ITU-D Regional Development Forums 2010 on
NGN and Broadband (ARB, EUR & CIS Regions):
"NGN and Broadband, Opportunities and Challenges"

Session 4

Benefit of using appropriate Planning Tools for Broadband and NGN

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HCTP/ITC, Bulgaria

Content of presentation

- Broadband and NGN
- Top level planning domains for broadband access
- Modeling of broadband access networks
- Broadband planning tools of ITU partners
- ITU validation process for planning tools
- Benefit of using plannig tools

Broadband as Definition for 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 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.

World Telecommunication /ICT Indicators (Indicators Handbook)

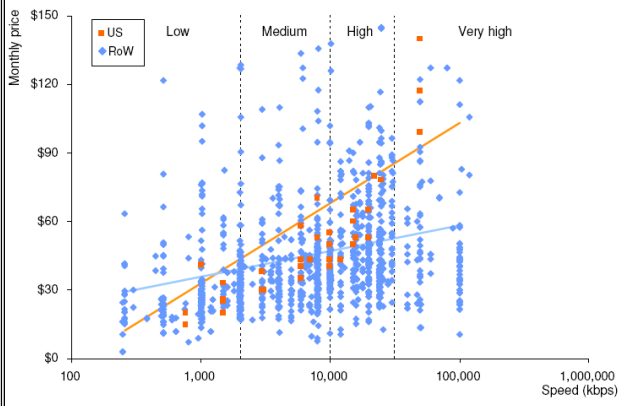
Related to transmission speed

Offered broadband connections by speed

By speed of connection:

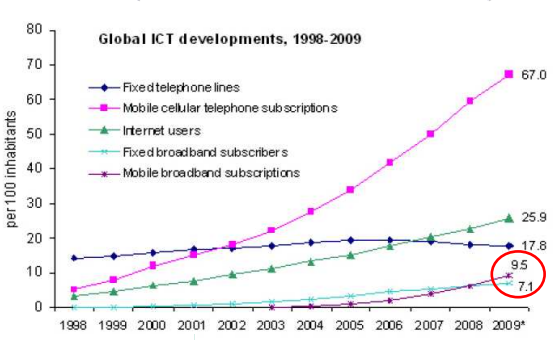
- **Low speed (256kbps – 2Mbps)**
- **Mediumspeed (2.5Mpbs-10Mbps)**
- **High speed (10Mpbs-32Mbps)**
- **Very-high speed (above35Mbps)**

Offered broadband connection – by price and speed

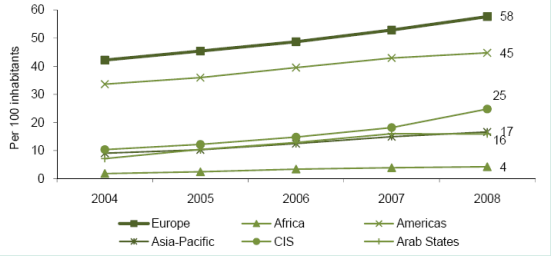


Source : **OECD, TeleGeography, Point Topic**

Broadband customers (ICT market trends)



Internet users



Source :

ITU Database 2009

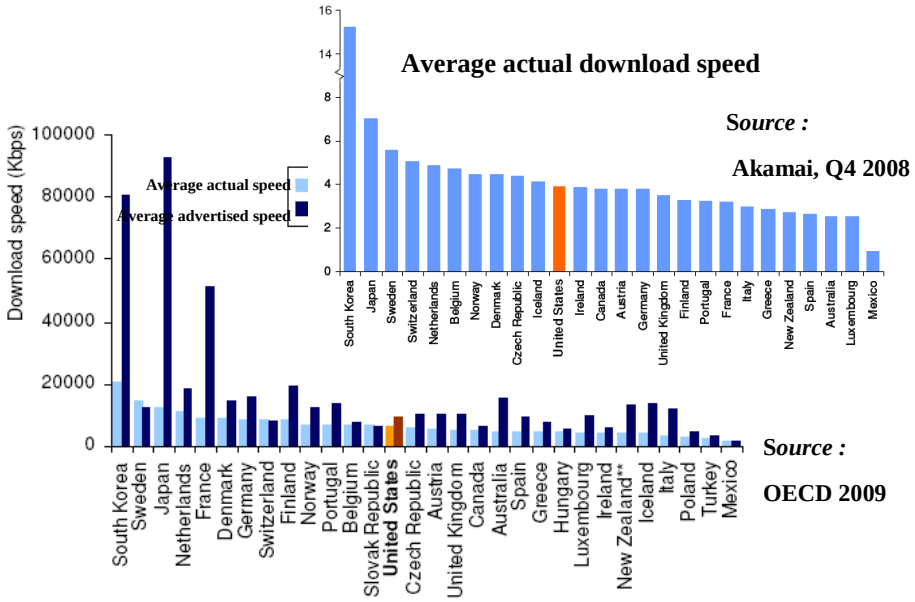
Broadband customers

Growth of broadband customers by region

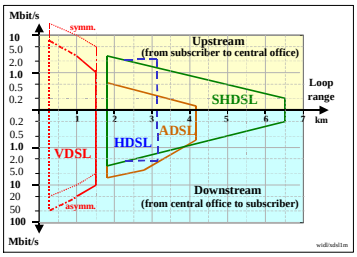
Territories	2008Q2	2009Q1	2009Q2			
		Total	Total	Net Qtr Add	growth in quarter	growth in 12 months
Asia-Pacific	60,875,668	64,598,397	65,959,917	1,361,520	2.11%	8.35%
Eastern Europe	19,408,909	23,713,655	25,107,902	1,394,247	5.88%	29.36%
Latin America	22,294,590	27,947,382	29,292,408	1,345,026	4.81%	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%
Global Total	380,683,051	431,344,773	444,299,968		**3%**	**14%**

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

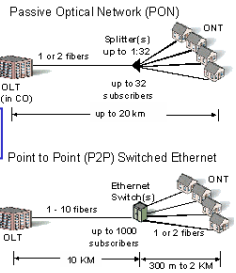
Broadband customers – download speed



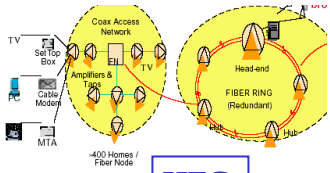
Broadband access technologies - wireline



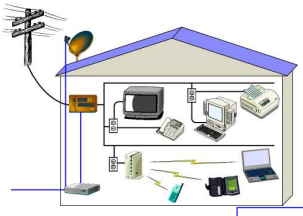
xDSL



FTTx

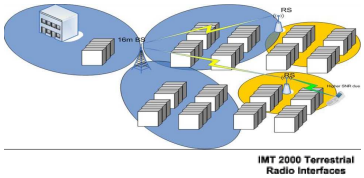


HFC

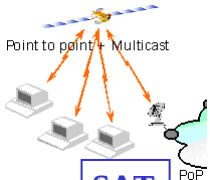


Power line

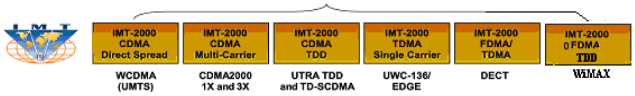
Broadband access technologies - wireless

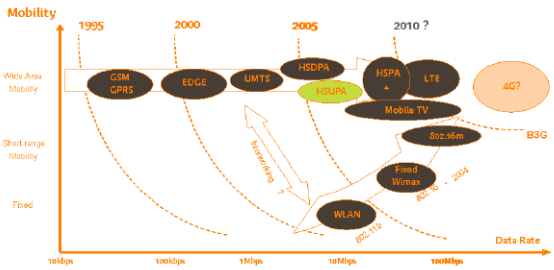


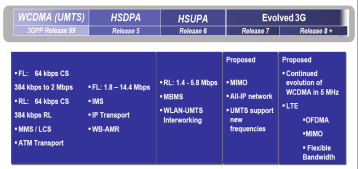
Terrestrial Wireless



SAT

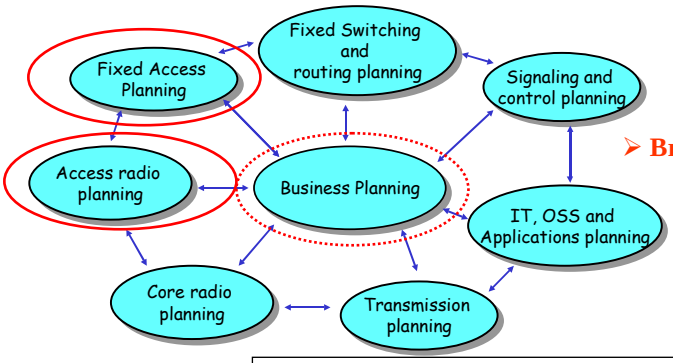






Top Level Broadband Planning Domains

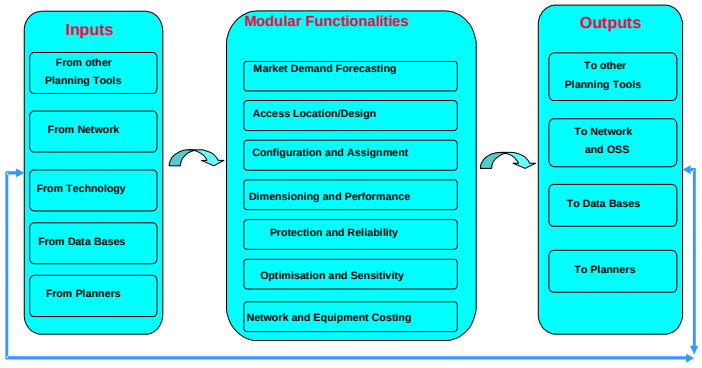
- **NGN requirements to the planning tools are organised by eight planning domains derived from planner needs and networking problems**



- **Broadband planning**

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

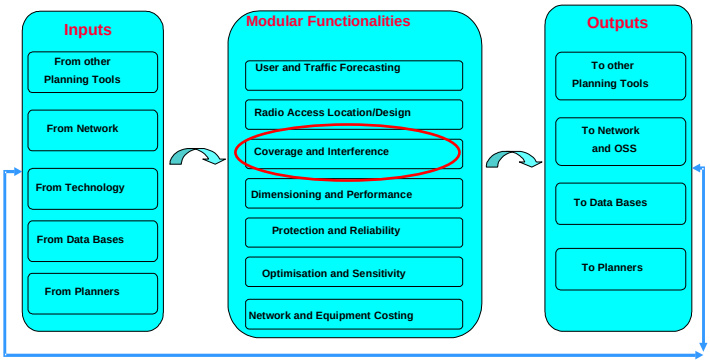
GNPT for Developing Countries and Countries with economies in transition, ITU, Geneva, 2005

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

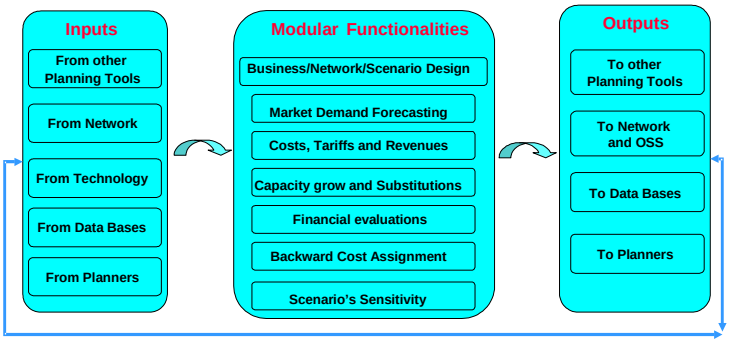
GNPT for Developing Countries and Countries with economies in transition, ITU, Geneva, 2005

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

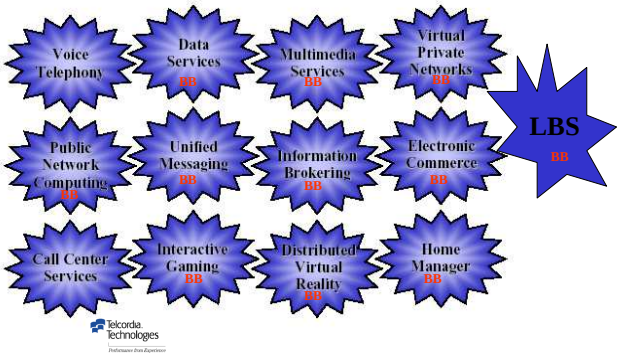
Modeling of broadband services

Combination of Services, e.g. triple play

Service models :

- ***Permanent (contention ratio)***
- ***Elastic***
- ***Real -Time CBR / VBR***

Customer classes - customers using same services – e.g. residential with triple play



Modeling of broadband customers

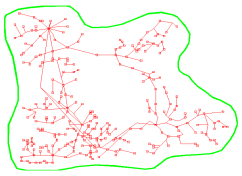
Model of geographical location of customers divided in customer classes

Digital maps – Geo referenced and scaled

= >

zones /areas

= >

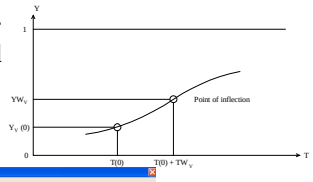


Possibility for interaction with GIS systems

nodes / sites

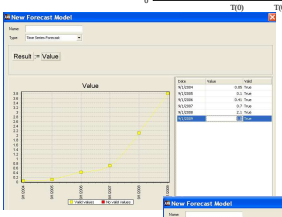
Forecasting of broadband customers

Trend methods - Logistic model

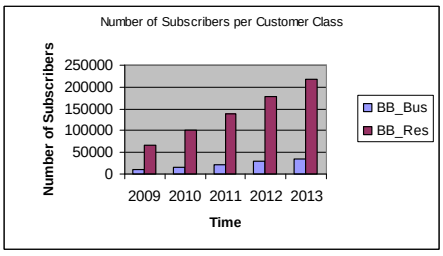


Forecasting of :

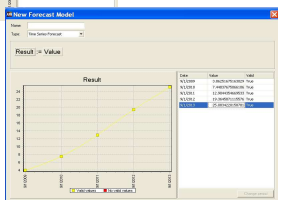
- **Customers and penetration,**
- **Service utilization,**
- **Service tariffs**



Historical data

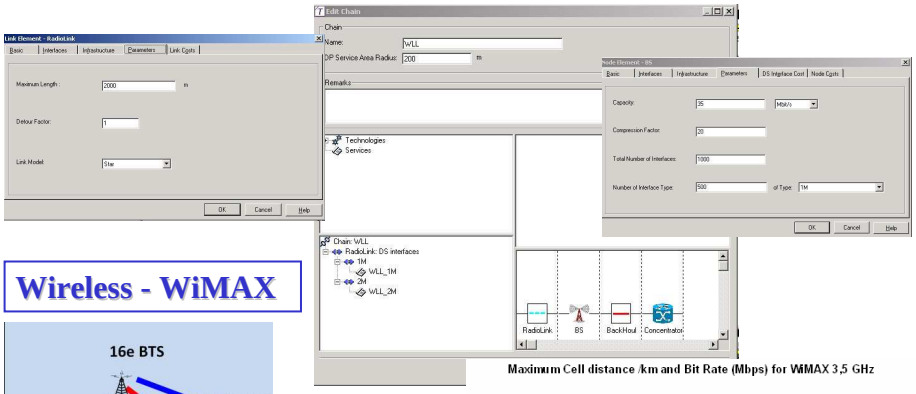


Evolution of BB customers

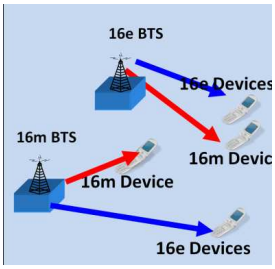


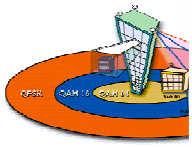
Forecasted data

Modeling of broadband access technologies

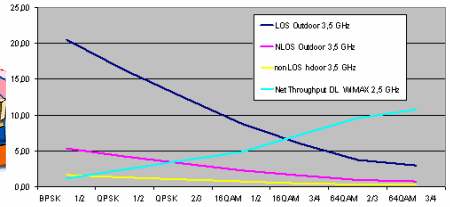


Wireless - WiMAX





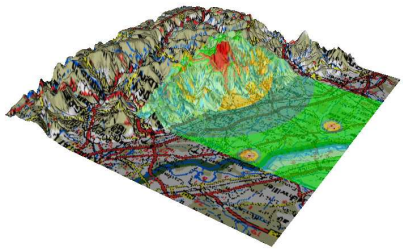
Maximum Cell distance /km and Bit Rate (Mbps) for WiMAX 3,5 GHz



Design and Optimization of Broadband Access Networks

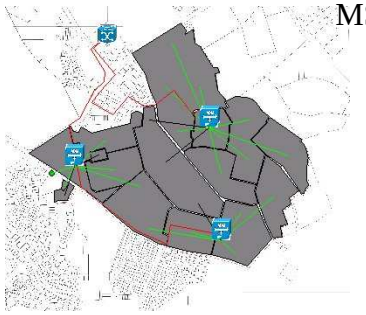
Optimization of node Locations :

E.g. optimal placement of BS



Optimization of Service areas :

E.g. optimal service areas of MSAN

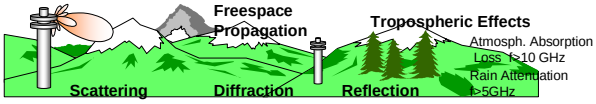


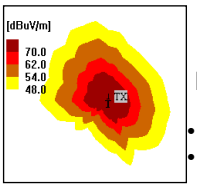
Combinatorial problem, not possible to check all possible solutions :

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

Modelling of Radio access - coverage

Prediction Models :

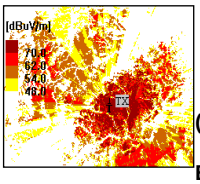




Non-Terrain Based

- Use of "effective antenna height"
- Monotonous decline of field strength with increasing distance to transmitter

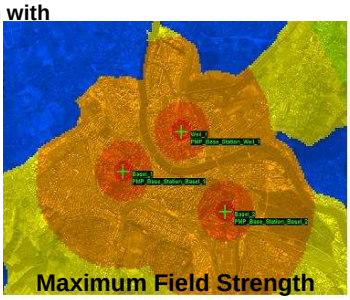
Example: ITU-R P. 370



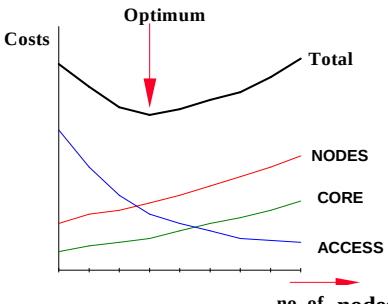
DTM Based

- Diffraction, shading, reflection
- Terrain elevation and land use (morphology)
- 2D and 3D models

Examples: "Epstein-Peterson", "Longley&Rice", "Okumura-Hata"



Costing of Access Networks

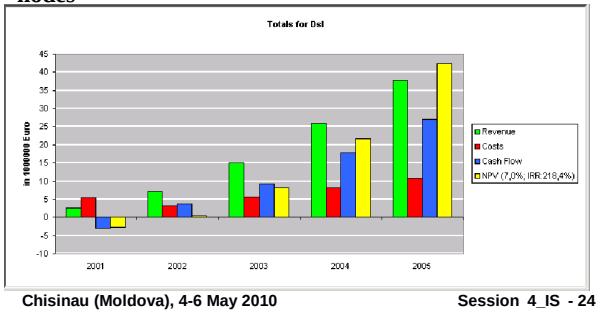


Cost components of telecom network

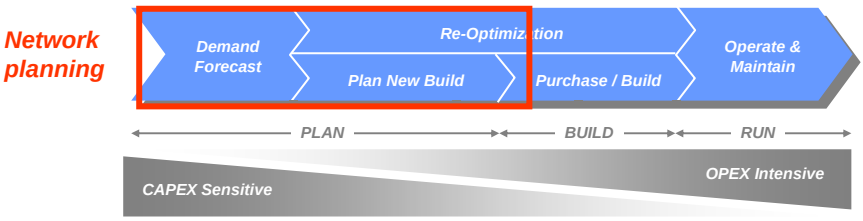
CAPEX
- Acquisition
- Installation

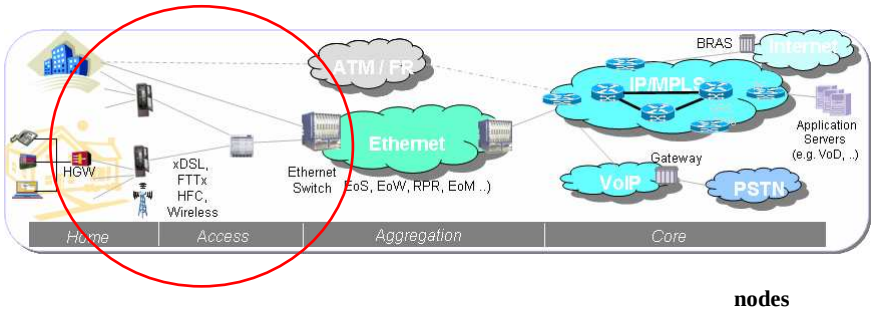
OPEX
- Maintenance

Overall economic results –
Revenues, Cost, Cash-flow and Net Present Value



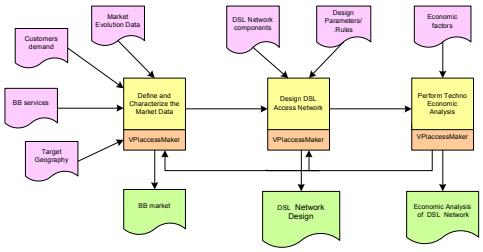
Planning of bradband access networks

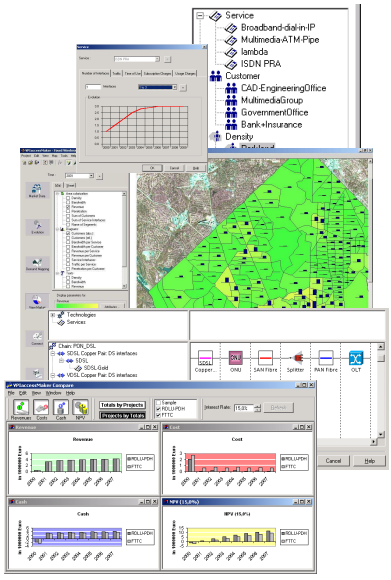




nodes

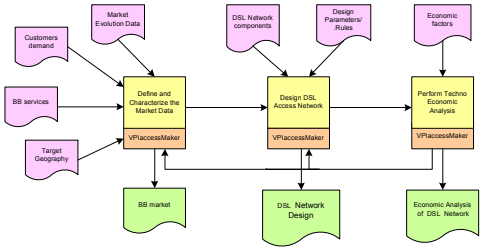
Broadband Planning Tools of ITU partners : Planning of wireline BB access network

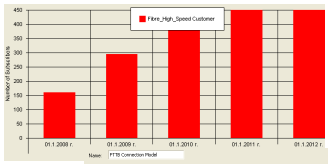


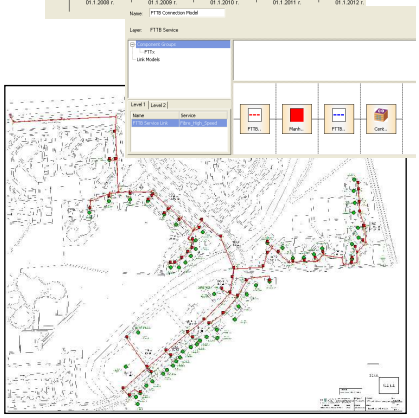


- *Capturing sophisticated market forecasts*
- *Selecting the best access technology for a geographic region*
- *Designing and dimensioning optimized access networks*
- *Providing detailed economic analysis based on forecasts and infrastructure investments*

Broadband Planning Tools of ITU partners : Planning of wireline BB access network



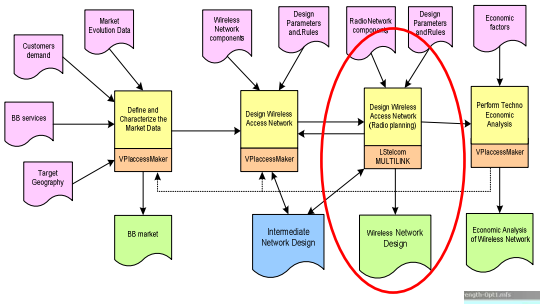


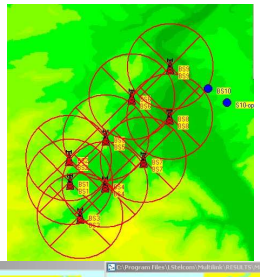


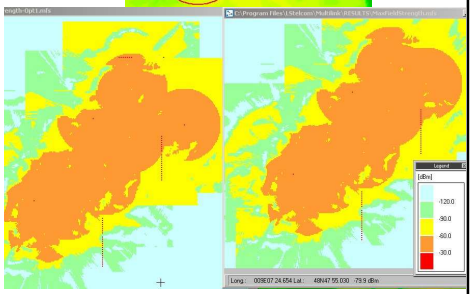
FTTx access network design for outside plant :

- *Capturing sophisticated market forecasts*
- *Determining the best locations for fiber splitters, MSANs or DSLAMS*
- *Dimensioning duct and conduit capacities*
- *Providing detailed economic analysis based on forecasts and infrastructure investments*

Planning of wireless BB access network





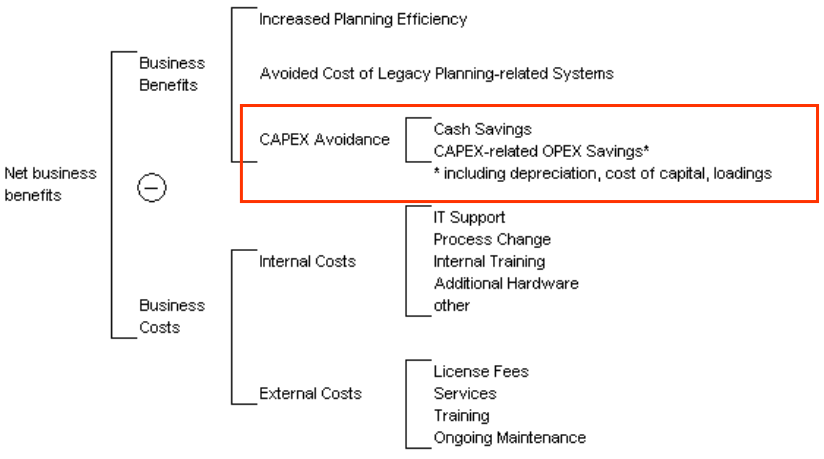


Radio access coverage :

- *Interactive microwave link engineering*
- *Design of radio access networks*
- *Planning wireless broadband networks*
- *Frequency allocation and coordination*

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**
- **Creating of Set of real data reference networks**

Benefit of using plannig tools