



**ITU Regional Development Forum 2008 for CIS,
CEE and the Baltic States**
**“Bridging the ICT standardization gap in
developing countries”**

Session 5

Network Planning

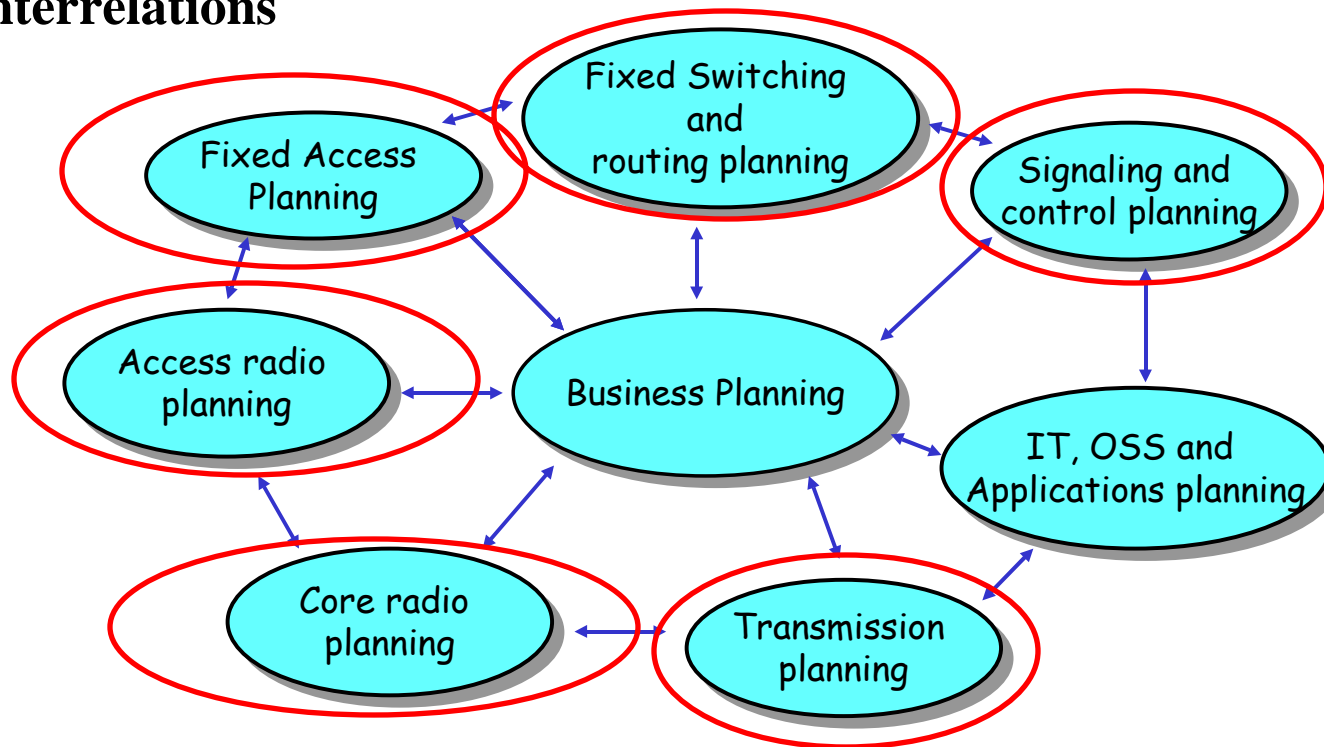
Ignat Stanev
ITC, Bulgaria

Presentation content

- **NGN requirements to the planning domains (referenced in ITU GNPT document)**
- **Fixed Network Planning Tools (referenced in ITU NP Manual)**
- **Radio Planning Tools (referenced in ITU NP Manual)**
- **ITU validation process for planning tools**
- ❖ **Case study of Planning Broadband Access**

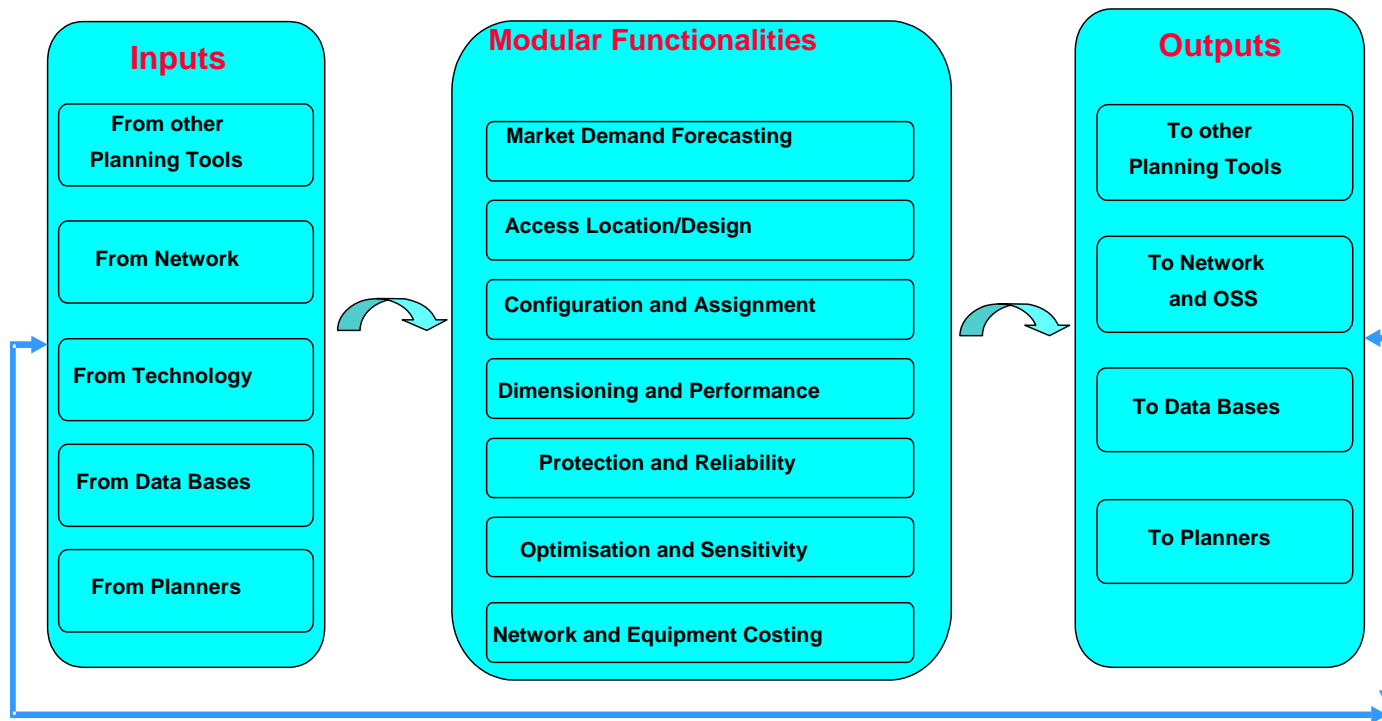
Planning Domains for top level Requirement Specifications

- requirements are organised by 8 planning domains derived from planner needs and networking problems
- minimise the number of tools to be applied and facilitate their interrelations



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

Fixed Access Planning



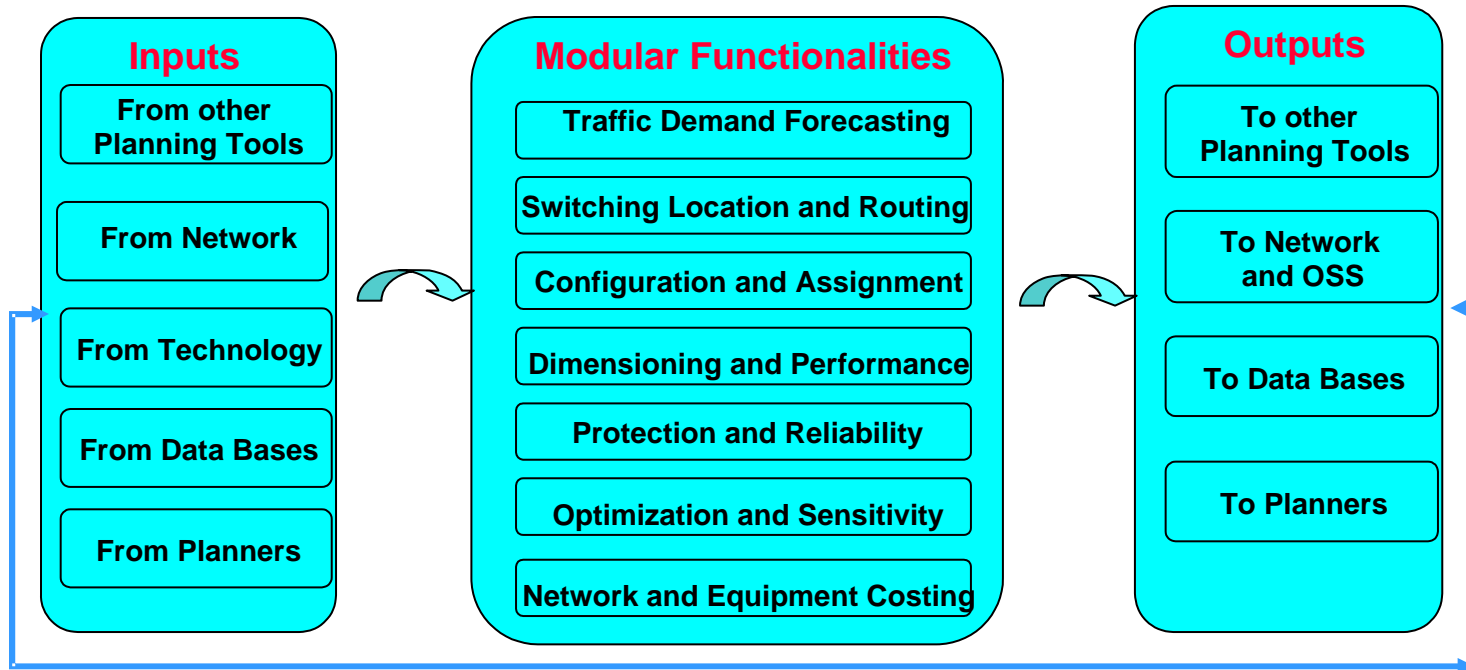
Requirements for the fixed access planning domain

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**

Fixed Switching And Routing Planning



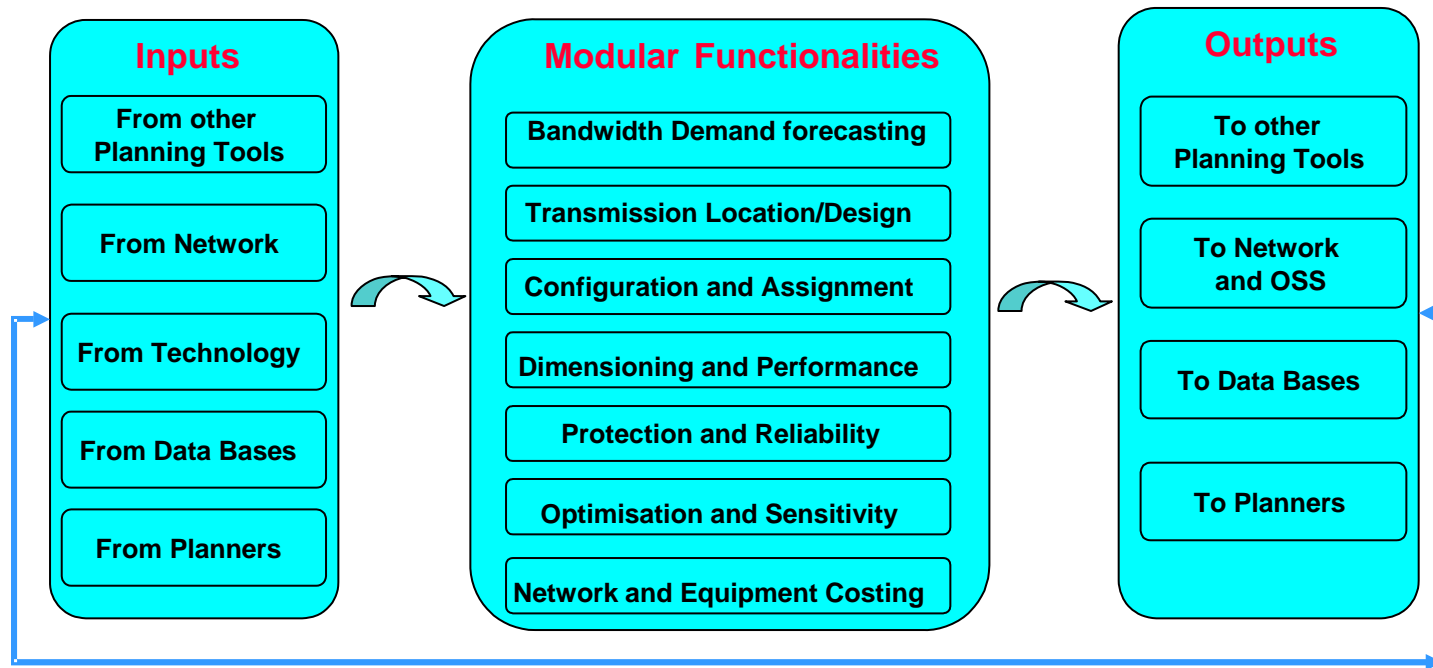
Requirements for the switching and routing domain

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

Requirements related to NGN and corresponding new technologies

- **Service demands characterisation and traffics for VoIP and NGN multi-service flows**
- **Device catalogue covering most typical NGN technologies**
- **Routing flows for most typical cases including OSPF, shortest path, widest path and weighted cost functions**
- **Routing methods for Labelled Switched Paths (LSP)**
- **Routing over ATM links or PDH/SDH systems or tunnelling via other IP links**
- **Exact allocation of the IP or MPLS links**
- **...**

Transmission Planning



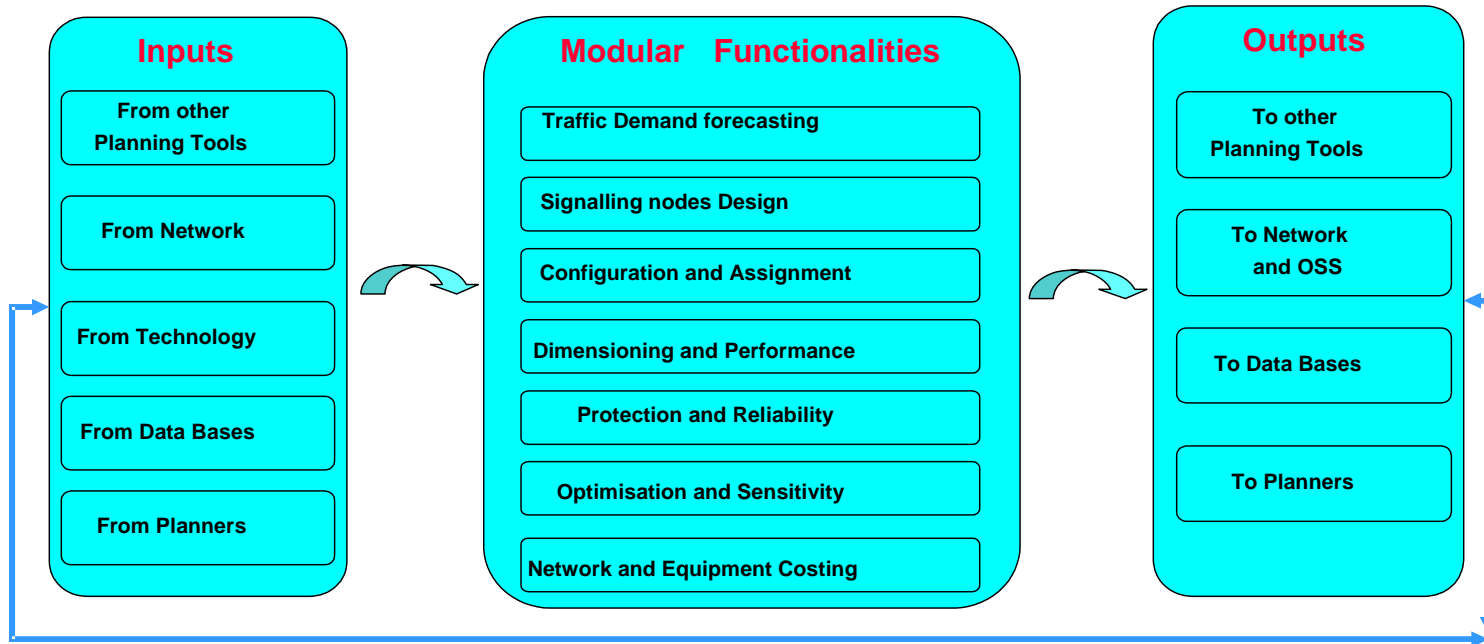
Requirements for the transmission domain

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

Requirements related to NGN and corresponding new technologies

- **Device catalogue covering Next Generation SDH technologies**
- **Formation of optical networks**
- **Capability to model IP over SDH and IP over WDM**
- **Modelling architecture and capabilities of Ethernet mesh topology and Ethernet ring topology**
- **...**

Signalling, Control And NM Planning



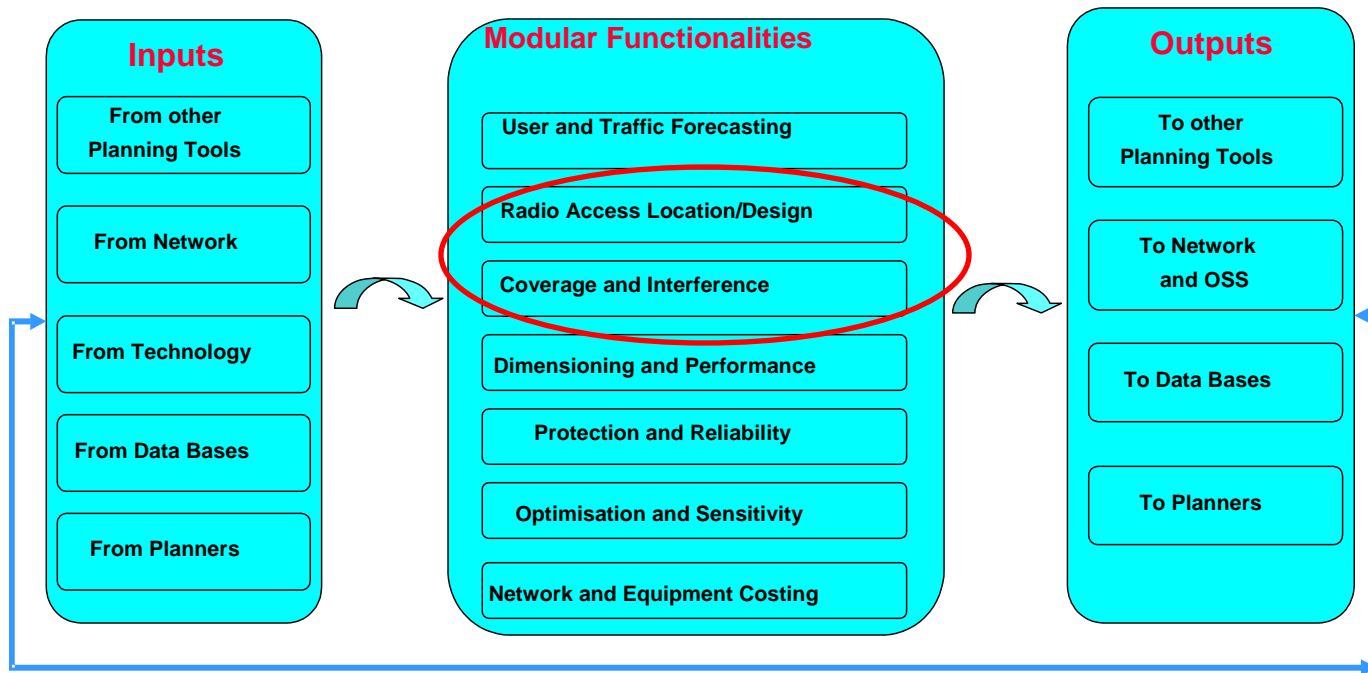
Requirements for the signalling domain

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

Requirements related to NGN and corresponding new technologies

➤ SS7 network planning tool should be easily upgraded for the requirements related to NGN and corresponding new technologies in respect to the demand flows and protection level. Also capabilities should be provided to analyze and optimize signalling gateway locations and dimensioning

Radio Access Planning



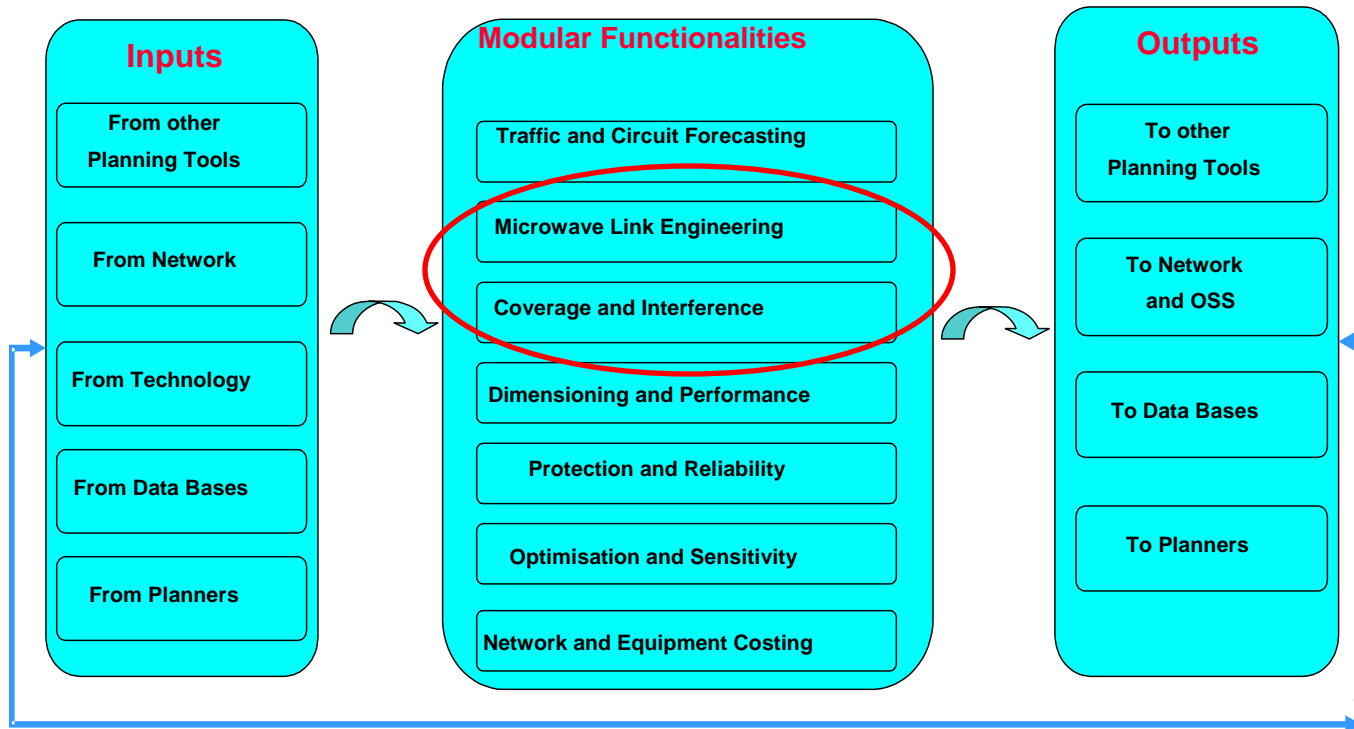
Requirements for the radio access domain

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**

Core Radio Planning



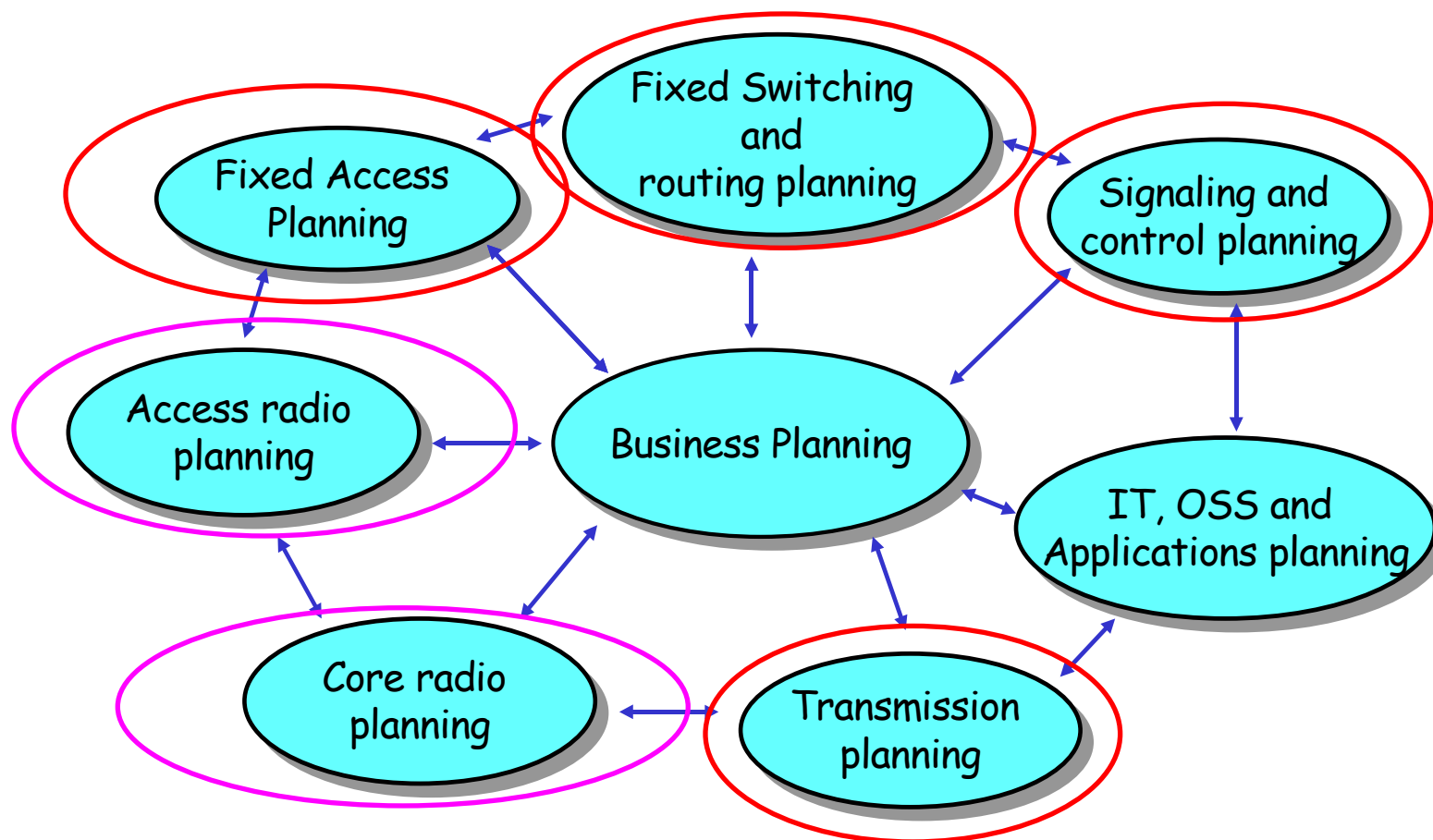
Requirements for the core radio domain

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

Requirements related to NGN and corresponding new technologies

- **Service demands characterisation and traffics for VoIP and NGN multi-service flows**
- **Device catalogue covering most typical NGN technologies**
- **Optimising locations and connections of network gateways**
- **Estimation of investment costs for the rollout and the extension of the investigated multi-service network**
- **...**

Fixed Network Planning Tools

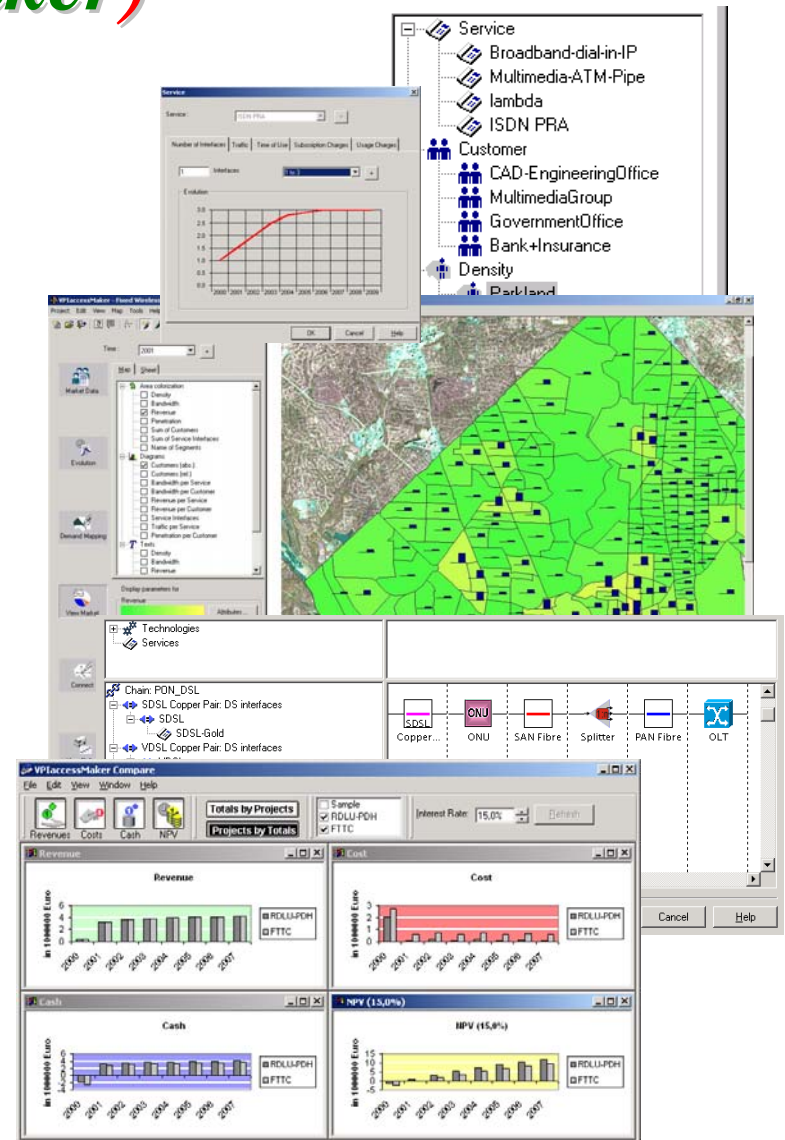


Planning tools - *OnePlan Access*TM (*VPIaccessMaker*)

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

OnePlan Access plans access networks of any technology and produces business cases for new services by:

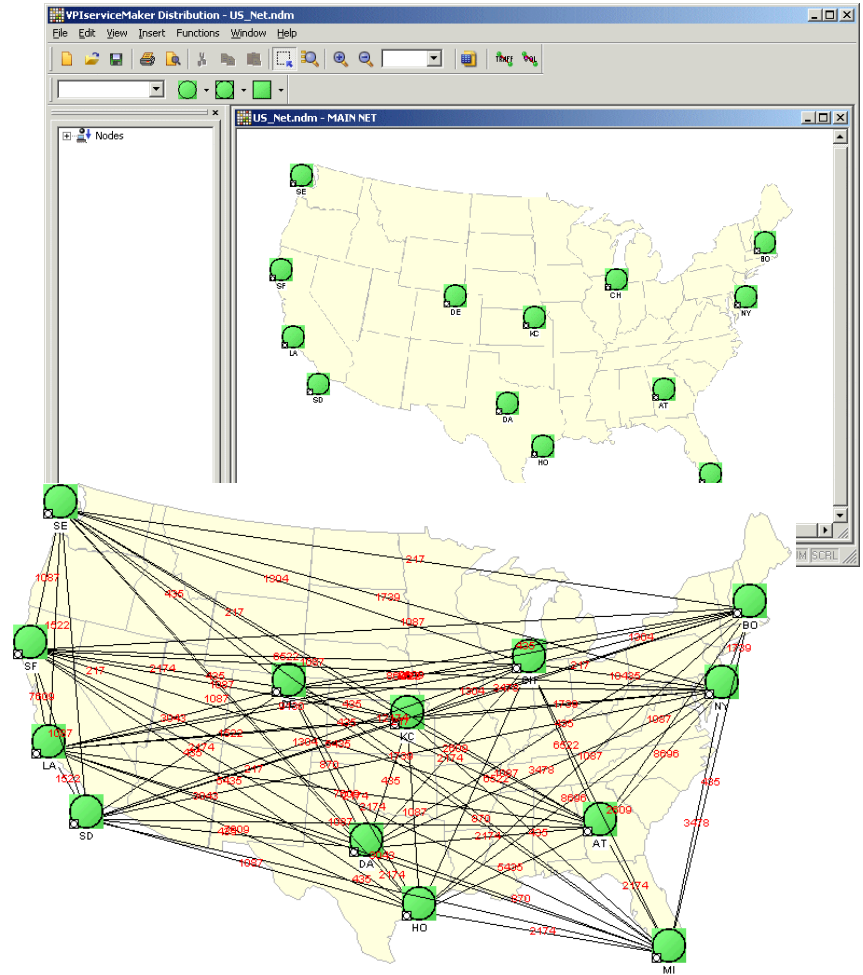
- *Capturing sophisticated market forecasts*
- *Selecting the best access technology for a geographic region*
- *Designing and dimensioning optimized access networks with wireline and wireless technologies*
- *Providing detailed economic analysis based on forecasts and infrastructure investments*
- *Visualizing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



Planning tools - *OnePlan Distribution*TM (*VPIserviceMaker Distribution*)

OnePlan Distribution supports users with the following major planning steps:

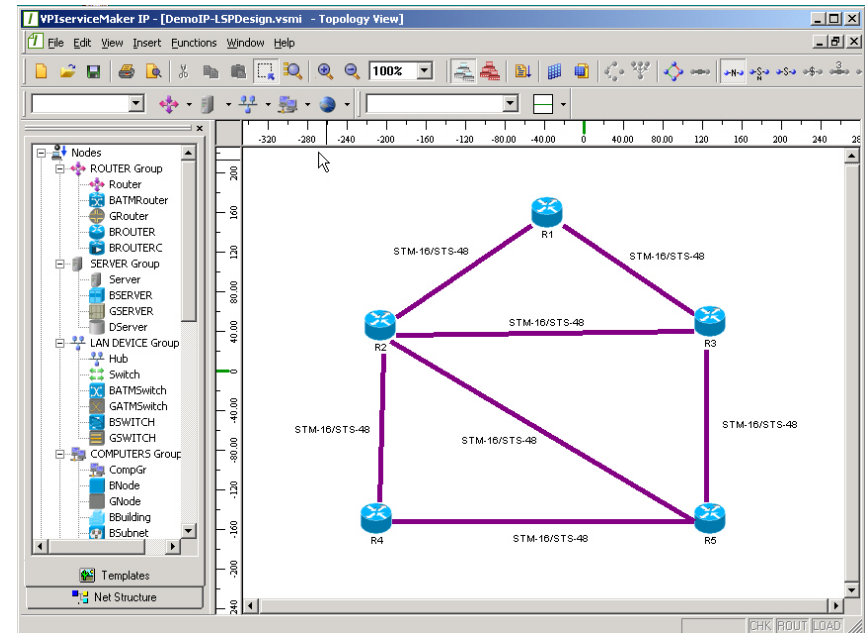
- *Calculating a traffic matrix based on input data*
- *Equalizing unbalanced traffic demands based on traffic measurement data*
- *Manipulating a traffic matrix (single, hybrid or interconnect) through changing values or interest factors*



Planning tools - *OnePlan IP*™ (*VPIserviceMaker IP*)

Key Features

- *Plans IP network capacity for best-effort services (such as HTTP, FTP, e-mail, news services, etc.) and other services in an access IP network*
- *Provides Open Shortest Path First (OSPF) topology checks, effective bandwidth calculation, bottleneck identification, export and import of user-definable access profiles and device libraries, detailed reports of all planning data and more*
- *Optimally computes the Label Switched Paths (LSPs) and allocates bandwidth for the MPLS core transport to meet the QoS requirements of different types of services*

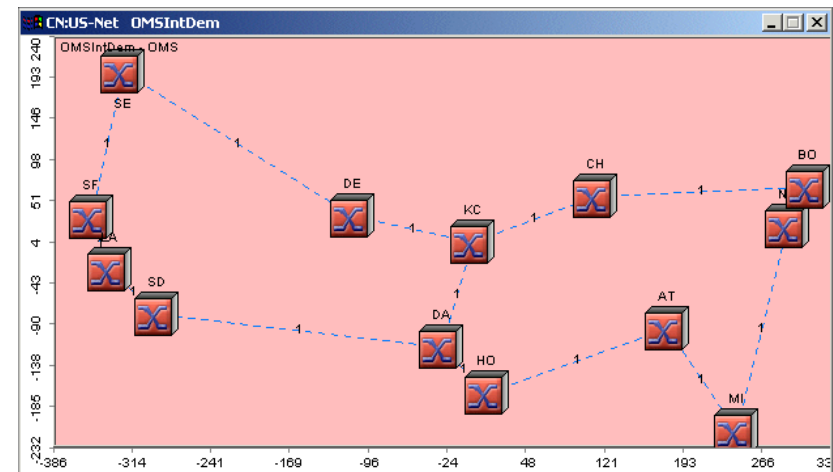
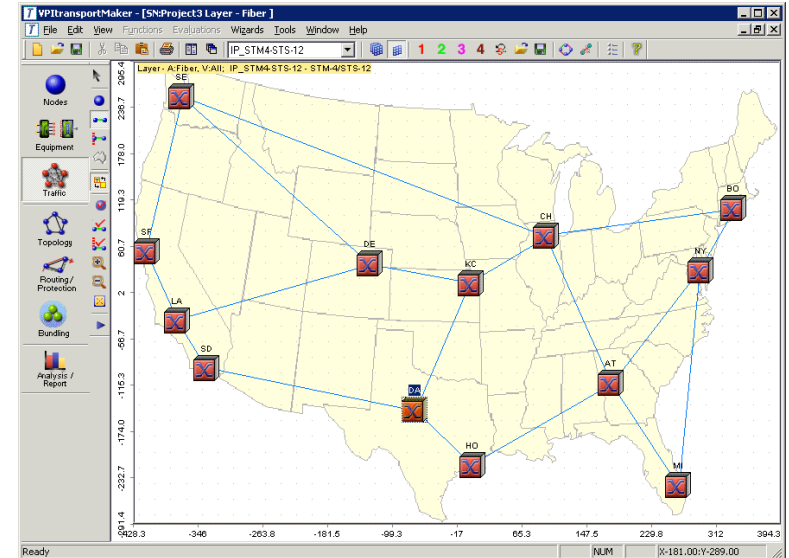


Node 1	Node 2	Effective utilization (Mbit/s) 1->2	Effective utilization % 1->2	OSPF utilization 1->2	LSP utilization 1->2	Effective utilization (Mbit/s) 2->1	Effective utilization % 2->1	OSPF utilization 2->1	LSP utilization 2->1	Free capacity 1->2	Free capacity 2->1
R2	R3	3400.000	141.350	0.000	3400.000	0.000	0.000	0.000	0.000	-994.624	2405.376
R2	R5	5800.000	120.563	0.000	5800.000	1200.000	24.944	0.000	1200.000	-989.248	3610.752
R1	R2	4800.000	99.777	0.000	4800.000	2400.000	49.888	0.000	2400.000	10.752	2410.752
R1	R3	2400.000	99.777	0.000	2400.000	0.000	0.000	0.000	0.000	5.376	2405.376
R5	R4	4400.000	91.462	0.000	4400.000	0.000	0.000	0.000	0.000	410.752	4810.752
R2	R4	3400.000	70.675	0.000	3400.000	1800.000	37.416	0.000	1800.000	1410.752	3010.752
R3	R5	1400.000	58.203	0.000	1400.000	0.000	0.000	0.000	0.000	1005.376	2405.376

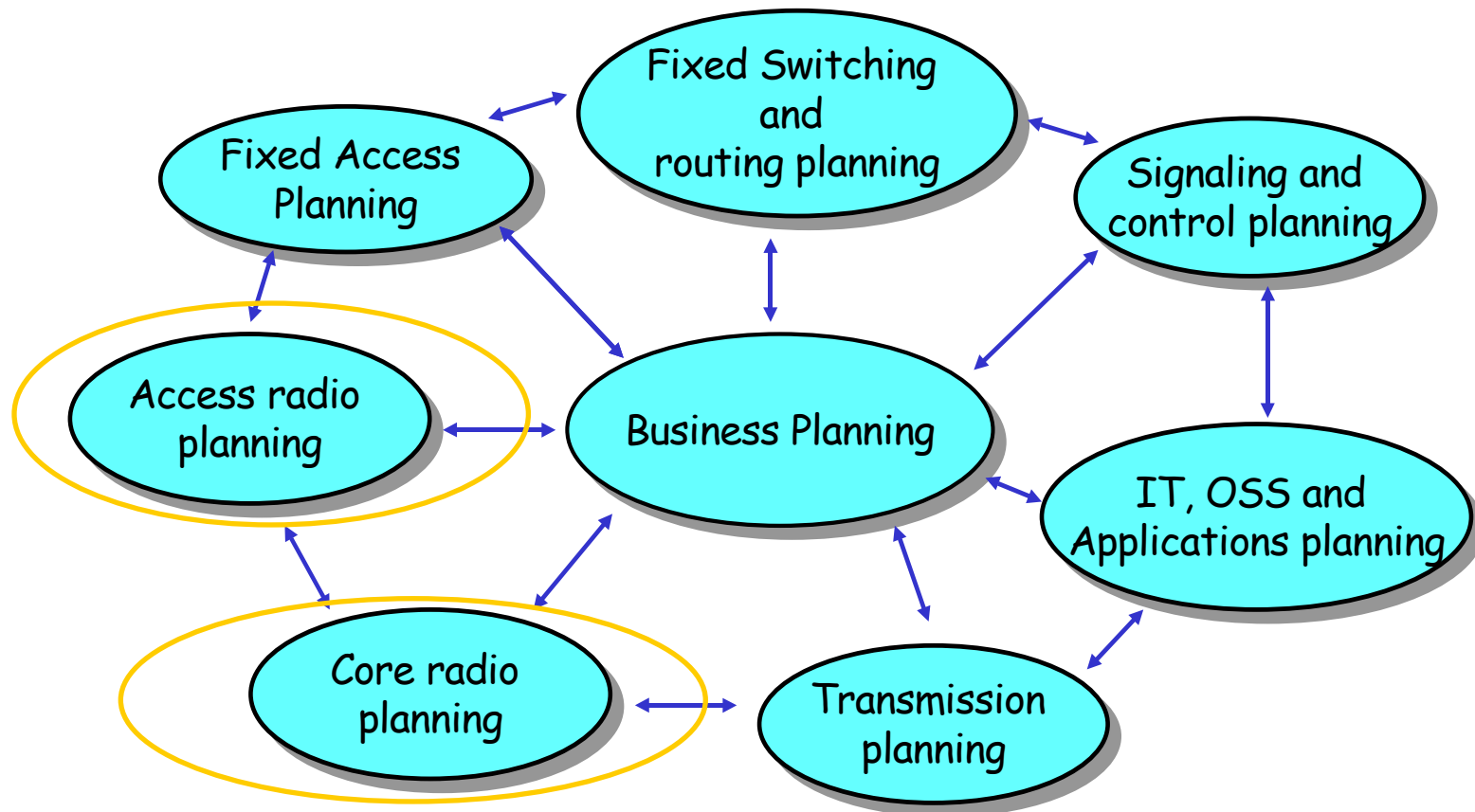
Planning tools - *OnePlan Transport™* (*VPITransportMaker*)

Key Features

- *Link/node failure analysis*
- *Network survivability studies*
- *What-if analysis and detailed reporting*
- *Hot-spot identification*
- *SDH/SONET/Ethernet/WDM modeling*
- *Equipment and Central Office (CO) modeling capabilities*
- *Scripting interface*
- *Multi-Period modeling*
- *Greenfield and brownfield modeling*
- *Top-down and bottom-up routing plans*



Radio Planning Tools



Radio planning tool - LStelcom MULTILINK

MULTILINK is a network planning tool for



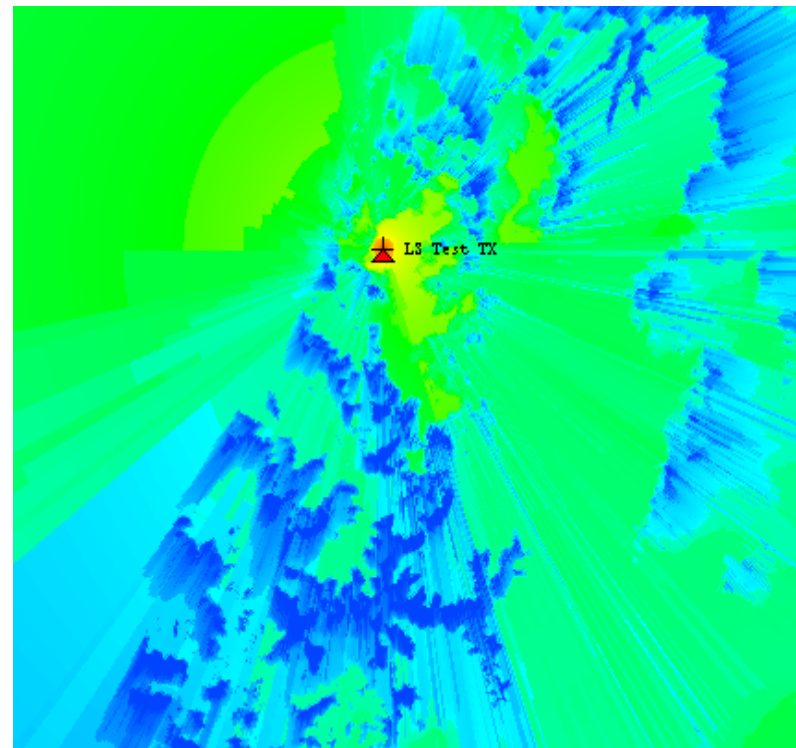
- Interactive microwave link engineering
- Planning of core radio network
- Design of radio access networks
- Planning wireless broadband networks
- Frequency allocation and coordination (ITU-R recommendations are implemented)

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

LStelcom MULTIlink - Propagation Models

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

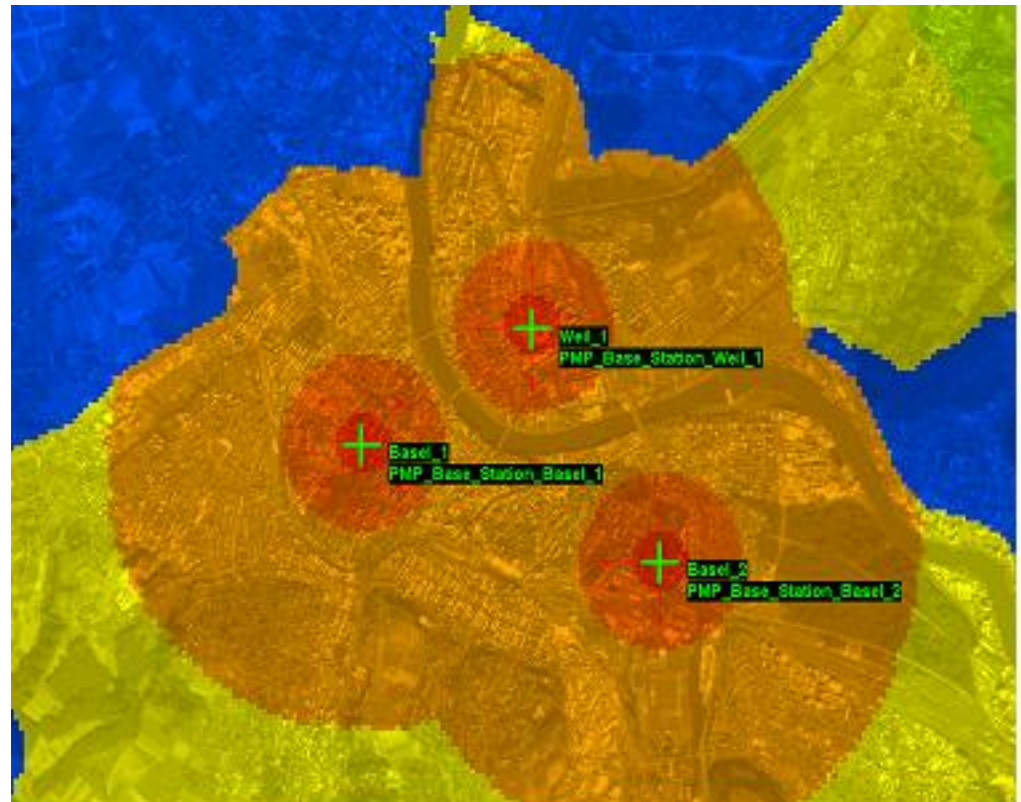
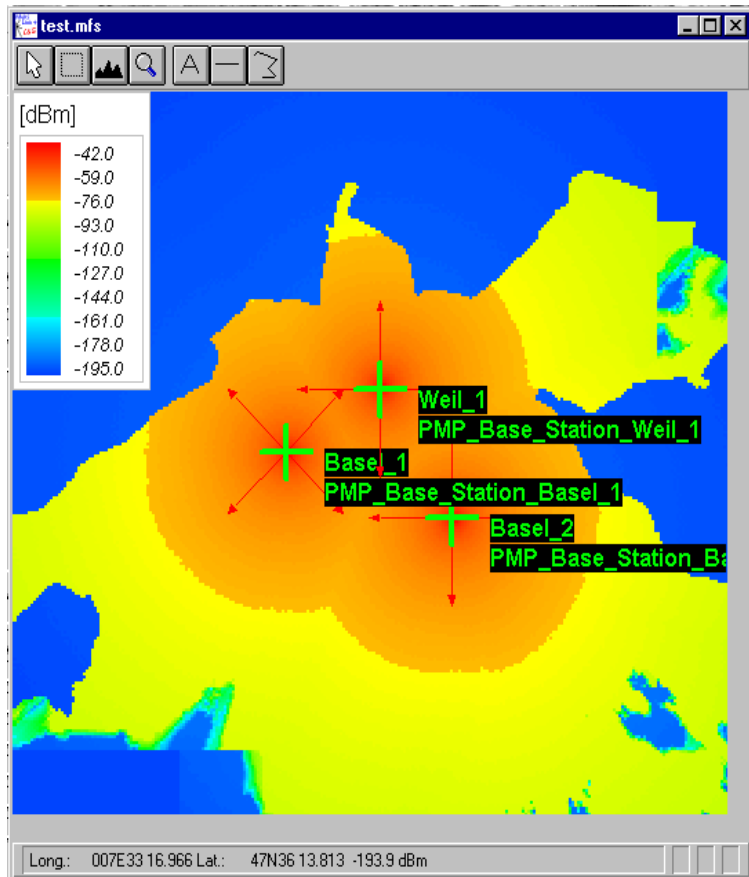
Propagation Prediction



LStelcom MULTiLink – Network Processor

Maximum Field Strength

Network Processor



ITU validation process for planning tools

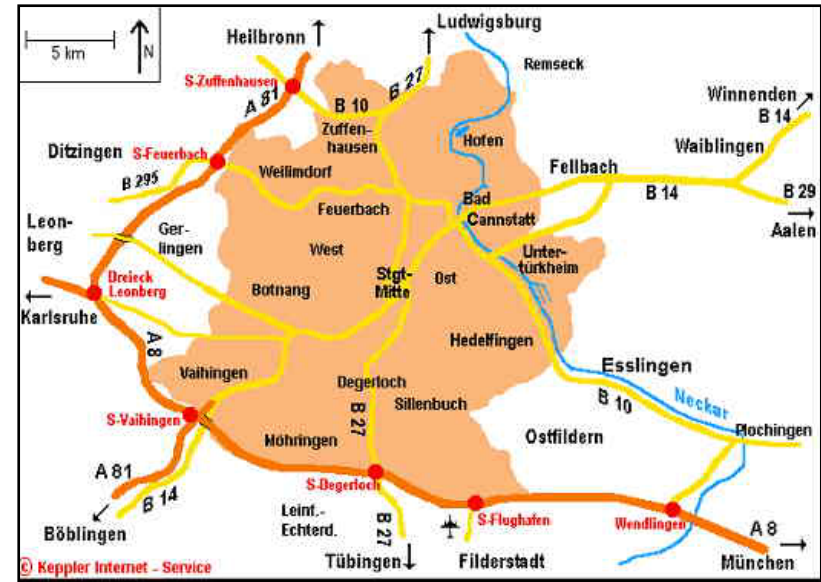
Purpose: Validation of Network Planning Tools for Developing Countries and Countries with economies in transition

- **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**

Case study of Planning Broadband Access

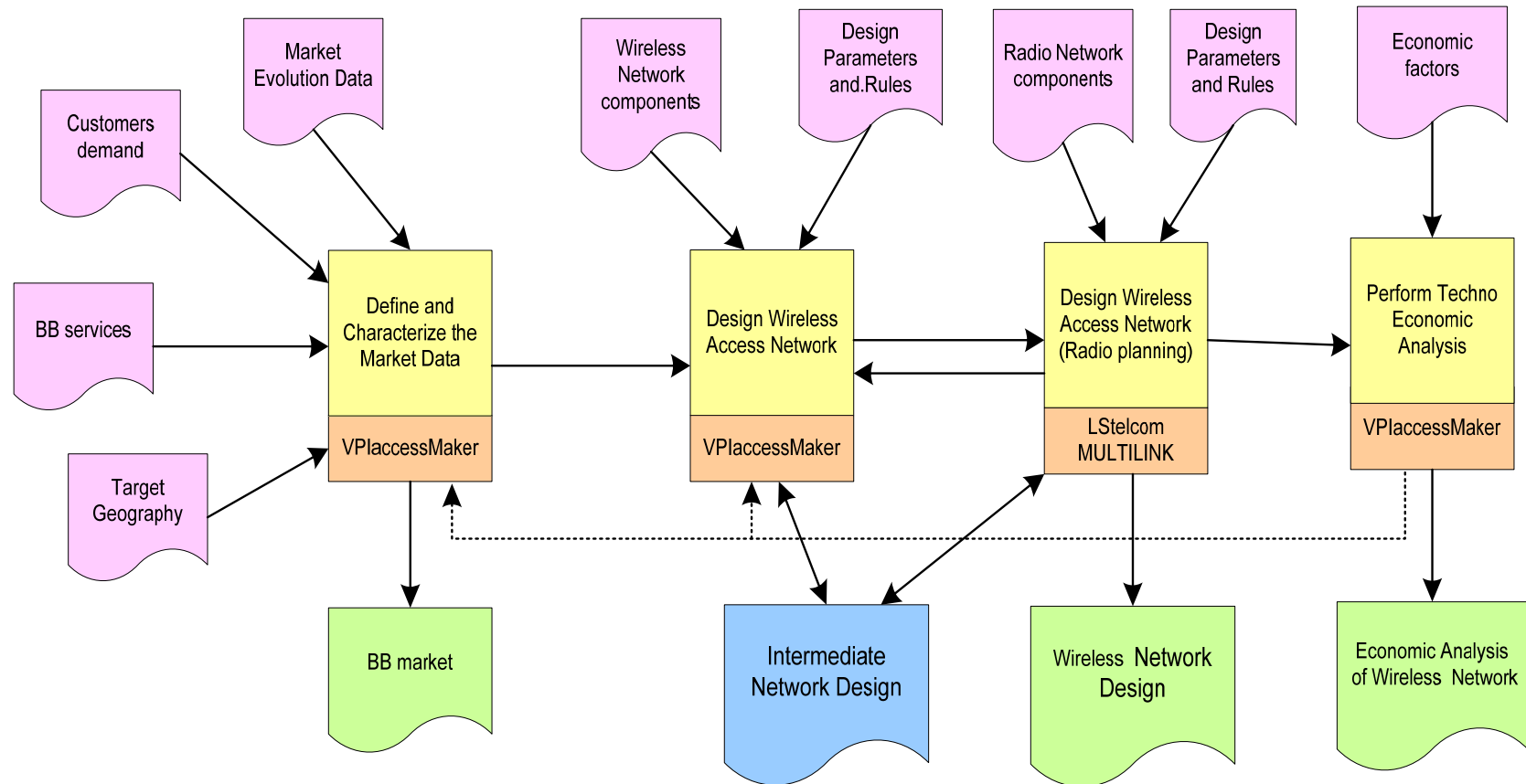
Description

- Broadband access
- Urban/suburban area
- Two different Scenarios
 - Scenario 1: *xDSL*
 - Scenario 2: BWA (WiMAX)



Presented on the ITU/BDT Regional Seminar on Mobile and Fixed Wireless Access for Broadband Applications for the Arab Region, Algiers (Algeria) 19-22 June 2006

Case study - Planning process



Case study – services and customers definition

The screenshot shows a 'Service' configuration window with the following details:

- Service: WLL_1M
- Service Type: Permanent
- Bandwidth: 1 Mbit/s
- Subscription Charges: 20 Euro per month
- Connection Charges: -10p

The 'Evolution' graph shows a linear decrease in subscription charges from 20 Euro in 2004 to approximately 8 Euro in 2010.

Year	Subscription Charge (Euro)
2004	20
2005	17.5
2006	15
2007	12.5
2008	10
2009	7.5
2010	5

➤ Permanent BB service – BB connection at 1 Mbit/s

Case study - Service Area definition

Service Area - Stuttgart

Service area

Name : Stuttgart

Density : Stt

Area Size : 35,1717 kml

Remarks

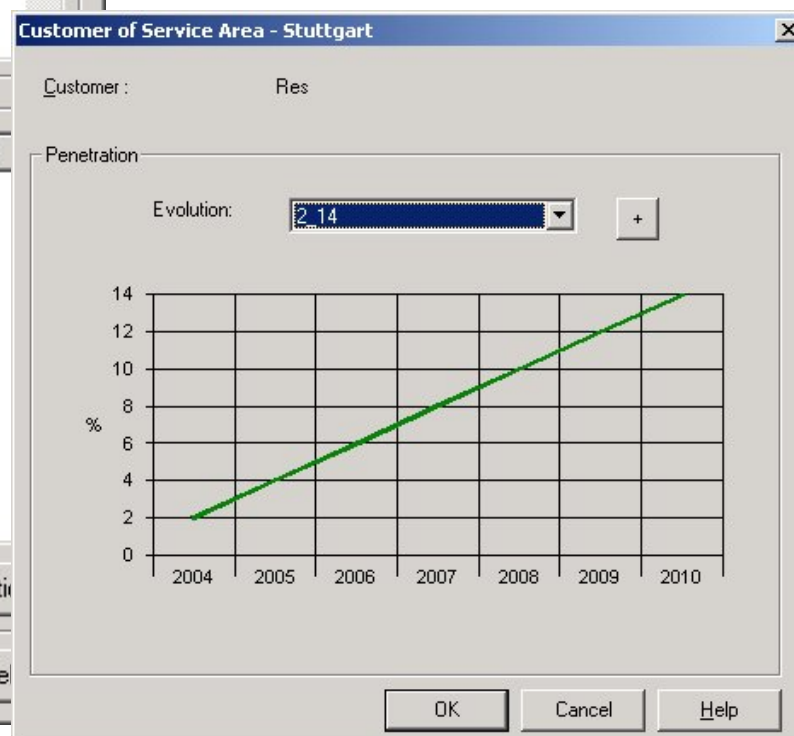
With BB penetration between 10% (2004) and 70% (2010) from all customers and strategy for 20% of the market, it makes penetration from 2% to 14%.

Customer Class	Evolution	Penetration ...	Total Number of Subscribers 2004
Res	2_14	2%	4811,49
SOHO	2_14	2%	534,61

Edit Penetration

OK Cancel Help

➤ Average BB penetration from 10% to 70% and strategy for 20% of the market

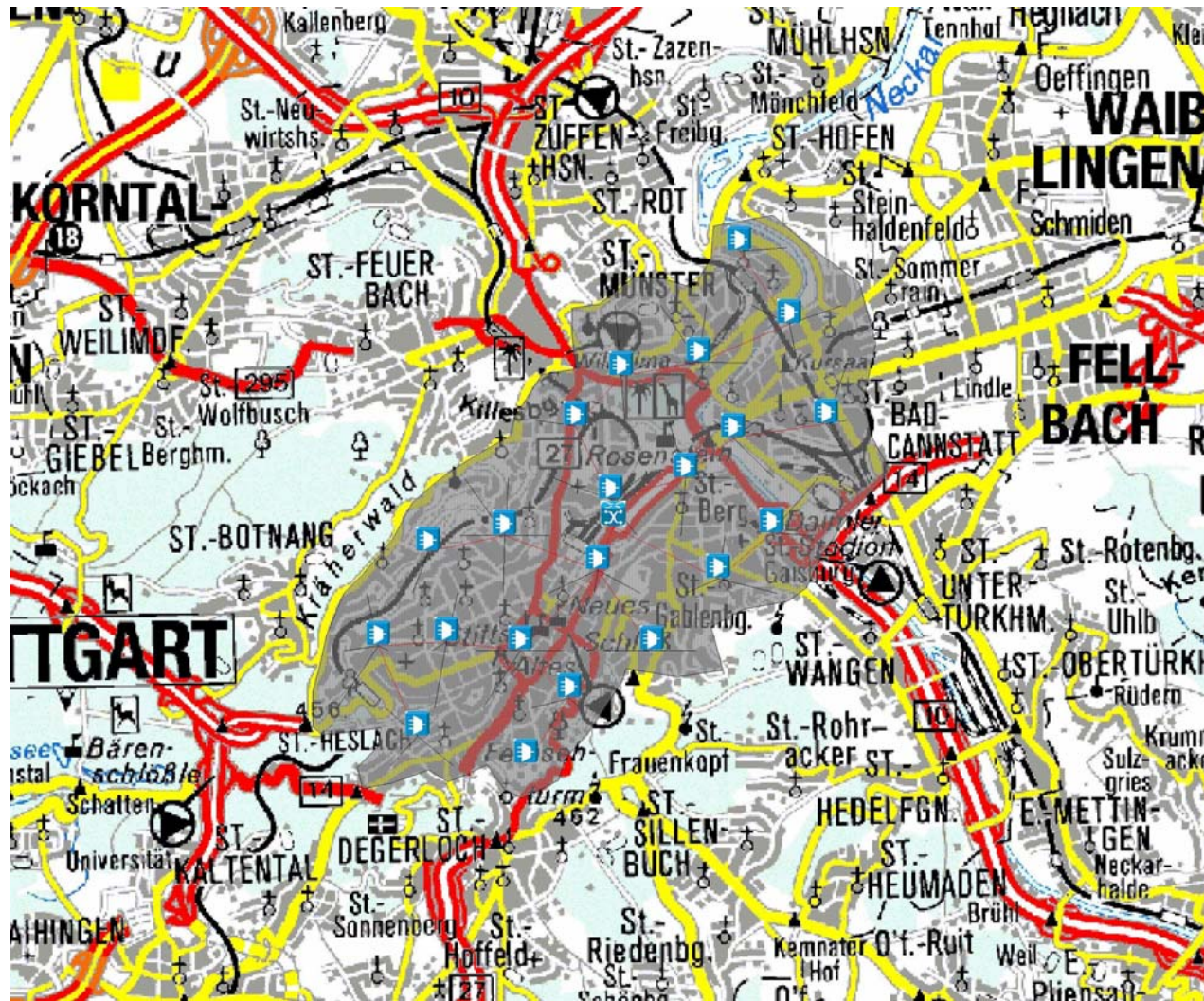


Case study - Technology Definition

The screenshot displays a network configuration application with the following components:

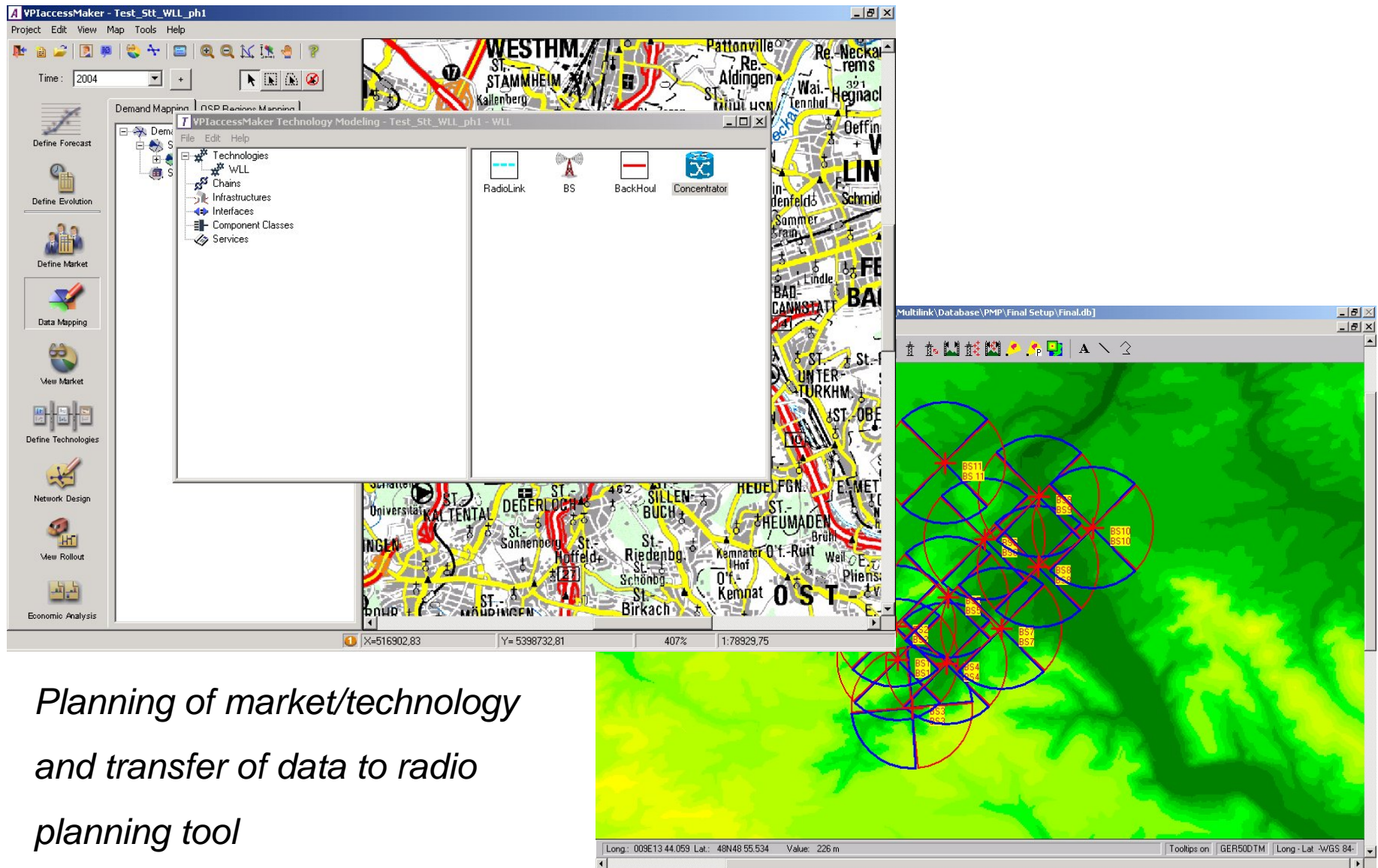
- Edit Chain Dialog:**
 - Chain Name: WLL
 - DP Service Area Radius: 200 m
 - Remarks: (Empty text area)
 - Technologies and Services tree: (Empty)
 - Chain: WLL
 - RadioLink: DS interfaces
 - 1M
 - WLL_1M
 - 2M
 - WLL_2M
- Node Element - BS Dialog (Basic tab):**
 - Capacity: 35 Mbit/s
 - Compression Factor: 20
 - Total Number of Interfaces: 1000
 - Number of Interface Type: 500 of Type: 1M
- Link Element - Rlink Dialog (Basic tab):**
 - Maximum Length: 5000 m
 - Detour Factor: 1
 - Link Model: Star
- Network Diagram:** A horizontal flow diagram showing the sequence: RadioLink → BS (Base Station) → BackHoul → Concentrator.

Case study – planning of DSL access network



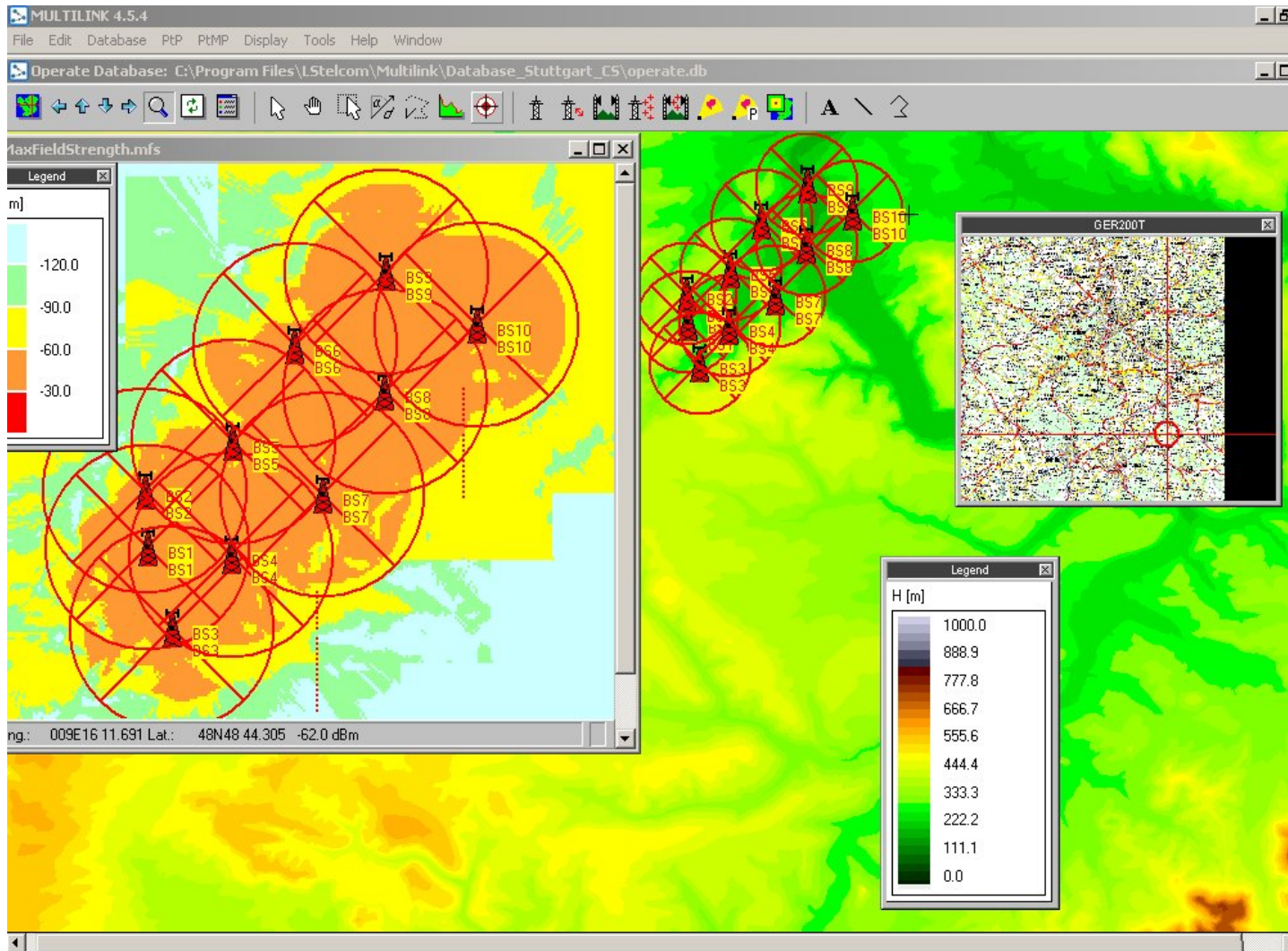
Optimization of access node number/locations and service areas

Case study – planning of wireless access network



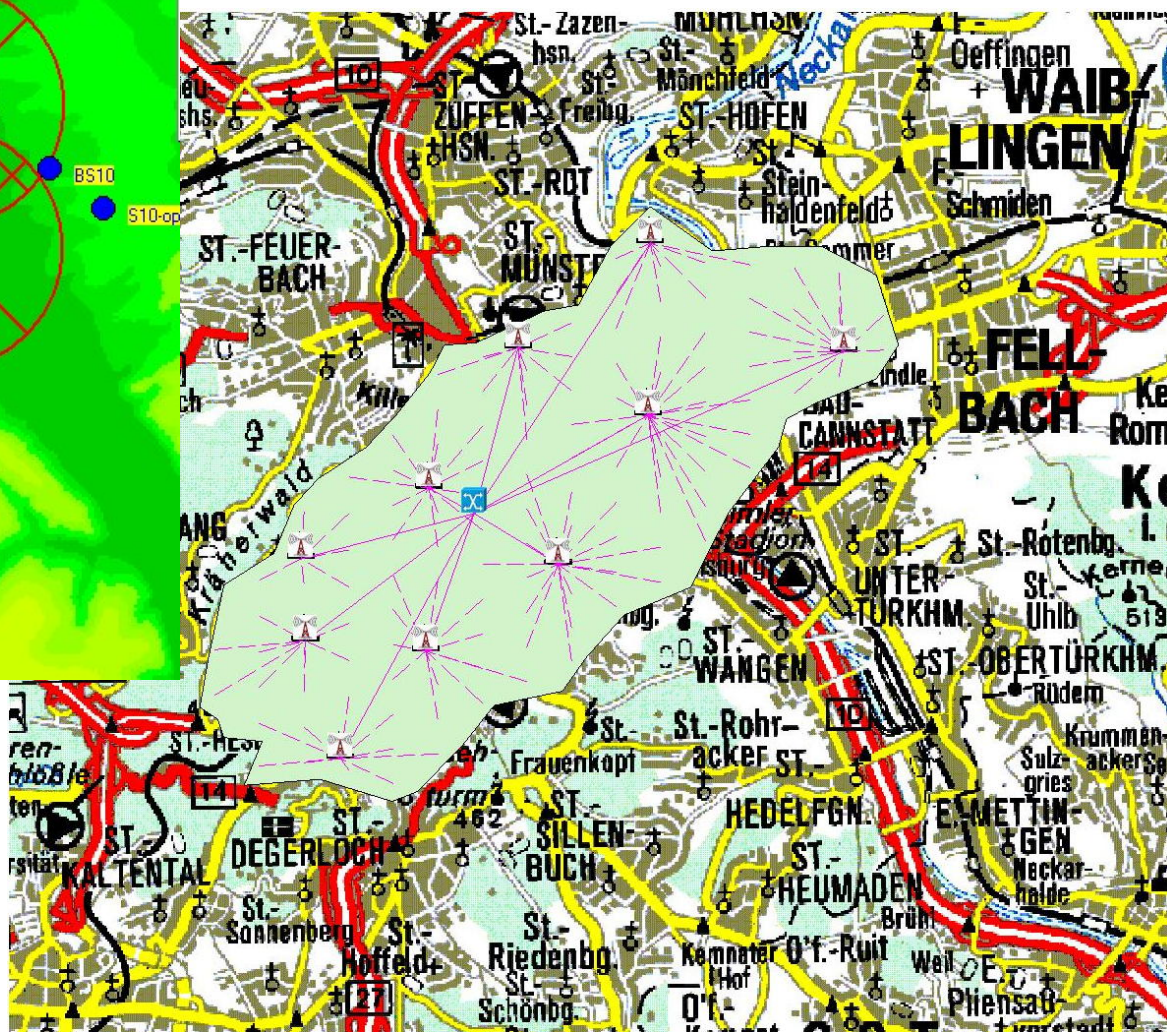
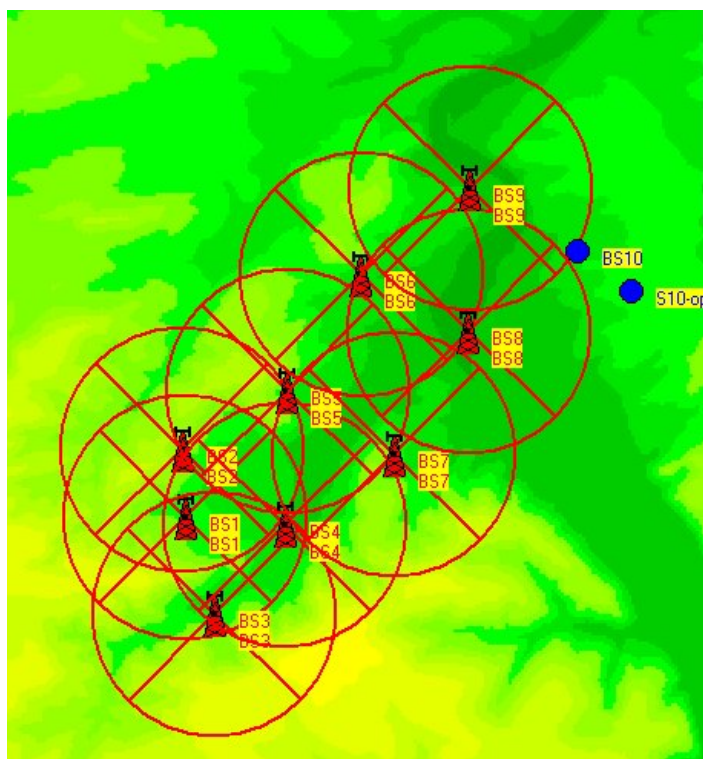
*Planning of market/technology
and transfer of data to radio
planning tool*

Case study – planning of wireless access network



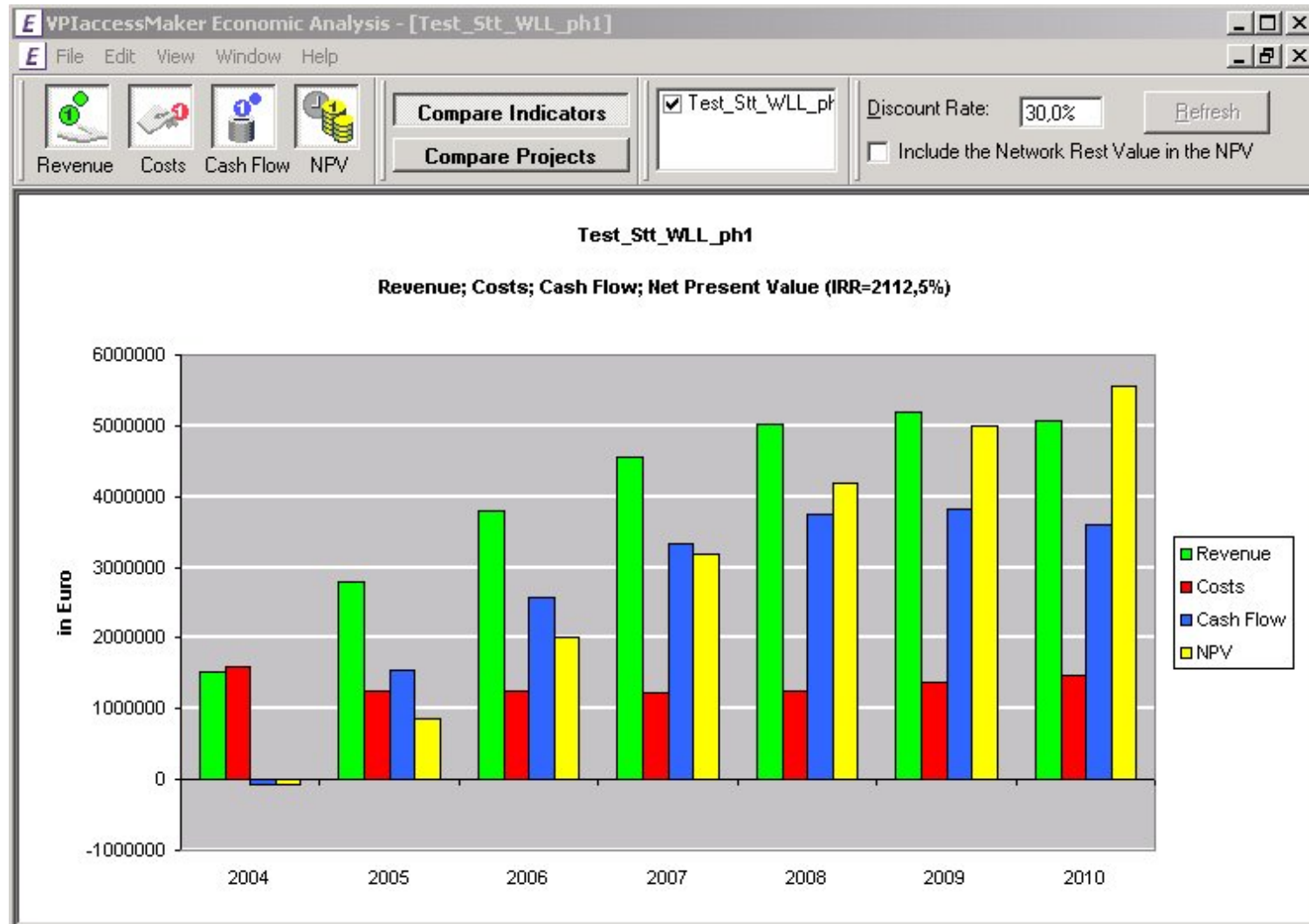
*Max server
coverage :
calculation and
improvement*

Case study – planning of wireless access network



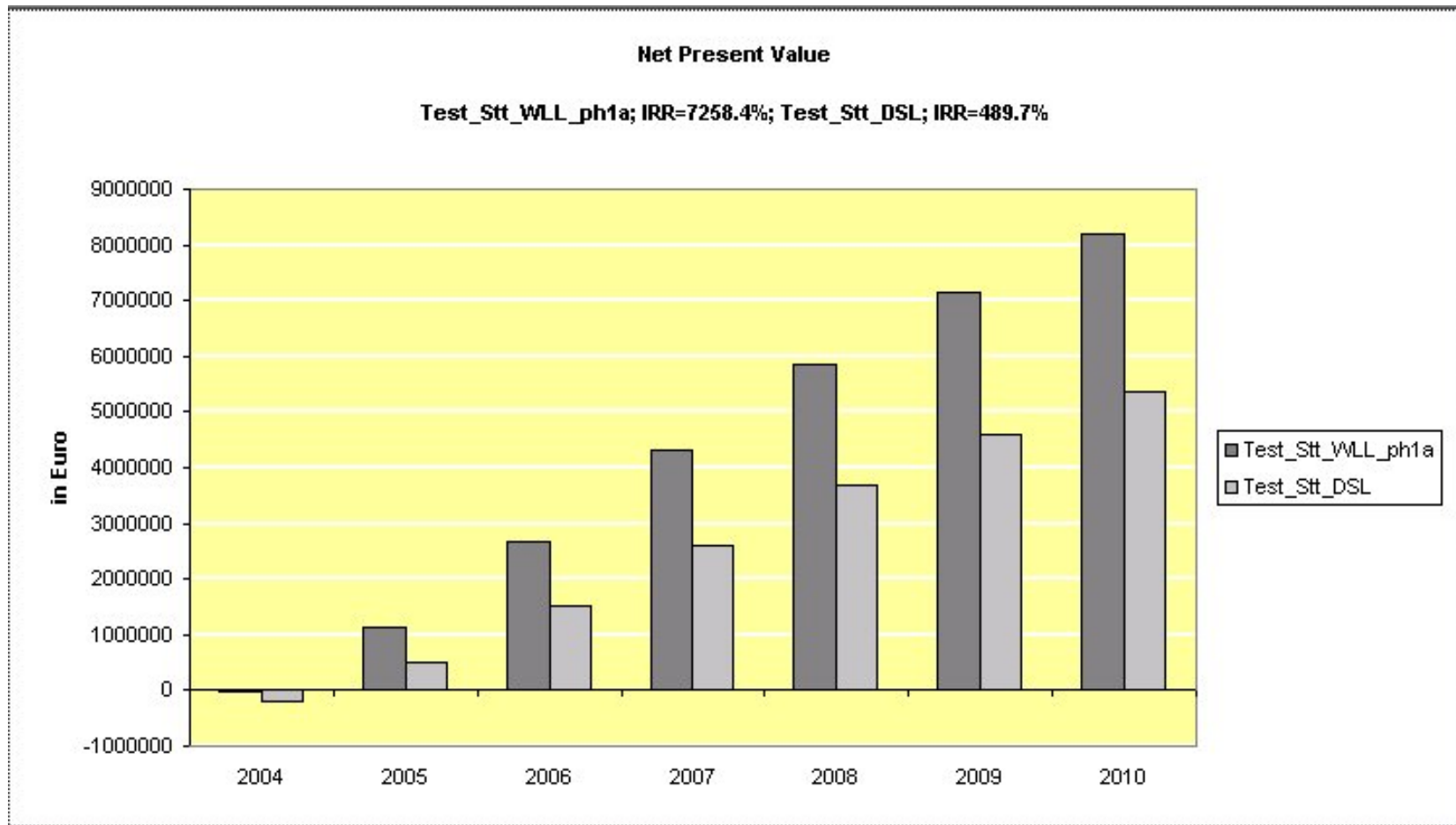
Transfer of results from radio planning tool for costing of the network

Case study - Economic Analysis



Wireless access network

Case study - Economic Analysis



Comparison of DSL and Wireless access network