Network Architecture consolidation towards NGN

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Content

• Key factors for the evolution towards NGN
  • Services and revenue motivations. Requirements

• Network architecture consolidation at transit, local and access levels
  • Topology and migration

• Network optimization based on planning methods and tools
  • Support to Design
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
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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.

- **Interoperability across networks** to allow to carry end to end services for flows in different network domains.

Network Architecture towards NGN
Key Factors: Issues to care

- **Introduction of new services** based on profitability.

- **Interworking** with existing PSTN and other operator's networks.

- **QoS** for guaranteed services and critical business customers.

- **Tariff principles** as a function of market demand and consumption of network resources (Backward Cost Assignment).

- **Universal Service Obligations** for basic services and internet.
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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 for security

• High protection level and diversity paths/sources in all high capacity systems, both at functional and physical levels
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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

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

What changes from current scenario towards target network?
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Architecture Consolidation: Topology

Structure Simplification

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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 consolidation: O.G.S.**

**Network Architecture towards NGN**

**Architecture Consolidation: Access evolution**

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

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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

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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
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Architecture Consolidation: Core

Softswitches/MGCs located in few sites
IP links
Long distance
Packet mode network
Trunking gateway in each local site
LEX Layer
Regional layer
Local Exchanges
Remote Units

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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
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Architecture Consolidation: Combined Segments (I)

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Architecture Consolidation: Combined Segments (II)
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

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Cost drivers and trends

- Network physical infrastructure as a function of location and density (costs proportion around 70% in the access segment)
- Volume of customers per category
- Bandwidth demand per origin/destination
- Packet processing rates for control related functions
- Variety of applications/services and related platforms
- Content storage and location within the network
- Leasing of physical or communication resources

Fundamental importance of economies of scale by volume and convergence at network resources, service platforms and OSS
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**Architecture Consolidation: Scenario evaluation**

- **Net Present Value (NPV)** for the overall migration project is the best global evaluator.

A large variety of country scenarios and transition strategies generate major differences in the economical results. Planning to be performed per country and operator.

**Network Architecture towards NGN Content**

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    - Support to Network Design
Network Architecture towards NGN

Support tools: Design and Optimization (I)

Required functionality for Technical design tools

- Service demands characterization and traffics for VoIP and NGN multiservice flows
- Conceptual Network Design and Capacity Planning
- Comparison of different network structures
- Routing flows for most typical cases including OSPF, shortest path, widest path and weighted cost functions.
- Optimizing locations and connections of network gateways
- Cost, Performance and Reliability Analysis
- Estimation of investment costs for the rollout and the extension of the investigated multi-service network

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Support tools: Design and Optimization (II)

Required functionality for Technical design tools

- Estimation of end-to-end delays
- Technical Site and System Planning
- Allocation of the IP or MPLS links
- Formation of virtual networks
- Routing over ATM links or PDH/SDH systems or tunneling via other IP links
- Sub-networking and addressing
- Configuring the network elements (IP router)
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Support tools: Design and Optimization

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Summary of Key Factors

- Plan **business and services first**, later the network with proven solutions.

- Implement **pilot cases** before network migration due to the many new technical issues

- **Differentiation** to competitors on new services and quality

- Design financial performance with **best business practices**: compare and optimize NPV.