# Name of Course : E1-E2 CFA

# Chapter 6

# Topic : Overview of NGN & IPTAX

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# OVERVIEW OF NGN & IPTAX

**Introduction**

Telecommunication industry is changing at a rapid pace. This change in the industry is basically driven by demand of new services from subscriber's side and urge to reduce CAPEX (Capital Expenditure) and OPEX (Operational Expenditure) from carrier side. Today All most all telecommunication giants are installing and maintaining at least three kinds of basic Network.

**PSTN**: Public Switch Telephone Network was basically developed and engineered for giving voice connectivity to the wire line subscribers. The network consists of Local exchange/RSU as a part of Access Network and TAXs as a part of core Network. Already huge amount of money has been invested in PSTN setup. Because of tough competition from Mobile & Voice over IP, it is becoming white elephant day by day for the operators. Another fact about PSTN is that most of its equipment are going to exhaust their lives in coming years.

**PLMN**: (Public Land Mobile Network): PLMN has been developed to provide voice services for wireless subscribers. Recent times SMS has emerged as killer application for mobile. PLMN includes BTS/BSC as access network and MSC as a core Network.

**Data Network**: This network was basically designed for accessing remote files and servers for defense people and universities but now a days nobody can think of living with data network services. The basic and most popular application of data networks is Internet. Other applications include E-commerce, online banking, online gaming, E-shopping, IPTV Video on demand and many more. Data network is an assembly of routers, which are responsible for forwarding information from one end to other.

The interesting fact about the current generation is that these networks have been developed during different time zones. That's why they are separate network infrastructure. There is no sharing of infrastructure among them. However some gateways are available for inter network communication.

Another disadvantage of the current scenario is that all the three networks are having their own service platforms in other words services are tightly coupled with their

networks because of that carrier or operators have to introduce service separately for separate networks.

Because all the three networks are having separate access transport and switching network service provider has to invest in all the three networks separately. Hence CAPEX increases on the other hand for maintenance of three different networks operational cost also increases. Manpower of the company has to have knowledge of multiple technologies.

**NGN Vision**

Next Generation Network is the framework where operator will have a common transport network based on Internet Protocol for providing all kinds of telecommunication services. Hence operators will have to install and maintain only a single network which will reduce its CAPEX and OPEX significantly. Moreover service provisioning will become easier because of the introduction of new and intelligent servers. NGN is able to provide Vendor independence because of the standard protocols it uses for interaction with network elements.

**NGN Definition**

A Next Generation Network (NGN) is a packet-based network able to provide Telecommunication Services to users and able to make use of multiple broadband, QoS-enabled transport technologies and in which service-related functions are independent of the underlying transport-related technologies. It enables unfettered access for users to networks and to competing service providers and services of their choice. It supports generalised mobility which will allow consistent and ubiquitous provision of services to users.

**[ITU-T Recommendation Y.2001 (12/2004) - General overview of NGN]**

In the above definition all the terms are self explanatory except Generalised mobility.

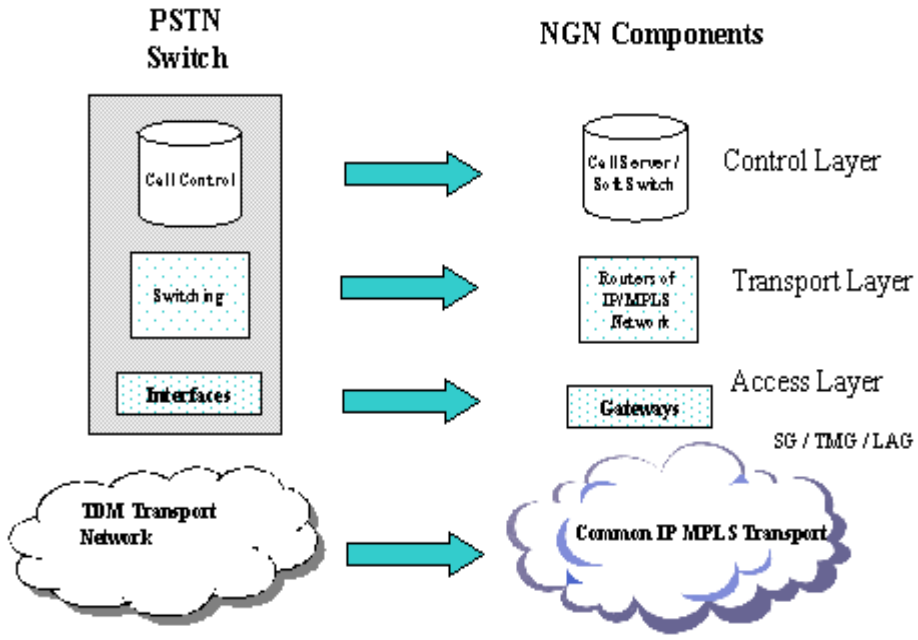
**Generalised mobility**:

At present subscribers are enjoying terminal mobility where network identification system is available in the form of SIM and the same is inserted in the terminal. If user is having that terminal he will be mobile with the identity of the SIM.

In NGN subscriber can have Generalised mobility. Here, each individual will have its own network identity in the form of "SIPURL: xyz @ domain name.com". Users have to make registration from his devices against the given URL. Registrar servers of the company will maintain bindings with URL and

physical location of registered devices. Users can register for more than one device at a time. With this subscribers need not to depend upon specific terminal. They can login with any device enabled with required protocols (SIP) and call will come to that device.

**PSTN versus NGN:**




- As shown in above figure PSTN Switch consists of interface, Switching and call control. All the functional entities are shown in one box that means they are interacting with each other using proprietary protocol. Where as in NGN model entities are interacting using standard protocols.
- In PSTN each node should have call control separately whereas NGN may have centralised call control
- PSTN is dedicated network for providing voice services to the subscribers whereas NGN is developing with the idea of carrying all kind of traffic over it.
- PSTN is working on circuit switched principle whereas NGN is working on Packet switching.
- PSTN provides excellent quality of voice and it is tested in all conditions whereas NGN will provide good quality of voice and it is to be tested in adverse network conditions.
- In PSTN service integration is very difficult and because of vendor dependent technologies, it is difficult to introduce services easily. Whereas NGN shall be able to

provide separate service platform for introduction of services without depending upon underlying network related technologies.

**NGN Architecture**

NGN is a layered architecture consisting of transport, access, control and application layer. It is important to note that all the layers are independent from each other. Change in one layer should not affect other layers.

**Access Layer:**

Access Layers is responsible for direct subscriber attachment function. NGN can support all kind of existing access as well as upcoming access. NGN is capable of processing traffic originated from PSTN, GSM, CDMA, xDSL, WiMAX or any other access system. Depending upon the type of access, protocol conversion and/or media conversion may be required at the NGN Gateways.

Access Layer consists of Gateways. Example of getaways is Media Gateway, Access gateway. Signalling gateway etc. Media gateway terminates media, coming from PSTN/PLMN in E1 / STM. Here, it is responsible for packetisation of media under the instruction of control layer. After packetisation of information it throws packets to the transport Network. Access gateway is nearer to subscriber. Subscriber can directly be terminated in Access Gateway. All the required configuration of such subscribers should be done at control layer. Access Gateway and Media Gateways are responsible for carriage of Media whereas Signalling gateway is carrying signalling generated by PSTN and informs Control Layer about the signalling in required format.

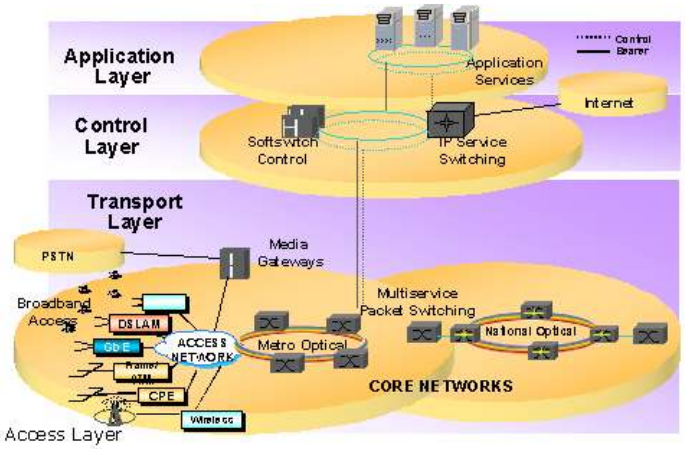



**Fig: NGN Architecture**

**Transport Layer**

Transport Layer of NGN is based on IP (Internet Protocol). It can utilize the advantage of MPLS (Multi Protocol Label Switching). Transport Layer forms the core of the Network. It basically consists of Routers, which are responsible for carrying traffic originated by access layer. As the same core network is going to be used for all kinds of subscribers enjoying different kind of real time and non real time services, it should be able to make use of band width policies and Qos policies. Operator has to think of managed Network for its subscribers. It is basically an assembly of routers connected with optical network. Traffic coming from gateways is properly routed by those routers.

**Control Layer**

It is responsible of call setup, routing and charging policies and other controls in NGN environment. It consists of call servers where all information of the network resides. These call servers are responsible for setting up, modifying, charging and tear down of the calls. NGN may work on soft switch principle. It consists of MGC (Media Gateway Controller) as an overall controller and MGs(Media Gateway) for termination of traffic. MGC is basically a server and it is having all the necessary information of network MGC instructs MGs for establishing the call. Under the control of MGC, MG performs different call related tasks such as connection, modification and termination of media streams, packetisation of media etc.

**Application Layer**

It is responsible for OSS/BSS. Enhanced services to the subscribers will be provided with the help of application servers. It may include prepaid servers, announcement servers, Service servers etc. Hence NGN is making service separation from Network. Any service can be introduced with the help of server at any time without any modifications in the control, transport or access.

**Migration from PSTN to NGN**

Migration from PSTN to NGN should be based on maximum possible reuse of existing equipment and replacement of components which are near the end-of-life.

Migration from PSTN to NGN involves:

- Replacement of TDM network elements in a phased manner
- Maximum reuse of existing resources
- Use of open and mature standards
- Convergence of access and backbone network
- Continuation of existing network capabilities and services with same or comparable QoS and security
- Interworking between different types of networks
- Addition of new services

It is true that NGN can provide operators, a better solution for their revenue models. But it is not possible for incumbent to replace their existing network overnight and install NGN. It will take time to migrate from PSTN to NGN. During that period of time both the networks will coexist. Operators have to follow some strategies to implement NGN in their network. Different phases for migration of PSTN to NGN are given below. However, the sequence of implementation depends on the business and strategic needs of a service provider. Different phases can be combined for implementation.

**Phase – I : Migration of TAX** :

In first phase of implementation operators can replace their transit network with softswitch architecture. Operators can make use of the SoftSswitch architecture for the National Long Distance calls.

At present Local Exchanges (LE) are connected with TAX for Long Distance Calls in turn TAX is connected with PSTN backbone which is carrying the traffic originated by subscribers of Local Exchanges. The setup of TAX and PSTN take care of signaling as well as voice media originated from LE subscribers.

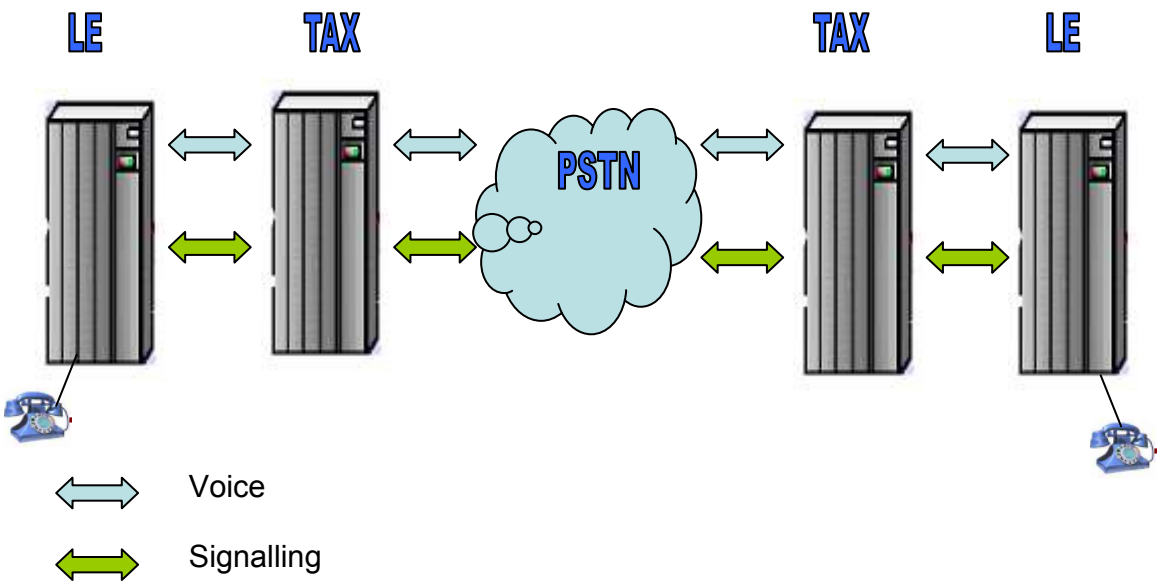
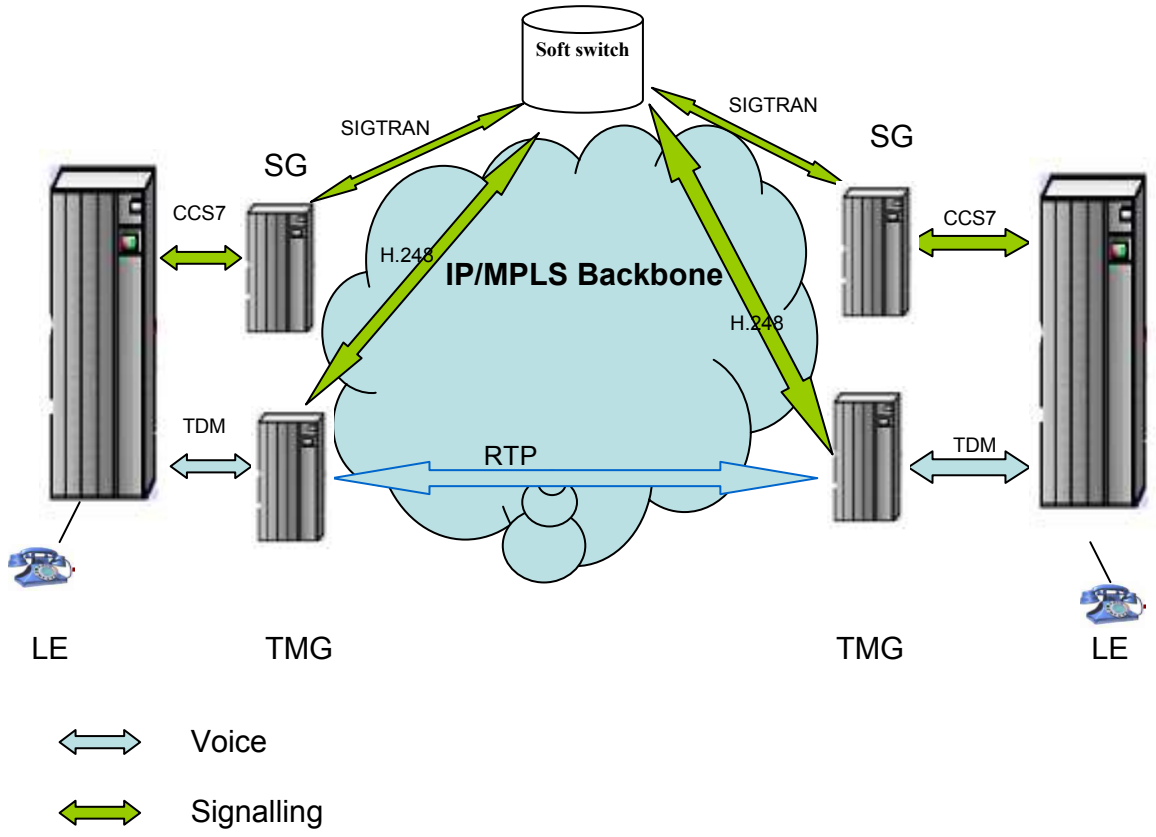



**Fig: Current Setup of PSTN**

In first phase of migration as discussed TAXs can be replaced by NGN components. **This can be named as IPTAX in general**. For that Local Exchanges have to be connected to Trunk Media Gateways for transportation of Media and will be connected to Signalling Gateway for signaling transport.

Here:

- Normal analog or ISDN subscriber dials the called party number
- PSTN creates CCS#7 Signalling and sends it towards Signalling Gateway.
- Signalling Gateway converts CCS#7 messages to compatible SIGTRAN messages and sends it towards Media Gateway Controller or SoftSwitch.
- After receiving signaling from SG, MGC instruct concerned originating and terminating media gateways to prepare connection for the desired call and at the same time through Signalling Gateway of destination PSTN side MGC / SS inform the destination PSTN exchange about the call. When all the condition for the call is met, MGC instruct concerned originating and terminating media gateways for finally maturing the two communications. Both the MGs convert received TDM voice to packets using Real Time Protocol and vice versa. All the communication between MGC and MG is in H.248 protocol.
- The disconnection of the call is informed by the concerned SG to MGC/SS and then MGC/SS instructs both the MGs to disconnect the RTP link.




**Phase I – Migration to NGN using TAX replacement**

**Phase II: Migration of Local Exchanges**

In this phase Local Exchanges (LEs) are replaced by the Softswitch and Access Gateways (AGW) with same services. Softswitch with local features will be used as a common control element for class 5 applications. Access Gateways (AG) provide various types of access to the subscribers (e.g. PSTN, ISDN, V5.2, xDSL etc.) and connects them to IP core network. AGs may be configured for various class 5 applications depending on end user topology, density, service requirements, etc. Depending upon the size of the network, a single softswitch with class 4 and class 5 applications may be planned.

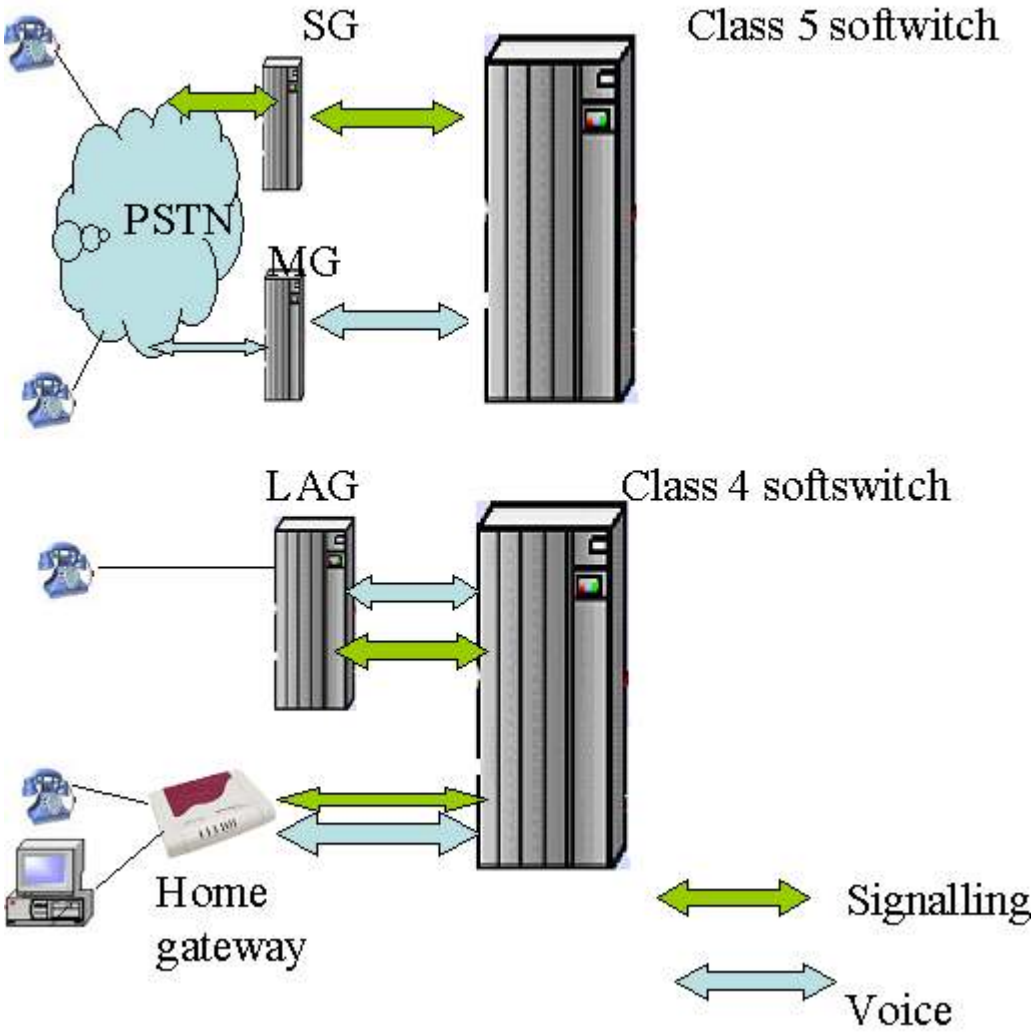



**Fig: Phase II: Migration of Local Exchanges**

**Phase – III Migration of Services**

While migrating from PSTN to NGN, all PSTN services with same equipment, same look and feel should be provided. Two PSTN networks connected via NGN transit network should be able to provide transparency to all bearer services. The existing IN services are provided though SCP. The softswitch interacts with SCP through Signalling Gateways, using Intelligent Network Application Protocol (INAP). In future, new IN and value-added services may be implemented using Application Servers (AS) which will be accessed by softswitch via Session Initiation Protocol (SIP).

During the migration process new applications may be developed. These new applications along with existing IN services (including prepaid and number portability) will be given by Application Servers in near future.

It is possible to have complete migration to NGN where end to end traffic will be IP and this migration may use another alternative approach which is known as IP Multimedia Subsystems (IMS).

This process of migration depends upon many factors one of the factor is Availability of efficient IP backbone network. Operators have to build a redundant and bandwidth efficient IP backbone network for NGN. Because all kinds of traffic including voice, data and video is going to be transported using IP network, it should be ensured that IP network is available for all the time and it can provide QoS based on applications used by subscribers.

**Conclusion**:

It is understood that in near future operators will migrate to complete IP communication. But it is to be ensured that during this migration should be smooth. At present there should not be any hurry to implement NGN immediately. Operators first work out for building reliable IP backbone and then process of migration can be started.

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