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.
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 drawn 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:

- 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 – map of the area:

Germany – Stuttgart area
### Case study - area:

<table>
<thead>
<tr>
<th>Name</th>
<th>Mr.</th>
<th>Capital</th>
<th>A (km²)</th>
<th>C 1987-05-25</th>
<th>E 1996-01-01</th>
<th>E 2002-01-01</th>
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<tbody>
<tr>
<td>Freiburg</td>
<td>RB</td>
<td>Freiburg</td>
<td>9,357</td>
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<td>3,862,311</td>
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<td>Tübingen</td>
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### Germany

#### Population data:

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<tr>
<th>Name</th>
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<tbody>
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Case study - services:

Broadband penetration forecasts for the residential market of West European countries

Market share evolution of ADSL, VDSL, FWBB (Fixed wireless broadband) and HFC/cable modem

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
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

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
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).
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.