tudy Paper on Trends in onvergence and Regulatory ractices

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vergence and Regulatory Trends

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ced level programming along with latest circuit designing techniques have made it e to merge the telecom and broadcasting services for delivery to the end customer using e IP platform. It has now become possible for a cable operator to provide telephony and band services and similarly we can see the mobile TV services being provided in advanced of the world. This shows that telecom and broadcasting networks are now supporting the es of each other. This has opened new business avenues for service providers and also many challenges for regulators in terms of establishing new licensing/regulatory regime. **egulatory regimes which discriminate between service providers on account of services g bottleneck in way of convergence.** The aim of this paper is to explore the trends in rgence and the associated regulatory reforms required for Pakistan Telecom Sector. It e noted that PTA came up with CVAS regime and on the recommendations of MOITT it inally introduced as data license and voice license. This was a major step towards reducing se categories which were no more required as per the international trend.

Introduction

egulators around the world are working on regulatory reforms to take care of convergence elecommunications and broadcasting markets. They want to support the provision of verged services with the objective of promoting the innovation, the reduction of prices and ncrease of efficiency in the provision of services.

he legacy networks the regulatory frameworks were often based on wireline, wireless or adcasting services. The markets were divided into local and long distance segments. ivergence has blurred these boundaries. In light of this, the regulatory reforms for iverged systems should focus on:

a. Introduction of the principles of technology and service neutrality

b. Greater flexibility in key aspects of existing regulatory framework like licensing which includes rights and obligations of operators, interconnection framework, numbering, QoS, universal service, and spectrum use. There are two main approaches in licensing reforms:

   - *Regulators have simplified the licensing structure* which involves the consolidation of different services in a single licence/unified licence.
   - Reduction of the administrative requirements to enter a telecom market. It means that regulators, instead of giving a service specific license, establish a general authorisation to allow more services or the establishment of registration system that replace licences or general authorisations. One extreme of this approach is open entry.

The regulatory reforms stated above are indeed vital as the importance of this subject has been recognized at the highest level; including World Summits for Information Society (WSIS). Decisions taken in WSIS have been indorsed by UN General Assembly. Major developments during the period 2002-2006 have occurred in the telecommunication/ICT environments that have significant and far-reaching implication including [1]

- The convergence of technological platforms for telecommunications, information delivery, broadcasting and computing and the deployment of common network infrastructures for multiple telecommunication services and applications;
- The continued growth, albeit uneven across countries, of the Internet and other IP-based platforms and related applications, and the deployment of national and regional IP-based backbone networks;
- The continuing rapid development of wireless and mobile radio communications, and their convergence with both fixed telephony and broadcasting services;
- The need for high-quality, demand-driven international standards, which are developed rapidly, in line with the principles of global connectivity, openness, affordability, reliability, interoperability and security;
- the substantial investment of resources being made by service providers and equipment manufacturers for standards-making in next-generation networks (NGNs);
- the emergence of key technologies, including radio-frequency identification (RFID) and sensor-network technologies, which will be, among others, vehicles for creating new services and applications, enhancing efficiency in a revolutionary way and thereby promoting the building of the information society;
- The conviction, as set out in para. 15 of the Tunis Commitment, adopted by WSIS, that ICTs are, among others, effective tools to promote peace, security and stability;
- the delivery of audiovisual services and applications over a wide variety of platforms, including both fixed and mobile networks, resulting in increased competition for media distribution;
- the continuing trend towards separation of regulatory and operational functions and the creation of many new independent telecommunication regulatory bodies, in particular in developing countries and regional economic areas, as well as the growing role of regional organizations, in order to ensure the consistency and predictability of regulatory frameworks, and encourage capital investment.

[1] This text and the following sub-paragraphs are copied verbatim from 2 of Annex 1 of Plenipotentiary Resolution 71, apart from the last four years" to "during the period 2002-2006".

- continuing market liberalization, in particular in developing countries, including greater competition, private-sector participation and licensing of new market entrants;
- the trend in a number of Member States to regulate telecommunications/ICTs with less reliance on sectoral regulation in competitive markets;
- encouraging the effective use of telecommunications/ICTs and recent technologies during critical emergencies, as a crucial part of disaster early warning, mitigation, management and relief strategies;
- ongoing challenges relating to capacity-building, in particular for developing countries, in the light of rapid technological innovation and increased convergence;
- significant differences and shortages, within and amongst Member States, both in deployment of telecommunication/ICT infrastructures and in the capability to use them to access information (i.e., the digital divide), particularly the lack of high capacity national backbone networks in developing countries, which would constrain the smooth introduction of the next generation networks;
- Increased awareness of the role of ICTs as a tool for the development of society;
- The important role of multilingualism is to enable all countries to participate fully in and contribute to ITU's work, and in creating a global information society opens to all.

NGN networks are rapidly proliferating and telecom operators prefer them over the legacy works. This has raised many challenges for the regulators around the world.

above list of developments clearly spells out the importance of convergence and regulatory orms needed for its support.

2. Technical Perspective of Convergence

ITU-T Recommendation Q. 1761, 3.1 defines convergence as the coordinated evolution of formerly discrete networks towards uniformity in support of services and applications.

In light of above definition, it is no more voice, data and video service, rather in the converged environment, it is packet based service. Fixed and mobile networks are changing to ubiquitous networks providing seamless connectivity. Voice and data networks are merging. The trend for voice is shifting from PSTN network to mobile network. This has caused the transformation of the telecom industry which includes:

- The emergence of VoIP;
- The migration to an all-IP environment;
- The influence of the Internet, especially in VoIP and peering
- The emergence of Peer-to-Peer (P2P) technologies (e.g., Skype). The Skype is one of the most popular VOIP service present around. It is based on peer to peer communication.

Alternatively it can be said that networks have merged. e.g in case of legacy environment, there were separate networks for voice, data and Cable TV services. In the converged environment single network (NGN) can support such services.

2.1 Fixed Mobile Convergence (FMC)

It is the convergence of Fixed (wireline) and Mobile (wireless) networks, services and terminal ITU-T recommendation Q.1761 highlights principles and requirements for convergence of fix and existing IMT-2000 Systems. FMC according to Q.1761 is *"Mechanism by which an **IMT-20** user can have his basic voice as well as other services through a fixed network as per subscription options, capability of the access technology."*

The ETSI has defined it as:

"Fixed Mobile Convergence (FMC) is concerned with the provision of network capabilities wi are independent of the access technique. This does not imply the physical convergence networks. It is concerned with the development of converged network architecture supporting standards. This set of standards may be used to offer fixed, mobile or hybrid servi

An important feature of fixed mobile convergence is the separation of the subscriptions services from individual access points and terminals and to allow users to access a consisten of services from any fixed or mobile terminal via any compatible access point. An imp

sion of this principle is related to internetwork roaming; users should be able to roam een different networks and to be able to use the same consistent set of services through visited networks."

se of networks, FMC means that same network (access & core) is used for fixed and mobile ces. Therefore an IMT-2000 mobile network user should be able to register in a fixed ork to obtain the same set of services normally available in the subscriber's home ork, except terminal mobility. Subscriber's registration, authentication and access to er service profile server of the home network by the visiting fixed network need to be ed. This particular case of convergence would apply in areas where 3G radio technology is vailable. In such cases the fixed network should provide the access to user.

e are different access means under consideration for IMT2000 user. These are[2]:

Multiple IMT-2000 Family members.

Fixed access, with seamless mobility with mobile systems : xDSL, Cable, narrowband (for IP services), WLAN in hot spots (e.g., WISP), etc.

Digital Audio Broadcast (DAB).

iously one cannot expect to have one terminal in such diversified access means; therefore it ossible to have different terminals to access same set of services in different networks.

- In case of services, FMC means that same service is obtained by customer in different kind of networks using different terminals.
- In case of terminals, FMC means that same terminal is used for accessing services offered by different networks. According to ITU[3]

"By standardizing access technology independent User Identity Module (UIM), any user ould be able to move anywhere in the world carrying UIM as a global roaming instrument. e user would not be required to carry highly complex multi mode radio technology terminal uipment. Instead the UIM would be compatible with all kinds of user terminals catering for y wireless or wireline access. Globally applicable mobile terminals supporting all the MT-2000 family member interfaces are still being developed and may not be widely available r some time."

2.2 Benefits of FMC

here are a number of benefits of FMC for the user which include:

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[2] ITU Q.1761
[3] ITU Q.1761

- Bundling of services reduces the cost for consumer.
- Convenient usage of the bundled services (Configuration, single billing)
- Seamless service experience.
- Provide services to a mobile user in an area where a radio network is not deployed
- Better utilization of radio spectrum in IMT-2000 networks
- Initial deployment of IMT-2000 network in small pockets would become attractive.

Similarly the benefits for the operators include:

- Network deployment and operational cost reduction.
- Bundling of services and offering better packages to consumer.
- Reuse the fixed line assets.

2.3 IP Multimedia Subsystem

The most prominent solution of FMC is IMS (IP multimedia subsystem). It is a standard that defines a generic architecture based on SIP which allows multiple real-time applications to run across a single network. According to IBM, IP Multimedia Subsystem (IMS) is a set of specifications that describes the Next Generation Networking (NGN) architecture for implementing IP based telephony and multimedia services. Although it was initially designed by the 3rd Generation Partnership Project (3GPP) for mobile networks, newer releases of IMS are designed to be access- agnostic so that it can be used by any type of access method, be it a fixed line, GSM, CDMA2000, WCDMA, Wireline broadband access, WiFi or WiMax. IMS defines a complete architecture and framework that enables the convergence of voice, video, data and mobile network technology over an IP-based infrastructure. The important landmarks in development of this most significant standard are:

- In 3GPP Release 5, "Session Initiated Protocol" (SIP), defined by the Internet Engineering Task Force (IETF), was chosen as the main protocol for IMS.
- In 3GPP Releases 6 and 7 additional features were included like presence and group management, interworking with WLAN and CS based systems, and fixed broadband access.
- 3rd Generation Partnership Project 2 (3GPP2), also standardized their own version of IMS which was quite similar to 3GPP's version with suitable adjustments.
- On top of IMS infrastructure, there is a service standardization process. For this purpose Open Mobile Alliance (OMA) plays an important role on specifying and developing IMS service standardization. The services defined by OMA are built on top of IMS

infrastructure, such as Instant Messaging (IM), Presence service, and group management Service.

Benefits of IMS

benefits of IMS are:

- Reduced time for delivering the new services to customers. Through the standard interfaces in IMS, the new services developed by third party can be made part of network.

- IMS is capable of enabling Quality of Service within the IP network which improves and guarantees the transmission quality. This is not the case in BE (Best Effort) QoS networks (which are typical in many wireless broadband networks), in which no BW is reserved for any user. An operator can only define "Maximum Sustaining Rate' for BE users, i.e. restrict them to reach a particular value.

- The operators need readily available charging schemes which could be used according to service type. IMS allows the operators to determine how to charge the users based on service types, i.e. they can choose to charge user by the number of bytes transferred, by the session duration (time-based), or perform any new type of charging.

5 IMS Architecture

S consists of different layers each responsible for specific function. The following figure ows a typical structure of IMS network.The IMS architecture provides a variety of choices for ers to choose end-point devices. The IMS devices such as computers, mobile phones, PDAs, d digital phones are able to connect to the IMS infrastructure via the network. Other types of vices, such as traditional analog telephone phones, although they are not able to connect to IP network directly, are able to establish the connection with these devices via a PSTN teway. The functions of various layers are:

Fig.1 IMS Architecture Diagram[4]

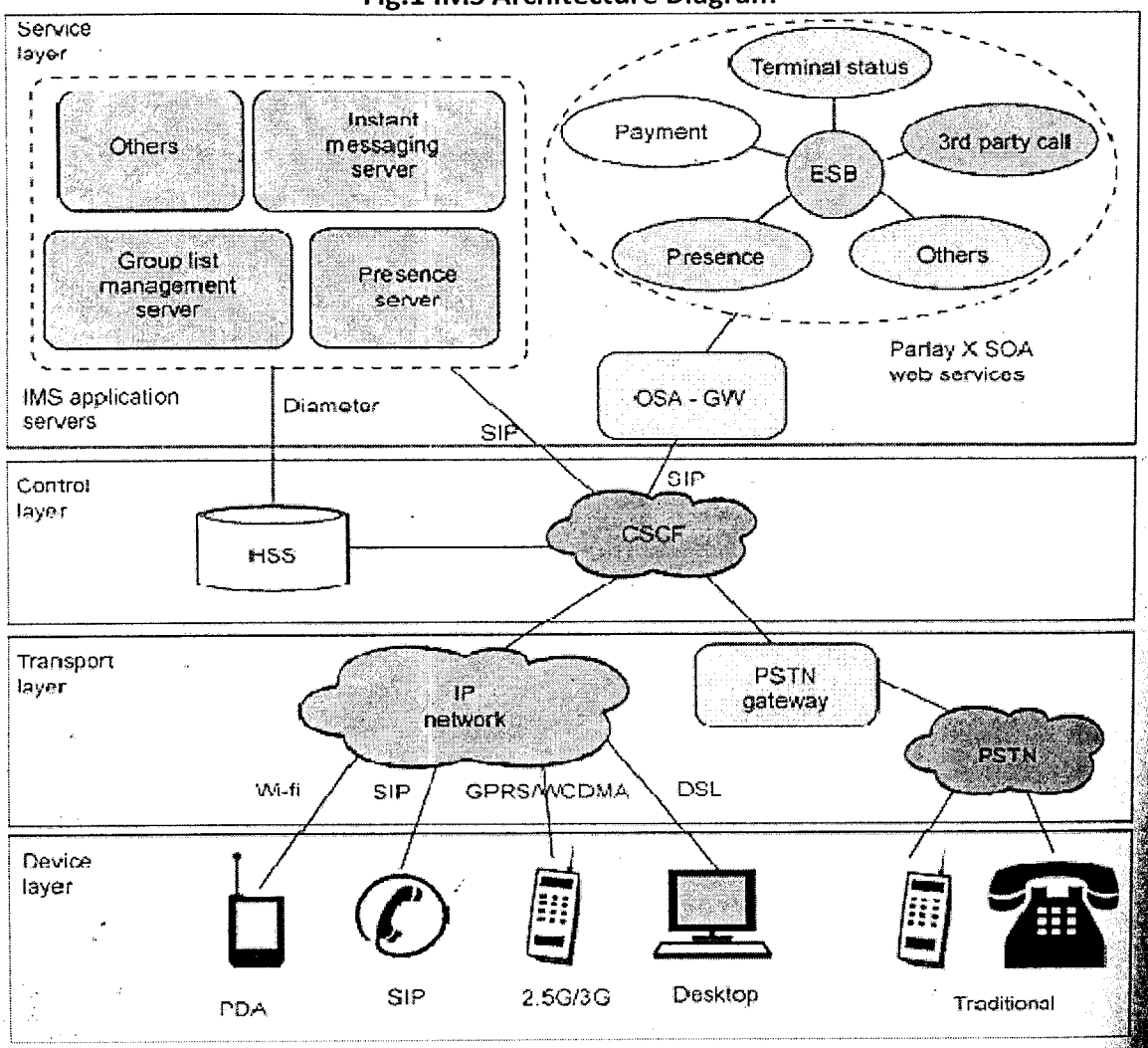

Table 1: IMS layers functions

Layer	Function
Device	• Enables devices (such computers, mobile phones, PDAs, and digital phones) to connect to the IMS infrastructure via the respective networks. • Networks include, but not limited to, UMTS (& other 3G standards) and DSL. Gateways are needed for connectivity of analog devices. • This layer refers to many access equipments such as Trunk Gateway, signaling gateway, Media gateway, Integrated Access Device, IP phone, soft-phone and so on.

[4] IBM Introduction to IP Multimedia Subsystem (IMS), Part 1: SOA Parlay X Web services

Transport	• It is the bearer network which is used to switch all of the packet information from access layer and control layer. This layer is composed of IP/ATM routers. • Initiating and terminating SIP sessions. • Conversion of data transmitted between analog/digital formats and an IP packet format.
Control	• Serves to control the switching through soft switch equipment. • The Call Session Control Function (CSCF)[5], which is a general name that refers to SIP servers or proxies, is one of the core elements in the control layer. CSCF handles SIP registration of the end points and process SIP signal messaging of the appropriate application server in the service layer. • Another element in the control layer is the Home Subscriber Server (HSS) database that stores the unique service profile for each end user. The service profile may include a user's IP address, telephone records, buddy lists, voice mail greetings and so on. By centralizing a user's information in HSS, service providers can create unified personal directories and centralized user data administration across all services provided in IMS.

Service	• Service layer is the top most layer in IMS network.
	• The services are hosted on applications servers which are not only responsible for hosting and executing the services, but also interface with control layer. The control layer uses SIP protocol.
	• Most of the IT experts are not familiar with those complex protocols like SIP and SS7. They need a APIs for services creation and development. In order to address this issue, Parlay Group has created Parlay X SOA (Service-Oriented Architecture) Web services in 2003 in order to create web based telecom services. The Parlay X SOA Web services are connected to the telecommunication network via:
	  • Open Services Access Gateway
	  • Data service components over IP Protocols.

[5] The information about CSCF and HSS is from 'IBM Introduction to IP Multimedia Subsystem (IMS), Part 1: SOA Parlay X Web services'

3. Regulatory Landscape and Recommendations

3.1 Policy Framework for Convergence in Pakistan

Pakistan telecom sector has been deregulated under the legislative framework of Telecom Act 1996 and the policies by GoP, i.e Deregulation Policy 2004 and Cellular Mobile Policy 2005. Both the policies have described the service specific license to be issued by PTA.

As far as the converged licensing is concerned, it has not been discussed in existing policy and therefore MOITT may add converged licensing option in the new policy along with applicable regulatory levies to create a level playing field between stakeholders. One big issue for which a policy is required is FMC.

3.2 Approaches to Licensing/Authorization

During 7th Global Symposium for Regulators, 2007, it was highlighted that the old licensing framework for legacy networks can become an obstacle to NGN development in following ways:

- Preserving unnecessary, onerous and complicated licensing requirements can act as a barrier to market entry and hinder competition.
- Requiring operators seeking to offer multiple-service offers to obtain multiple licenses, often with different fees, requirements, and geographic scope (i.e., national versus local or regional licenses) can limit competition and impede the deployment of new services to consumers.
- Maintaining outdated and irrelevant licensing classifications can hinder technological advancement and service development.
- Licensing classifications based on specific types of technologies can act as artificial barriers to the introduction of alternative new technologies.

The Symposium also highlighted the best practices to promote NGN regulatory frameworks. These are:

- Adopt licensing frameworks which are flexible and technology neutral, recognizing that these attributes are vital for the transition towards an NGN world, characterized by the decoupling of service/application provision from the underlying infrastructure.
- To simplify procedural requirements to obtain a license by introducing registrations, notifications, and in certain instances, deregulation and to secure rights of way in order to facilitate the roll-out of NGN access networks. This will ultimately allow market players to make use of NGN to access global markets and consumers to benefit from such global competition in the provision of services.
- An example of simplifying licensing categories into broad categories of services is Malaysia, where the adoption of a new licensing framework simplified the existing

service-based licenses into four broad technology-neutral licensing categories: Network Facilities Provider (NFP); Network Services Provider (NSP); Application Services Provider (ASP); and Content Application Service Provider (CSP; a special subset of application services that includes television and radio broadcast services and Internet content services). The service providers that fall under any of these categories may request an individual license or a class authorization depending on the degree of control for each service that is deemed necessary.

- Singapore's method is another example of license simplification. There are only two categories of licenses for the provision of telecommunications services: (1) Facilities-Based Operator (FBO) licenses and (2) Services-Based Operator (SBO). The FBO license is always an individual license, whereas the SBO may be an individual license or for some services, a class license.

In a converged environment, regulators have adopted three main approaches to authorizations. These are:

2.1 Service specific authorization

The salient features of this type of authorization are:

- Licensee can provide a specific type of service.
- A specific type of network and technological infrastructure can be used. However, some service specific authorization regimes are technology neutral

2.2 Unified authorizations

- These authorizations are technology and service neutral.
- They allow licensees to provide all forms of services under the umbrella of a single authorization

2.3 Multi-service authorizations

- It allows service providers to offer multiple services under the umbrella of a single authorization

Keeping in view the above regulatory trends, it is recommended to make a suitable converged licensing framework (in particular FMC scenario) for Pakistan.

3.3 Need for Infrastructure Sharing

Converged platforms are costly to deploy. The new operators in the market are always reluctant to take risk if the expected service uptake trend is low. Given this, it is very important

that regulators encourage the operators to share the network components and to compete each other in services arena. But before it is done, it is important to analyze the following:

- The fiber availability for services like FTTH.
- Domestic long distance fiber
- International fiber capacity.

3.3.1 Encouraging Network Deployment

If the above network components are not according to the country's requirement, then the regulators must encourage the deployment of new infrastructure and not reply only on competition in services. The availability of fiber at customer door step is critical for availability of triple play services. This involves Right of Way (RoW) which is currently the biggest hurdle for the operators in Pakistan.

3.3.2 Encouraging the competition in services layer

When the above network components are sufficiently deployed, it is good for the regulator to encourage the service layer competition to make it possible for customers to opt the service provider according to requirement. It also helps in reducing the retail tariffs.

With the above points in view, we need to have a clear policy framework for infrastructure sharing and Right of Way (RoW) in Pakistan. Two recently completed consultancies on LLU(horizontal spread in ACCESS) and In-House Wiring(vertical spread in the last fractional mile) will facilitate the regulator in upcoming convergent era.

3.4 Technical Standards:

Ofcom is one of those regulators which took initiative for regulation of NGNs standards and decided to implement ex-ante regulations. It has established industry led body known as NGNuk, which takes care of interconnection issues in NGN environment with industry consensus. India has followed UK by establishing 'NGNeCo' (NGN expert Committee) involving experts from DOT, TEC, C-DOT, service providers, vendors and academia to deliberate upon the various migration and interconnection issues.

Technical interconnection standards and interfaces of legacy telecom networks are different from NGN. The main question is; should interconnection in NGNs be regulated or not. Given the situation of Pakistan telecom market w.r.t building consensus on important matters through industry's self initiatives, the answer is yes. Involvement of industry is important for NGN technical standardization and development of interconnection guidelines in Pakistan.

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5 Interconnection:

commercial agreements of service providers and infrastructure owners may largely be to stakeholders to decide appropriate terms and conditions. With reference to erconnection standards, QoS parameters for interconnect and mination/transit/origination charges, we may need some changes in the fully IP vironment.