# ITU-D/ ITU-T Seminar on Standardization and Development of Next Generation Networks for the Arab Region

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# Network Architecture Migration towards NGN

Oscar González Soto
ITU Consultant Expert
Strategic Planning and Assessment



## Network Architecture towards NGN Content

- Key factors for the evolution towards NGN
  - Services and revenue motivations.
  - Requirements and issues
- Network architecture consolidation at transit, local and access levels
  - Topology and architecture migration
- IMS rational and structure
  - Evolution and benefits

# Network Architecture towards NGN

## Key Factors: Motivation

- **New services and revenue** increase with multimedia services:
  - Compensate voice revenue reduction and increase BB related business
- **Cost reductions** by sharing network infrastructure and systems
  - Savings are a function of network scenario, equipment modernization status and customers grow speed
- **Simplification of O&M**, thus lowering OPEX
  - Integrated operation platforms, maintenance and training



# Network Architecture towards NGN

## Key Factors: Operator Requirements (I)

- **Business continuity** required to maintain ongoing dominant services and customers that require carrier-grade service
- **Flexibility** to incorporate existing new services and react quickly to the ones that appear on real time (main advantage of IP mode)
- **Profitability** to allow feasible return on investments and in the best practices market values

## Network Architecture towards NGN
### Key Factors: Operator Requirements (II)

• **Survivability** to allow service assurance in case of failures and external unexpected events

• **Quality of Service** to guarantee the **Service Level Agreements** for different traffic mixes, conditions and overload.

• **Interoperabilty across networks** to allow to carry end to end services for flows in different network domains



## Network Architecture towards NGN
### Content

- **Key factors for the evolution towards NGN**
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  - **Requirements and issues**
- **Network architecture consolidation at transit, local and access levels**
  - **Topology and architecture migration**
- **IMS rational and structure**
  - **Evolution and benefits**

# Network Architecture towards NGN

## Architecture Consolidation: Topology

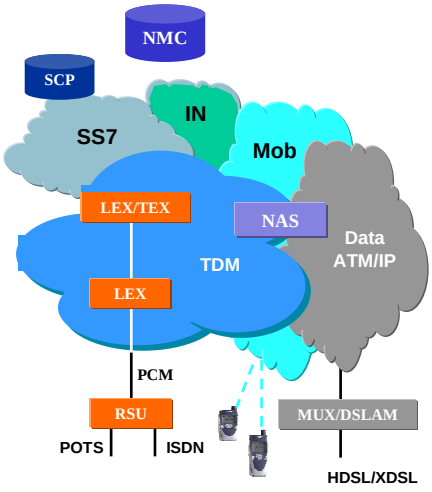
Topological changes impact on infrastructure and are slower to implement than technology substitution

- **Less network nodes and links** due to the higher capacity of systems (one order of magnitude).
- **Same capillarity** at access level due to identical customer location
- Topological **connectivity higher** for high capacity nodes and paths due to security
- **High protection** level and diversity paths/sources in all high capacity systems, both at functional and physical levels



# Network Architecture towards NGN

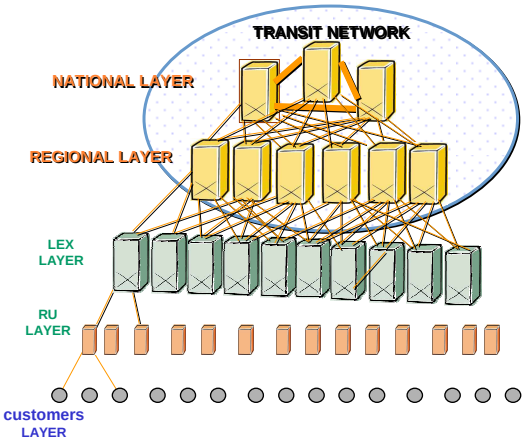
## Existing networks and architecture




- 5 different network types to handle telecom services
- TDM for fixed and mobile networks working in circuit mode with end to end reserved paths
- SS7 and IN network working with message switching mode
- Data network working with leased lines and packet mode with different and conventional IP protocols

# Network Architecture towards NGN

## Existing networks and architecture

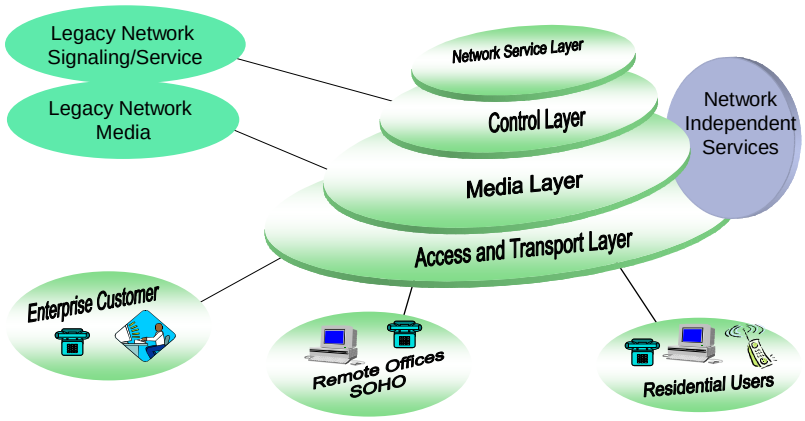



- Hierarchical topology with 4 to 5 layers, connectivity to the upper next layer and within each layer as a function of economical optimization
- Number of nodes as a function of O/D traffic and nodes capacity
- Service handling for media, signaling and control at all exchange nodes
- Carrier grade quality with well defined QoS criteria and standardized engineering rules



# Network Architecture towards NGN

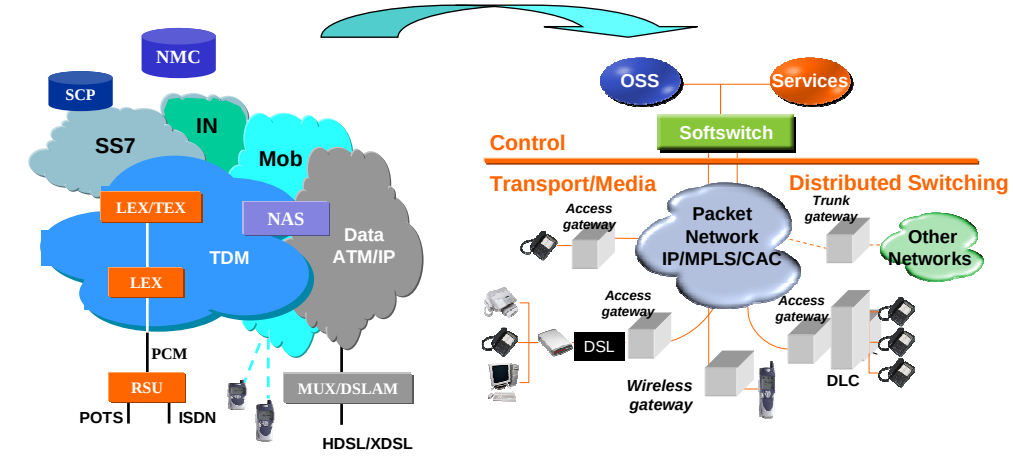
## Architecture: NGN Layers



# Network Architecture towards NGN

## Architecture migration: Topology

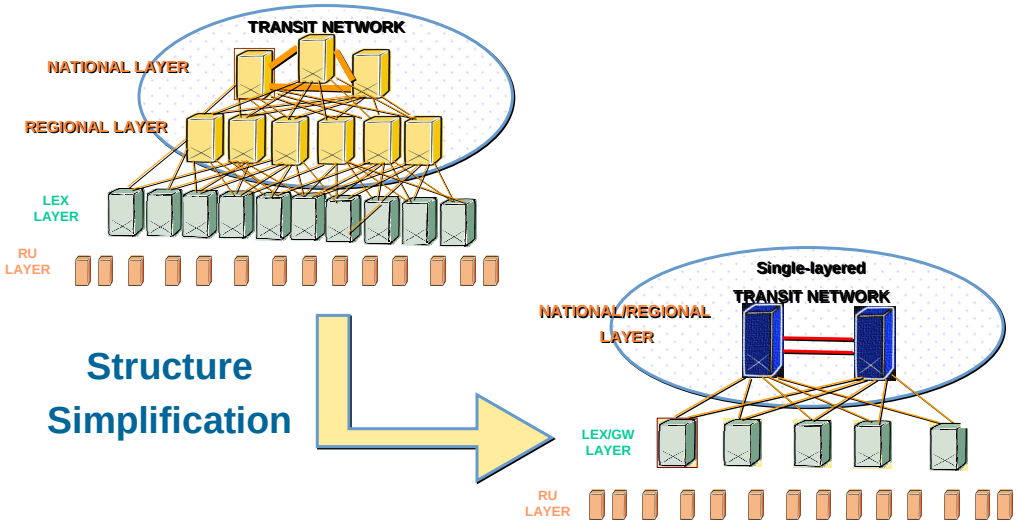
*What changes from current scenario towards target network ?*






# Network Architecture towards NGN

## Architecture Consolidation: Topology



# Network Architecture towards NGN

## Architecture Consolidation: Access

### Access dominated by physical infrastructure cost and deployment time

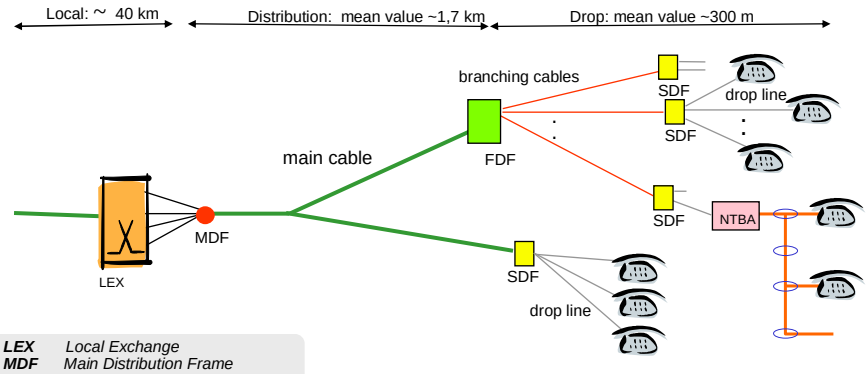
- Quick deployment of DSL and Multimedia Services
- FO closer to customer when implementing new outside plant or renovating existing one
- New Wireless technologies for low density customer scenarios
- Shorter LL length than classical network to be prepared for high bandwidth Multimedia services



# Network Architecture towards NGN

## Architecture Consolidation: Wireline Access

### Typical historical Access Network structure

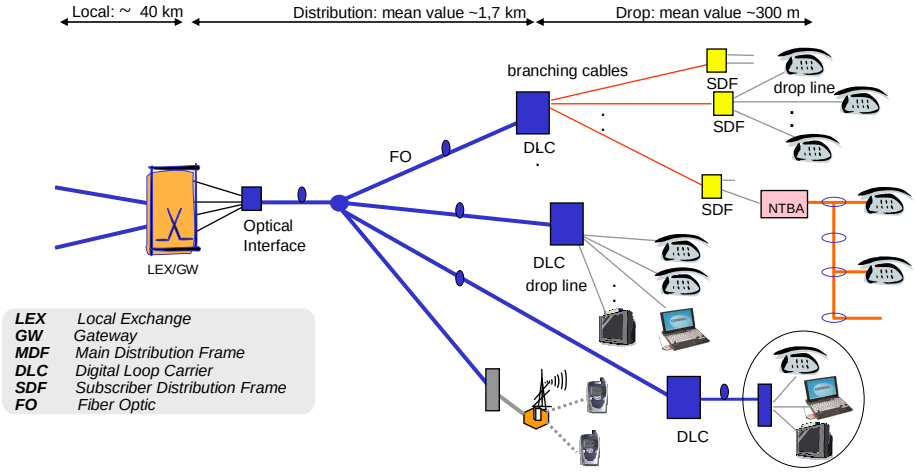



| | |
|---|---|
| ***LEX*** | *Local Exchange* |
| ***MDF*** | *Main Distribution Frame* |
| ***FDF*** | *Feeder Distribution Frame* |
| ***SDF*** | *Subscriber Distribution Frame* |

# Network Architecture towards NGN

## Architecture Consolidation: Access evolution

### Typical Access Network evolution




| | |
|---|---|
| ***LEX*** | *Local Exchange* |
| ***GW*** | *Gateway* |
| ***MDF*** | *Main Distribution Frame* |
| ***DLC*** | *Digital Loop Carrier* |
| ***SDF*** | *Subscriber Distribution Frame* |
| ***FO*** | *Fiber Optic* |



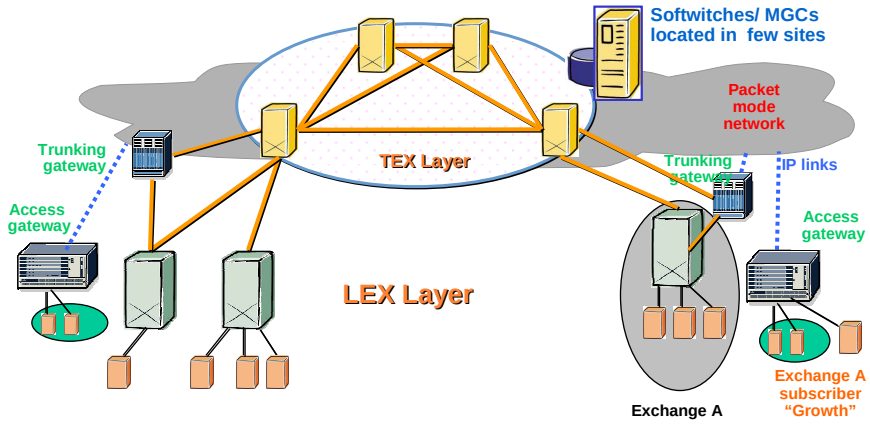
# Network Architecture towards NGN

## Architecture Consolidation: Local

### Dominated by functions migration investment and interoperability

- Move from joint switching and control to separated control and media GW
- Introduce Multimedia Services at all areas
- Optimize number, location of nodes and interfaces among existing and new network
- Requires longer time and higher investments due to variety of geo-scenarios and geographical distribution

# Network Architecture towards NGN
## Architecture Consolidation: Local





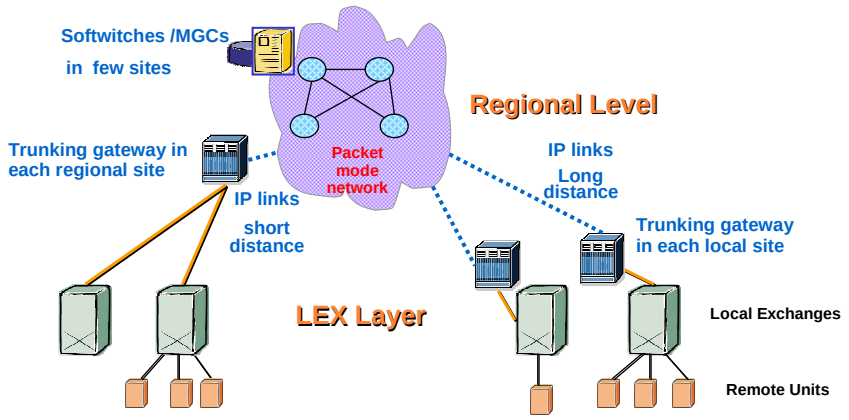

# Network Architecture towards NGN
## Architecture Consolidation: Core

### Dominated by high capacity and protection level

- Overlay deployment for full coverage in all regions
- Quick deployment needed for homogeneous end to end connections
- Strong requirements for high quality, protection and survivability
- Importance of the optimization for location and interconnection

# Network Architecture towards NGN

## Architecture Consolidation: Core






# Network Architecture towards NGN

## Architecture Consolidation: Combined Segments

### Where to start and how to co-ordinate migration?

**Network "consolidation"**

Cost Optimisation of the network

- Reducing nodes and increase their capacity
- Deployment of ADSL and multiservice access

**Network expansion**

NGN solution :

- Cap and Grow; this means keeping the existing PSTN network as it is, and grow demand with NGN equipment

**Network replacement**

Replacement of out-phased (end of life) TDM equipment

- gradual replacement : this means coexistence of the two technologies
- full accelerated replacement with a short transition period

***Need to optimize overall network evolution: technically and economically***

# Network Architecture towards NGN
## Architecture Consolidation: Combined Segments

### Overall impact of evolution on network CAPEX and OPEX

**CAPEX**

- TDM and NGN CAPEX are close
- NGN CAPEX in the first years driven by geographic coverage
- Access systems represent a large part of CAPEX
  - similar values in TDM and NGN

**OPEX**

- OPEX in NGN trends to be lower
- Migration scenarios will have a mix of TDM OPEX (installed base) and NGN OPEX (substitution and growth)
- Significant impact of manpower cost due to convergence in operations

**Key factors for the evaluation: Geo-scenarios, Network grow rates, Aging of equipment, New services**



# Network Architecture towards NGN
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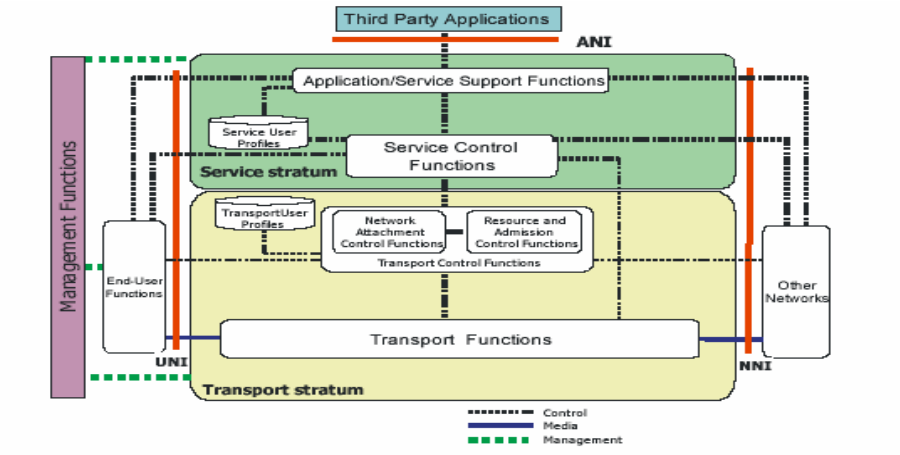
# Network Architecture towards NGN
## Unified IMS Model for Mobile and Fixed

### Why IMS?

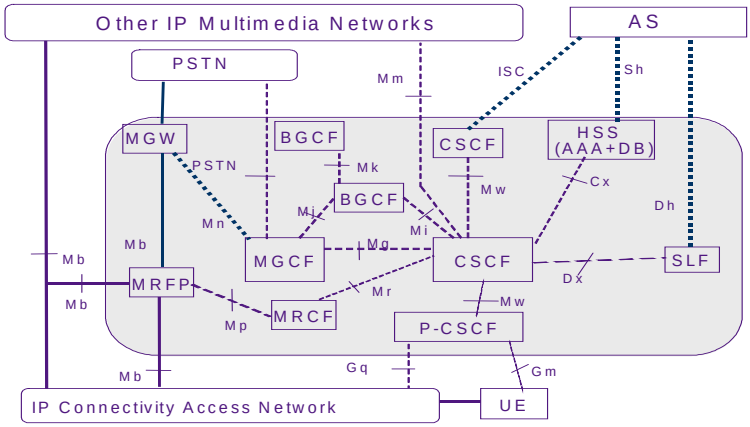
- Deliver person-to-person real-time IP-based multimedia communications
  - Person-to-person, person-to-machine
- Fully integrate real-time with non-real-time multimedia communications.
  - i.e., live streaming and chat
- Enable different services and applications to interact
  - i.e., combined use of presence and instant messaging
- Easy user setup of multiple services in a single session, or multiple synchronized sessions
- Operators have better control of service value chain
  - End-to-end QoS



# Network Architecture towards NGN
## IMS Architecture



# Network Architecture towards NGN
## IMS Functional Structure and Interfaces






# Network Architecture towards NGN
## IMS Architecture

**IMS functional elements:**

- **Application Server (AS)**
- **Home Subscriber Server (HSS)**
- **Call Session Control Function (CSCF)**
- **Breakout Gateway Control Function (BGCF)**
- **Media Gateway Function (MGW)**
- **Media Gateway Control Function (MGCF)**
- **Multimedia Resource Function Controller (MRFC)**
- **Multimedia Resource Function Processor (MRFP)**

# Network Architecture towards NGN
## IMS Architecture

### Application Server (AS)

- **Contains Call Related Application Logic**
- **Facilitates a Service Creation Environment**
- **Queried by S-CSCF in Real Time to Execute Logic**
- **Generally Specialized for Each Service**
- **May Provide Gateway to Legacy Applications (e.g. AIN)**



# Network Architecture towards NGN
## Evolution to IMS: Benefits

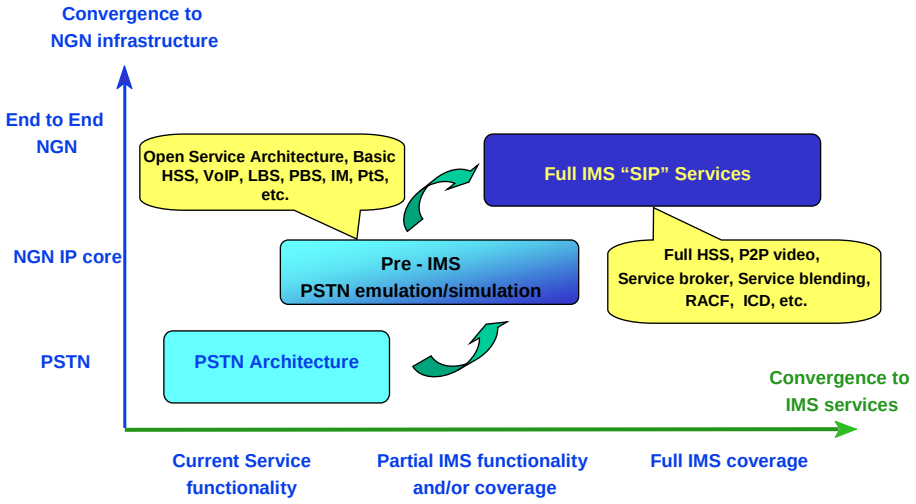
- **First advantage is the higher flexibility of the IMS functionality to adapt to the customer services**, irrespective of the technology they use and the access method to reach the network.

- **Saving in effort and time for the development and deployment** of a new service is considerably reduced once the architecture is ready at the network, implying economic savings and better Time to Market for a given service provider in a competitive market.

- **Efficient introduction on new services at a lower cost** will increase the service provider revenues and ARPU which is the major business driver for the healthy operation, market grow and financial results.

- **Higher utilization of services and better personalization** of functions to specific requirements from the end customers' point of view, a common use and feel for all services and applications

# Network Architecture towards NGN
## Evolution to IMS: Phases






# Network Architecture towards NGN
## Summary of Key Factors

- Plan a **phased approach** for the network migration based on business evaluation per scenario type.
- Implement **pilot cases** before network migration due to the many new technical issues.
- Consider first group of IMS services implementation to benefit on flexibility and time to market.