ITU/ BDT «Training and Trials on Network Planning Tools for Evolving Network Architectures»

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Role of Network Planning Tools and Cases

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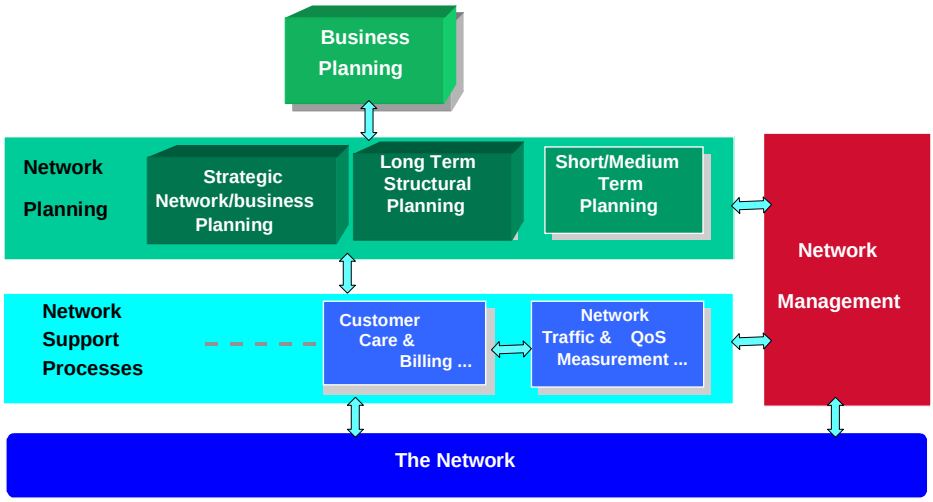
Network Planning Tools
Content

- Network planning process and domains
- Objectives and classification for the different tool types
  - Overall techno-economical evaluation
  - Network design and optimization
  - Detailed design and configuration
  - Network evaluation and simulation
- Example of business cases

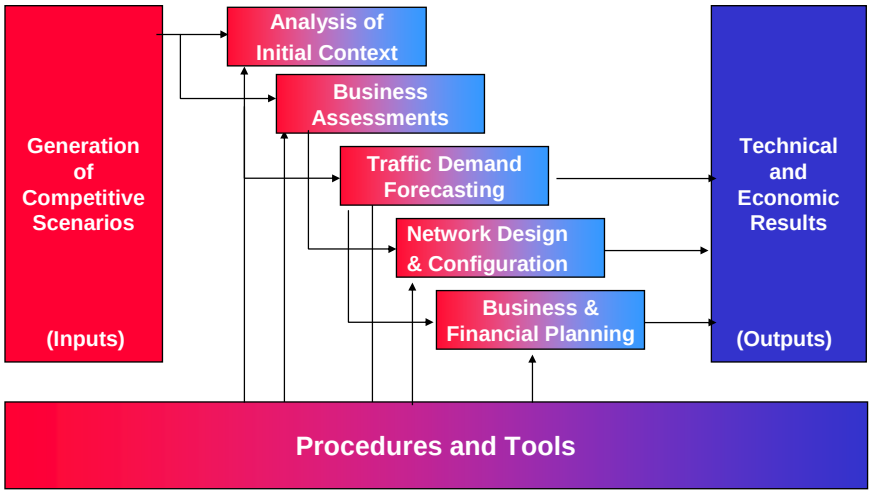
Network Planning Tools

Network Planning: Related Processes

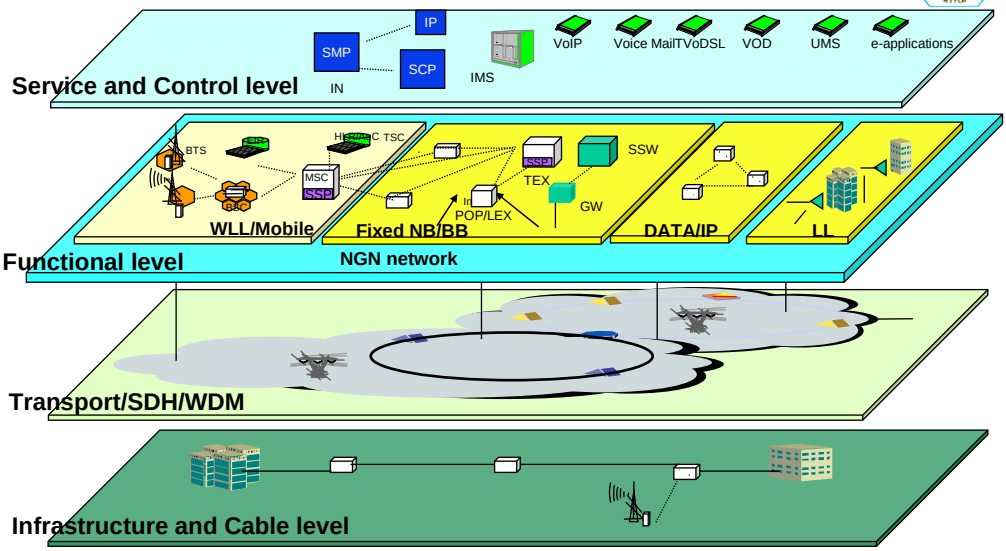


Network Planning Tools

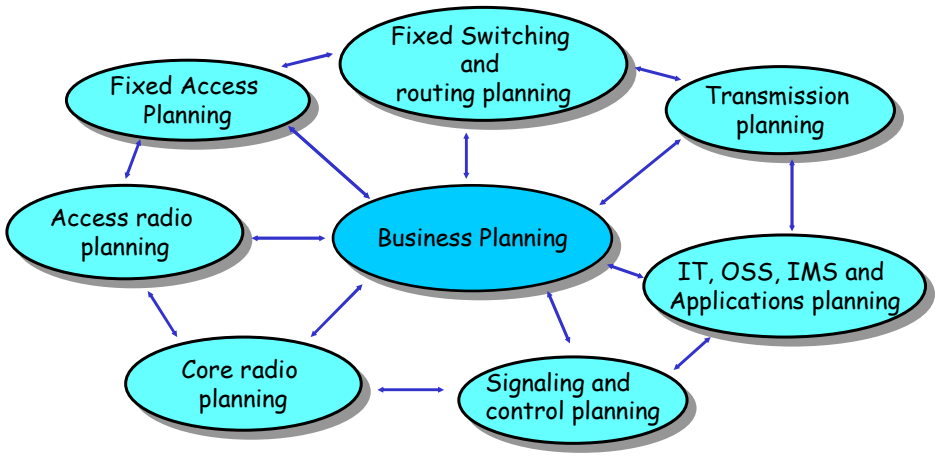
Integrated Iterative Planning Process



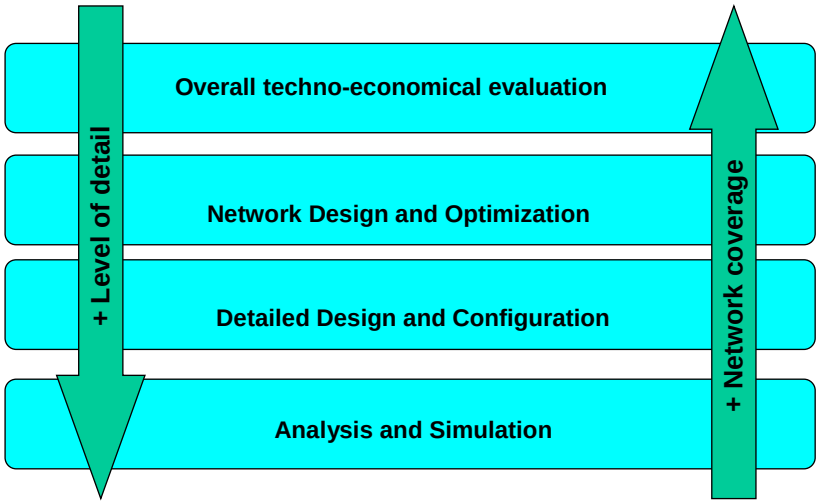
Network Planning Tools
Strategic view: Network Layer Modeling



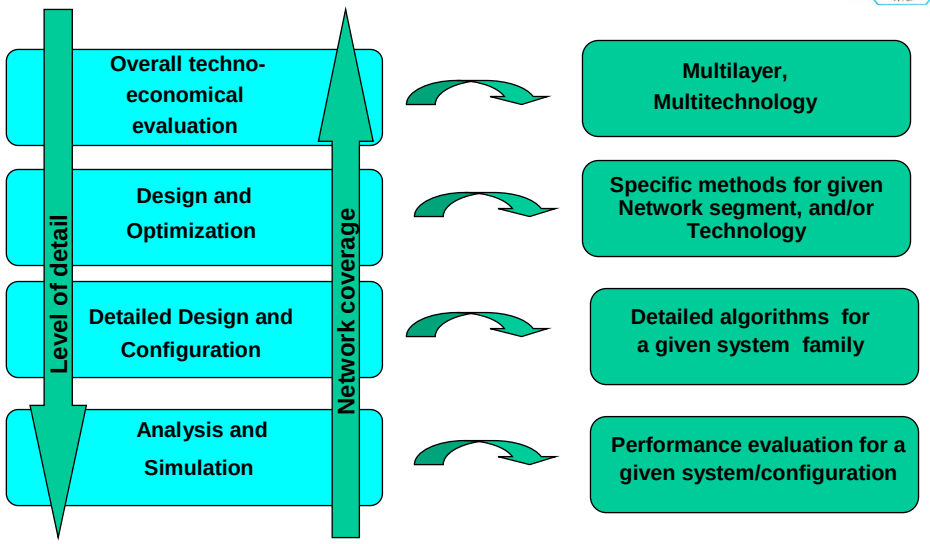
Network Planning Tools
Planning domains



Network Planning Tools:
Tool categories by coverage and detail



Network Planning Tools:
Tool categories by coverage



Network Planning Tools
Support tools: Business

- **Required functionality for Business tools in NGN**

  - **Service Demand Projection**
  - **Dynamic modeling for technology substitution and migration rates**
  - **Dimensioning multiple flows (circuit and packet modes)**
  - **Evaluation of network resources and associated investment (CAPEX)**
  - **Evaluation of revenues for given tariffs and installation rate**
  - **Modeling multiple resource lifetimes**
  - **Modeling of demand elasticity to tariffs**
  - **Interrelation between network growth and operational cost (OPEX)**
  - **Cost assignment as a function of utilization rates**
  - **Generation of standard financial results like Cash Flow, Profit & Loss, Balance Sheet, NPV, IRR, etc.**

Network Planning Tools
Support tools: Design and Optimization (I)

- **Required functionality for Technical design tools in NGN**

  – 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 Planning Tools
Support tools: Design and Optimization (II)

- **Required functionality for Technical design tools in NGN**
  - 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 Planning Tools
Example of Strategy Business Case

Operator needs to decide and evaluate market position on services:

- Specific strategy to ensure survivability in competition in a "medium –developing" country
- What customer classes to serve
- What service categories to address
- What are the business impacts due to different combinations of services
- What-if analysis for business at Short-term view and Long-term view

Network Planning Tools
Example of Strategy Business Case

Case study for medium size country with mixes of customer classes and triple play services domains:

– Multi-service IP Network with integrated operation available

– Three customer classes considered: Business, SOHO/SME and Residential

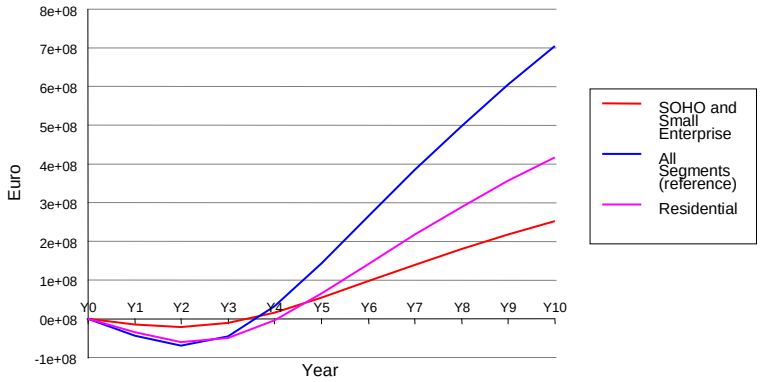
– Three service categories to analyze: Voice, Data/Internet, IPTV

– Scenario considering the modeling of demands, multi-service traffic flows, dimensioning, network resources, CAPEX, OPEX and financial results for different levels of competition

– Evaluate future Net Present Value (NPV) for a 10 years period

Network Planning Tools
Example of Strategy Business Case

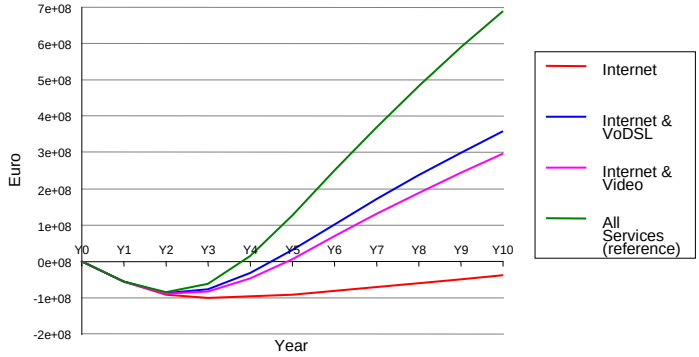
Effects of the mix of customers on Reference Scenario: Low competition level
Network NPV



- SME and SOHO with quicker recovery but less NPV and company value at medium term
- "All customer segments" case with much better behavior

Network Planning Tools
Example of Strategy Business Case

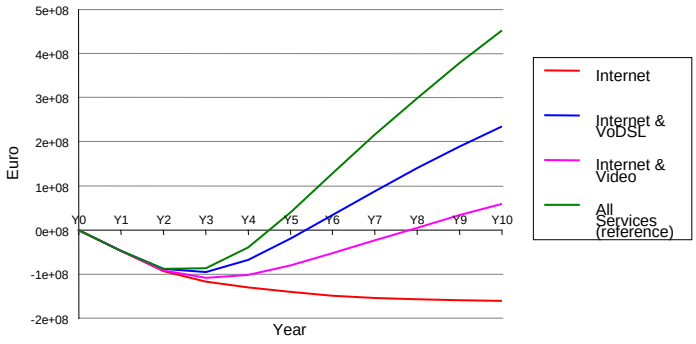
Effects of the mix of services on Reference Scenario: Low competition level
Network NPV



- Major impact of service classes on NPV and company survivability
- Single service classes without future
- High benefit of “all services” case

Network Planning Tools
Example of Strategy Business Case

Effects of the mix of services on typical scenario: Medium competition level
Network NPV



- Increase of competition level amplifies the previous effects on feasibility: big differences between service mixes
- Data only or single service classes without feasibility at medium term
- Very robust behavior for the “all services” case

Network Planning Tools
Example of Strategy Business Case

Lessons to care

- The mix of customer classes and service provided have a high impact on the business results at medium and long term
- Addressing all service categories provides more robust financial behavior that service subsets
- Business customers provide quickest rate of return but highest number of residential customers higher capability to increase volume at long term
- Service convergence will improve economies of scale and survivability in a competitive environment

Network Planning Tools
Example of Business Migration to 3G

Operator needs to model and evaluate evolution of mobile network:

- Migration strategy from a 2G network towards a 3G solution in a "medium–developing" country
- How to model and dimension the mix of voice and data services
- What is the impact of new services on the network design, bandwidth requirements and quality
- What are the consequences on CAPEX, OPEX and Revenues due to new services
- What-if analysis for business at Short-term view and Long-term view

Network Planning Tools
Example of Business Migration to 3G

Case study for a country with existing 2G with medium penetration level

- Country with a typical mix of urban, suburban, rural and hot-spots geo-scenarios
- Installed GSM network with 90% of territory covered and customers penetration of 30%
- New customers expected to duplicate in the study period
- Migration period planned to be completed in 5 years
- Differentiation in the modeling of customer traffic and dimensioning per geo-scenario

Network Planning Tools
Example of Business Migration to 3G

Multicriteria Dimensioning principles for multimedia services

C1) - Radio Coverage per frequency type: 900, 1800, 2500: dominant for low voice traffic without data.

C2) - Traffic in erlangs for voice: dominant in urban scenarios and hot-spots

C3) - Data services quality as a function of speeds: dominant in suburban and rural scenarios

C4) - Data bandwidth as a function of mix of data services Sustained Bit Rates and QoS along the cell due to the cell-breathing effect: dominant for significant proportion of data and video consumption in all scenarios

Actual dimensioning for cells and equipment as a result of the convolution of all of them per geo-scenario

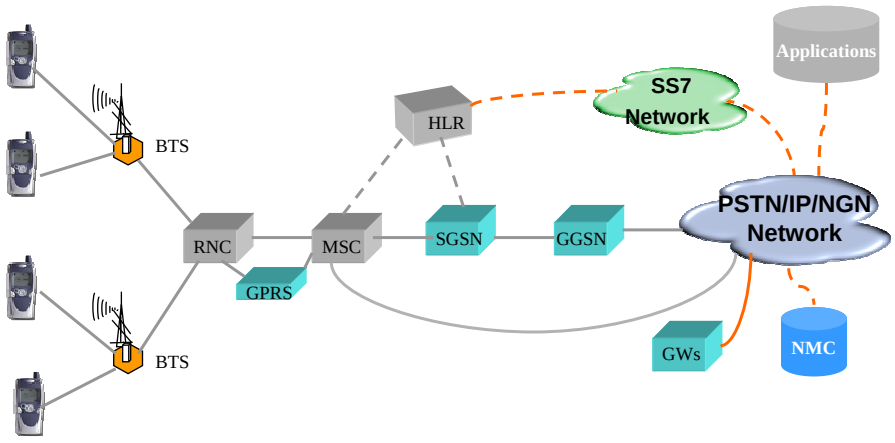
Network Planning Tools
Example of Business Migration to 3G

Network Systems Modeling for the migration

– Customer Segments (business, residential) and Services (Voice and Data low/medium/high speed)
– Sites and Base Stations at Urban, Suburban, Rural and Hot spots
– Backhaul per geo-scenario
– Core Network with the specific network elements in the architecture
– Transport for voice, circuit mode data and packet mode data
– Interconnection for voice and data

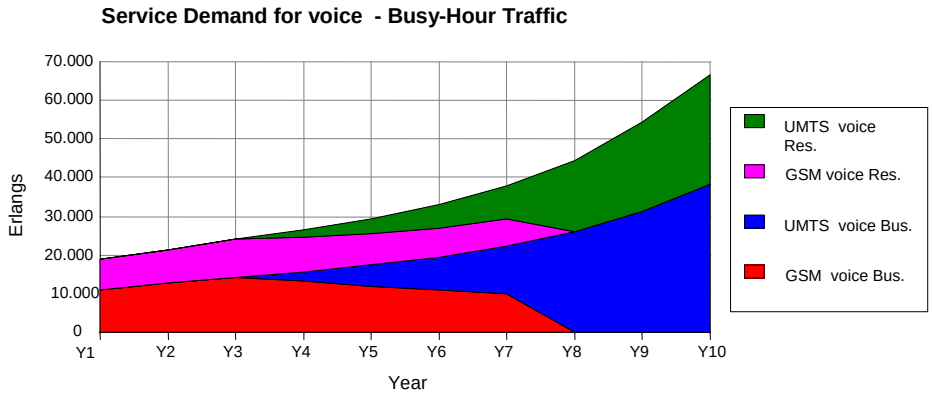
Network Planning Tools
Example of Business Migration to 3G

Evaluated architectures



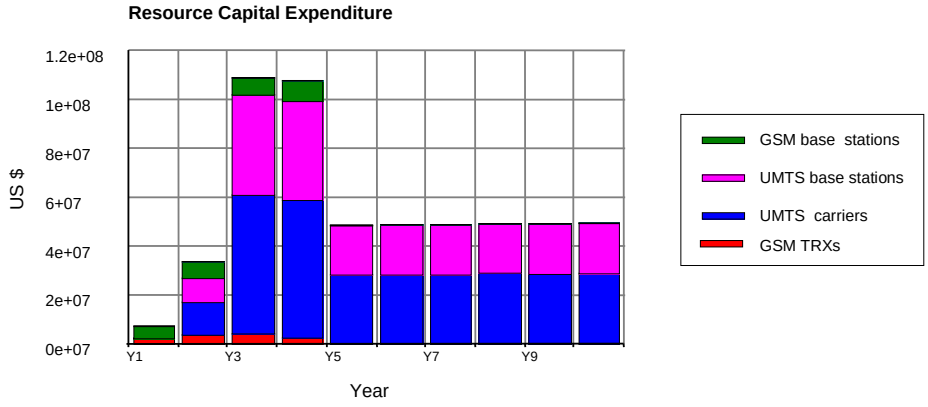
Network Planning Tools
Example of Business Migration to 3G

Typical planning results



Network Planning Tools
Example of Business Migration to 3G

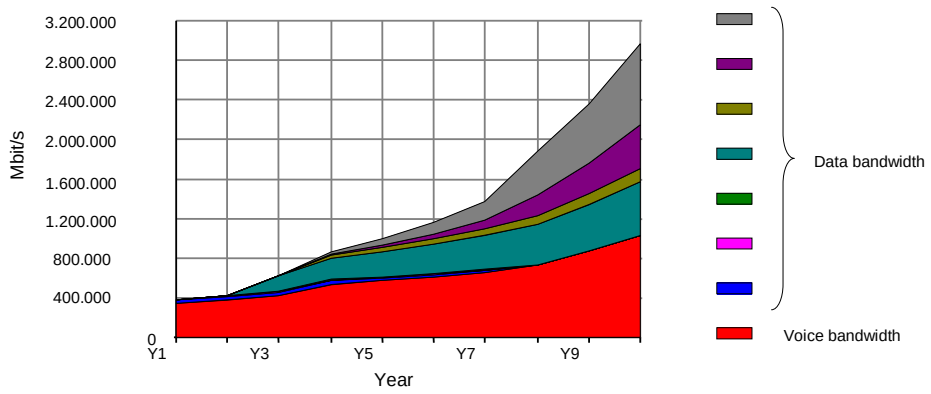
Typical planning results



Network Planning Tools
Example of Business Migration to 3G

Typical planning results

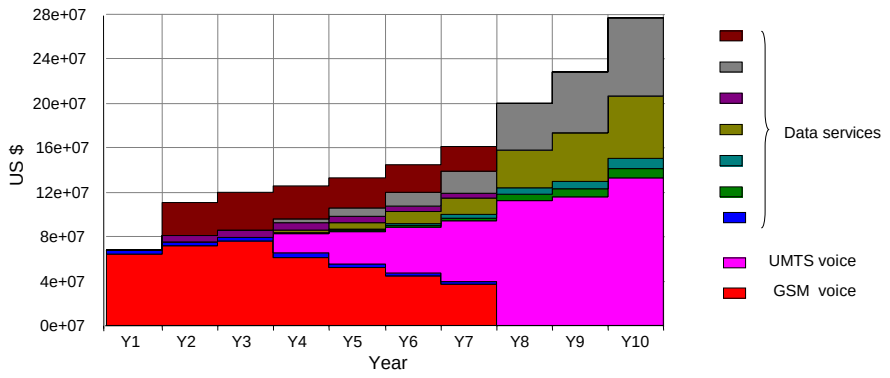
Bandwidth per service class of business customers



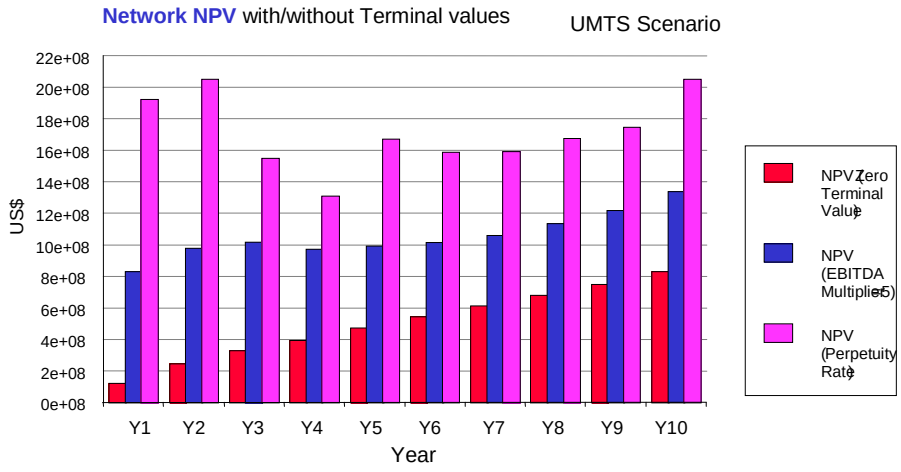
Network Planning Tools
Example of Business Migration to 3G

Typical planning results

Revenue per service type for consumer customers



Network Planning Tools
Example of Business Migration to 3G



Network Planning Tools
Example of Business Migration to 3G

Lessons to care

- Modeling of the migration of 2G to 3G requires careful modeling of the two architectures at the same time
- Dimensioning of 3G networks imply a network redesign due to high speed services
- 3G networks require important CAPEX investments during first years
- New services introduction strategy is fundamental to benefit from the new revenues of data services
- Business profitability is positive after initial years as well as strategic positioning in competition

Network Planning Tools
Summary Remarks

- Ensure proper modeling of key techno-economical factors
- Focus on multiple customers, multiple services domains
- Take benefit of all economies of scale in the evolution towards convergence
- High number of alternatives require the use of powerful and professional tools