ITU Regional Seminar

Belgrade, Serbia and Montenegro, 20-24 June 2005

Session 6.8

VPI - Case study

Planning of different broadband solutions in the last mile for urban and suburban areas

Planning of different broadband solutions in the last mile for urban and suburban areas :

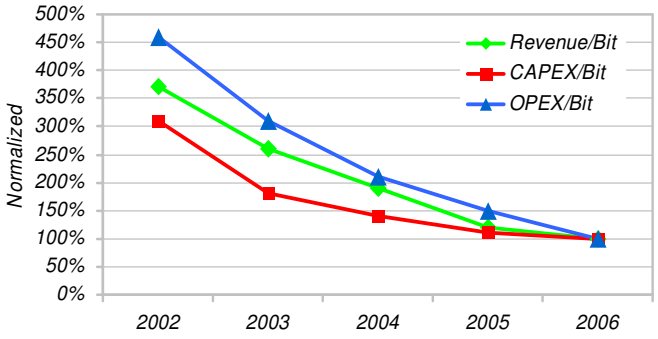
- The ongoing evolution of the present networks to NGN as well as the invasion of the market from new operators and service providers implementing the latest technological solutions makes the precise network planning and optimisation necessary task and important instrument

- There are different possible broadband solutions for the so-called last mile of the network, especially for urban and suburban areas

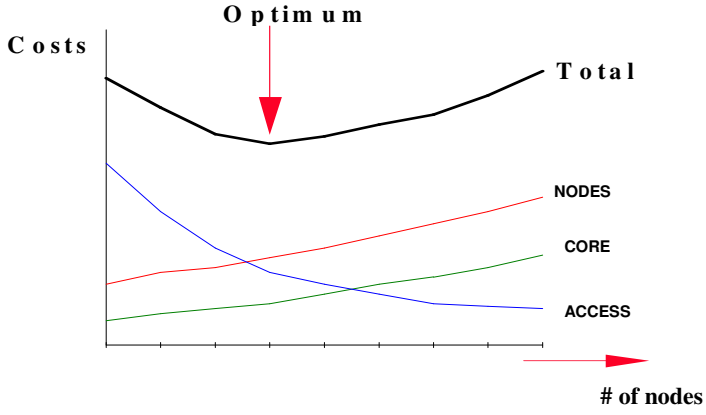
- Through careful planning of the different alternatives and comparison of the corresponding economical consequences the best long-term solution could be taken

Planning of different broadband solutions in the last mile for urban and suburban areas :

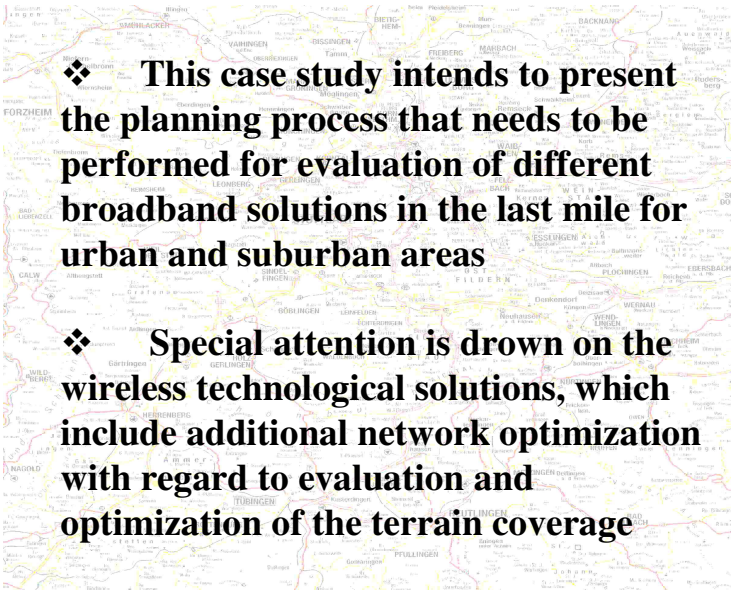
Projected Per-Bit Trends for North American Wireline Service Providers (RHK, 2003)



Planning of different broadband solutions in the last mile for urban and suburban areas :

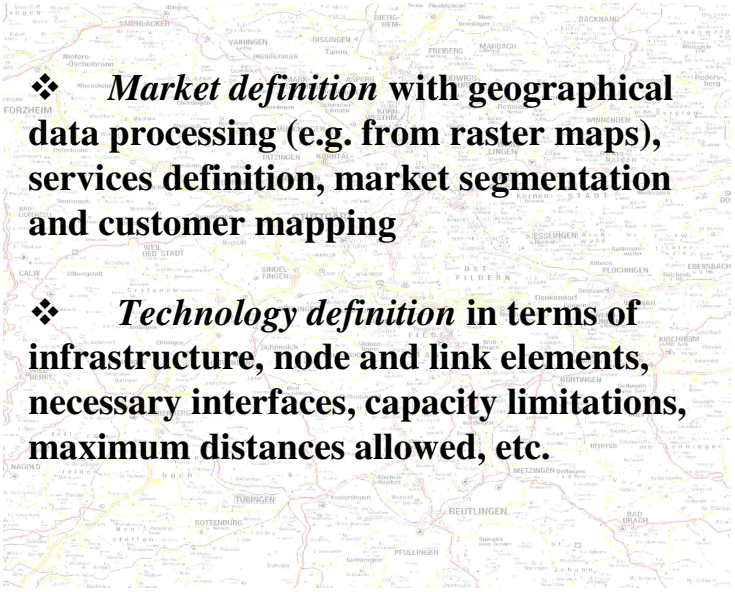


Case study objectives :



- This case study intends to present the planning process that needs to be performed for evaluation of different broadband solutions in the last mile for urban and suburban areas
- Special attention is drown on the wireless technological solutions, which include additional network optimization with regard to evaluation and optimization of the terrain coverage

Case study includes several phases :



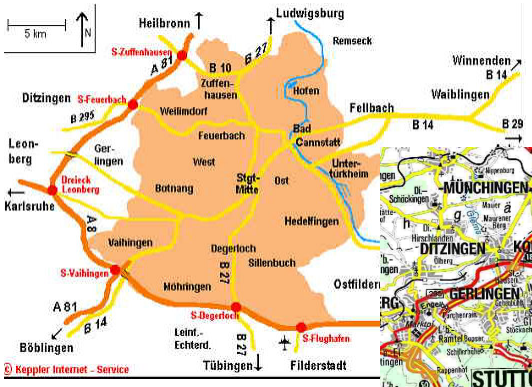
- *Market definition* with geographical data processing (e.g. from raster maps), services definition, market segmentation and customer mapping
- *Technology definition* in terms of infrastructure, node and link elements, necessary interfaces, capacity limitations, maximum distances allowed, etc.

Case study phases (continuation) :

- ***Network optimisation***, including minimization of the number of necessary network elements, best possible node locations within the studied area, optimisation of the service areas for the separate node elements

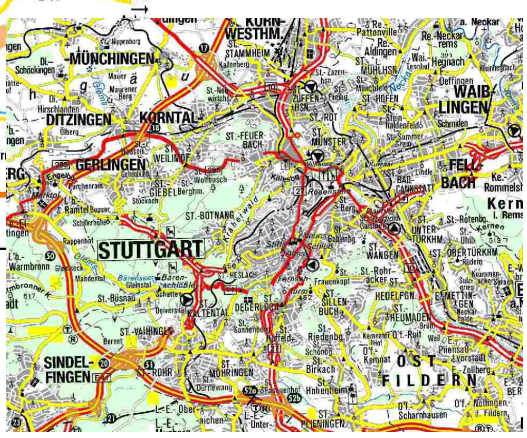
- ***Economic evaluation*** of the resulting network in terms of revenues, investment costs, installation costs, maintenance costs, cash flow, NPP, IRR, etc.

Case study Stuttgart area :



Maps of Stuttgart area

Residential BB market



Case study - Stuttgart area :

	Name	Abr.			Capital	A (km2)	C 1987-05-25	E 1996-01-01	E 2002-01-01
<	Freiburg		RB	BW	Freiburg	9,357	1,869,032	2,087,042	2,156,851
<	Karlsruhe		RB	BW	Karlsruhe	6,919	2,395,523	2,644,430	2,701,376
<	Stuttgart		RB	BW	Stuttgart	10,558	3,491,787	3,862,311	3,964,162
<	Tübingen		RB	BW	Tübingen	8,918	1,530,045	1,725,584	1,778,517
<	**Baden-Württemberg**	**BW**	**BL**		**Stuttgart**	35,752	9,286,387	10,319,367	10,600,906
	Germany	**DEU**			**Berlin**	**357,022**	**77,718,000**	**81,817,499**	**82,440,137**

Germany – geo data

Fixed network users potential

Highly developed countries (close to saturation):

Country	Population (in thousands)	Teledensity [%]	Average house-hold size	Teledensity per house-hold [%]	Percent of residential lines
Australia	19,157	53,86	2,64	101,2	75,0
Canada	30,750	63,45	2,65	98,2	63,9
France	58,892	56,89	2,46	94,0	69,2
Germany	82,260	65,08	2,16	95,5	77,0
Italy	57,298	48,07	2,71	96,9	79,2
Japan	126,919	55,83	2,70	116,8	75,8
New Zealand	3,831	44,81	2,91	103,0	78,5
Republic of Korea	47,300	48,86	3,04	105,5	74,1
Spain	40,600	50,62	3,25	100,8	83,5
Sweden	8,881	68,20	2,22	98,7	67,9
Switzerland	7,204	74,42	2,39	99,6	60,0
United Kingdom	59,766	59,086	2,38	93,0	71,0
United States of America	275,130	64,58	2,58	94,1	67,6

Teledensity per house-hold ~ 100% - one connection per household

Case study Stuttgart - population data :

	Name	C E 2002-01-01
1	Stuttgart	587,152
2	Mannheim	308,385
3	Karlsruhe	279,578
4	Freiburg	208,294
5	Heidelberg	141,509
6	Heilbronn	120,163
7	Ulm	118,347
8	Pforzheim	118,002
9	Reutlingen	111,338
10	Esslingen	90,905
11	Ludwigsburg	87,502
12	Tübingen	82,444
13	Villingen-Schwenningen	81,691
14	Konstanz	79,240
15	Aalen	66,559
16	Schwäbisch Gmünd	61,873
17	Sindelfingen	60,878
18	Offenburg	58,280
19	Friedrichshafen	57,538
20	Göppingen	57,536
21	Baden-Baden	53,084
22	Waiblingen	52,536

- With **587** thousand population in Stuttgart area and **2,16** average HH size it means about **272** thousands HH on an area of **35,7** sq. km., i.e. **7600** HH per sq. km, who are the BB market (and **1,33**% population increase per year – from UN statistics)

Case study Stuttgart – BB market statistics:

<>	time	2002m07	2003m07	2004m07
geo				
eu25		:	:	6.5
eu15		2.3	4.5	7.6
be		6.7	10.1	14
cz		:	:	0.7
dk		7.4	10.4	15.6
de		3.2	4.8	6.7
ee		:	:	7.6
gr		0	0	0.2
es		2	4.3	6.7
fr		1.2	4	8.2
ie		0	0.2	1.7
it		1	2.8	6.1
cy		:	:	2
lv		:	:	1.5
lt		:	:	2.5
lu		0	2.3	5.7
hu		:	:	2.2
mt		:	:	3.5
nl		6.3	9.8	14.7
at		4.7	6.6	8.7
pl		:	:	0.5
pt		1.5	3.6	6.4
si		:	:	3.8
sk		:	:	0.4
fi		3	6.6	11
se		4.6	8.6	12.1
uk		1.6	3.7	7.4

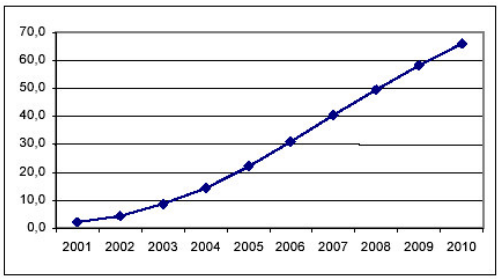
Broadband penetration
of Germany

Germany	2001	2002	2003
Main telephone lines per 100 inhabitants	63.62	65.16	65.87
Broadband DSL penetration	2.5	3.8	5.5
% broadband of total	4.0	5.9	8.3

Source: ITU World Telecommunication Indicators Database

Eurostat

Case study Stuttgart - market :



Broadband penetration *forecasts for the residential market of West European countries*

➢ **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%**

Planning tools - VPIaccessMaker Markets

Market definition

- ✓ *Define services classes (service nature, bandwidth, SLA)*
- ✓ *Create customer classes (service mixes, tariffs, lines)*
- ✓ *Define density classes (as mixes of customer classes)*
- ✓ *Define planning period*

Evolution forecasting

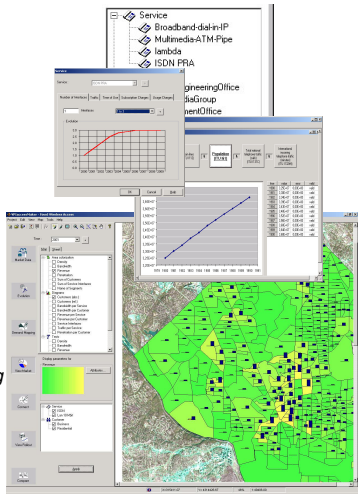
- ✓ *Tariffs*
- ✓ *Market penetration and traffic prediction*
- ✓ *Component costs*

Demand mapping

- ✓ *Import maps*
- ✓ *Define service areas (sub urban, down town, etc)*
- ✓ *Geometrical modeling of service areas & site locations*
- ✓ *Model in-building networks*
- ✓ *Define outside plant cost regions for accurate cost modeling*
- ✓ *Import/ export market demands*

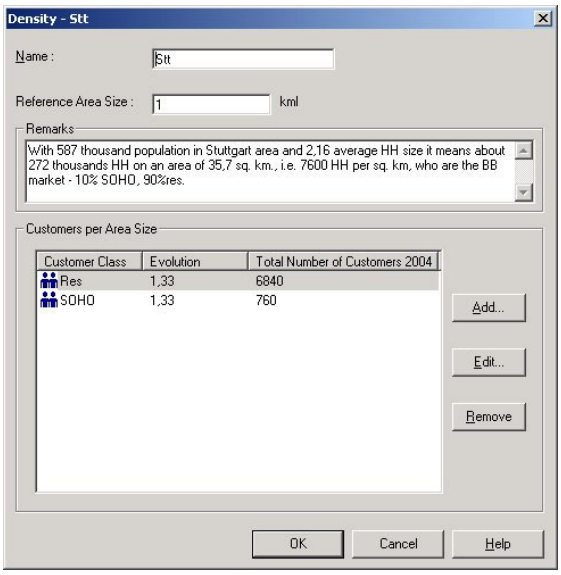
Geomarketing results

- ✓ *Extensive and flexible user defined query system*
- ✓ *Results are displayed on the GIS (selected year)*
- ✓ *Results are displayed on annual tables & charts*

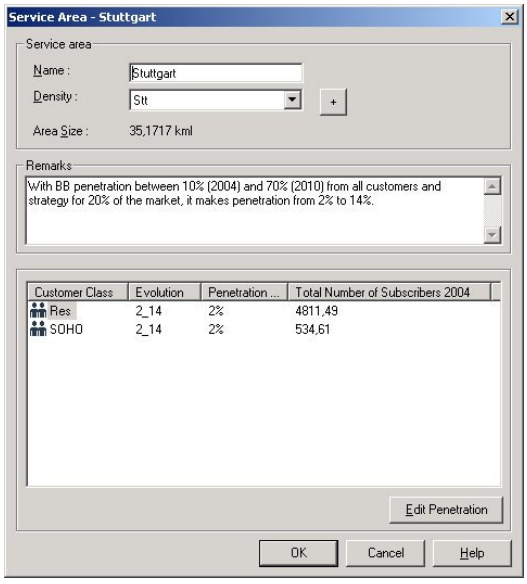


Market capture for a service provider

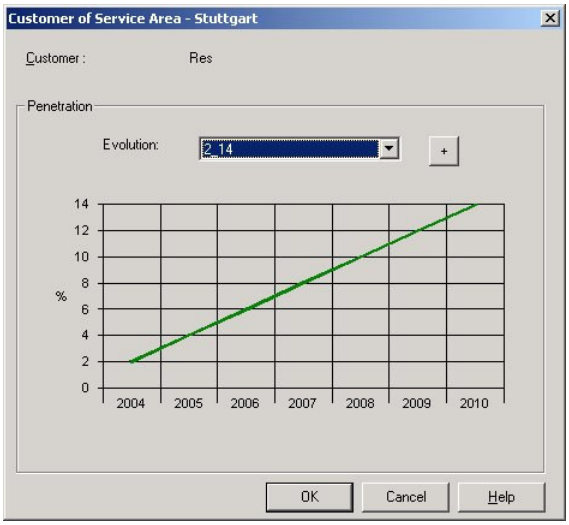
Case study Stuttgart - Density definition :



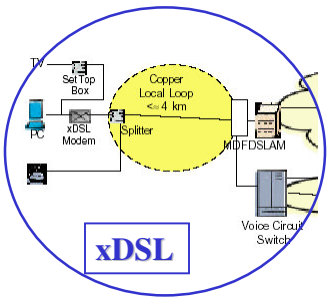
Case study Stuttgart - Service Area definition :

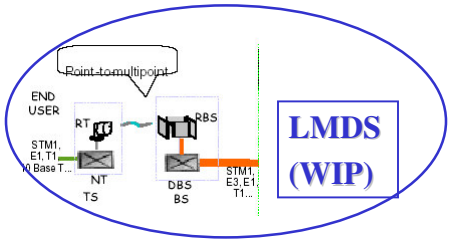


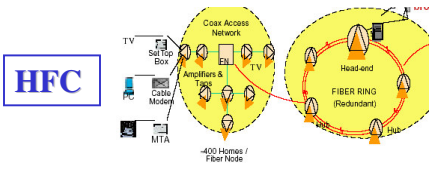
Case study Stuttgart - Penetration definition :

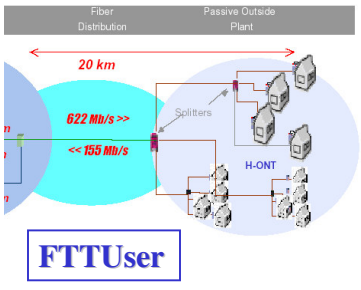


Case study Stuttgart : technological access alternatives









Planning tools - VPIaccessMaker Technologies

Technology modeling

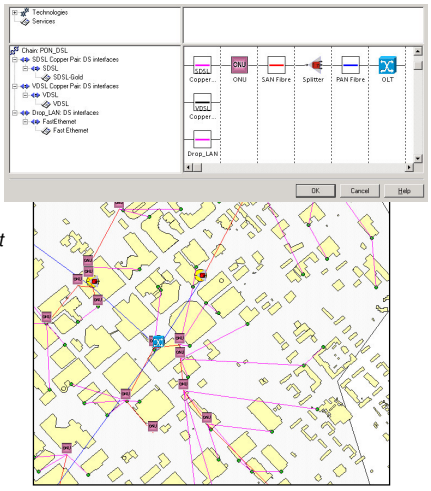
- ✓ *Specification of network infrastructure*
- ✓ *Specification of network elements*
- ✓ *Specification of interfaces (upstream, downstream)*
- ✓ *Planning rules (bandwidth, distances, topology)*
- ✓ *Chains of nodes and links for topology modeling*

Network design optimization

- ✓ *Optimize clustering to satisfy bandwidth requirement*
- ✓ *Support of multiple technologies and constraints*
- ✓ *Cost regions*
- ✓ *Support of star and tree network topologies*
- ✓ *Considers legacy infrastructure*

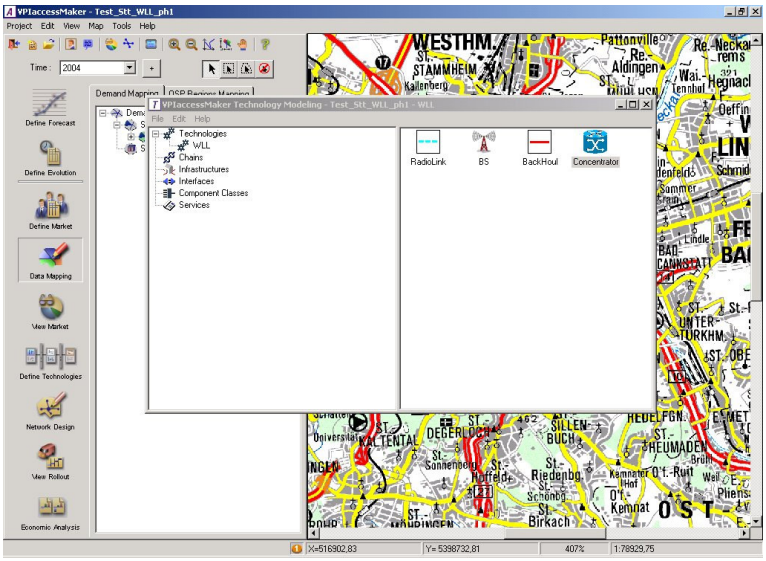
Roll-out results

- ✓ *Calculate automatically all network costs*
- ✓ *Each element has its own set of results*
- ✓ *Multiple roll-out with different technologies*
- ✓ *Bill of materials*
- ✓ *Results are displayed on the GIS and tables / charts*

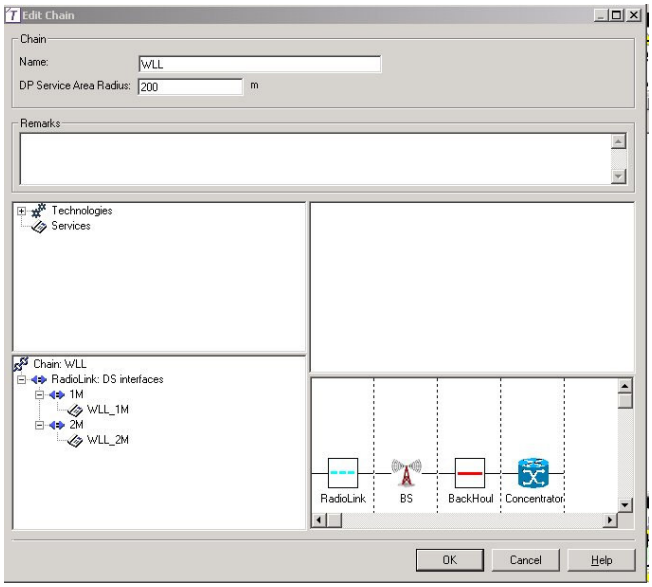


Modeling a PON network deployment in a city center

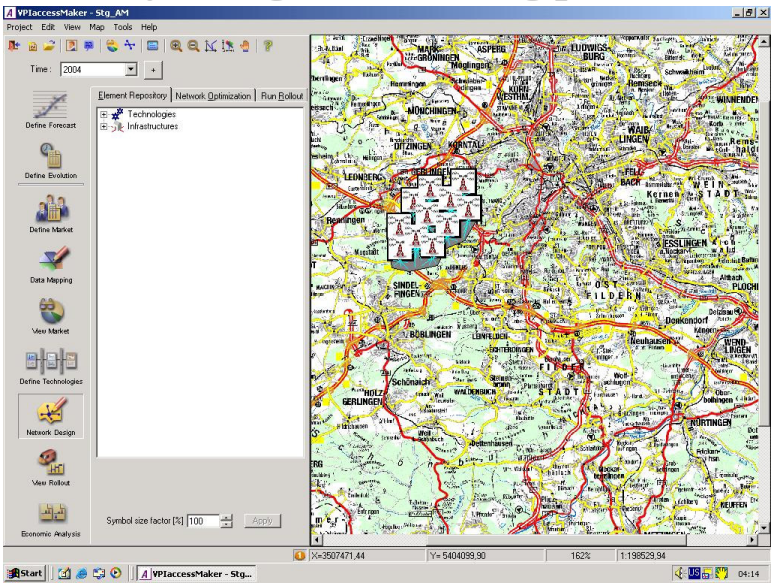
Case study Stuttgart - Technology definition :



Case study Stuttgart - Technology Chain definition

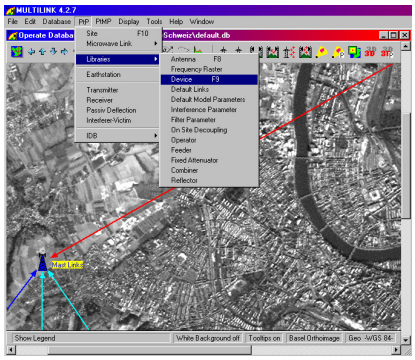


Case study Stuttgart - Planning process :



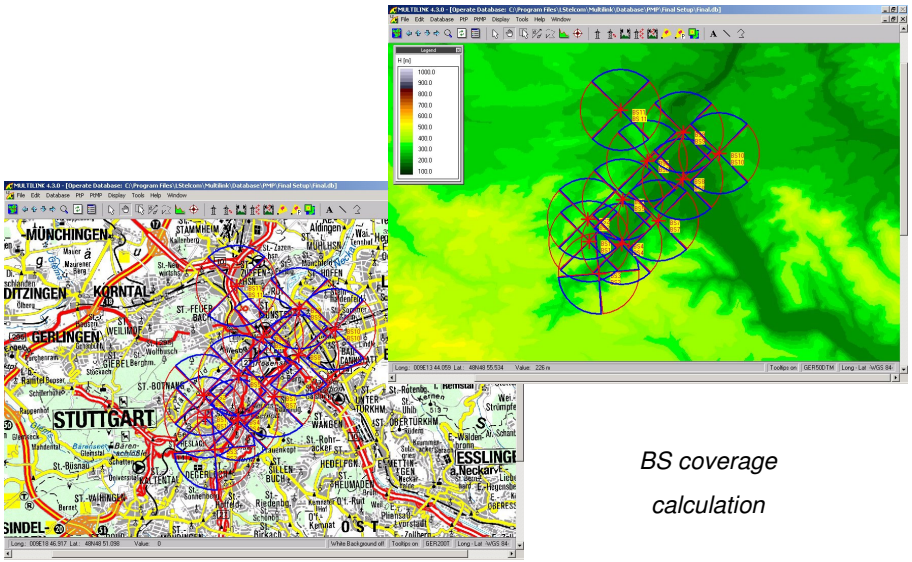
Planning tools - LStelcom MULTIlink

MULTIlink is a complete solution for fast microwave link engineering and designing of PMP/WLL/LMDS networks.



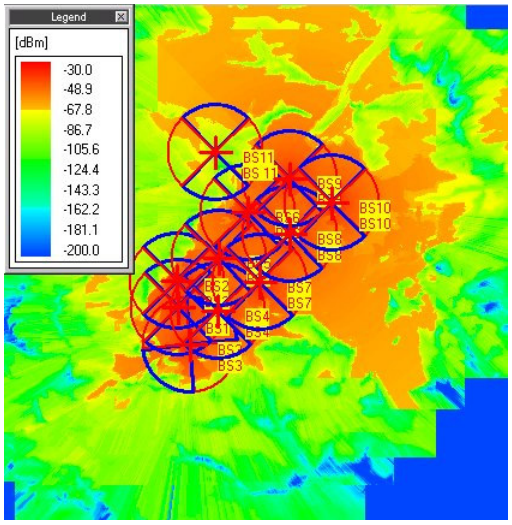
It can be used for planning and optimizing single links (e.g. path loss, coverage and availability calculations) as well as for doing network-wide analysis (e.g. interference calculation, channel assignment).

Case study Stuttgart - Planning wireless :



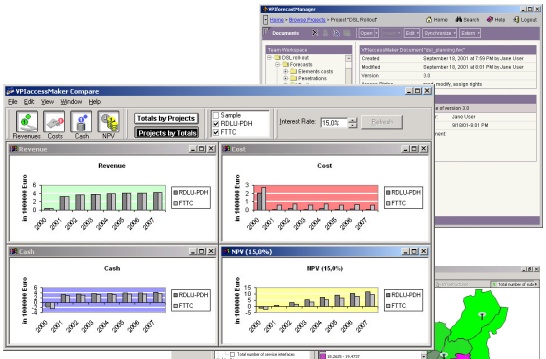
BS coverage calculation

Case study Stuttgart - Planning wireless :



Max server coverage

Planning tools - VPIaccessMaker Economics

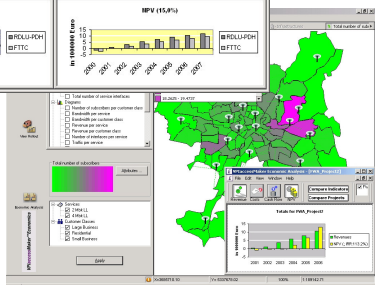


Financial calculations

- ✓ *Project revenues*
- ✓ *Project cost structure*
- ✓ *Project cash-flows*
- ✓ *Project net present value*

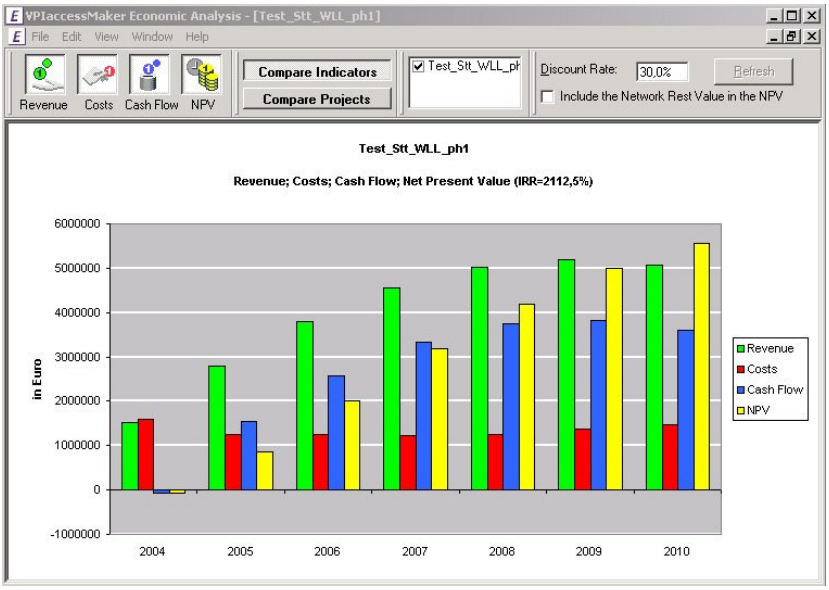
Scenario analysis

- ✓ *Full geographical visualization of the business case*
- ✓ *Specification of network infrastructure*
- ✓ *Various scenarios can be compared in terms of the main economics indexes*
- ✓ *All data exportable to Excel*



Return on investment from a deployment in a metro area

Case study Stuttgart - Economic Analysis :



Summary

- This case study presents the planning process that needs to be performed for evaluation of different broadband solutions in the last mile for urban and suburban areas
- Through careful planning of the different alternatives and comparison of the corresponding economical consequences the best long-term solution is taken.
- The whole case study is performed with NP tools operating on real data. The highly professional NP tools are provided by companies, partners of ITU in the network planning programs and activities.