



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

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Network Planning Tool Specifications (NPTS)

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Network Planning Tools Specs (NPTS) Content



- Objectives of the specs
- Need for multiple tools and support
- Document structure
- Type of requirements
 - Technical requirements per domain
 - Tendering requirements



Network Planning Tools Specs Objectives



- **Context**
 - Today the high number of options for telecom solutions and services with the complexity of planning increases the needs for a systematic and reliable planning methodology
- **Objective**
 - Following ITU mandate and agreements, the Reference Document, Network Planning Tool Specs (NPTS) is defined to meet countries' requests for assistance in the field of Network Planning for Developing Countries and Countries with economies in transition.
 - Document provide support in the network planning activities, technical requirements for tools and selection criteria for tools that fulfill the requirements



Network Planning Tools Specs Users



- **Users of the NPTS**
 - The Reference Document on NPTS is intended for use by network planning experts and managers from telecom operators, policy makers and regulators
- **Reference document**
 - *Reference Manual on Telecom Network Planning for Evolving Network Architectures* Version 02, ITU, Geneva, 2005
link : <http://www.itu.int/ITU-D/tech/network-infrastructure/index.html>
 - Background for the content is the experience on planning projects, the needs by operators in competition and the know-how of capabilities of new technologies



Network Planning Tools Specs Need for multiple tools



- **Multiple dimensions of the planning activities**
 - Due to timeframe for planning at short, medium or long term
 - Due to variety and complexity of network solutions
 - Due to new technologies
 - Due to different network layers
 - Due to planning type: strategic, tactical or operational
- **Need for combination of tools**
 - Tools should specialize to solve different problems
 - Interrelation is needed to combine evaluations and decisions
 - Assessment is required to select and combine most appropriate tools

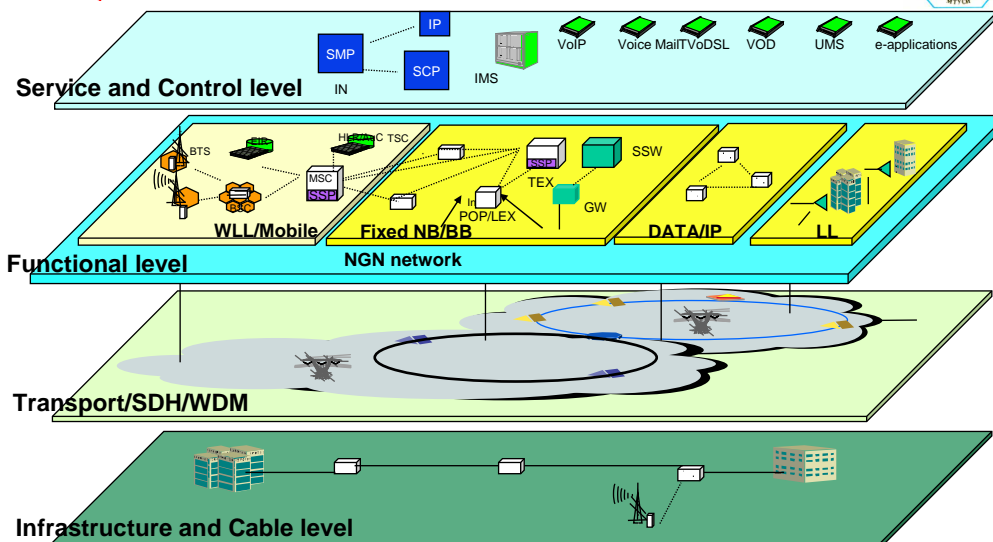
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Network Planning Tools Specs Strategic view: Network Layer Modeling



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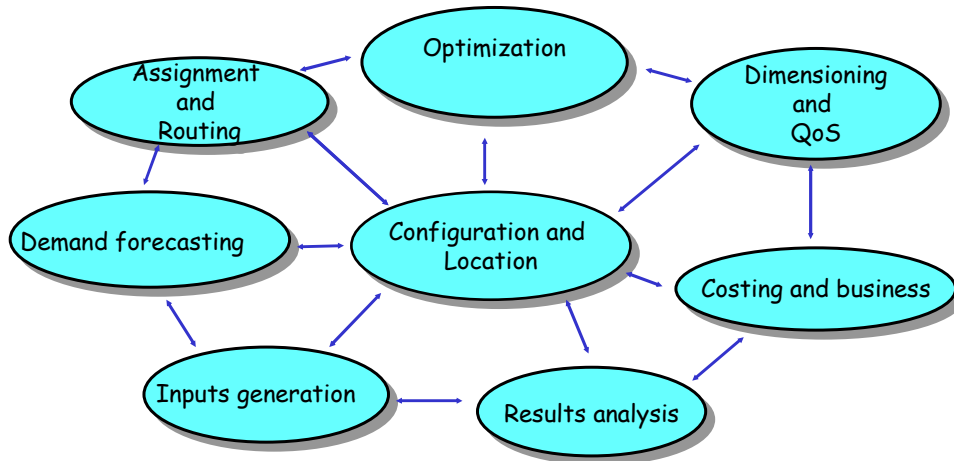
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Network Planning Tools Specs Type of requirements



A large variety of Planning activities needed



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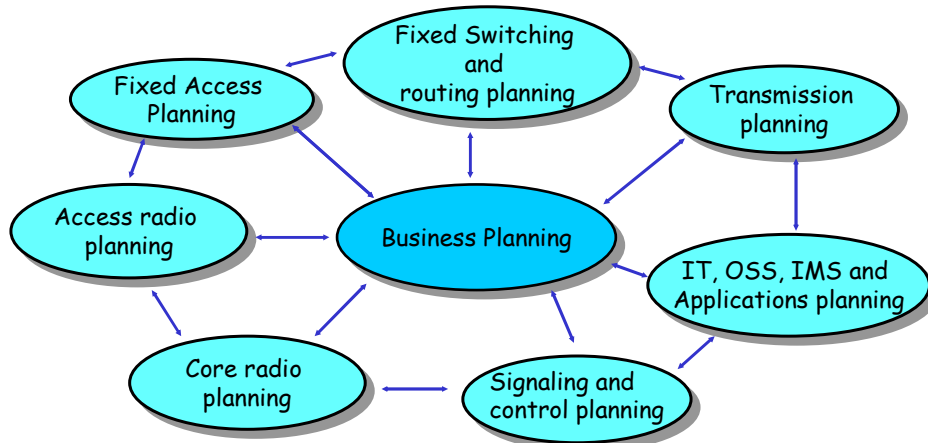
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Network Planning Tools Specs Type of requirements



Interrelation among planning domains to be addressed



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Network Planning Tools Specs Document Structure (I)



1.- Introduction and scope

- 1.1. ITU Vision on Network Planning
- 1.2. Who should use this Reference Document
- 1.3. Content of the Reference Document
- 1.4. Relation to other ITU documents

2.- Needs for planning by ITU members

- 2.1. Needs for assessment on proper tools and tool combination
- 2.2. Needs for training on tool applicability and capabilities
- 2.3. Needs for documentation
- 2.4. Needs for tool support, updates and maintenance
- 2.5. Selection criteria for planning tools



Network Planning Tools Specs Document Structure (II)



3.- Network planning problems to be addressed

- 3.1. Network planning problems and activities
- 3.2. Network planning types and domains

4.- Technical requirements per planning domain

- 4.1 Business
- 4.2 Fixed switching and routing
- 4.3 Transmission
- 4.4 Fixed access
- 4.5 Signaling, control and NM
- 4.6 Radio access
- 4.7 Core radio
- 4.7 IT,OSS, IMS and Applications

Annex: Example of RFP for a planning tool



Network Planning Tools Specs Technical requirements per domain



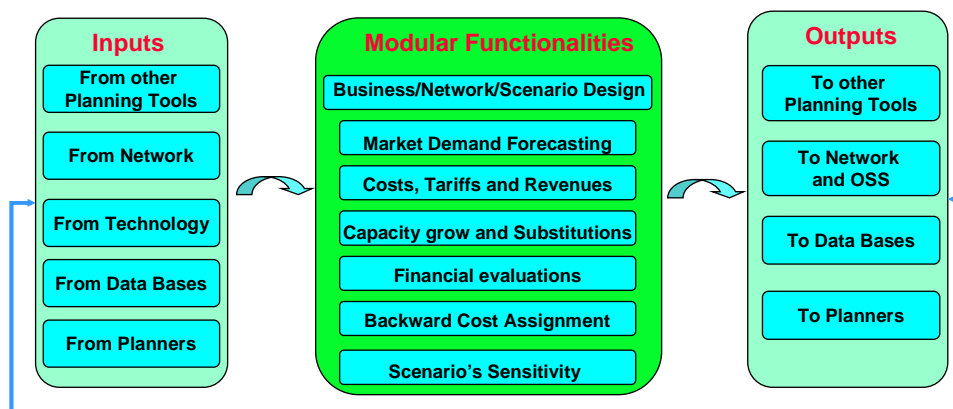
- Scope and main characteristics
- Network model - network architecture, customers, services, traffic, etc.
- Forecasting - services, traffic matrix, users distribution and user segments
- Calculation modules, network dimensioning and optimization
- Input/output data- GUI, maps, reports
- Platform- tool architecture and system requirements
- NGN- requirements related to NGN and new technologies



Network Planning Tools Specs: Overview of modular requirements



Illustration of functional requirements for the **business** planning domain

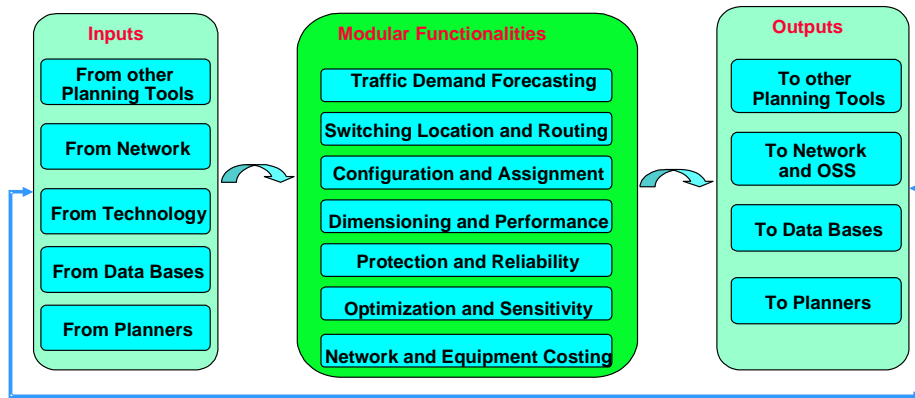




Network Planning Tools Specs: Overview of modular requirements



Illustration of functional requirements for the switching and routing planning domain



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Network Planning Tools Specs: Overview of modular requirements



Illustration of calculation procedures required for the switching and routing planning domain

- Dimensioning methods for loss based systems including Erlang-B formula, overflow routing, and equivalent random method. Application of the methods to circuit-switched networks including hierarchical alternative routing and non-hierarchical routing. Multi-hour dimensioning methods.
- Dimensioning methods for delay based systems including Erlang-C, Erlang multi-rate, hyper-exponential models and processor sharing models. Application of the methods to packet-switched mode networks.
- Traffic evaluation models for equivalent sustained bit rate in multi-service environments. Capability for traffic evaluation and dimensioning based on additional given predefined rules. Annual traffic to busy hour and busy period traffic conversion.
- Evaluation methods for calculating link, path and route GoS, at the designed network and utilisation factors at nodes and links.
- Evaluation methods for reliability of network, sub-networks and systems based on individual reliability parameters

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Network Planning Tools Specs: Overview of modular requirements



Illustration of calculation procedures required for the switching and routing planning domain

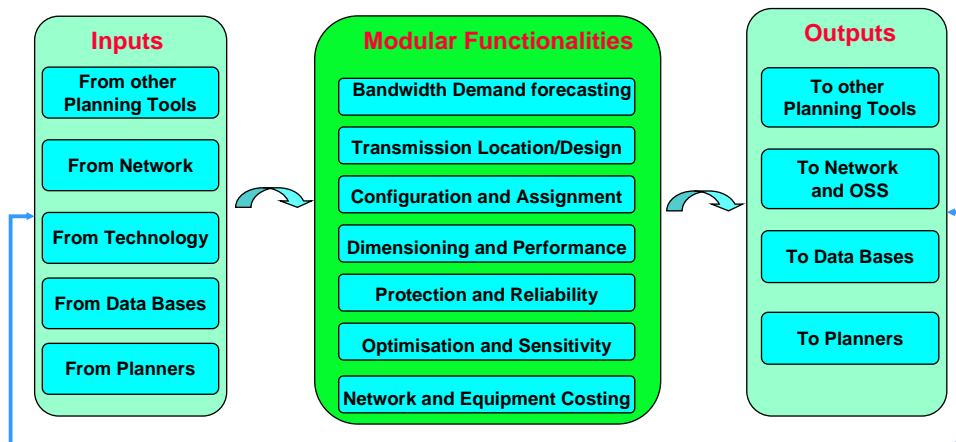
- Calculation of protection levels for end-to-end routes and diversity paths with single node, single link and combined failure survivability.
- Evaluation of costs with polynomial models based on fixed and marginal costs per cost driver such as systems, cabinets, modules, racks, cards, ports, erlangs, Mbytes, Mbps, etc.
- Optimisation algorithms for network topology and routing, including minimal connectivity, connectivity of level "n", flow optimisation, GoS objective functions, disjoint paths and protection. Associated dimensioning methods for resilient circuit-switched networks and packet-switched networks with single node, single link and combined failure survivability.
- Calculation models for circuit switching and packet switching mode are applicable in an NGN in which subnetworks and Network Elements need both type of models such as the Gateways and Application Servers. It is preferred to have all models available in the tools with an integrated view of NGN and have the planner to decide were to apply each, as many hybrid situations appear both in the networks and the systems.



Network Planning Tools Specs Functional modular requirements



Functional requirements for the transmission domain

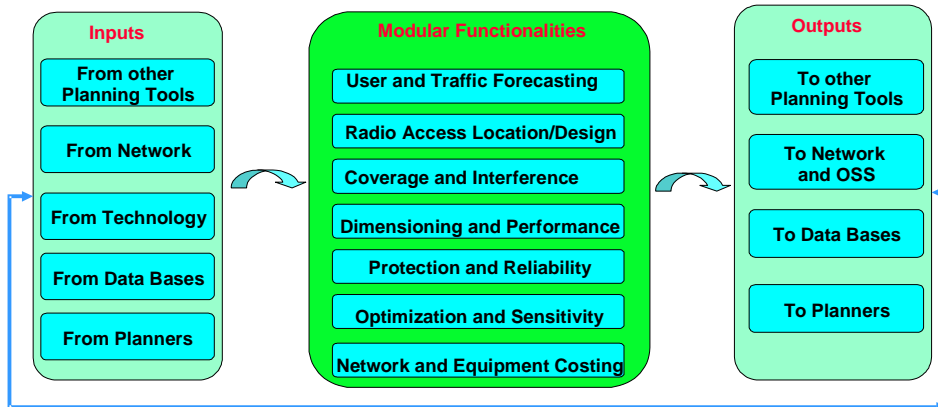




Network Planning Tools Specs: Functional modular requirements



Functional requirements for the **radio access** domain



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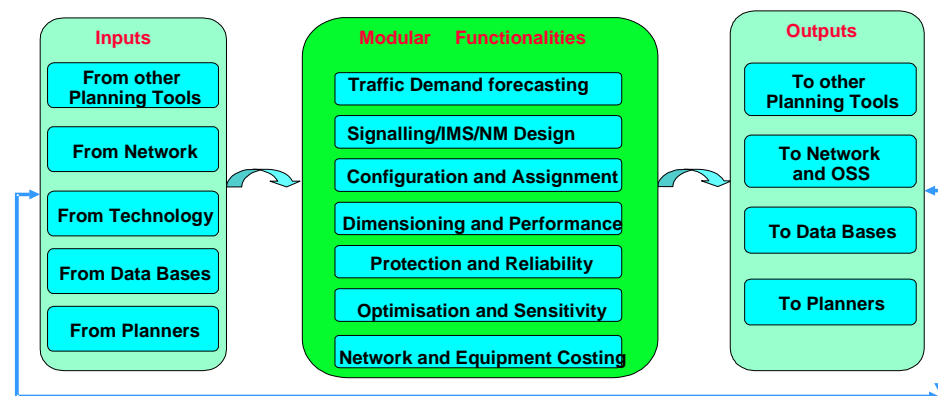
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Network Planning Tools Specs: Functional modular requirements



Functional requirements for the **Signalling/IMS/NM** domain



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Network Planning Tools Specs Tendering requirements



Requirements to observe and criteria for the tool selection

- Capability to model modern technologies and technical requirements
- Commercial availability
- Capability to interrelate different planning tools
- Explicit documentation of models, inputs and results
- Commitment for periodical updates and maintenance
- Training program with reference cases
- Validation process for a range of cases
- Being well proven in the field



Network Planning Tools Specs Tendering requirements



Explicit documentation of models, inputs and results

- The tool content should be available with enough accuracy for the inputs, network models, algorithms, technologies and results in order to facilitate the applicability to the pretended solutions as follows:
 - Model features with the functionalities related to the planning problem to be solved
 - Level of description of the technologies represented
 - Inputs required to run the tool end expected results
 - User guide for a user that has to install, maintain and run the tool with the corresponding list of known error messages
 - Range of tool validity in the network sizes and optimization degree
 - Exchange of information with other applications and tools
 - Editorial procedures for maps and tables associated to the network, nodes and paths



Network Planning Tools Specs Tendering requirements



Commitment for periodical updates and maintenance

- Support and maintenance should be provided to the tools in their life cycle according to the specified Service Level Agreement as summarized:
 - Timeframe for the generation of new tool versions
 - Periodicity in the tools update either due to the regular upgrades or to the corrections of detected bugs
 - Reaction time to solutions and/or corrections for the issues detected by the customer subject to the contract
 - Updating for the features description and user manual



Network Planning Tools Specs Tendering requirements



Training program with reference cases

The tools should have available training program including the following:

- Training Packages on tool application and capabilities
- Training on reference cases with data from real networks
- Duration of each training block and the recommended number of participants
- Total time period that is necessary to conduct all training blocks and the training language
- Training Documentation to be delivered for each training module
- Training Logistics



Network Planning Tools Specs Tendering requirements



Validation process for a range of cases

- Acceptance test procedures to verify that the tool guarantees compliance with all technical requirements specified by the customer during the acquisition process should be available. In particular, the following validation process needs to be available:
 - Validation process for network routing procedures, system functionality, capacity and costing models as described in chapter for calculation procedures.
 - Validation process on the performance of the planning tool in terms of size of the network (number of nodes, links, cells, etc.)
 - Validation process on the performance of the planning tool in terms of time to execute one typical planning case
 - Set of reference networks with applications for the performance evaluation.