ITU-BDT Regional Seminar on Fixed Mobile Convergence and new network architecture for the Arab Region

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Network Architecture consolidation towards NGN

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Network Architecture towards NGN 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

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
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

Network Architecture towards NGN
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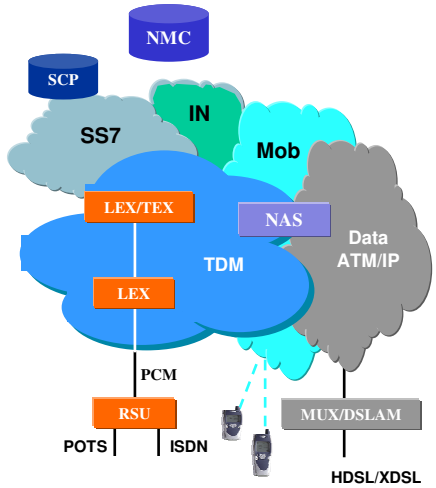
Network Architecture towards NGN
Architecture Consolidation: Topology

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

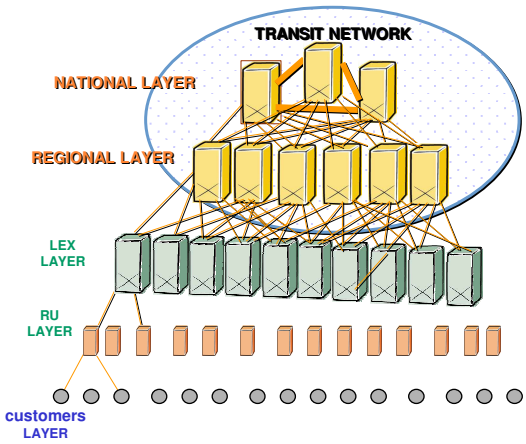
- **Less network nodes and links** due to the higher capacity of systems (one order of magnitude).
- **Same capillarity** at access level due to identical customer location
- Topological **connectivity higher** for high capacity nodes and paths for security
- **High protection** level and diversity paths/sources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

Network Architecture towards NGN
Existing networks and architecture



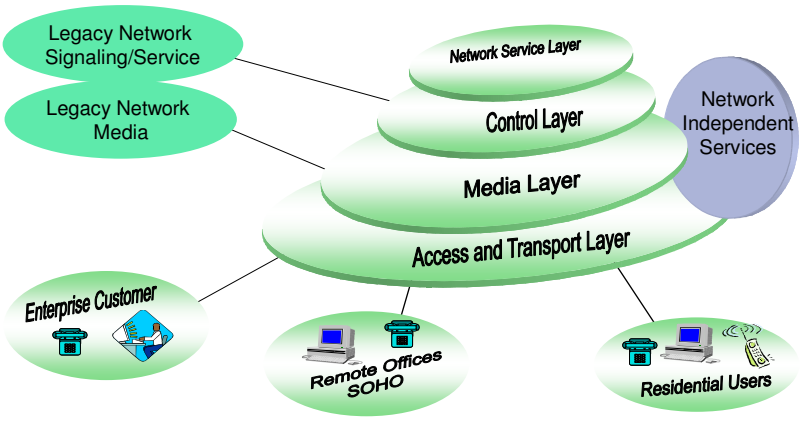
- 5 different network types to handle telecom services
- TDM for fixed and mobile networks working in circuit mode with end to end reserved paths
- SS7 and IN network working with message switching mode
- Data network working with leased lines and packet mode with different and conventional IP protocols

Network Architecture towards NGN
Existing networks and architecture



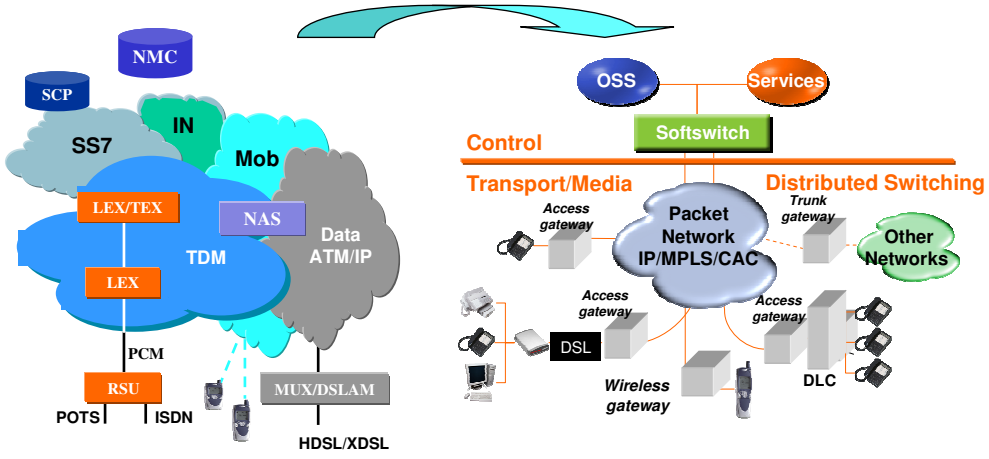
- Hierarchical topology with 4 to 5 layers, connectivity to the upper next layer and within each layer as a function of economical optimization
- Number of nodes as a function of O/D traffic and nodes capacity
- Service handling for media, signaling and control at all exchange nodes
- Carrier grade quality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

Network Architecture towards NGN
Architecture: NGN Layers

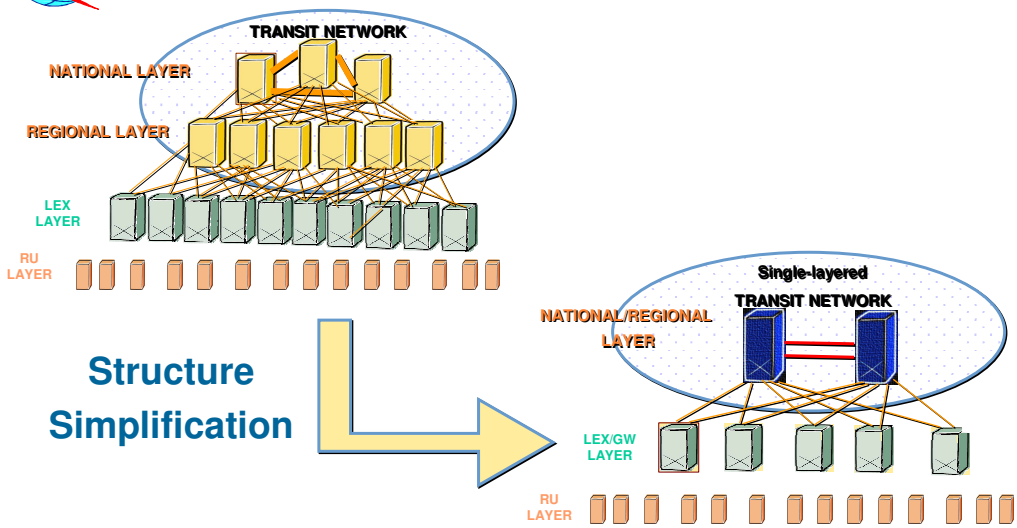


Network Architecture towards NGN
Architecture migration: Topology

What changes from current scenario towards target network ?



Network Architecture towards NGN Architecture Consolidation: Topology



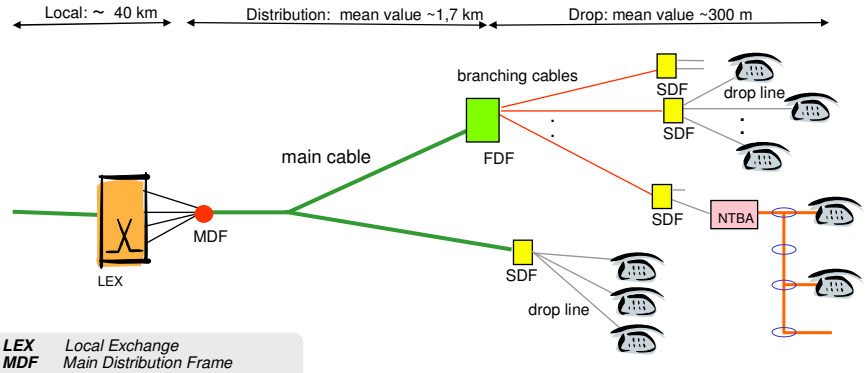
Network Architecture towards NGN Architecture Consolidation: Access

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

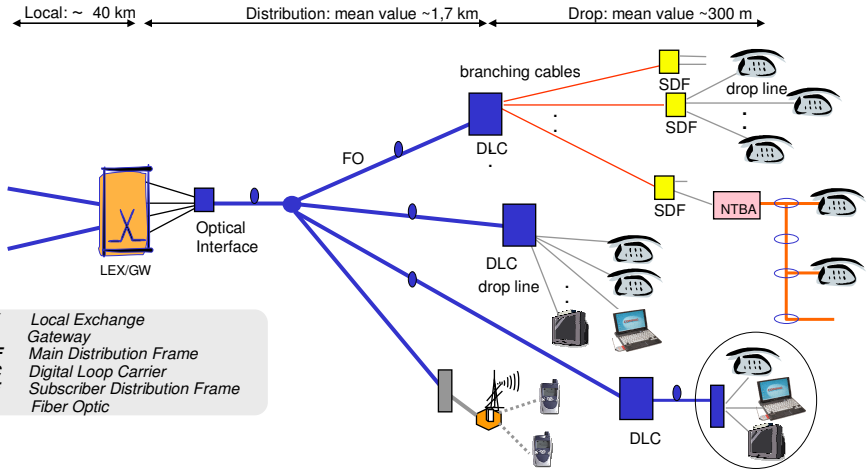
Typical historical Access Network structure



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



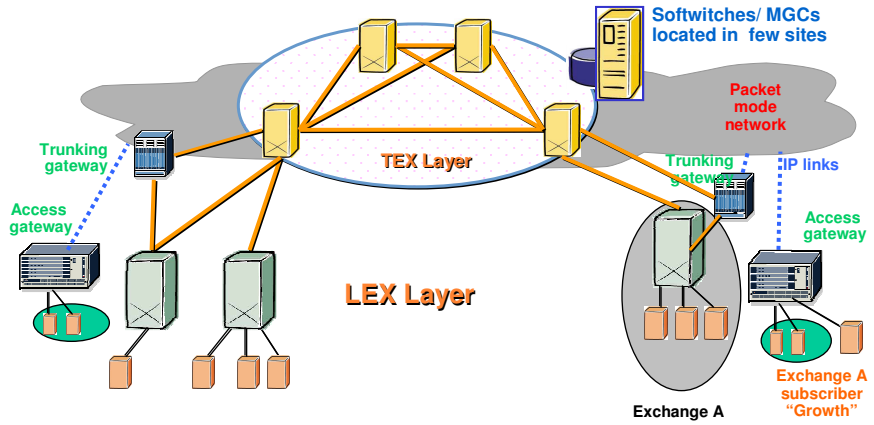
LEX	*Local Exchange*
GW	*Gateway*
MDF	*Main Distribution Frame*
DLC	*Digital Loop Carrier*
SDF	*Subscriber Distribution Frame*
FO	*Fiber Optic*

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

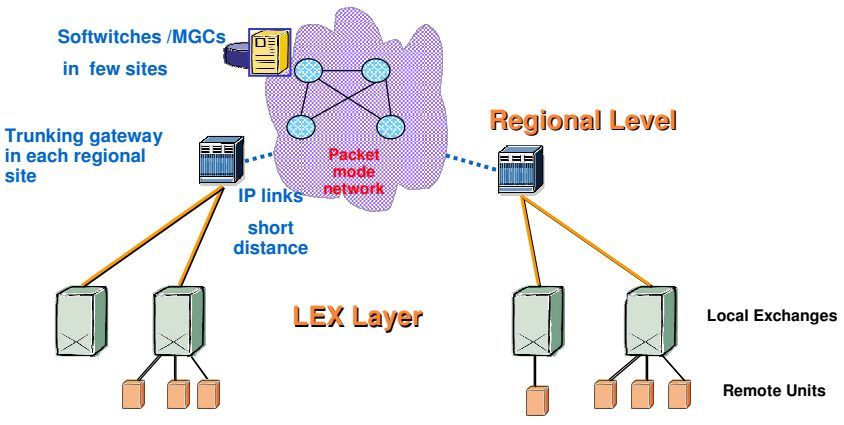


Network Architecture towards NGN
Architecture Consolidation: Core

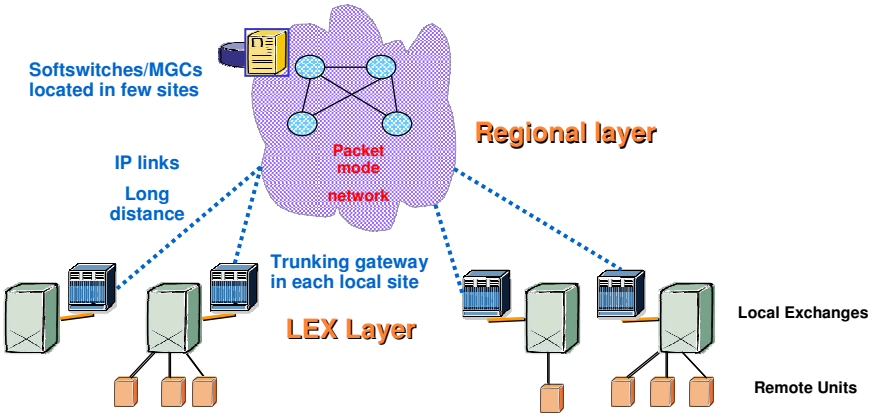
Dominated by high capacity and protection level

- 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: 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

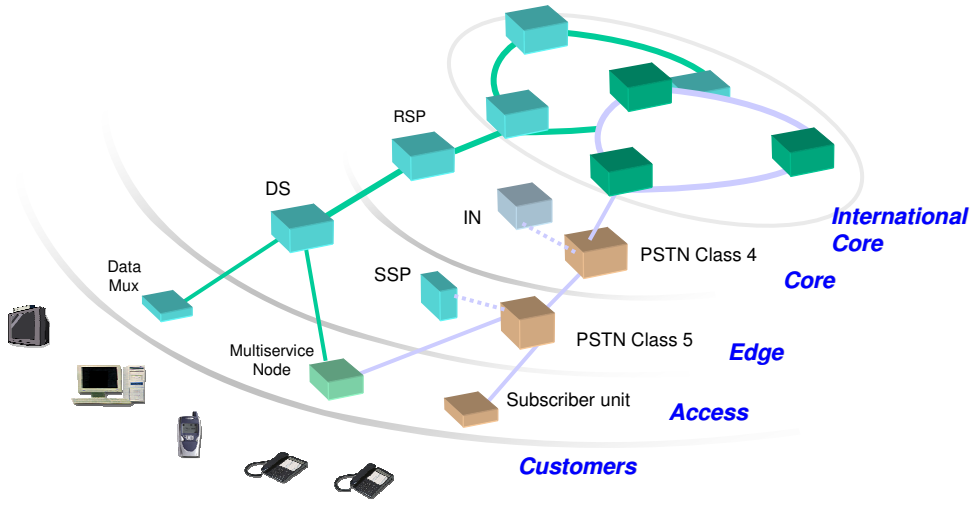
Replacement of out-phased (end of life) TDM equipment

- 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

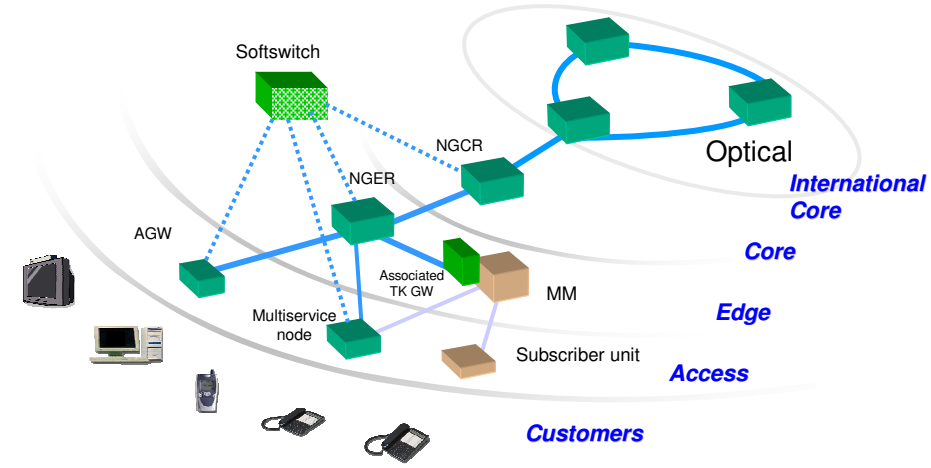
Network Architecture towards NGN

Architecture Consolidation: Combined Segments (I)



Network Architecture towards NGN

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

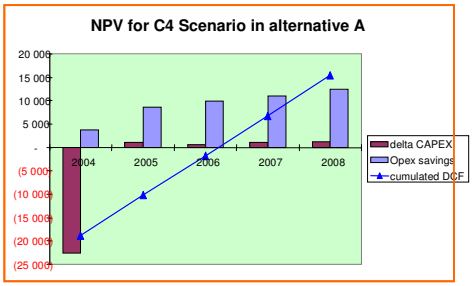
Network Architecture towards NGN
Cost drivers and trends

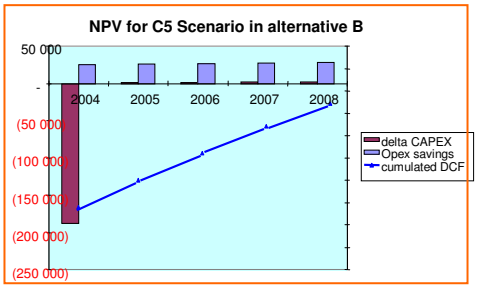
- Network physical infrastructure as a function of location and density (costs proportion around 70% in the access segment)
- Volume of customers per category
- Bandwidth demand per origin/destination
- Packet processing rates for control related functions
- Variety of applications/services and related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

Network Architecture towards NGN
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

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Network Architecture towards NGN
Support tools: Design and Optimization (I)

Required functionality for Technical design tools

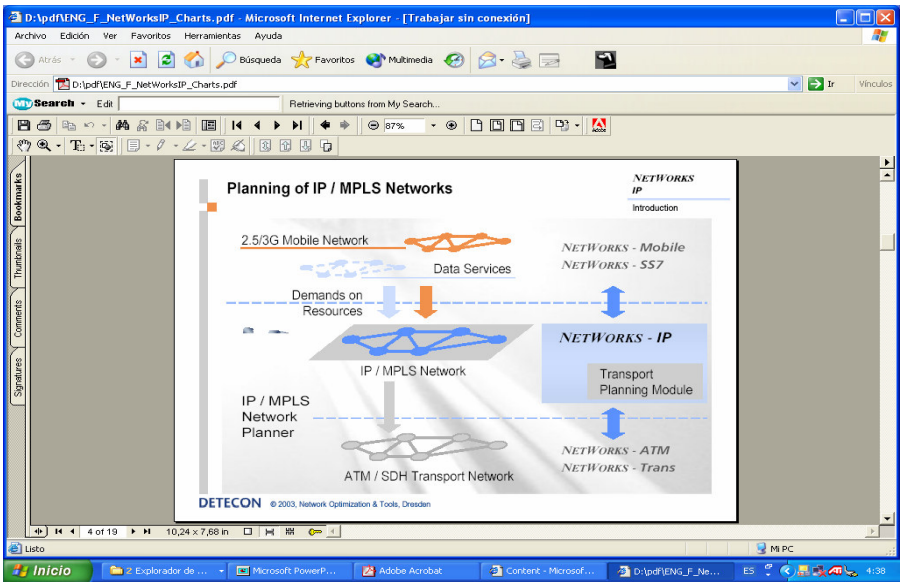
- Service demands characterization and traffics for VoIP and NGN multiservice flows
- Conceptual Network Design and Capacity Planning
- Comparison of different network structures
- Routing flows for most typical cases including OSPF, shortest path, widest path and weighted cost functions.
- Optimizing 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

Network Architecture towards NGN
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)

Network Architecture towards NGN
Support tools: Design and Optimization



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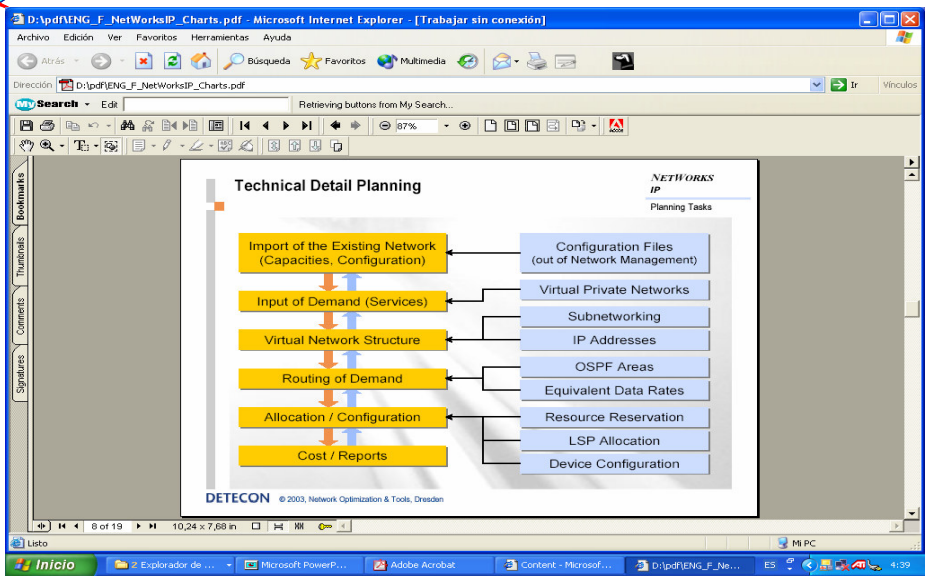
Support tools: Design and Optimization



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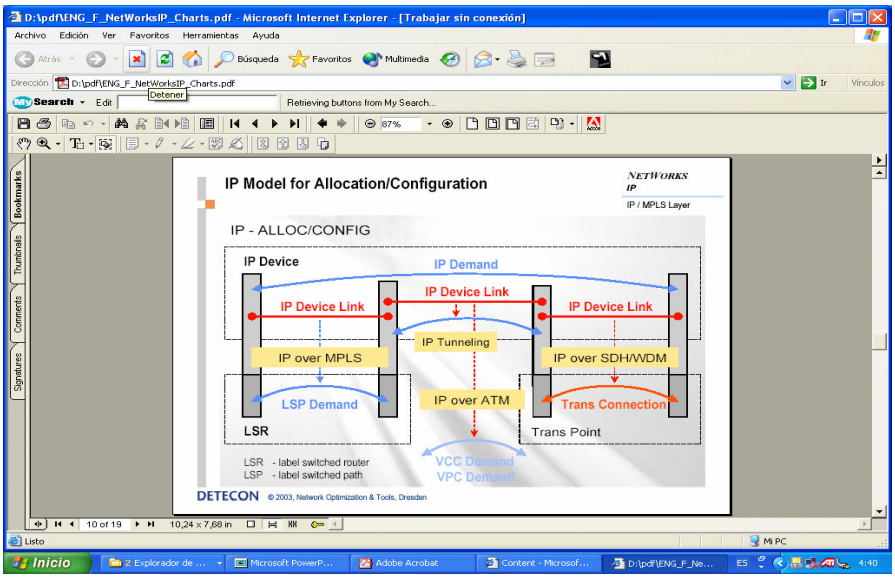

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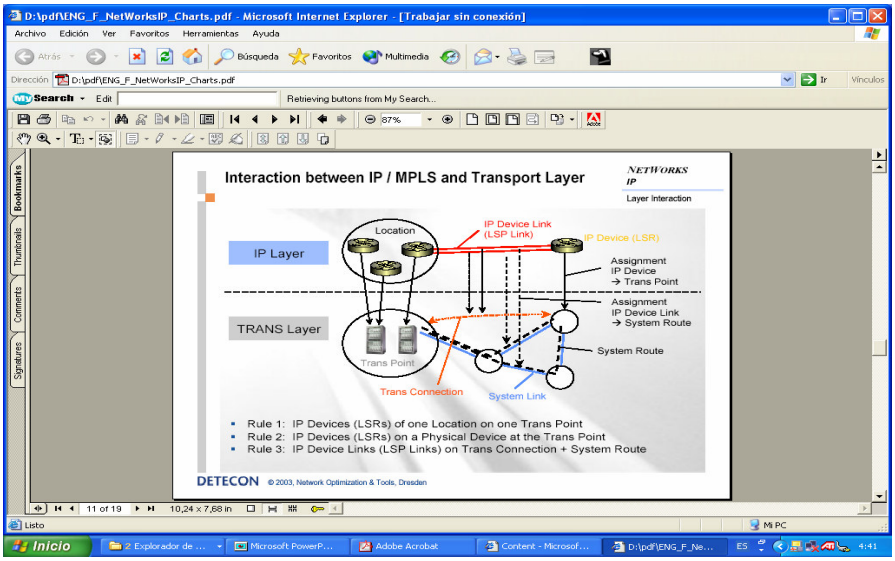

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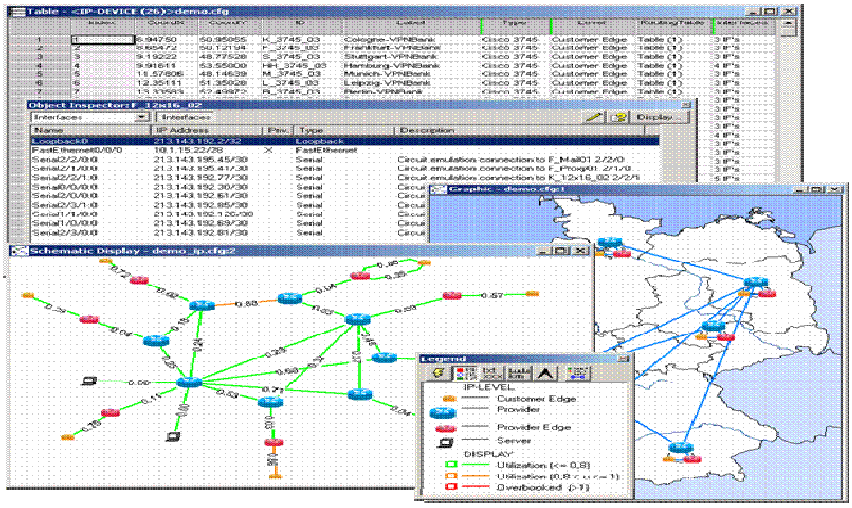

Network Architecture towards NGN
Summary of Key Factors

- 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.