



**ITU-D Regional Development Forum  
for the Americas Region:  
“NGN and Broadband, Opportunities and Challenges”**

## **Session 5**

# **NGN and Broadband planning tools**

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ITC, Bulgaria*

ITU-D Forum

Santo Domingo, Dominican Republic, 25 – 27 November 2009

Session 5\_IS - 1

## **Content of presentation**

- **NGN and Broadband**
  - ❖ **Broadband in the NGN definition and structure**
  - ❖ **Broadband definitions**
  - ❖ **Broadband technologies**
  - ❖ **Broadband customers**
- **Top level broadband planning domains**
- **Modeling of broadband access networks**
- **Broadband planning tools of ITU partners**
  - ❖ **Access networks (OnePlan Access)**
  - ❖ **Radio access (MULTILINK)**
- **ITU validation process for planning tools**

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Session 5\_IS - 2

## Broadband in the Definition of the Next Generation Networks

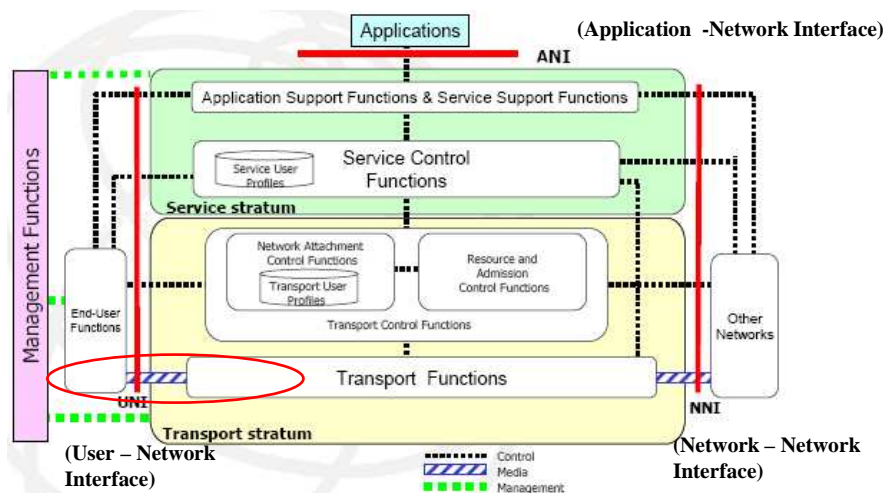
**Definition of NGN**

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.

## Broadband access in the Structure of the Next Generation Networks



## What is broadband (definitions 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.

*Related to transmission speed*



## 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.

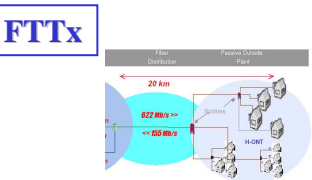
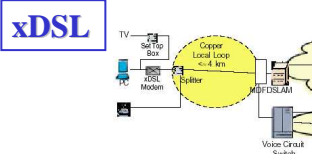
The term “broadband” refers to advanced communications systems capable of providing high-speed transmission of services such as data, voice, and video over the Internet and other networks. Transmission is provided by a wide range of technologies, including digital subscriber line and fiber optic cable,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



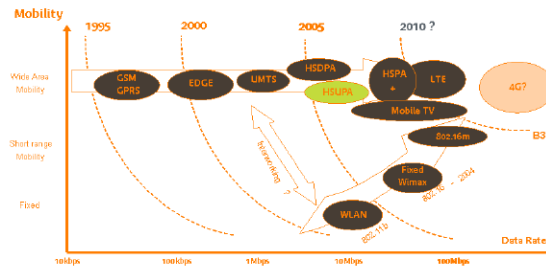
*Related to services and technologies*

## Broadband access technologies

Main wireline technologies :



Wireless landscape :

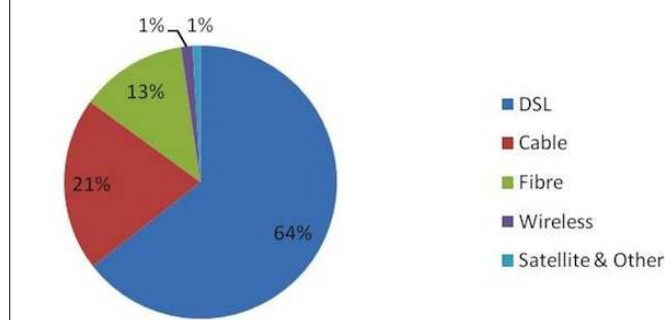


Other technologies :



## Broadband access technologies

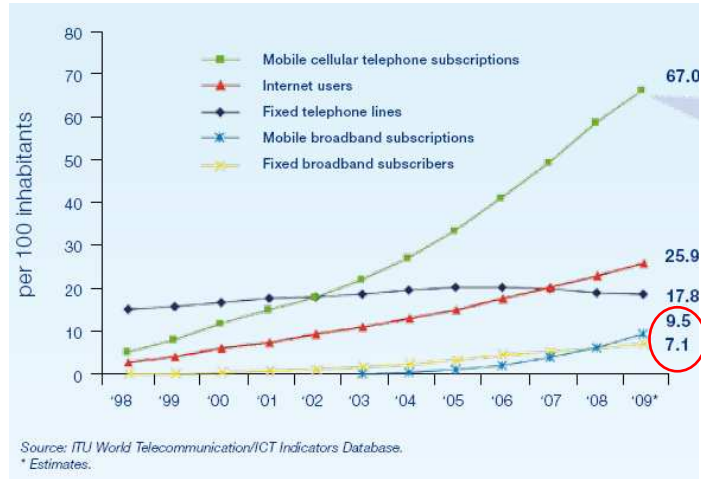
Global technology market shares - Q209



Source: PointTopic

Fixed broadband technologies

## Broadband customers



### Mobile and Fixed broadband customer penetration

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Session 5\_IS - 9

## Broadband customers

### Growth of broadband customers by region

Territories	2008Q2	2009Q1	2009Q2		growth in quarter	growth in 12 months
		Total	Total	Net Qtr Add		
Asia-Pacific	60,875,668	64,598,397	65,959,917	1,361,520	2.11%	8.35%
Eastern Europe	19,408,909	23,713,655	25,107,902	1,394,247	5.88%	29.36%
Latin America	22,294,590	27,947,382	29,292,408	1,345,026	4.81%	31.39%
Middle East and Africa	10,934,739	12,819,703	13,054,260	234,557	1.83%	19.38%
North America	83,445,376	93,502,047	95,845,689	2,343,642	2.51%	14.86%
South and East Asia	84,002,699	100,884,917	105,389,289	4,504,372	4.46%	25.46%
Western Europe	99,721,070	107,878,672	109,650,503	1,771,831	1.64%	9.96%
<b>Global Total</b>	<b>380,683,051</b>	<b>431,344,773</b>	<b>444,299,968</b>		<b>3%</b>	<b>14%</b>

Source: Data provided for the Broadband Forum by Point Topic ([www.point-topic.com](http://www.point-topic.com))

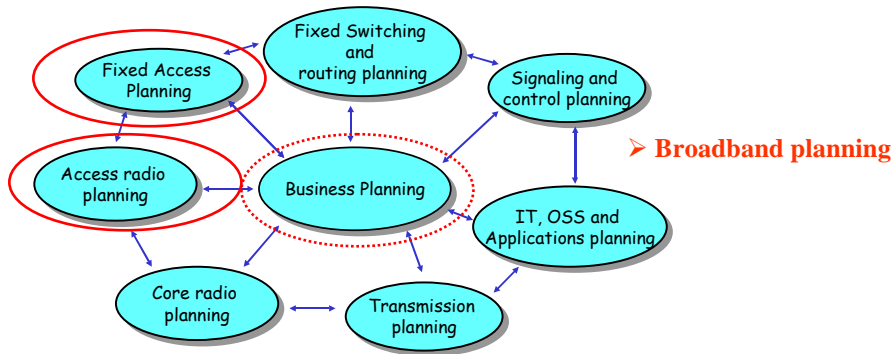
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Santo Domingo, Dominican Republic, 25 – 27 November 2009

Session 5\_IS - 10

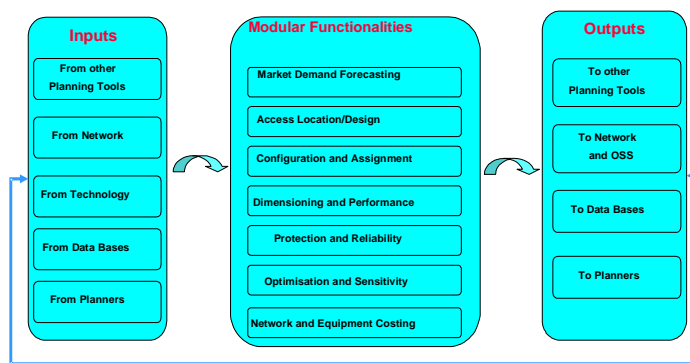
## Top Level Broadband Planning Domains

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



*Guidelines for Network Planning Tools for Developing Countries and Countries with economies in transition, ITU, Geneva, 2005*

## Fixed Access Planning



Requirements for the fixed access planning domain

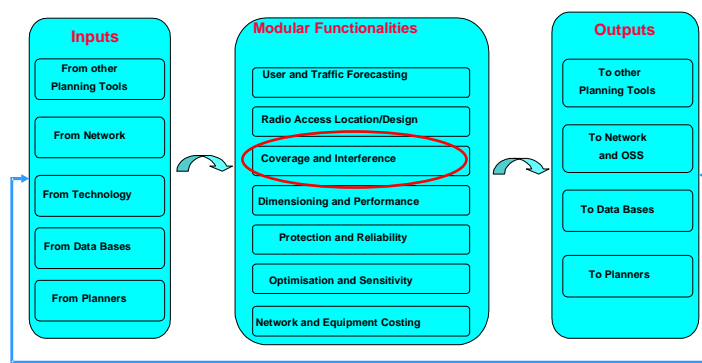
*GNPT for Developing Countries and Countries with economies in transition, ITU, Geneva, 2005*

## 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

**Modeling of new services and new NGN access technologies**

## Radio Access Planning



Requirements for the radio access domain

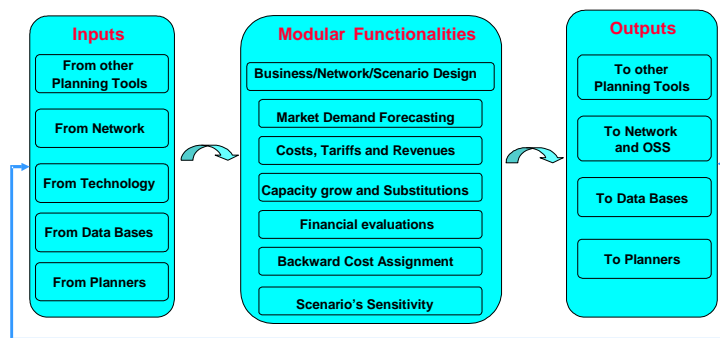
*GNPT for Developing Countries and Countries with economies in transition, ITU, Geneva, 2005*

## 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**

**Coverage calculation methods related to the new NGN access technologies**

## 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**

**Pricing of new services and costing of new NGN access technologies**

## Modeling of broadband access networks - 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 access networks - customers

Model of geographical location of customers  
divided in customer classes

Digital maps – Geo  
referenced and scaled

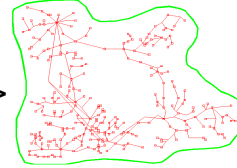


=>



zones / areas

=>



nodes / sites

Possibility for interaction  
with GIS systems

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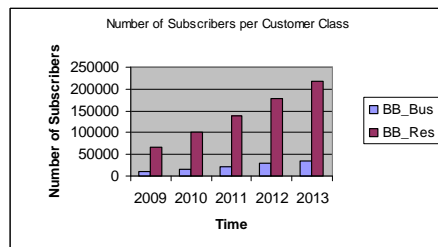
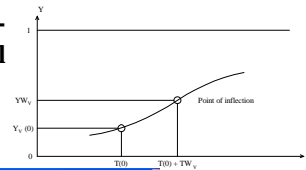
Session 5\_IS - 19

## Forecasting of broadband customers

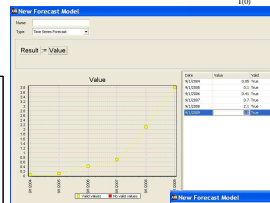
Forecasting of :

- Customers and penetration,
- Service utilization,
- Service tariffs

Trend methods -  
Logistic model

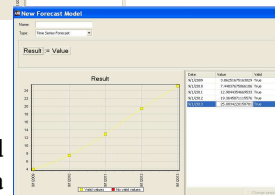


Evolution of BB customers



Historical  
data

Forecasted  
data

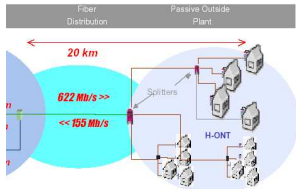


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Session 5\_IS - 20

## Modeling of broadband access technologies



**FTTH - GPON**

**Edit Physical Component - Splitter 1:32 cost**

Basic | Resources | Component Costs

Cost Class: equipment Add...

Acquisition: 500

Installation: 80

Maintenance: 30

**Edit Link - OF Distribution**

Basic | Interfaces | Link Costs

Name: OF Distribution Extended Properties:

Stage: OF Distribution Add Reset

Parameters:

Maximum Quantity: 1000

Maximum Length: 1000 Meters

Delay Factor: 1.2

Maximum Physical Count:

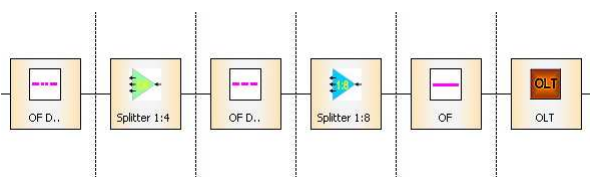
Maximum Total Length:

Maximum Allocation Quantity:

Remarks:

Image: Select stage

Link Model: Star

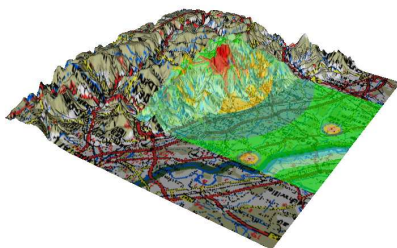


**Technology chain**

## Design and Optimization of Broadband Access Networks

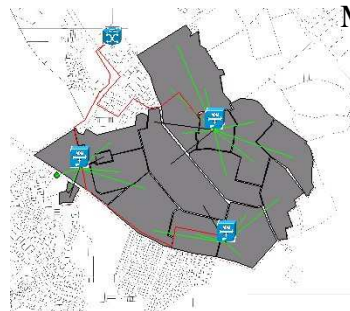
### Optimization of node Locations :

E.g. optimal placement of BS



### Optimization of Service areas :

E.g. optimal service areas of MSAN

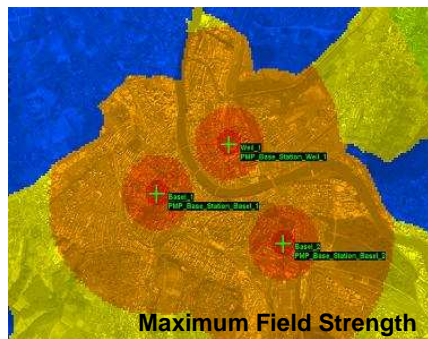
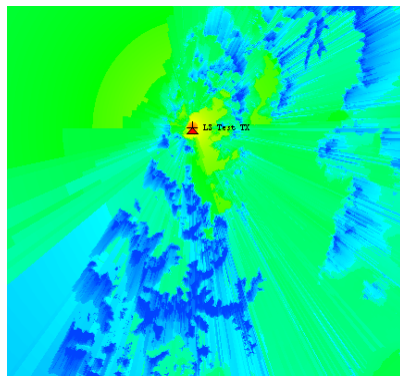


**Combinatorial problem, not possible to check all possible solutions :**

- Heuristic algorithms
- Genetic algorithms, Simulated annealing algorithms

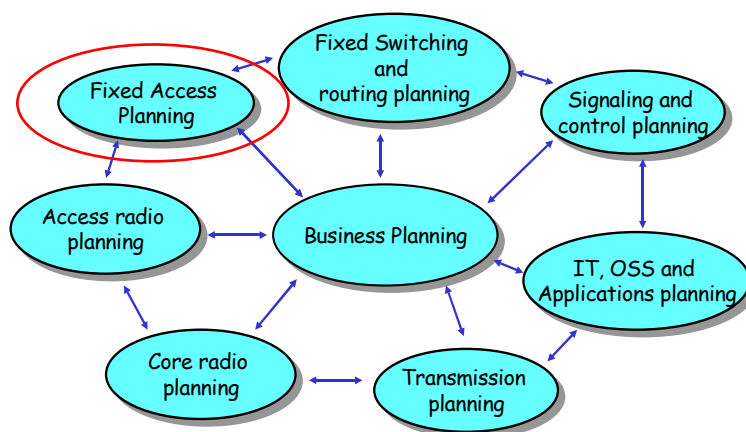
## Modelling of Radio access - coverage

Propagation Prediction



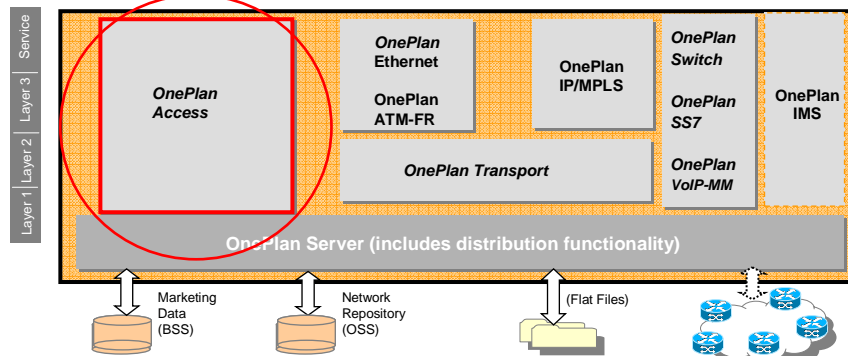
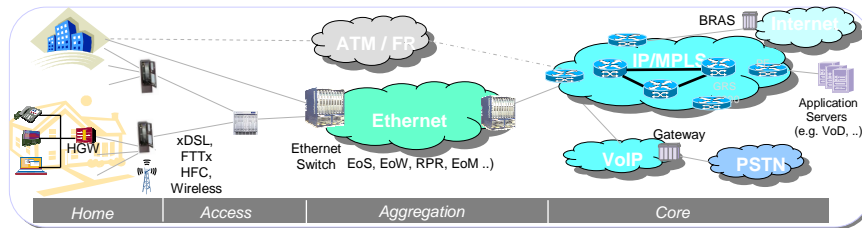
- Physical models, e.g.:
  - Free space
  - Epstein-Peterson
- Empirical models, e.g.:
  - Okumura-Hata
- Mixed models, e.g.:
  - ITU-R P.370
  - ITU-R P.1546

## Broadband planning tools of ITU partners - Fixed Access Planning Tools



*Tools of ITU partners – OnePlan Access*

## Fixed Network Planning Tools - OnePlan Access



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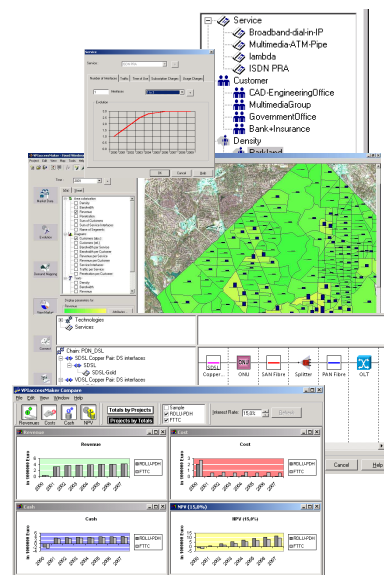
Session 5\_IS - 25

## Fixed Network Planning Tools - OnePlan Access

### VPI systems

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

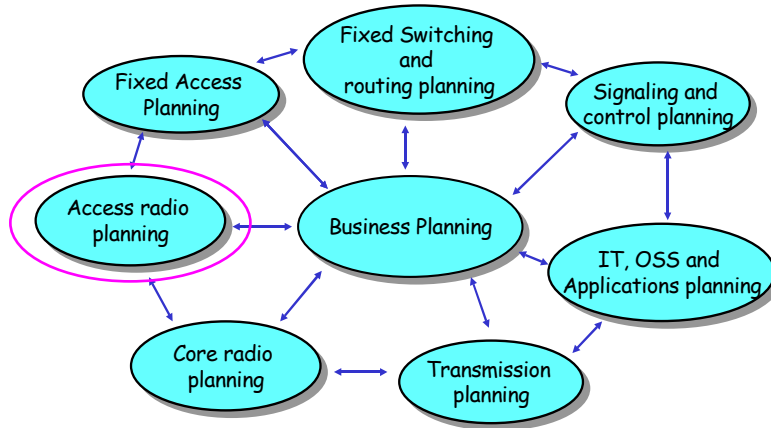


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Session 5\_IS - 26

## Broadband planning tools of ITU partners - Access Radio Planning Tools



*Tools of ITU partners – MULTILINK*

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Session 5\_IS - 27

## 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)

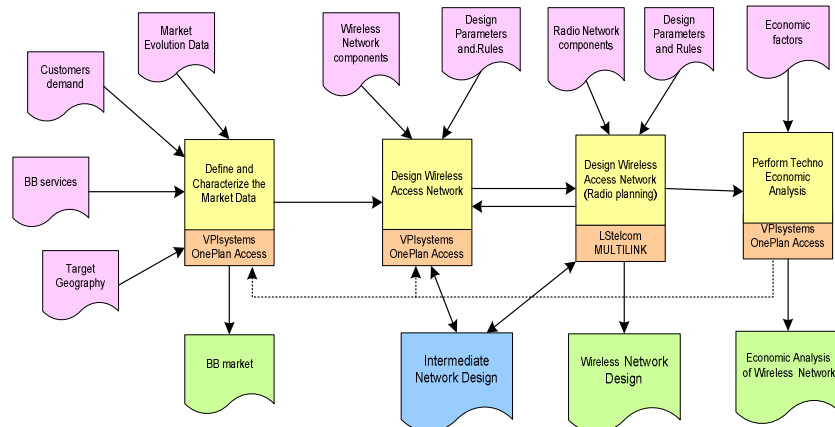
**MULTILink** could be used for case studies, as well as for the planning, operation and optimization of real wireless networks

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Session 5\_IS - 28

## Broadband Access Networks - 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**