ITU-D Regional Development Forum
for the EUR and CIS Region:
"NGN and Broadband, Opportunities and Challenges"

Session 5

NGN and Broadband planning tools

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Presentation content

- NGN and Broadband
  - NGN definition and structure
  - Broadband definition
  - Broadband technologies
  - Broadband customers
- Top level planning domains
- Modeling of broadband access networks
- Broadband planning tools of ITU partners
  - OnePlan Access
  - MULTILINK
- ITU validation process for planning tools

Definition of Next Generation Network

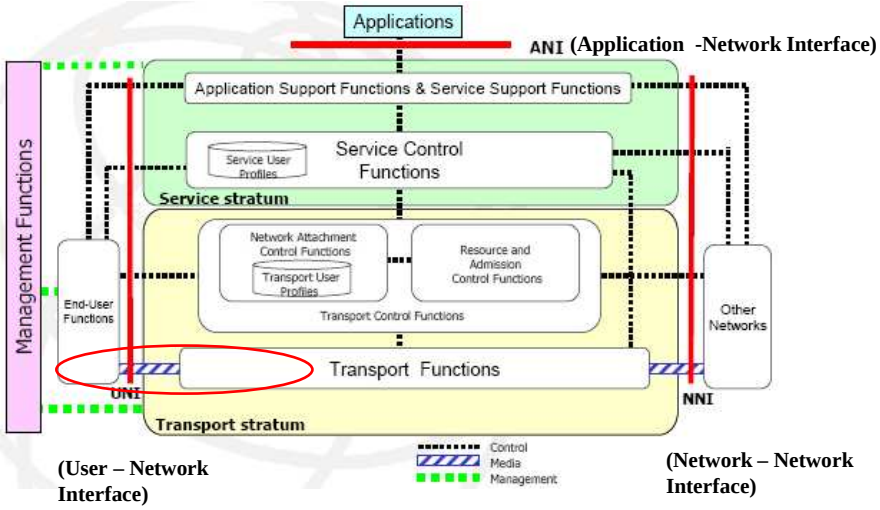
Definition of NGN

ITU-T Rec. Y.2001

Next Generation Network (NGN):
a packet-based network able to provide telecommunication services and able to make use of multiple broadband, QoS-enabled transport technologies and in which service-related functions are independent from underlying transport-related technologies.

It enables unfettered access for users to networks and to competing service providers and/or services of their choice. It supports generalized mobility which will allow consistent and ubiquitous provision of services to users.

Structure of Next Generation Network



What is broadband (definition of ITU)?

Recommendation I.113 **of the ITU Standardization Sector defines broadband as :**

Transmission capacity that is faster than primary rate Integrated Services Digital Network (ISDN) at 1.5 or 2.0 Megabits per second (Mbits)

Mobile	i271L: Number of mobile cellular subscribers with access to data communications at low speeds (below 256kbit/s). Typically referred to as 2.5G.
Mobile broadband	i271mb: Number of mobile cellular subscribers with access to data communications at broadband speeds (defined as greater than or equal to 256 kbit/s in one or both directions). Typically referred to as 3G.
Fixed broadband	Total fixed broadband Internet subscribers: high speed access to the public Internet at speeds equal to, or greater than, 256kbit/s, in one or both directions.

World Telecommunication /ICT Indicators (Indicators Handbook)

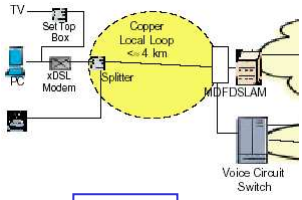
What is broadband (other definitions)?

Broadband **– A general term used in reference to high-speed Internet services, including those provided through cable, DSL, and/or satellite.**

The term "broadband" refers to advanced communications systems capable of providing high-speed transmission of services such as data, voice, and video over the Internet and other networks. Transmission is provided by a wide range of technologies, including digital subscriber line and fiber optic cable, coaxial cable, wireless technology, and satellite. Broadband platforms make possible the convergence of voice, video, and data services onto a single network.

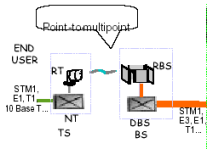
FCC Federal Communications Commission

Broadband access technologies

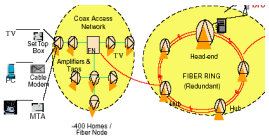


xDSL

SAT

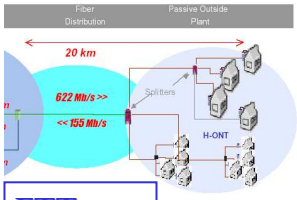


Wireless



HFC

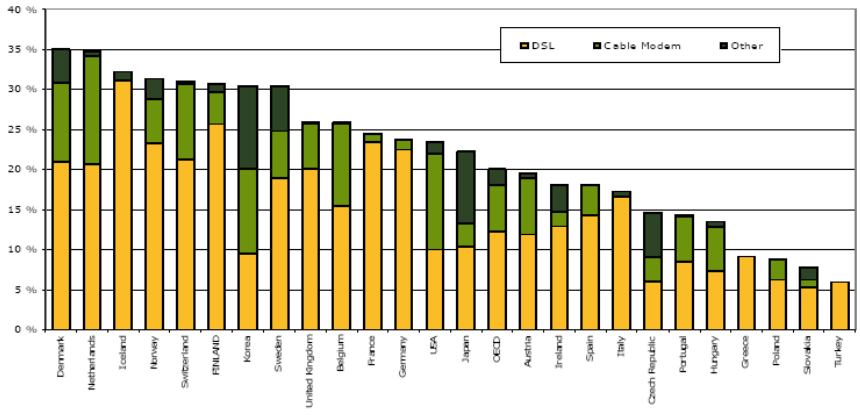
Power line



FTTx

Broadband access technologies

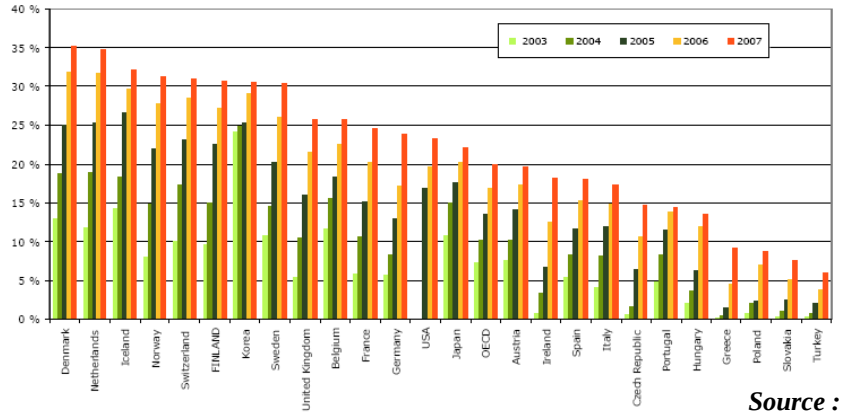
Application of different broadband technologies in 2007



Source : Statistics Finland 2008

Broadband customers

Development of broadband penetration in 2003–2007



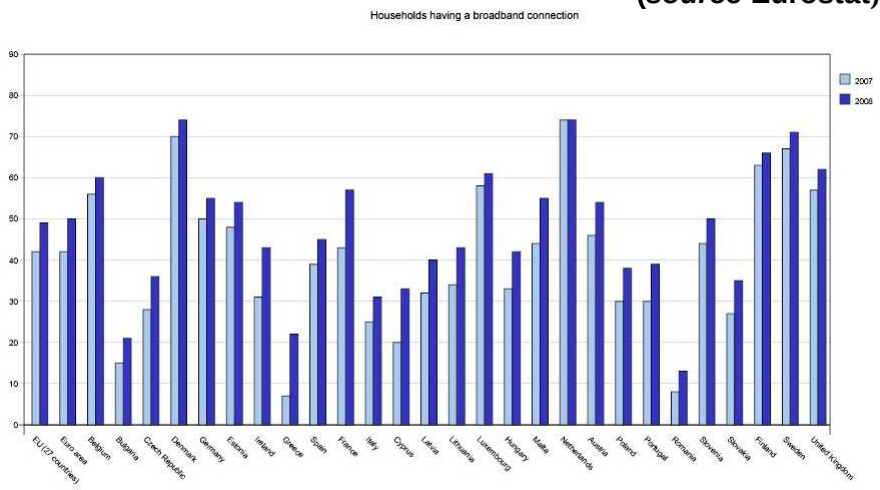
Source : Statistics Finland 2008

Fixed telephone penetration – from 51.9% (Denmark) to 24.6% (Turkey)

Source : ITU Database 2007

Broadband customers (residential)

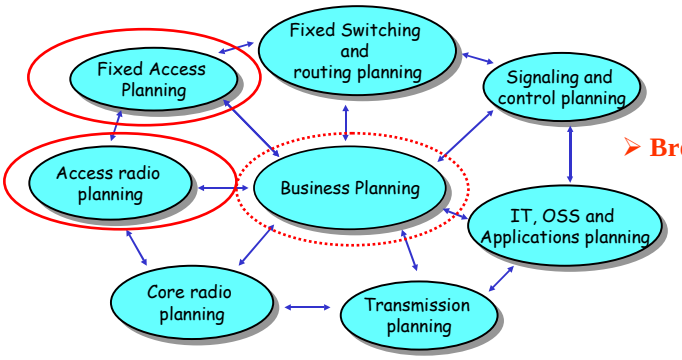
(*source* Eurostat)



percentage of households connected to an exchange with xDSL technology, to a cable network upgraded for Internet traffic, or to other broadband technologies; it covers all households having at least one member in the age group 16 to 74 years

Top Level Planning Domains

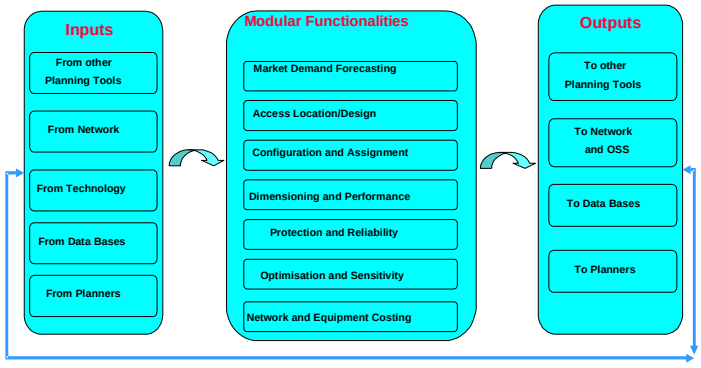
- **NGN requirements to the planning tools are organised by eight planning domains derived from planner needs and networking problems**



- **Broadband planning**

GNPT for Developing Countries and Countries with economies in transition, ITU, Geneva, 2005

Fixed Access Planning



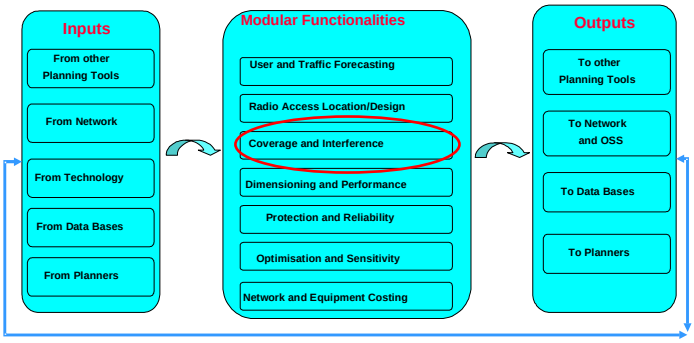
Requirements for the fixed access planning domain

GNPT for Developing Countries and Countries with economies in transition, ITU, Geneva, 2005

Requirements related to NGN and corresponding new technologies

- **Modeling of future NGN access network equipment, including equipment parameters, technological constraints, costs structures**
- **Extending of the forecasting models and methods due to NGN service/customer requirements**
- **Adapting of the calculation modules to the NGN access network requirements**

Radio Access Planning



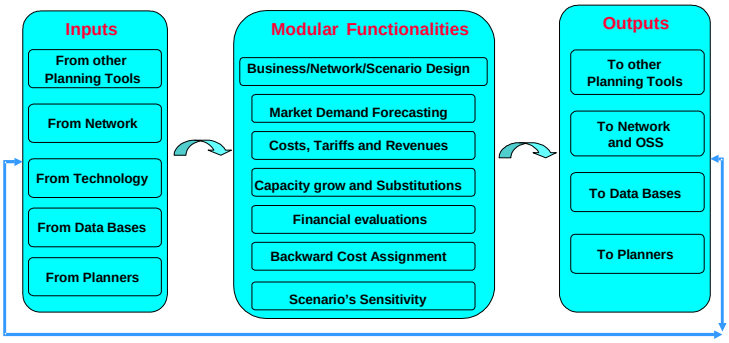
Requirements for the radio access domain

GNPT for Developing Countries and Countries with economies in transition, ITU, Geneva, 2005

Requirements related to NGN and corresponding new technologies

- Modeling of new NGN services which do not fall in the present service models and specially multimedia service types
- Modeling of future NGN access network equipment, including equipment parameters, technological constraints, costs structures
- Extending of the forecasting models and methods due to NGN service/customer requirements
- Adapting of the calculation modules to the NGN access network requirements

Business Planning



Requirements for the business planning domain

GNPT for Developing Countries and Countries with economies in transition, ITU, Geneva, 2005

Requirements related to NGN and corresponding new technologies

- **Modeling of service demands characterisation and traffics for VoIP and NGN multi-service flows**
- **Network and systems dimensioning with the multi-service NGN criteria**
- **Modeling of NGN systems with their corresponding capacities, capital costs, operational costs, lifetimes, etc.**
- **Representation of interrelations among NGN network subsystems, nodes and links**

Modeling of broadband services

Permanent Services Model
Permanent services model assumes, that the network allocates the required resources permanently.
Defined by the required bandwidth, or bit rate.
Compression factors (contention ratio, overbooking techniques) at the service level and at network element level are used.

Elastic Services Model
Packet-switched non-real-time services.
Defined by access link data rate, guaranteed bandwidth, average bandwidth at the file transfer layer, and traffic at the session layer.

Real -Time CBR / VBR Services Model
To model real-time data streams that require constant data rate and are sensitive to transmission delay / real-time bursty stream traffic (data rate is no longer constant).
Defined by required bit rate / mean bit rate, peak bit rate, packet or cell loss ratio and traffic.

Modeling of broadband customers

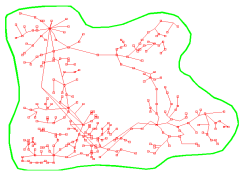
Model of geographical location of customers divided in customer classes (groups of customer using the same services)

Digital maps – Geo referenced and scaled

= >

zones /areas

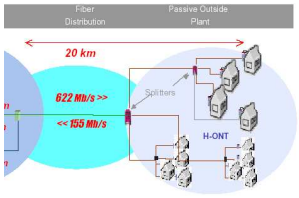
= >



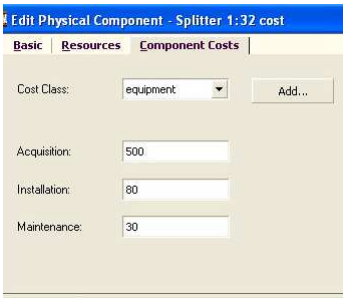
Possibility for interaction with GIS systems

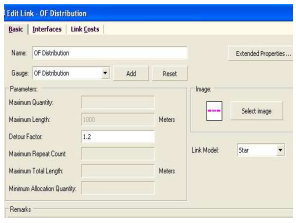
nodes / sites

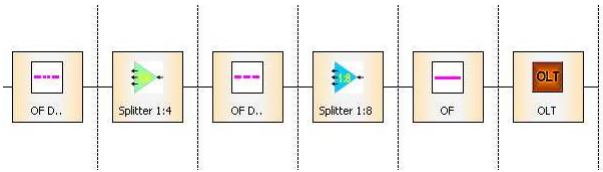
Modeling of broadband access technologies



FTTH - GPON





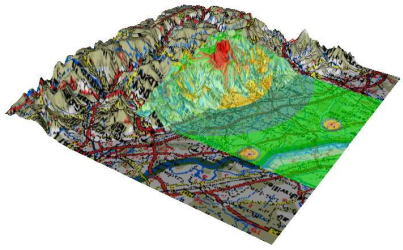


Technology chain

Design and Optimization of Access Network

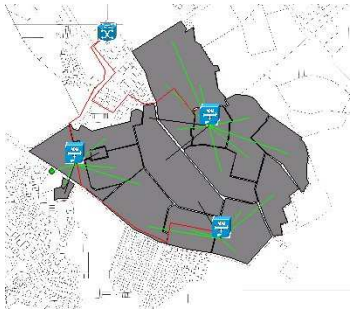
Optimization of node Locations :

E.g. optimal placement of BS



Optimization of Service areas :

E.g. optimal service areas of MSAN



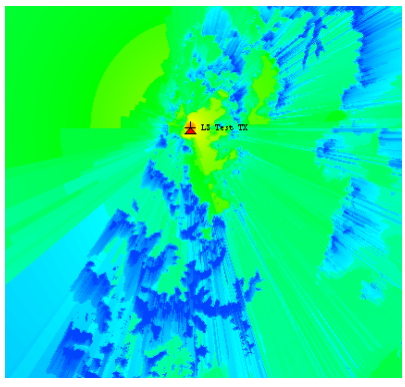
Combinatorial problem, not possible to check all possible solutions :

- **Heuristic algorithms**
- **Genetic algorithms, Simulated annealing algorithms**

Radio access - Propagation Models

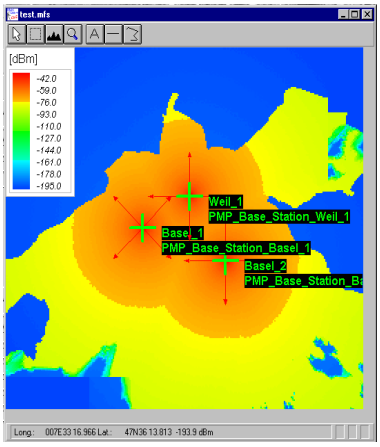
- **Information models**
  - Sight Check
  - Sight Check (Fresnel)
- **Physical models, e.g.:**
  - Free space
  - Epstein-Peterson
- **Empirical models, e.g.:**
  - Okumura-Hata
- **Mixed models, e.g.:**
  - Longley-Rice
  - ITU-R P.370
  - ITU-R P.1546
  - GEG
  - L&S VHF/UHF

Propagation Prediction

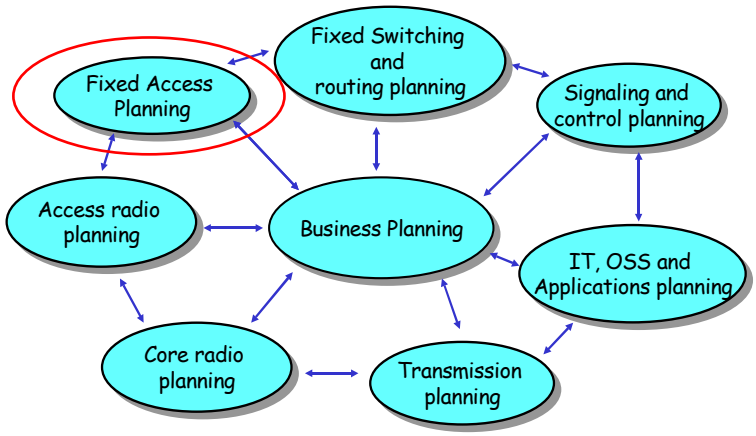


Radio access – Network Processor

Maximum Field Strength

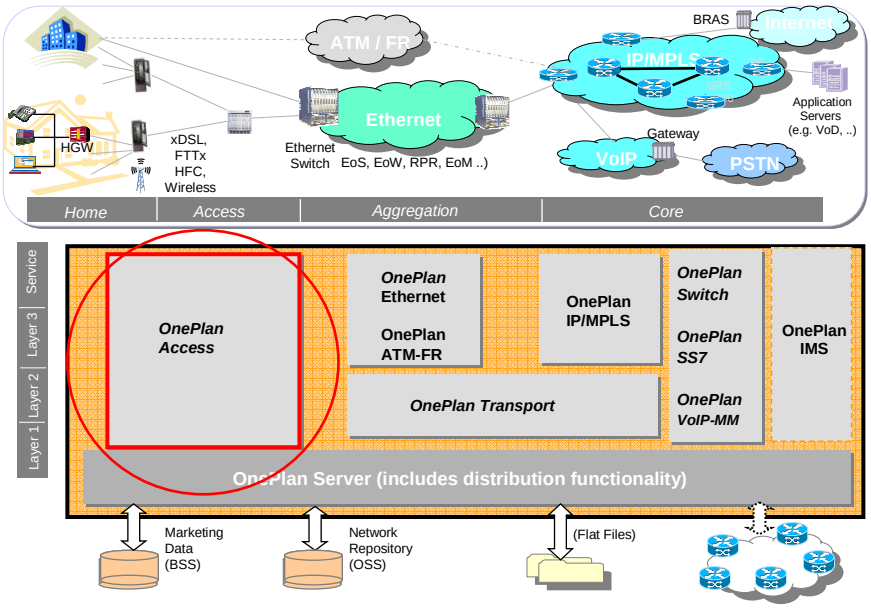


Fixed Network Planning Tools



Tools of ITU partners – OnePlan Access

Fixed Network Planning Tools - OnePlan Access

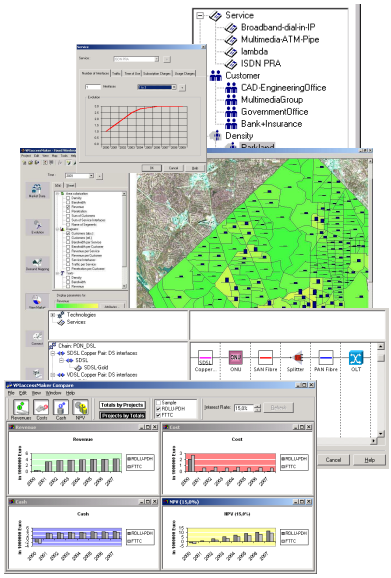


Fixed Network Planning Tools - OnePlan Access

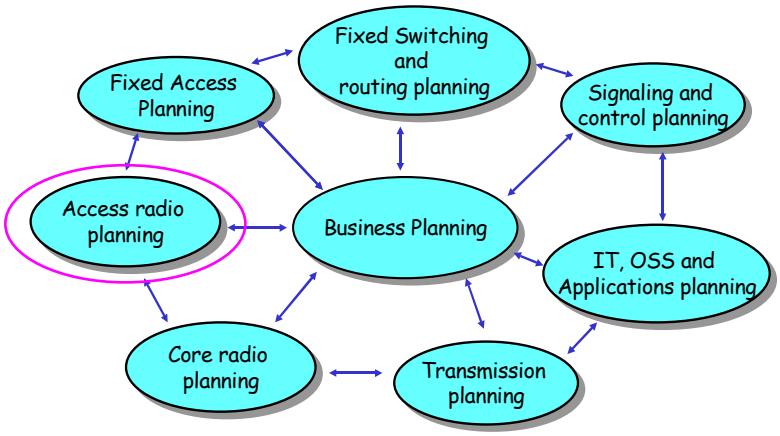
VPIsystems

Provides geo-market forecasting, access network design and dimensioning, and economic analysis functionality

- *Capturing sophisticated market forecasts*
- *Selecting the best access technology for a geographic region*
- *Designing and dimensioning optimized access networks with wireline and wireless technologies*
- *Providing detailed economic analysis based on forecasts and infrastructure investments*
- *Visualizing geographic data such as area maps, customer locations and network layout*



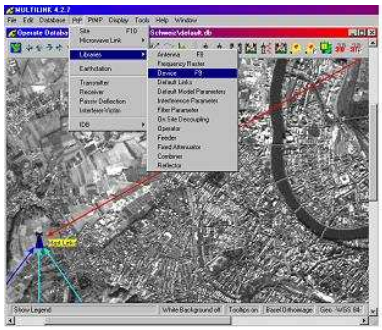
Radio Planning Tools



Tools of ITU partners – MULTILINK

Radio planning tool - LStelcom MULTILINK

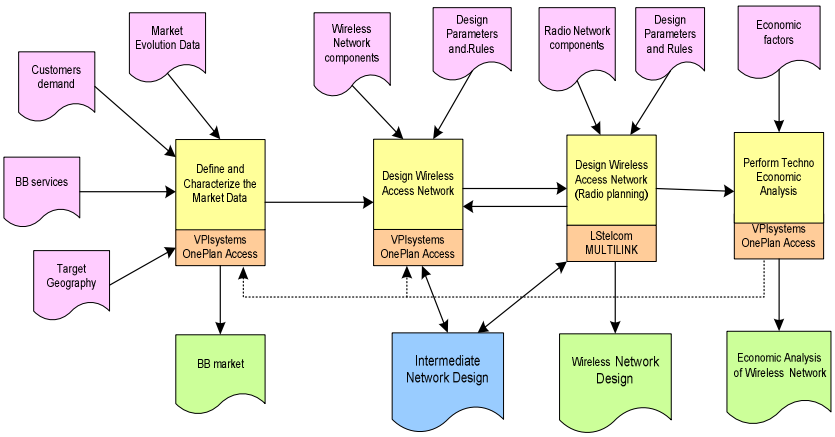
MULTILINK is a network planning tool for



- **Interactive microwave link engineering**
- **Planning of core radio network**
- **Design of radio access networks**
- **Planning wireless broadband networks**
- **Frequency allocation and coordination (ITU-R recommendations are implemented)**

MULTIlink could be used for case studies, as well as for the planning, operation and optimization of real wireless networks

Broadband Access Network Planning process



ITU validation process for planning tools

Purpose: Validation of Network Planning Tools for Developing Countries and Countries with economies in transition

- **Compliance with the technical requirements specified in the ITU Guidelines for Network Planning Tools**
- **Performance of the planning tool in terms of size of the network and time to execute typical planning cases**
- **Crating of Set of real data reference networks**