong Kong. Many other countries are expected to follow soon (e.g. other countries in the European Union and Japan have work in progress to derive charges based on TSLRIC data). In all of the countries that have charges based on TSLRIC in place, apart from Hong Kong, the interconnection charge includes a mark-up added to the TSLRIC.
In addition the USA and UK have also experimented with the FDC policy. The figures for BT are shown in the table below:

<table>
<thead>
<tr>
<th>Pence per minute</th>
<th>FDC historical cost</th>
<th>FDC current cost</th>
<th>TSLRIC plus equal mark up</th>
</tr>
</thead>
<tbody>
<tr>
<td>Local exchange segment</td>
<td>0.46</td>
<td>0.37</td>
<td>0.35</td>
</tr>
<tr>
<td>Single tandem</td>
<td>0.59</td>
<td>0.56</td>
<td>0.53</td>
</tr>
<tr>
<td>Double tandem</td>
<td>0.94</td>
<td>0.75</td>
<td>0.73</td>
</tr>
<tr>
<td>% difference from TSLRIC markup</td>
<td>30%</td>
<td>5%</td>
<td>-</td>
</tr>
</tbody>
</table>

Source: Consultative Document on Interconnections, Govt of Jamaica

The costing mechanisms to determine the quantitative aspects of the above pricing policies are varied in nature. The various schemes are:

1) **Top down Approach** – Builds upon the company’s accounting information. The results be traced back to recorded costs and can be audited and verified but it includes company’s inefficiencies so results are above efficient level of costs.

2) **Bottom-up approach** – Engineering model determines elements of a network required to supply service using most efficient commercially available technology (e.g. LECOM and HCPM). This understates true level of costs and assumes ideal network design.

3) **International charge comparison** - Comparison with charges in other countries. Average charge ranges derived are used to set charges. The advantage is that it reflects interconnection charges actually in place, and not hypothetical costs. The downside is that charges in other countries do not directly reflect costs in host nation

All three approaches have been used around the world.

?? USA – Proxy models using HCPM and LECOM

?? UK and the Netherlands – Hybrid approach verifying both top-down and bottom-up models and then reconciling the results

?? Germany, France – Comparisons have been used as the basis to set interconnection charges
6.5 TRAIs Actions

Interconnection charges prevalent in the country include payment for a link established between two networks, and for the use of the interconnection provider’s network facilities.

Interconnection prices vary both in the manner in which they are paid (e.g., lump sum, flag fall, or per minute charge), and with respect to the basis used to charge them (e.g., distance covered by a call, elements of the network used, density of the delivery zone, time of the day when a call is made, and capacity required for transmission of traffic).

A review of the interconnection charges is carried out periodically.

The basic principles proposed by the TRAI are:

- **Set up costs of interconnection** – The set up costs of interconnection are borne by the interconnecting Service Provider, i.e. the Service Provider seeking interconnection to the interconnected Service Provider i.e., the Service Provider whose network is sought to be interconnected.

- **Access charges** – Access charges are fixed by TRAI from time to time.

- **Charges for leased lines** – Charges for leased lines are fixed by TRAI from time to time.

- **Linking with other networks** – The connectivity between two service providers in the same service area for terminating traffic only is left to the mutual agreement and not forced through the third network in that service area.

- **Sharing of facilities with other networks** – The Passive Network should be allowed to be shared freely based upon mutual agreement.

- **Interconnection charges are cost-based**; i.e. these costs are those "caused" by constructing the link with, and through the use of, the network of the interconnecting service provider. Thus, these are "incremental", or "additional" costs arising due to interconnection (equivalent to the TELRIC/TSLRIC).
For any particular interconnection service, the same interconnection charges apply to any service provider irrespective of the service provided.

All interconnected service providers are allowed to charge an interconnection price.

Interconnection charges for ancillary and supplementary services (directory enquiries, operator assistance, charging and billing, and complaint and emergency services) are settled among the operators themselves, without intervention from the TRAI.

The operators have to report their costs within a specified format:
- Elements of the network required for interconnection are identified
- The operators inform the TRAI on the costs of providing interconnection to these elements, and TRAI, if required, specifies the interconnection charges for these elements based on long run incremental costs
- To the extent that the cost information for this purpose is not readily available, present average costs shall be used to determine certain interconnection charges (a transition to estimates based on more detailed incremental costs will occur as and when the relevant data becomes available).

With respect to the TSLRIC:
- The set-up costs incurred for establishing interconnection are fully taken accounted for.
- Additional (or incremental) costs arising due to usage of the network facilities are included.
- A margin (mark-up) on the cost estimates is provided, to cover the joint or common fixed costs involved.

6.6 Critique Of The Actions In India

Reduction Of Cost To End User – If cost based tariffs are not implemented at the same time as cost based interconnection charges, the decrease in the cost of operation for service providers will not be passed on to the final consumers of
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telecom services. The phase-in period is estimated at around three years, and even for prices being phased in, most of the tariff reduction would likely be achieved within a minimum of one year from implementation. This means that the gains visualised for the final consumer shall be realised in the near future and the operators would be able to garner excess profits.

Use of TSLRIC – The TRAI requires that the TSLRIC be based upon cost data available from the various companies internal sources. However given the state of accounting principles in the country, with high occurrences of window dressing, poor corporate governance and lack of reliability in audited results there is a high probability of manipulation of records and figures in order to garner higher revenues.

The use of TSLRIC suffers from all the disadvantages listed above, in the previous subsection. Therefore it is possible that as and when a superior costing system is devised, a complete overhaul would be required, which shall be costly and time consuming.

Use Of Price Comparison – A possible solution for pricing is to use international price comparisons across the globe with similar countries also planning to implement these reforms (e.g. Jamaica). This method has been tested in Germany and can be used until a conducive atmosphere for other practices is developed.

Gradual Deployment Of Costing Mechanism - The TRAI should look to move to TSLRIC gradually and use FDC in the initial stages of deployment.

Setting Of The Margin – The margin (mark up) allowed to the various operators should not exceed the SAC (stand alone cost). Also this figure has to be carefully reviewed as the figure of 25% suggested is derived from Canada and may not applicable to the Indian context.
7. Issues In Interconnection While Converting From 2G To 3G

7.1 The Move To 3G

The third generation (3G) of mobile communications systems, due to succeed to the present second generation networks (2G) such as the GSM, will be able to provide users with a large range of high throughput capacity multimedia services and applications. These new possibilities will be founded upon three main innovations:

- Broadband radio-frequency access allowing rates up to 2 Mbit/s;
- Intelligent network (IN) architecture allowing to create a single access mode to the services for the user whatever the network he uses, and to provide numerous supplementary services;
- Convergence between fixed and mobile networks (FMC) is in progress.

This third generation of mobile communication systems will thus provide personal and interactive multimedia services by means of a single portable terminal, combining cordless networks, cellular networks and satellite networks. UMTS will contribute to introducing mobility in multimedia applications (GMM) within the framework of the emerging "Information Society". The UMTS concept, characterized by global ubiquity, is summarized in a single slogan:

"In contact anytime, anywhere, with any one!"

7.1.1 3G and Interconnection

Interconnection is going to be the key driver to fructifying the above concept. Interconnection is obviously the cornerstone of liberalization in the telecommunications sector. Interconnection regimes are tending to multiply and become more and more complex with the growing number of operators and services, the different charging

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3 GSM = Global System for Mobile communications
4 FMC = Fixed Mobile Convergence
5 UMTS = Universal Mobile Telecommunications System
6 GMM = Global Multimedia Mobility
systems and the international context. The diversity of 3G mobile systems will increase the needs for interconnection, particularly with networks bearing data transmission services. However, the issues concerning interconnection and interoperability conditions between networks and services gave rise to very divergent positions.

### 7.1.2 The 2 schools of thought

**Free Market school:**
Some consider that the complexity and diversity of services expected from 3G mobile networks, especially in multimedia, will increase the functionalities to be borne by interconnection but that present uncertainties do not allow to devise beforehand an appropriate regulatory regime: negotiation of required agreements should therefore be left to the commercial initiative of the operators and service providers concerned. This school of thought also mention the following reasons for not imposing compulsory roaming agreements between 2G and 3G networks - the possibility, for a 3G network operator, to conclude national roaming agreements with existing 2G network operators is not likely to promote investments in 3rd generation networks and could lead to systematic cherry-picking of the most attractive zones by new 3G operators while 2G operators have to continue a heavy investment policy in their GSM networks.

**The compulsory school:**
On the contrary, others consider that the future operators of 3G mobile networks should enjoy an enforceable right to obtain interconnection from other operators of public networks, for any type of network (fixed, mobile, international) and for any rate and transmission mode usually applied in telecommunications networks. It will probably be difficult for a new operator to set up rapidly a national UMTS network and such an operator could therefore be interested in supplementing its services by providing more traditional mobile telephony services.

Among other things, it is suggested to extend the obligation of interconnection to any type of special access: WAP servers, intelligent networks (IN), roaming gateways, etc. Moreover, for operators with significant market power, interconnection charges must absolutely be cost-based, which has to be scrupulously verified by the regulator. On the
contrary, other respondents think that an obligation of access to their GSM networks should be imposed on the present 2G operators.

Whatever school of thought one might belong to there is no debate on the fact that rapid introduction of new technology and services at prices affordable for the mass consumer is required to enable this industry to continue fulfilling its potential. Access issues become critical for the development of the industry. Building up a new mobile network requires significant time and money, while obtaining access to an existing digital mobile network can enable the speedy and cost-efficient introduction of new technologies and services. Thus, the commercial pressures to gain access to mobile networks are mounting.

7.2 The Stand Of 2G Operators

Mobile network operators have always underscored an important difference between mobile and fixed network operators: the latter are mainly former State monopolies that control fully-financed and largely amortized networks that have been built over many decades. The mobile operators, on the other hand, have had to make heavy investments within a short period of time and often in a competitive environment to enter the market. In many cases, these investments still need to generate sufficient returns. Mobile network operators (2G) therefore vigorously oppose any access obligations that could lead to what they perceive as free riding on their investments (by 3G operators). Mandatory call origination at cost-based tariffs, is seen by mobile network operators as one (potential) form of free riding, since it requires unbundled cost-based access to the most investment-intensive part of the network: the 'air interface' with the subscriber's handset.

7.3 The EU Transition Experience: A Case Study

The objectives of the new regulatory environment would be to ensure open access to networks and services, and to guarantee the rights of market players to obtain interconnection with the networks and services of others where this is reasonably justified.
The proposed harmonized framework for interconnection will be characterized by:

- Application of the open network provision principles of transparency, objectivity, and non-discrimination, in accordance with the principle of proportionality;
- Priority given to commercial negotiations between interconnecting parties while reserving some conditions to be set a priori by national telecommunications regulatory authorities;
- Clear responsibilities for national regulatory authorities, in accordance with the principle of subsidiarity, including effective mechanisms for dispute resolution.

The proposed Directive lays down a framework for interconnection in which the rights and obligations of the parties concerned are clearly set out. A new market entrant wishing to acquire strong rights to interconnect must accept correspondingly strong obligations; another, depending on the services to be offered, may be content with fewer rights and fewer obligations.

The players will be subject to certain a priori conditions laid down by the national regulatory authority (e.g. regarding international standards, numbering, etc.), but in all other respects, interconnection agreements would be the result of technical and commercial negotiation between the parties.

Organisations who also have significant market power would be assigned certain obligations, in particular, those aimed at compensating for an imbalance in negotiating power with much smaller new market entrants. Significant market power may be defined in terms of a number of factors which may be considered separately or in combination, such as size, market share, degree of vertical integration, ability to act independently of their competitors, control of scarce resources, any privileges with respect to other market players, etc. Obligations for these types of organisations would include requirements for published interconnect price lists, for cost-oriented interconnection tariffs supported by transparent cost-accounting systems, and for accounting separation in certain cases.
The Directive

The Interconnection Directive The Voice Telephony Directive's "special network access" provisions (Article 16 of Directive 98/10) apply only to fixed networks (incumbent mobile operators successfully resisted an initiative to extend them to the mobile sector). The only sector-specific regulatory basis for imposing access obligations on mobile network operators is the Interconnection Directive (Directive 97/33, as amended). Article 4(1) of the Directive specifies that all mobile operators, regardless of their market power, be under an obligation to negotiate interconnection with other telecommunications organisations.

In addition, mobile operators with significant market power (SMP) must meet "all reasonable requests for access" (Article 4(2)). In practice, there is a rebuttable presumption that an operator has SMP if it has a share of more than 25 per cent of a particular telecommunications market in a defined geographical area.

Cost orientation - In the fixed telephony sector, an operator with SMP must grant access to its network on a cost-orientated basis. In contrast, mobile operators (falling under Article 4(2) of the Interconnection Directive) are not generally subject to price regulation. Agreement on terms for access, including price, will depend on the success (or failure) of commercial negotiations. The principle of cost orientation will only apply if, in addition to having SMP in the market for the provision of mobile networks or services, a mobile operator is also notified by the competent NRA (National Regulatory Authority) as having SMP on the national market for interconnection – i.e. the combined market for mobile and fixed interconnection.

An operator would be found to have SMP if it:

?? Is dominant in a particular market, determined on the basis of general competition law principles and

?? Has had special or exclusive rights in the past or is vertically integrated and controls facilities to which access is required to compete in a downstream market.
7.4 Other Key Issues In Transition From 2G To 3G

**Pricing**

Pricing for interconnection is a key factor to determine the structure and the intensity of competition in the transformation process towards a liberalised market. Organisations with significant market power must be able to demonstrate that their interconnection charges are set on the basis of objective criteria and follow the principles of transparency and cost orientation, and are sufficiently unbundled in terms of network and service elements offered. A list of interconnection services and charges must be published to enhance the necessary transparency and non-discrimination. Flexibility in the methods of charging for interconnection traffic should be possible, including capacity-based charging. The level of charges should promote productivity and encourage efficient and sustainable market entry, and should not be below a limit calculated by the use of long run incremental cost and cost allocation and attribution methods based on actual cost causation, nor above a limit set by the stand-alone cost of providing the interconnection in question.

**National regulatory authorities**

National regulatory authorities shall have an important role in encouraging the development of a competitive market in the interests of users, and of securing adequate interconnection of networks and services. National regulatory authorities setting down certain conditions in advance, and identifying other areas to be covered in interconnection agreements can facilitate negotiation of interconnection agreements. In the event of a dispute over interconnection, an aggrieved party must be able to call on the national regulatory authority to resolve the dispute. National regulatory authorities must be able to require organisations to interconnect their facilities, where it can be demonstrated that this is in the users' interests. The task of national regulatory authorities could be facilitated by the publication of non-binding guidelines in these areas.
Billing

The question of internetworking agreements is intertwined with the extremely problematic issue of billing. Indeed, internetworking supposes efficient settlement agreements between carriers, which in turn rely heavily on the existence of data pricing systems. The switch to IP mobile communications (in 3G) implies that billing will be databased, and not voice-based as it is the case with 2nd generation networks. Should the users be charged on a flat-rate basis, a per minute basis or a per byte basis? While the per byte basis seems to be the most appropriate, so that users are charged in accordance with their personal use of the network, such a system might alienate consumers. In addition, the per-byte billing involves huge technical challenges, which are far from being resolved. Keeping track of bytes is a technical nightmare that will require new switches, new clearing houses and new billing settlements. Another complication will be to figure out billing settlements between carriers, portals, ISPs and value-added services providers. In any case, internetworking and billing constitute huge challenges. Nobody knows yet how they will be dealt with, but the successful deployment of 3G networks relies on the industry’s ability to overcome them. Internetworking also constitutes a challenge for the regulators, as they must ensure that new entrants can interconnect seamlessly at fair rates with the existing operators.

Charges for interconnection

Charges for interconnection shall follow the principles of transparency and cost orientation, and promote economic efficiency and sustainable market entry. The burden of proof that charges are cost-oriented shall lie with the organisation providing interconnection to its facilities. National regulatory authorities may request an organisation to provide full justification for its interconnection charges, and where appropriate shall require charges to be adjusted. Charges for interconnection shall be based on the costs of providing the interconnection services requested, and shall normally contain the following elements, each of which should be itemised separately:
1. A charge to cover re-imbursement of the one-time costs incurred in providing the specific elements of the interconnection requested; (ie the initial cost of any engineering work needed to provide the interconnection facilities requested);

2. Usage charges related to the utilisation of the network elements and resources requested. These may include capacity-based charges or/and traffic related charges

**Overall Interconnection Charges**

**Connection charges**
- Are based on the costs of providing the specific interconnection services requested by the interconnecting organisation. They may include *inter alia*:
  - *One-off and rental costs* of implementing the physical interconnection (eg. specific equipment; signalling resources; compatibility testing; connection maintenance; etc.);
  - *Variable costs for ancillary and supplementary services* (eg. access to directory services; operator assistance; data collection; charging; billing etc.);

**Usage charges**
- Are based on the costs incurred in the conveyance of traffic through the interconnected network (eg the costs of switching and transmission). Usage charges may be on a call-per-call basis, and/or on the basis of additional network capacity required.
In addition, interconnection charges may include a fair share, according to the principle of proportionality, of the costs incurred in providing equal access (eg. the support of identical end-user access procedures), and number portability, and costs of ensuring essential requirements (maintenance of the network integrity; network security in cases of emergency situation; interoperability of services; and protection of data).

**Accounting separation**

Appropriate accounting separation between interconnection activities and other activities ensures transparency of internal cost-transfers. Where an organisation with special or
exclusive rights in a non-telecommunications field also provides telecommunications services, accounting separation is an appropriate means to discourage unfair cross-subsidies.

**Accounting Separation – International Experience**

<table>
<thead>
<tr>
<th>Country</th>
<th>Accounting Separation</th>
<th>Price Caps</th>
</tr>
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<tbody>
<tr>
<td>Australia</td>
<td>Has horizontal separations</td>
<td>Implemented for PSTN</td>
</tr>
<tr>
<td></td>
<td>Working on vertical separations</td>
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</tr>
<tr>
<td>Canada</td>
<td>Has horizontal and vertical separations</td>
<td>Implemented for PSTN</td>
</tr>
<tr>
<td>Japan</td>
<td>Has accounting separations for interconnection tariffs</td>
<td>Implemented for PSTN in non-urban areas</td>
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<td>Proposed move to incremental costing in 2000</td>
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<tr>
<td>New Zealand</td>
<td>Has proposed a “Line of Business” approach for the incumbent based on Avoidable Costs</td>
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<tr>
<td>European Community</td>
<td>Has adopted a “line of business” approach</td>
<td>Implemented for PSTN</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>Implementing incremental costs for network charges – using EC approach</td>
<td>Implemented for most retail services</td>
</tr>
<tr>
<td>United States</td>
<td>Has implemented incremental costs for interconnection charges</td>
<td>Implemented for most retail Services</td>
</tr>
</tbody>
</table>
7.5 Accounting Separation - The Indian Experience

India has proposed to move toward an Accounting Separation approach that has common elements with other world jurisdictions, while still reflecting the policy concerns that are unique to the Indian environment. The Service Specific Costing approach for products and services is in line with the approach adopted by other advanced justifications. The accounting-separation methodology lays down the concepts, approach and practices for attributing revenues and costs, captured in entity accounting, to individual products and services, or aggregations thereof. All revenues and costs reported for the licensed entity are disaggregated to determine the profitability of retail and inter-service provider segments. Following concepts are relevant in the context of accounting separation:

- Assignment and allocation;
- Cost classifications; and
- Distribution of costs

Aggregated information has its limitations for the purposes of regulatory decision making such as for tariff and cost analysis. Accounting Separation is, therefore, significant from the regulatory perspective in a multi-operator environment. It sets out the accounting requirements for the segments for which the Authority requires financial information.

In the case of an incumbent/dominant operator, the accounting separation would enable costing details relating to different activities. It would encourage confidence in the cost allocation and attribution methodology by making it transparent. This would also ensure that the costs related to interconnection services are clearly identified and separated from the costs of providing other services; services provided internally (from one activity within the incumbent to another) are provided on similar terms to those offered externally.

**It is proposed that the costing concepts be based on two systems namely, Broad Financial Category Costing (BFCC) and Service Specific Costing (SSC).**

*BFCC* provides a framework to identify the sources and recipients of cross subsidies among broad categories of existing services (i.e. particularly the existence, if any, of a cross-subsidy of competitive categories by monopoly categories). Its procedures assign a
service provider’s total realised revenues and costs among a few broad categories of services. These results are summarised in a presentation of revenue surpluses (shortfalls) for each category reconciled to the service provider’s income statement. All existing categories are grouped into broad categories. This system is extremely useful for monitoring rate re-balancing initiatives and it supplies initial pre-requisites for exercising regulatory forbearance. It also helps in establishing benchmarks for access deficit data used in setting contribution charges.

SSC provides a framework for comparing alternative courses of action (i.e. particularly the introduction of new services) in order to determine the one that is most attractive from an economic point of view. Its procedures estimate streams of future revenues and costs caused by the introduction of a new service. The results are summarised in a net present value (NPV) (i.e. the present worth of all cash inflows minus all cash out flows). It can also provide useful inputs for decision-making connected with significant changes in the pricing of an existing service.

7.6 Critique Of Some Of The TRAI Proposals

Proposal - The TRAI proposes that the new service providers file a business plan including a forward looking study for each of the major business categories identified as broad service categories. The business plan should include a forecast of capital expenditures, revenues, and expenses for at least five years. The service provider will file a revised five-year forecast each year including a comparison of the previous year’s results to the previous forecast and to the revised forecast for the future years. An explanation of significant variances between forecasts and results and between forecasts by year should be provided.

Critique – When you consider the rapidly evolving nature of the business and the rate of technological obsolescence it becomes clear that the 5-year time horizon is too long. So any projections made for this horizon is likely to be very inaccurate. Hence it makes more sense to consider a smaller time window for projections like 3 years.
Proposal - Wherever a service provider is providing more than one service e.g., Internet, WILL, cellular, paging or related service along with wire-line facility from the same entity, it will be obligatory to segregate these services into separate categories or to assign them to the Other Category to ensure consistency between service providers.

Critique – The head of “Other Category” is too ambiguous and the service providers could misuse this. Stricter guidelines will have to be spelt out on how to exactly segregate the services of multiple service providers.

Proposal - The TRAI proposes that the following seven steps be used to assigning costs to the Broad Service Categories:

- Describe the categories in terms of facilities;
- Assign the operating revenues;
- Assign the telephone plant investment;
- Assign the operating expenses associated with plant investment;
- Assign operating expenses associated with employees activities;
- Determine the net investment for each category to assign financial and income tax expense;
- Report the results in the form required.

Critique – This method of assigning costs might make sense for the fixed line operators. But in the case of wireless operators interconnection charges itself is a big cost head and the process for its allocation has not been specified. In general, the cost of data transfer has not been addressed.

Proposal - The TRAI proposes that the service providers be required to prepare a Category Costing Manual, which will provide a detailed description and procedure on how the costing information will be developed. This Manual will be filed with the TRAI and subject to approval by the Authority. The Manual will be updated periodically to reflect changes in assignment procedures resulting from company structure, technological innovations, organizational changes, improvements in costing techniques or any other change the service provider may
consider appropriate. Changes to the Manual will require approval of the Authority.

Critique – The major problem of this proposal is that the time for the preparation of this manual has not been specified. Even the frequency of updation needs to be specified to avoid any subsequent ambiguities.

Proposal - The TRAI proposes that each service provider prepare a Service Specific Costing Manual, which will provide a detailed description of how the costing information will be developed using the prescribed methodologies and how the study results will be presented. This Manual will be filed for approval by the TRAI. Periodic updates will reflect changes in methodologies and costing techniques, as better resource cost information becomes available. These changes will also require TRAI approval.

Critique – The same as above in the sense that the reasonable time frame for preparation of this manual has not been specified.

Proposal - The TRAI proposes that all resource costs may be broadly classified as follows:

- Direct;
- Indirect;
- Variable Common;
- Fixed Common.

The TRAI proposes that the service providers identify and describe the direct and indirect resources required for implementation of a new service. The description of the indirect resources should include an explanation of their relationship to the direct resources.

Similarly, the service providers will identify and describe the variable common cost proportion being assigned to the proposed service.

Critique – This should be more concretized and the criteria for classification into any of the above heads need to be spelt out.
7.7 Some Open-Ended Questions

Should the cost-based pricing and decision-making in general, be based on the total long run incremental cost of providing the service?

Would the constitution of a ‘Steering Committee’ made up of service providers with the TRAI’s representative as an Observer be useful to provide advice and input to the TRAI on various implementation issues?
8. Issues in Reference Interconnection Offer (RIO)

8.1 An Introduction

It is a specific step taken to address the incumbent's incentive to delay access to its networks in an effort to frustrate its competitors. It can be made mandatory for the incumbent player to produce for general circulation separate Reference Interconnection Offers (RIOs) for its fixed and mobile networks. These offers also cover those facilities of the incumbent to be shared with entrants. It is called The Register of Interconnect agreements by TRAI and came about through THE REGISTER OF INTERCONNECT AGREEMENTS REGULATIONS 1999 (2 of 1999). These Regulations prescribe the modalities for the maintenance of the Register of Interconnect Agreements between service providers and matters connected therewith. The Access to the Register is not free in India as against some other countries. The Register shall be open for inspection by any member of the public on payment of prescribed fee.

8.2 Advantages Of The RIO

The following benefits can be had by requiring the dominant networks to produce and make available RIOs:

- It provides new entrants with sufficient information about the incumbent's network which can be used to make informed business decisions, example to plan its interconnection requirement;

- It ensures that new entrants wishing to interconnect with a dominant network are initially presented with a standard offer against which they may negotiate and do not have to start from scratch in negotiations; and

- It assists in ensuring non-discrimination among interconnecting operators through the publication of a standard offer
8.3 Contents Of A Typical RIO

According to TRAI, the register shall be maintained in three parts:

*Part I* containing a list of all Interconnect Agreements with the names of interconnecting service providers, service areas of their operation, and the dates of the execution of such Agreements;

*Part II* containing portions of the Interconnect Agreements, which the Authority may direct to be kept confidential;

*Part III* containing the contents of Interconnect Agreements other than those directed by the Authority to be kept confidential. This part shall be open for inspection by the public.

The RIO may go onto cover the following elements

- The terms of billing and collection procedures;
- Requirements concerning the exchange of information between the two operators; requirements concerning the use of information exchanged between the two operators for the purpose of interconnection;
- Definition and limitation of liability and indemnity between operators;
- Procedures to be followed in the event of alterations being proposed to the interconnection offer or agreement by one of the parties

The incumbent should be made to make the following technical information available to entrants on its network:

- The signaling protocol used
- Measures or restrictions required to ensure network security or integrity
- Billing information supplied at the interconnect interface
- The quality of service provided, availability, security, efficiency, and synchronization
- Full details of the points of interconnection available and their location
- Description of the physical arrangements for the interconnection
- Traffic routing arrangements
- Arrangements for clearing and recording faults
Furthermore, the RIO can contain the following

Description of Interconnection Services to be provided: List of interconnection services offered to value-added service providers and public network operators; full description of each interconnection service; conditions governing access to services; conditions governing physical or virtual co-location.

Schedule of Charges for Interconnection Services: The full charge for each interconnection service - where relevant broken down into or built up from the charges for the network components; where relevant, showing the different charges for the same service depending on time of day or day of week; surcharges must be shown separately; the charging unit (eg. per second).

Arrangements for the Establishment of Interconnection: Conditions governing service provision: traffic forecasting arrangements and the implementation of interconnection interfaces; arrangements for the reciprocal sizing of the interface equipment and the systems common to each network; arrangements for testing the operation of interfaces and the interoperability of services; deadline for interconnection to be established following receipt of a request.

8.4 Provisions To Include In An RIO

The incumbent firm should get the RIOs approved by the Regulator who can check whether the minimum requirements have been satisfied. A possible drawback to this approach is that the Regulator may 'sign off' on a document but later find that there are material deficiencies, eg following comments or concerns raised by new entrants. Provision has to be made for changes to the RIO but any subsequent changes should not adversely affect those interconnected to the network before the changes.

Negotiation – Each RIO should contain a section setting out the procedure for initiating and conducting negotiations over interconnection agreements. It should specify how a request for interconnection is to be made, to whom it is to be sent, and the information that needs to be included in the application. Ideally, the RIO should contain a standard application form for an interconnection request, which an applicant should complete.
The negotiation should commence within a specified number of days, from the receipt of all the required preliminary information from the applicant. The RIO should include guideline timings for the completion of negotiations. These may vary depending upon the nature of interconnection requested by the applicant. After a specified timeframe has elapsed, a submission could be made to the Regulator to resolve a dispute. TRAI has specified a period of three months after the process has been initiated, when the Authority may intervene to settle the matter *suo moto* or on the application of either party.

**Specifications for the negotiation process for interconnection agreements** –

Publication Requirement: In the interest of transparency and to assist in ensuring that interconnection agreements are non-discriminatory, the public availability of agreements is desirable. Interconnection agreements should be submitted to the regulatory authority within a specified period following signing.

**Settlement of Disputes** – Failure to arrive at an interconnection agreement or in the event of dispute arising subsequent to the conclusion of an interconnection agreement, either party may refer the regulator. First, an operator would need to send the Regulator a request for dispute resolution. This request would need to include:

The reason(s) for the disagreement

?? What network services were requested, and

?? On which issues agreement failed to be agreement;

?? Full description of the complaint, including in particular, what attempts have been made to reach agreement before referral to the Regulator;

?? Essential information about the dispute, which is the subject of the complaint;

?? An indication of what is sought from the Regulator and why regulatory intervention is

?? appropriate
Regulator should decide on the case taking into account the principles and approaches to be set out in the Interconnection Guidelines such as:

- The need to ensure satisfactory end-to-end communications for users;
- The needs of the seller and buyer of interconnection services,
- Resources and market power;
- The need to stimulate innovation;
- The need to stimulate a competitive market; and
- Protect the integrity of the network as well as interoperability.

The regulator should make the judgment available publicly in writing including the underlying reasoning.
9. Analysis Of The Judgements Delivered By TRAI

9.1 The Change Of Tariff By DOT For Intra Circle Calls To Mobile Phones

*Petition 1 of 1997*

*Messrs : AIRCEL DIGILINK INDIA LIMITED Versus : Union of India*

The controversy here was with regard to the tariff to be charged from Public Switched Telephone Network Subscribers for Intra-Circle Calls to Mobile Cellular Phones. The petitioner had challenged the letter of the Department of Telecommunications (DOT) of January 29, 1997, which introduced a new formula for computation of tariff for intra-circle calls from the fixed network to cellular telephones, while at the same time leaving untouched the charging rate for metro city calls, that is, for Calcutta, Chennai, Delhi and Mumbai.

The petitioners sought to contend that after the promulgation of the Telecom Regulatory Authority of India Ordinance 11 of 1997 on January 25, 1997 DOT stood divested of its jurisdiction to fix tariff for telephone and consequently its impugned order of January 29, 1997 lacked legal authority and was thus void. TRAI rejected this contention as TRAI’s notification was not issued till February 19, 1997.

DOT challenged the TRAI’s order, through the Review Petition No. 1 in Petition No. 1 of 1997. M/s Union of India & another Vs. M/s Aircel Digilink India & another; Others Order: Dated August 22, 1997. On the issue of tariff for PSTN to mobile calls, it was their contention that prior to January 29, 1997, no tariff had been fixed for such calls.

9.1.1 Giving The Mobile Operators A Hearing Before The Tariff Revision

Another issue that the petitioners raised was that DOT did not hear them before revision of tariff. Moreover, the tariff for mobile cellular telephone was to be the same as finalised for the four metro cities. Rules laid down also said that, "Ordinarily, the licensee will be hear by the competent authority for reviewing tariff". Therefore, the TRAI saw that it was
clearly incumbent upon the DOT to have afforded an opportunity of hearing to the licensees while considering revision of tariff.

In the review petition\(^7\), It was argued on behalf of the Petitioners that they had the authority to revise the tariff without consulting any one. TRAI found it difficult to accept this proposition. In the given context, the revision of tariff was only for calls from PSTN to mobile which not only involve PSTN consumers but also mobile cellular operators, particularly in view of the fact that calls originating on PSTN constitute a substantial proportion of all calls terminating on the mobile phones. For this reason also it was incumbent on the DOT to enter into consultations with the cellular mobile phone service providers on this subject.

9.1.2 Scope Of Connectivity Provided By DOT

According to the petitioners, after leading them to believe to the contrary, DOT gave them only one way connectivity at the points of inter-connect and not both ways as was essential to enable their system to grow and become viable. Further, it was said that DOT had also not permitted them to have multiple gateway MSCs that they may require. The argument being there being no prohibition or restriction to that effect either in the tender or the licensing documents, they had every reason to believe that there would be both way connectivity at the points of inter-connect and that they would be entitled to have multiple points of interconnect and gateway MSCs. In other words, DOT was not legally justified in denying them this facility. Great stress was, in this behalf laid upon the letter of DOT, which provided strong indication of DOT having no objection to operators having multiple points of interconnect or multiple gateways MSCs. It was thus argued that DOT cannot now be allowed to turn around and deny these facilities to the operators.

According to the petitioners, the multiple points of interconnect with both way connectivity and multiple gateway MSCs would enable PSTN subscribers to make calls to cellular subscribers at a much cheaper rate. This would increase the number of such calls and thereby generate more revenue, not only for the cellular operators, but also for

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DOT. In addition, a sufficient number of gateway MSCs, MSCs and points of interconnect would make the mobile network optimal and efficient. A point in favour of the petitioner’s argument was that multiple gateway MSCs and MSCs are costly equipments and, therefore, in putting them up, the cellular operators would be incurring huge expenses. These were not, therefore, facilities that the cellular operators would lightly ask for.

DOT on its behalf forwarded the argument that multiple points of inter-connect could give rise to the possibility of PSTN subscribers having to pay different rates for access to mobile subscribers of different operators. This may happen as they may not necessarily have points of inter-connect always at the same place, meaning thereby that one operator may have it at a place, say 10 kilometres away, while in the case of the other, it may be 100 kilometres away. This would mean that in calling up the former, the PSTN subscriber would pay the 10 kilometre rate and for the latter that of 100 kilometre rate – a phenomenon, it was said, likely to ensure for a considerable period of time as the mobile network system would evolve and develop at a very slow pace.

TRAI found DOT’s line of argument based on misconceptions. It is true that if all operators in their respective circles did not have points of inter-connect at the same time, a PSTN subscriber seeking to access mobile subscribers of different operators, would have to pay different rates for his calls. However, market dynamics would drive out that operator whose accessibility is more expensive for the PSTN subscriber than that of the other. In other words, market forces would compel all operators to have points of interconnect at the same place.

In the light of the above, TRAI held that DOT was not justified in denying cellular operators both way connectivity at the points of inter-connect or any number of points of interconnect and multiple GMSC's that they have required and the revision of tariff was made without any opportunity of hearing being granted to the cellular operators.
9.2 Appeal For Deferment Of License Fee On The Ground Of Not Getting Timely Interconnection Approvals

Petition Nos. 2 & 3 1997
M/s Fascel Limited & Others Vs. Union of India & Others A N D M/S Modi Korea Telecom Ltd. & Others Vs. Union of India & Others

The Petitioners had sought the relief for deferment of the license fee payment on the alleged ground of the Respondents not having provided certain clearances and approvals and not having granted timely interconnection with the Respondent's network. TRAI was of the view that the objection of the Respondents was not sustainable because the Licensing Agreement concerning the resources to be provided for interconnection with the DOT network was exempted from the overage under arbitration in terms of the Arbitration provisions of the Licensing Agreement.

9.3 Appeal Against Dual Role Of Licensor And Licensee

Petition 3 of 98 & Civil Misc. 1
M/s Bharti Cellular Ltd. & Another Versus Union of India & Another

The issue regarding the introduction of new service providers arose from the move of the Mahanagar Telephone Nigam Ltd. (MTNL) to commence the business of providing cellular services in Delhi and Mumbai. The petitioners questioned the licence granted by Government to MTNL to commence this business without any recommendation having been made by TRAI.

The contention of the respondent was that a split in Government's role as the licensor of telecom services and as the service provider was a viable proposition. It said that the two roles could be played out in separate compartments. According to TRAI, this stand could not stand scrutiny. TRAI found the dual roles of the government unsustainable. The Government's claim of having a right to receive a licence fee from the licensee without any responsibility for discharging its obligations as a service provider to provide interconnection met with an outright rejection.
10. Issues In Interconnection While Roaming

10.1 Introduction

The cellular industry has grown due to the numerous advantages that it provides. Perhaps one of the most important of these, for some the USP, is Roaming. Roaming allows a subscriber to use the mobile phone wherever he or she travels. Voice quality and data transmission are important features but they may pointless if the mobile phone stops working as soon as it leaves the home territory. This is especially true for small countries like Hong Kong and Singapore, where the need to ensure connectivity outside the country is extremely important to have a sustainable subscriber base.

Roaming has been one of the major innovations of the GSM technology and has contributed to the growth of the Cellular Industry.

There are essentially two kinds of roaming options. *Automatic Roaming* means that there is a roaming agreement in place with another carriers in the area. When using automatic roaming, the charges for the calls will appear on the customer’s invoice and they pay the roaming rate. Cellular operators have formed consortiums that allow the members to provide roaming access to subscribers.

*Manual Roaming* occurs after a customer reaches an area where there is no digital service and where there is no roaming agreement with another carrier. When this occurs, the carrier will require the customer to pay for service using a credit card, and the carrier will charge higher rates.

The focus is to make the subscriptions and services independent from individual access points and terminals and to allow users to access a consistent set of services. Users should, therefore, be able to roam between different networks and to be able to use the same consistent set of services through those visited networks. This feature is referred to as the Virtual Home Environment (VHE).
10.2 The Technicalities

The process of GSM Roaming\(^8\) is described in this section. When a GSM telephone is switched on, it automatically detects the various networks available. In the home territory it will ignore other networks and connect with the operator, which provided the SIM card. In a different territory, the handset transmits a signal that is picked up by the appropriate local mobile network and automatically checked against a database of correspondent operators. If a roaming agreement exists, a signal locating the customer is then transmitted using a leased circuit to the customer’s home mobile operator.

Roaming throws up interesting challenges for interconnection between cellular service providers and for fixed-mobile interconnection.

10.3 Issues In Roaming

10.3.1 Complexity of Billing Process

The revenue earned from subscribers roaming into the country from other Networks or when a licensee’s subscriber roams out to other Networks as well as for the calls transported on GMPCS network but originating from and terminating into terrestrial networks within the country will have to be shared among the different parties. This has thrown up a slew of issues relating to revenue sharing and even the billing process itself. Since the late 1990s users of mobile telecommunications have been concerned by the apparently arbitrary and invariably complicated charges for international roaming. Operators make little effort to inform their customers of the charges they will incur when abroad. Checking the accuracy of bills from published information ranges from the difficult to the impossible. The charges seem to have no relationship to the underlying costs, to best practice or to other telecommunications charges.

Roaming is contingent upon the agreement between different cellular networks. This is usually facilitated by the promise of greater revenue that would accrue to the original

\(^8\) GSM roaming was made possible by the Memorandum of Understanding (MoU) signed in 1987
provider. One of the major issues that need to be sorted out is the billing process. Under an Inter-operator Tariff (IOT) system the Visited Public Mobile Network (VPMN) sends the billing information or Call Detail Record (CDR) together with their own charge at an IOT rate to the subscriber’s network via a clearing house. The subscriber’s network may add its own mark-up before billing the customer.

Under a previous system of national network tariffs a markup was an agreed ceiling, but competition leading to subsidies and bundled services has rendered the old system obsolete.

The GSM technology also specifies the list of available networks for the customer to choose once a call is received. However, given the complexities of the tariffs they are highly unlikely to know which network they should select for a particular type of call and a specific time of day.

The vast majority of GSM networks use a Calling Party Pays (CPP) system. However, when roaming in another country the GSM user also incurs costs for incoming calls, to cover the cost of the call from the home territory to the roaming territory. In a few cases it is cheaper for the person being called to refuse the call and to call back, because the charge to the roamer is greater for an incoming call than for a roaming call back to the person calling. To make this saving requires a detailed knowledge of the charges and also for the number of the incoming call be displayed on the handset.

10.3.2 Network Interconnections

Issues have also been raised regarding the compatibility or otherwise of the different technologies. Coverage is often incomplete, with problems moving from the GSM networks to others, notably in the USA, Japan, South Korea and parts of South America.

There is a need to build the necessary commercial standards and technical requirements to allow roaming between GSM and other wireless standards, currently CDMA, iDEN,
TETRA and TDMA so as to harmonize a seamless roaming strategy across all technologies.

The new GSM Global Roaming Forum (GGRF) brings together networks using different technologies, including CDMA and looking to third generation technologies. In doing so it raises many complicated issues concerning contracts, tariffs, regulation and privacy.

GSM and TDMA, for example, are two of the world's leading digital network standards. However, it is currently technically impossible for users of either to make or receive calls in areas where only the other standard is available. Once interoperability is in place, users of both GSM and TDMA handsets will - subject to the relevant agreements between mobile operators - be able to roam on the other network type. Full interoperability between GSM and time division multiple access (TDMA) networks is set to become a reality by the end of this year, according to the GSM Roaming Forum, the organization co-coordinating efforts to harmonize the two cellular technologies. The GSM Roaming Forum is, in addition, working on making GSM and Code Division Multiple Access (CDMA), also mainly a US digital standard, interoperable. It is expected that the entire global digital mobile market will be interoperable by mid-2002.

10.3.3 Revenue Sharing

The treatment to be given to annual charges payable by the Licensee to the Satellite Constellation/ Space Segment Provider for arriving at the Gross Revenue will need a debate. There may be double counting of related turnover on account of revenue earned from subscribers roaming into the country from other Networks, as the same will have to be shared. Similar revenue sharing would be involved when licensee’s subscriber roams out to other Networks as well as for the calls transported on GMPCS network but originating from and terminating into terrestrial networks within the country.

10.4 Status – Roaming In India

All major cellular players in India have tied up with various consortia to provide roaming facilities to their subscribers. This started in 1991 with 9 cellular players coming together
to form a consortium. The TRAI has agreed to let individual operators choose their own partners. Bharti Cellular, for example, has active roaming agreements with cellular operators in 70 countries. Similarly, Sterling Cellular has tied up with operators in 31 countries.

In the existing MPP regime, in case of a roaming call, the calling party pays for the long distance charges from his PSTN location to the home location in the network of the called party, while the call charges from the home location to the visiting location (on account of roaming) are borne by the called mobile party.

10.5 Critique – Roaming In India

However, in event of CPP being implemented for roaming calls as well, the PSTN caller may have to be charged in a different manner depending upon the place where the mobile subscriber is roaming. Apart from this being technically complex, the PSTN caller would not know the amount that he is going to be charged in this situation, as he would not know the roaming location of the mobile called party. Important issues of confidentiality are also involved, as the mobile subscriber may not like the caller to know his roaming location. It may perhaps be advisable that in such a scenario, the PSTN caller be charged the same tariff in a CPP regime as for a call to cellular subscriber who is not roaming. The charges on account of roaming may be borne by the mobile subscriber.¹⁰

¹⁰ For example, let us take a scenario where a PSTN subscriber ‘A’ in Delhi is calling a mobile subscriber ‘B’ in Mumbai, who is actually roaming. PSTN subscriber ‘A’ would be charged for making a call to ‘B’ in Mumbai under a CPP regime (long distance PSTN charges + charges on account of CPP had the call been terminated at home location) irrespective of where ‘B’ is roaming. To clarify it further, if the ‘B’ is roaming in Chennai, the charges from Mumbai to Chennai whether on the mobile network of his own operator or that of another PSTN operator will be paid by the mobile subscriber himself because he has the advantage of protecting the privacy of his location.
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