



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

Session 2


Broadband Wireless Access

*Ignat Stanev
ITC, Bulgaria*

What is broadband ?

Recommendation I.113 of the ITU Standardization Sector defines broadband as :

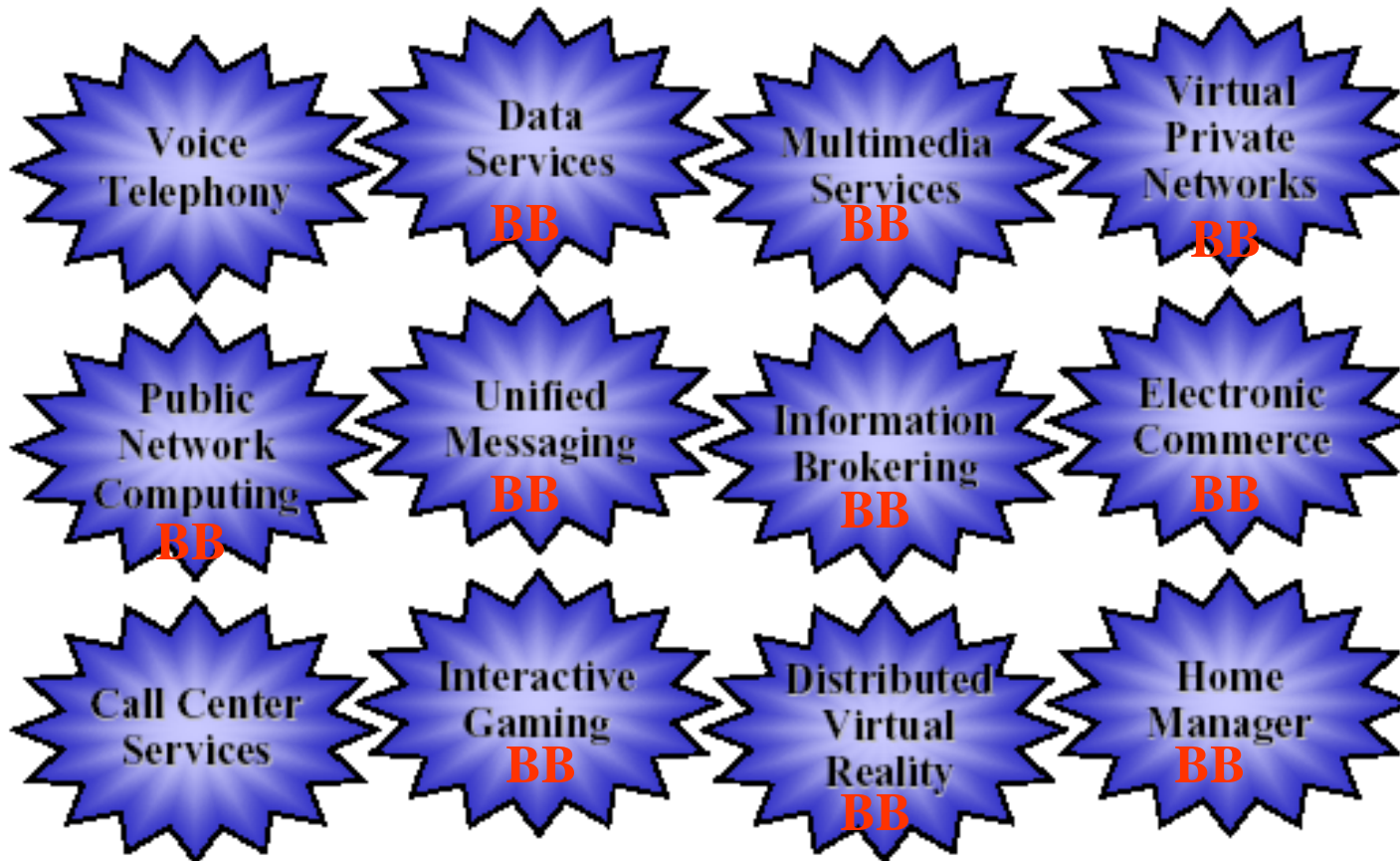
Transmission capacity that is faster than primary rate Integrated Services Digital Network (ISDN) at 1.5 or 2.0 Megabits per second (Mbits)

<p>Mobile</p> 	<p>i271L: Number of mobile cellular subscribers with access to data communications at low speeds (below 256kbit/s). Typically referred to as 2.5G.</p>
<p>Fixed broadband</p>	<p>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.</p>



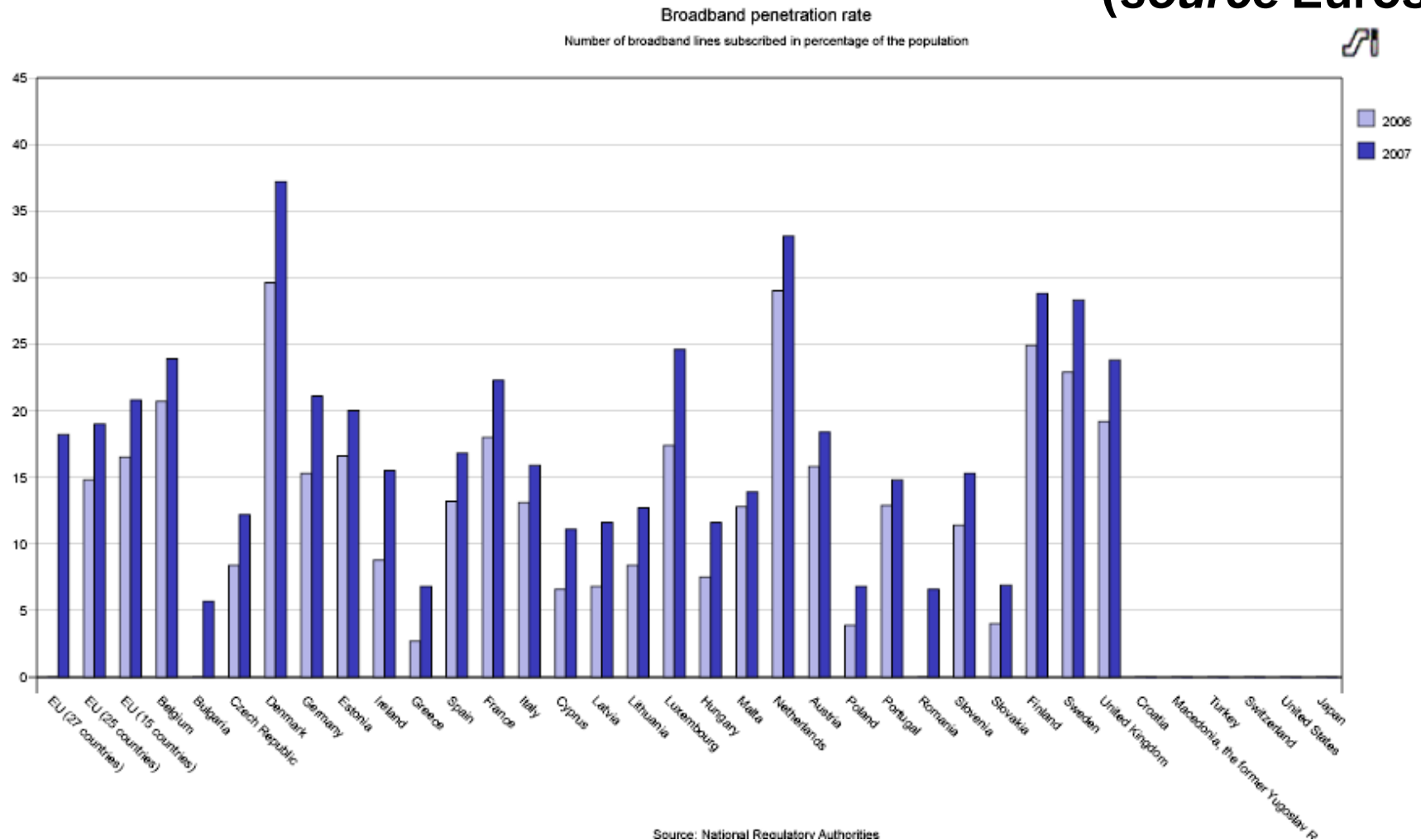
Why broadband ?

Definition of future services in 12 main groups, most of them require broadband access :



Broadband customers (penetration)

(source Eurostat)



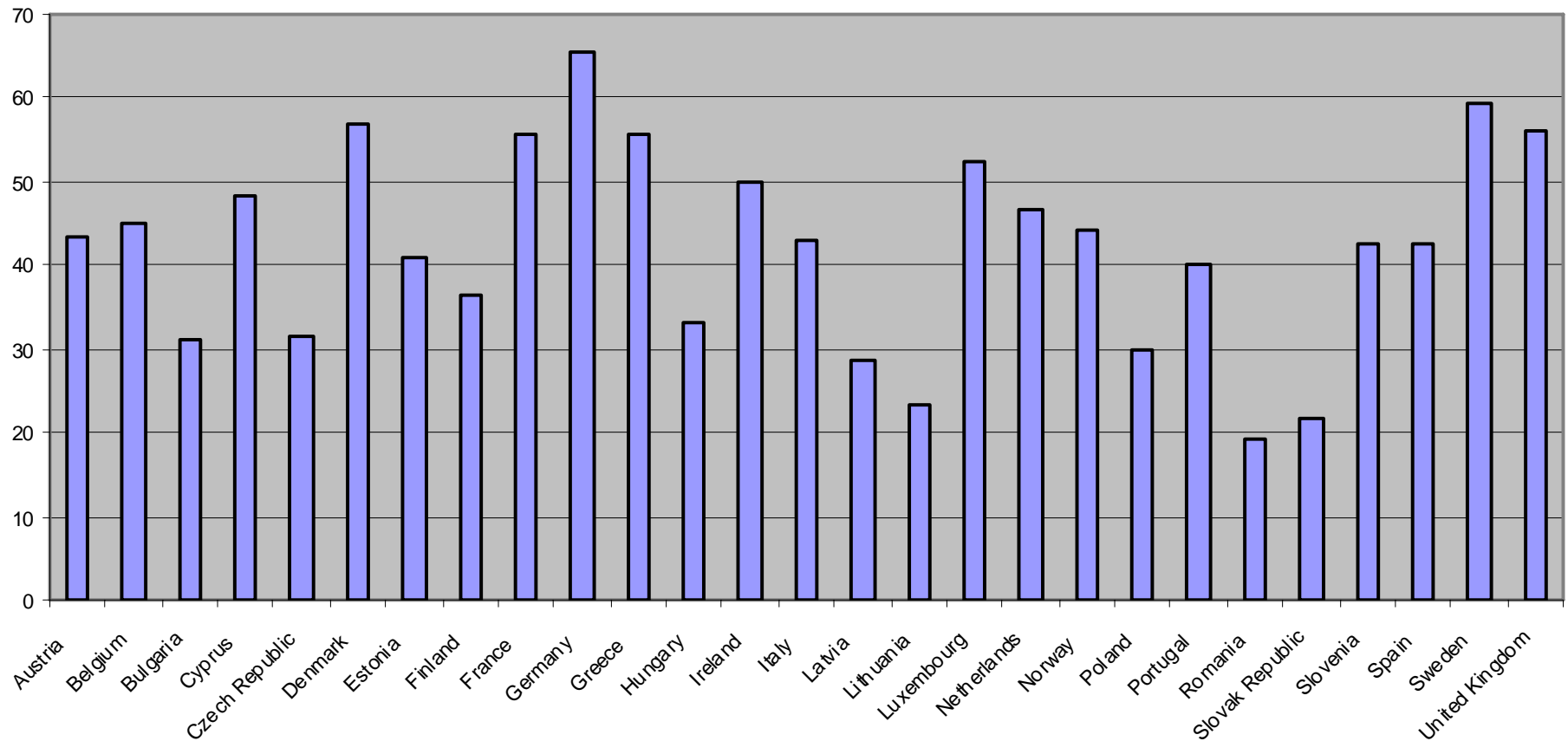
The number of broadband connections related to population. This indicator shows how widely broadband access to the internet has spread in the countries on the general level, not specifying by user group.

Broadband customers

Telephone density per 100 inhabitants for EU countries, 2006

Main (fixed) telephone lines per 100 inhabitants

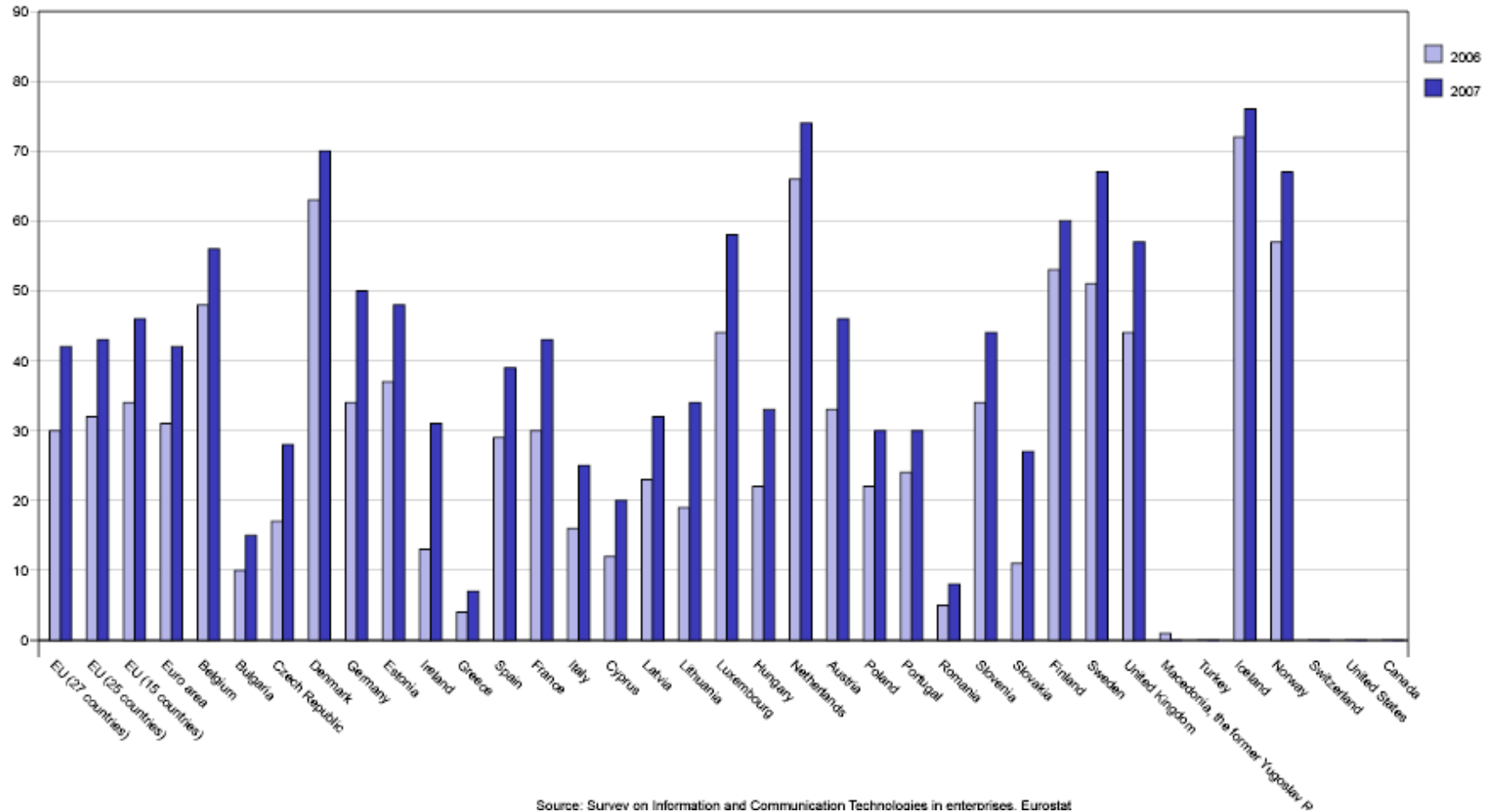
Source ITU Database 2007



Broadband customers (residential)

Share of households having a broadband connection

(source Eurostat)



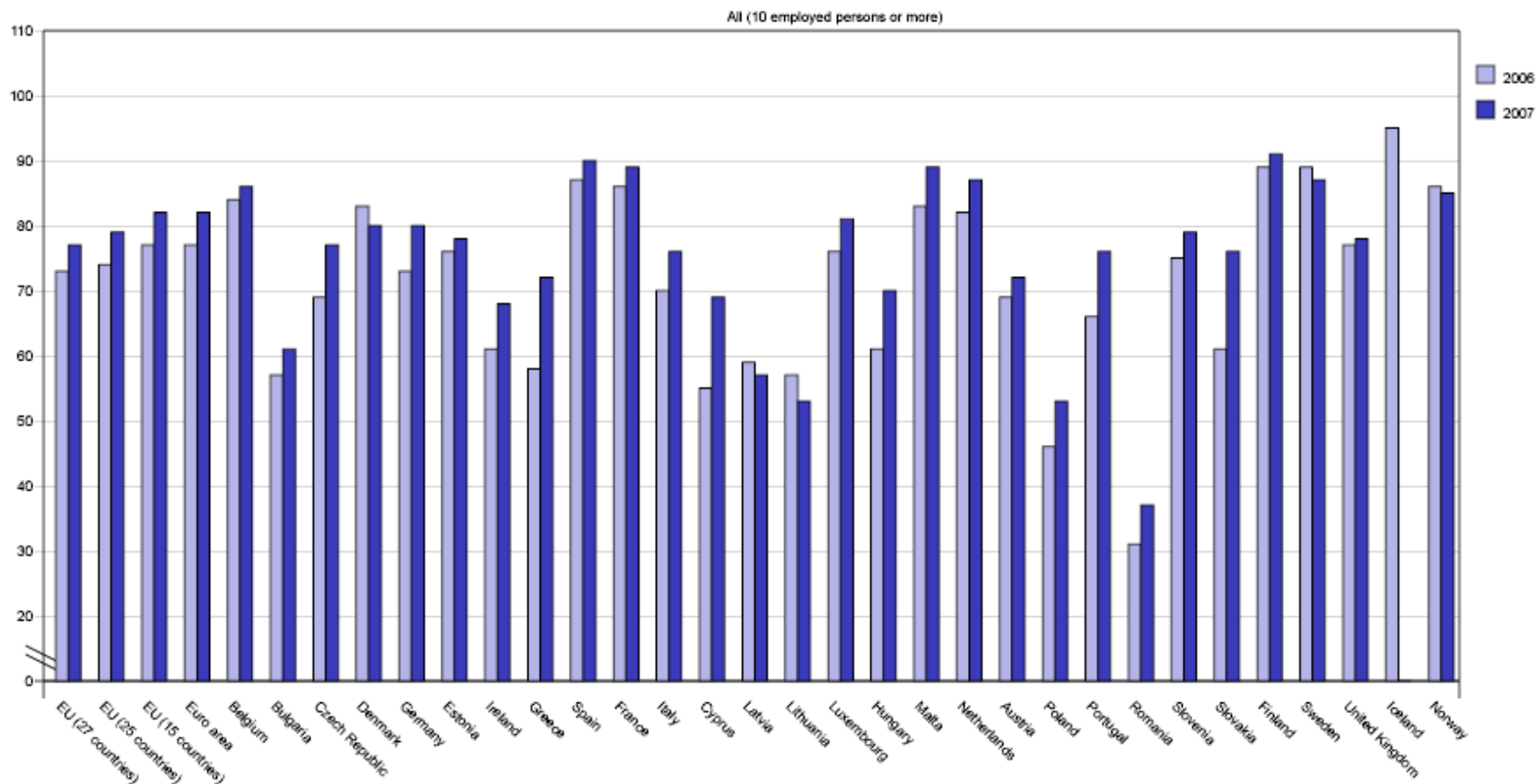
Source: Survey on Information and Communication Technologies in enterprises. Eurostat

The availability of broadband is measured by the percentage of households that are connectable to an exchange that has been converted to support xDSL technology, to a cable network upgraded for Internet traffic, or to other broadband technologies; it covers all households having at least one member in the age group

Broadband customers (business)

(source Eurostat)

Share of enterprises having a broadband connection

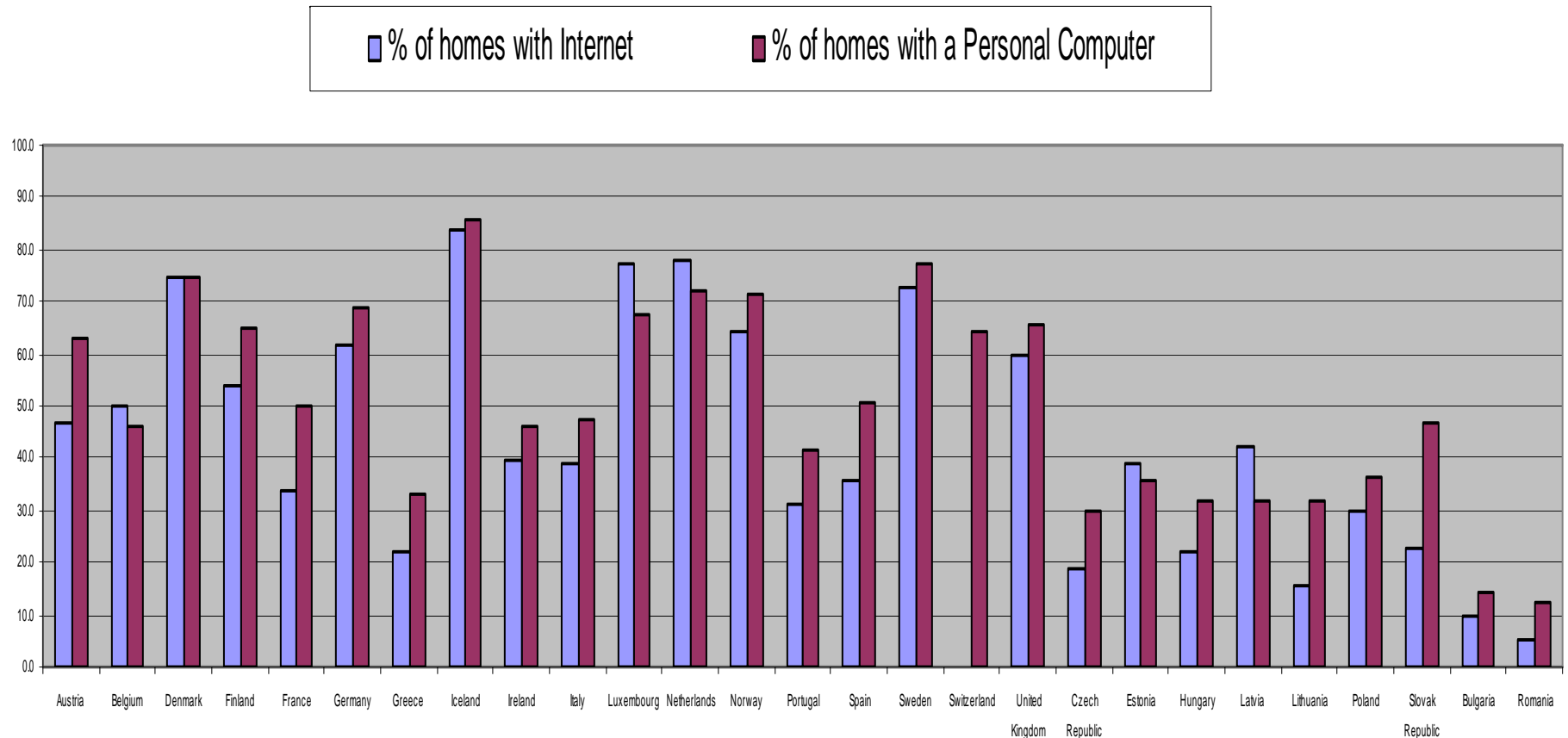


Source: Survey on Information and Communication Technologies in enterprises. Eurostat

Enterprises with 10 or more full-time employees; all forms of Internet use are included; broadband is measured by the percentage of enterprises connected to an exchange that has been converted to support xDSL technology, to a cable network upgraded for Internet traffic, or to other broadband technologies .

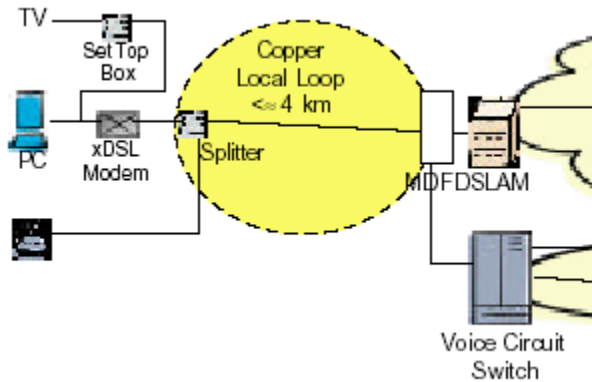
Broadband customers – influence of ICT

ICT presented by % of homes with Personal Computer and with Internet for EU countries, 2005



Source ITU Database 2006

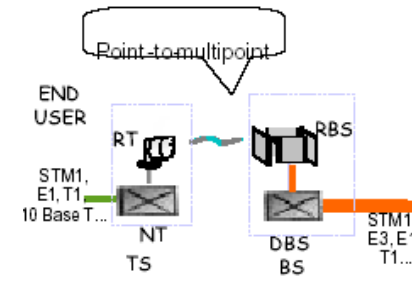
Broadband access technologies



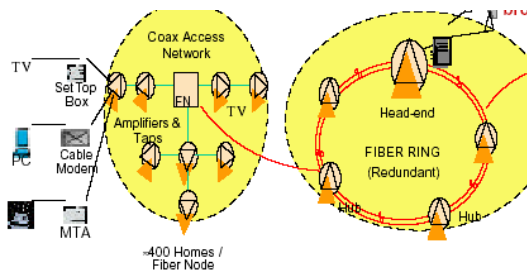
xDSL



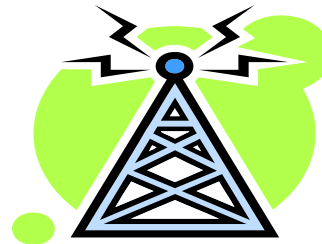
SAT



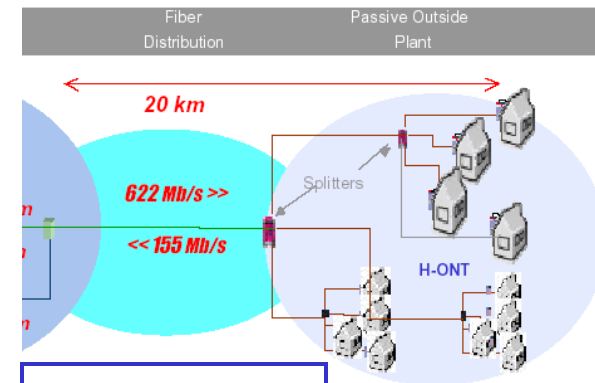
Wireless



HFC

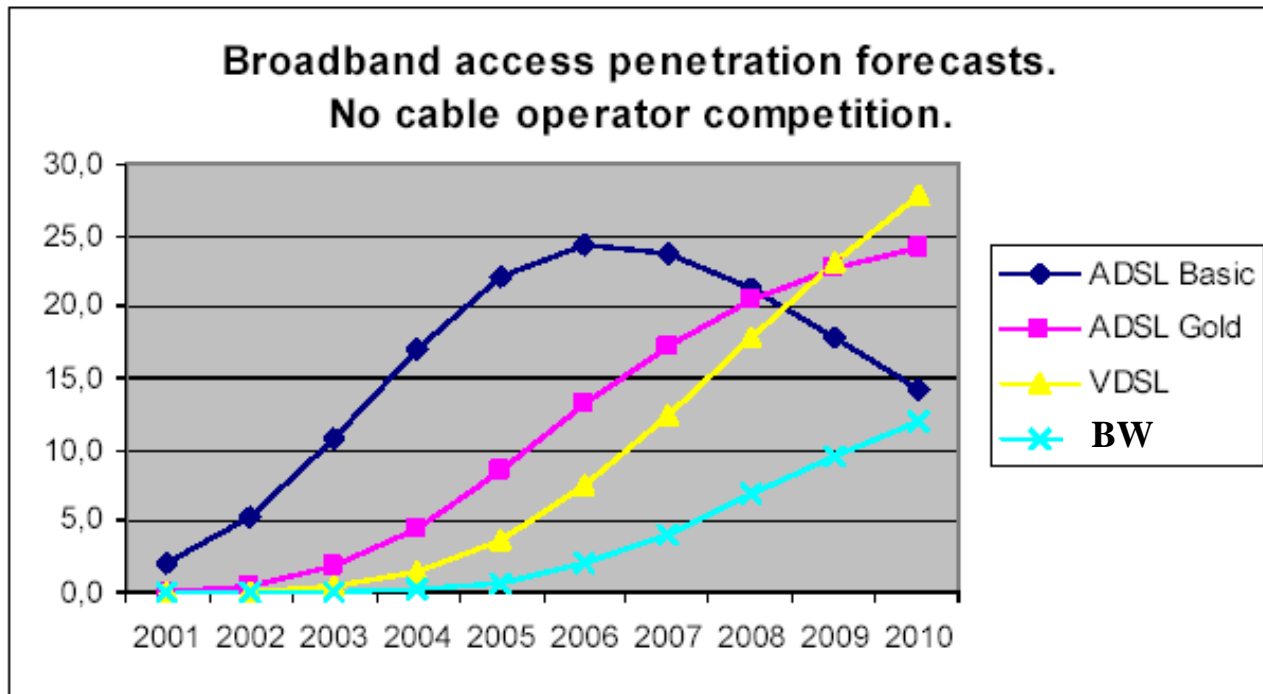


Power line



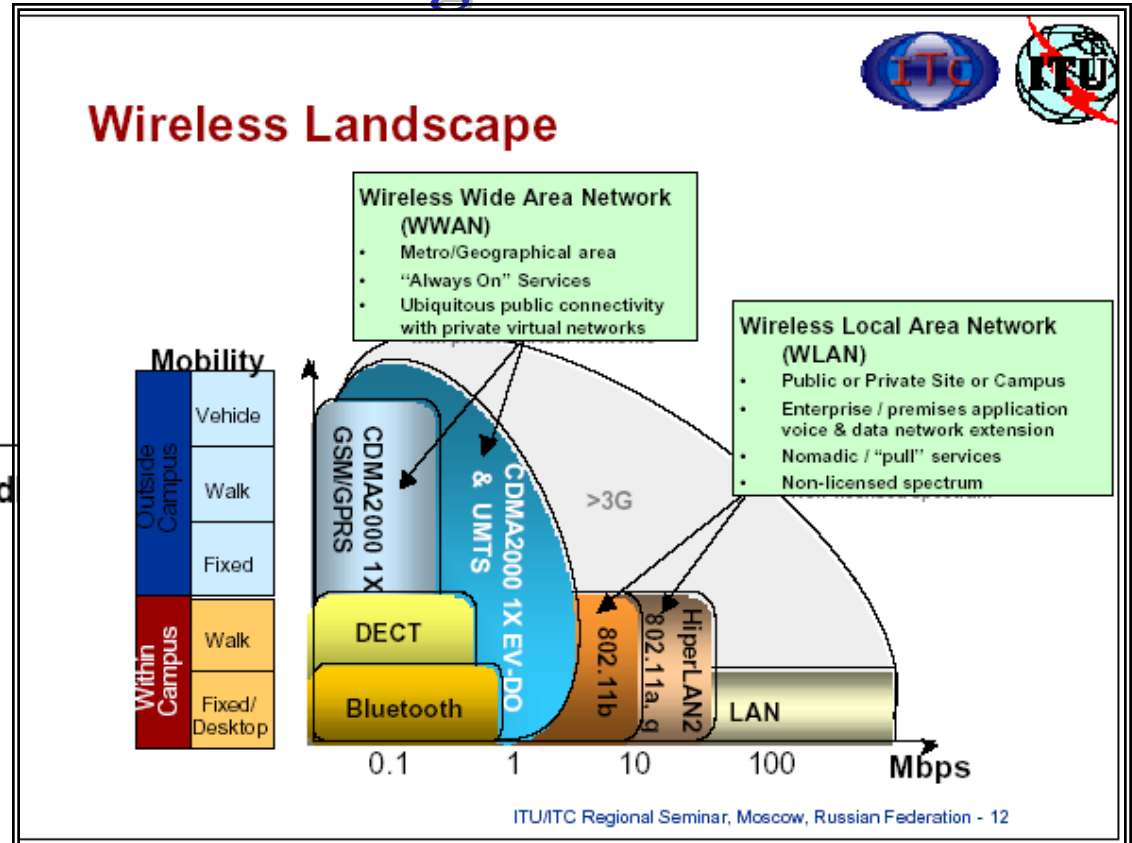
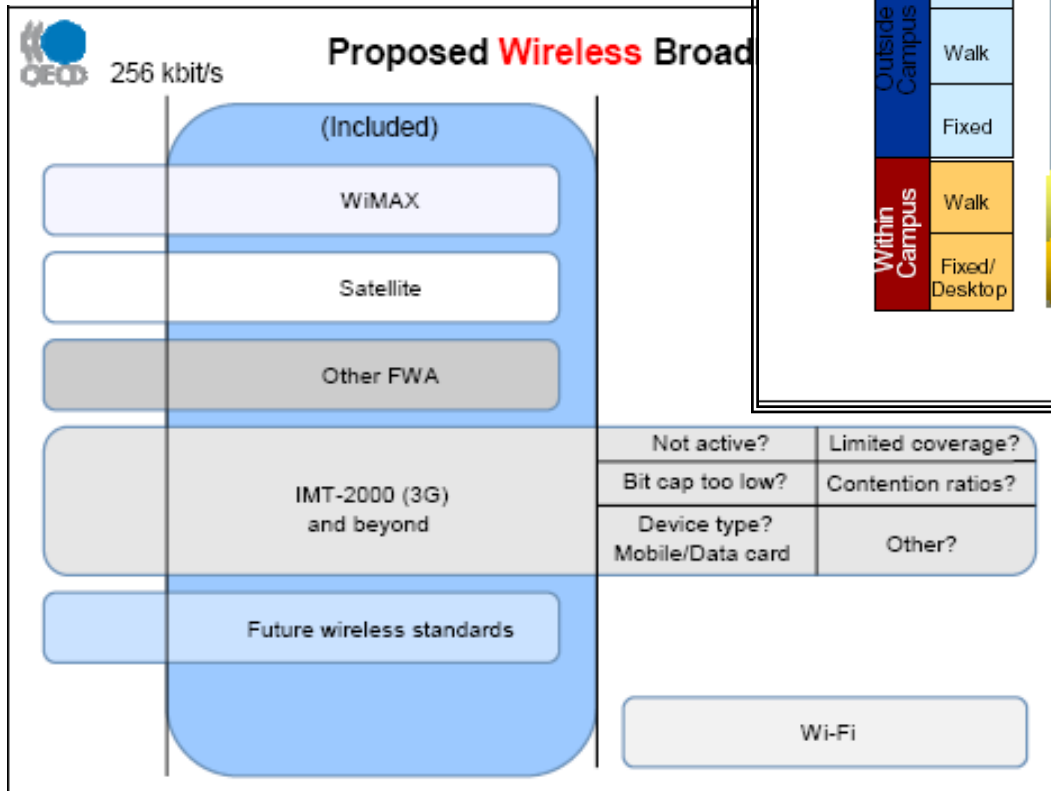
FTTx

Broadband access technologies



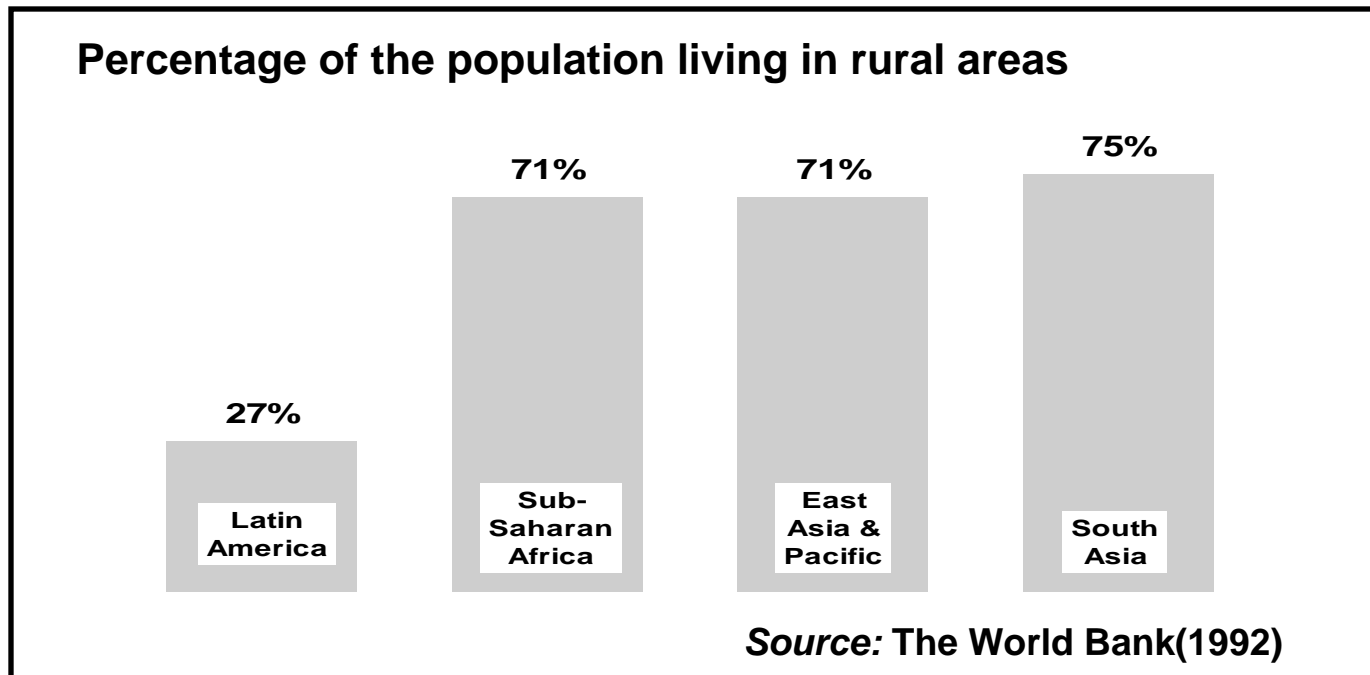
Broadband Wireless This general term could refer to any of the high-speed wireless technologies currently available, such as 802.11a, 802.11b, or 802.11g for WLANs (**WiFi**), or the emerging 802.16 standards for WMANs (**WiMAX**) (*source CNET*)

Broadband access technologies - Wireless



Rural and remote areas telecom case

- ❖ usually not interesting from business point of view
- ❖ telecom development should be supported by government



Findings of the United Nations : all growth in population will concentrate in urban areas, no growth in rural areas

Rural population and teledensity

1 : 4,3

1 : 3,4

1 : 1,5

1 : 1,05

	Population of large cities as %	Large city teledensity [%]	Rural areas teledensity [%]	Overall teledensity [%]
Low Income	6,0	9,26	2,15	2,54
Lower Middle	5,8	24,84	7,30	8,77
Upper Middle	16,1	30,77	21,10	22,94
High Income	10,8	57,49	54,83	55,21
Africa	12	6,42	1,39	1,99
Americas	13,6	34,8	21,72	11,39
Asia	4,8	25,97	6,94	7,84
Europe	10,9	48,24	30,19	31,98
Oceania	17,8	45,97	36,77	38,38
WORLD	7,7	17,4	25,25	9,20

ITU WTID 2002



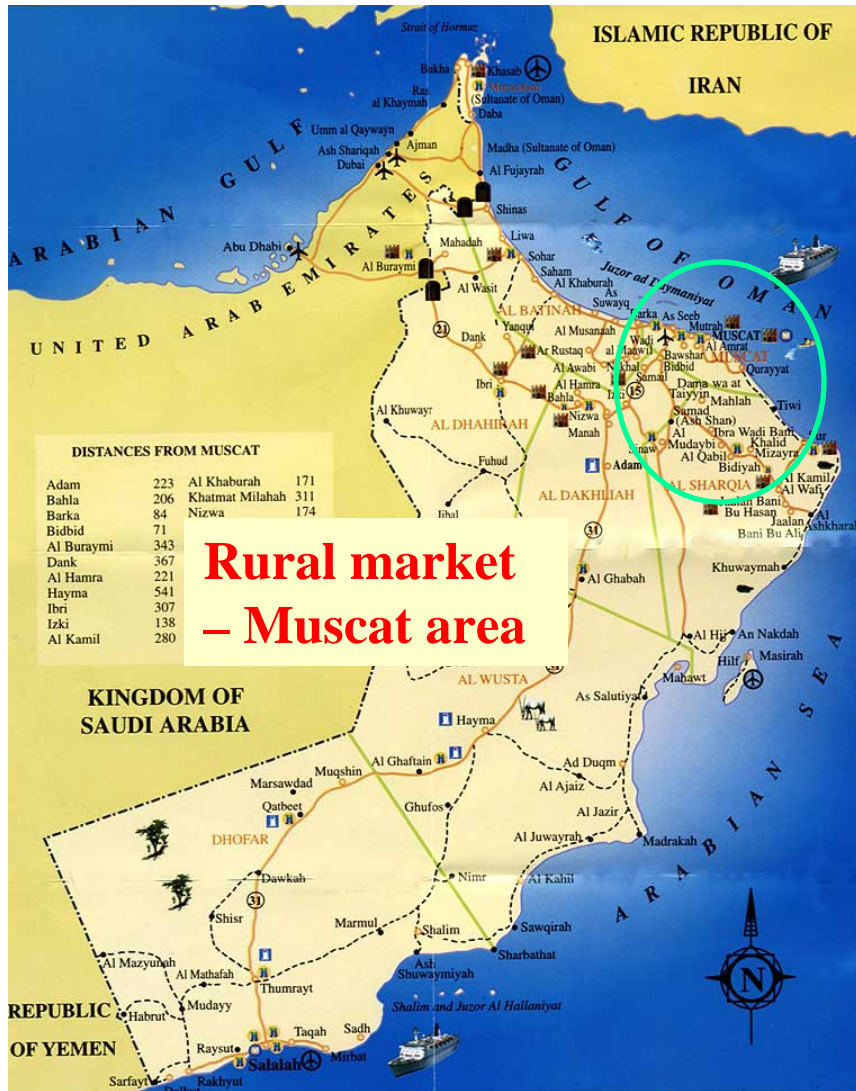
EU Project - Broadband for All

- To develop the network technologies and architectures allowing a generalised and affordable availability of broadband access to European users, including those in **less developed regions, peripheral and rural areas.**
- Optimised access technologies, as a function of the operating environment, **at affordable price** allowing for a generalized introduction of broadband services in Europe including less developed regions

Case studies on broadband wireless access

- **The case studies present the planning process that needs to be performed for evaluation of wireless broadband access**
- **Planning includes market definition and optimization of the access network. First access network is optimized regardless of the terrain characteristics, then network is analysed for coverage and result is adjusted correspondingly**
- **The case studies are planned with professional NP tools, available through ITU partners**

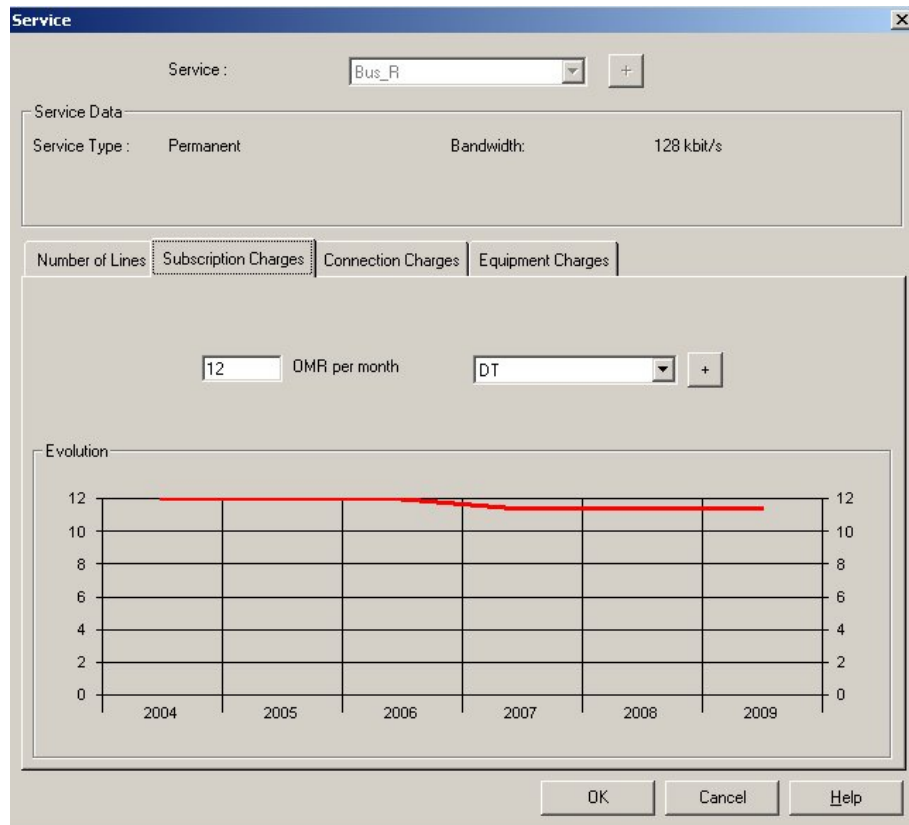
Oman – Test Case study



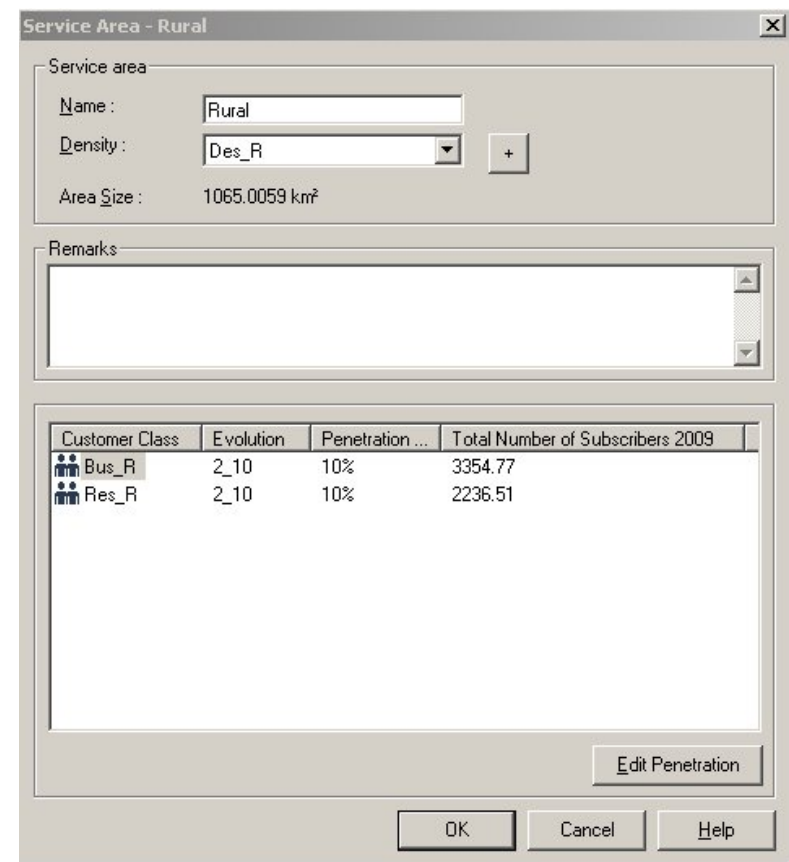
ITU/BDT Arab
Regional
Workshop on
“Wireless
Network
Evolution”
Muscat-Oman, 03-05
May 2004



Case study Oman - Market forecasting:



- **Permanent service –**
Residential - connection at 64 Kbit/s
Business - connection at 128 Kbit/s



- **Market based on inhabitants / households per sq. km. and penetration from 2% to 10%**

Case study Oman - Technology definition :

The screenshot displays the VPIaccessMaker software interface for a rural network design project in Oman. The main window, titled "VPIaccessMaker - CS_Oman_Rural", features a menu bar (Project, Edit, View, Map, Tools, Help) and a toolbar. A vertical toolbar on the left includes icons for "Define Forecast", "Define Evolution", "Define Market", "Data Mapping", "View Market", "Define Technologies", "Network Design", "View Rollout", and "Economic Analysis". The central workspace shows a map with a network overlay, including a legend for "Technologies" and "Infrastructures". A "Node Element - BS" dialog box is open, showing a table of capacity options:

Name	Capacity
64k	64 kbit/s
128k	128 kbit/s

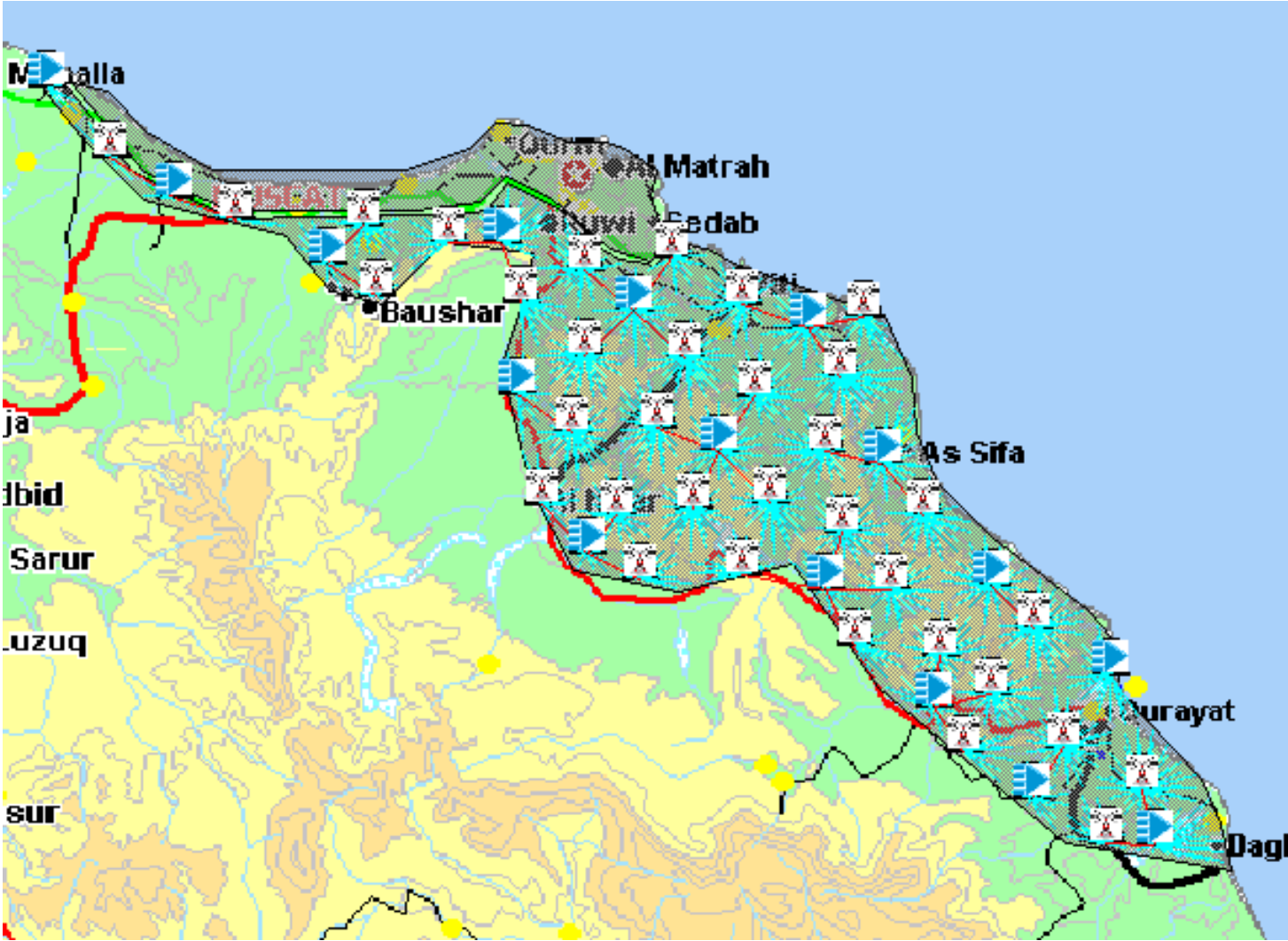
The dialog also includes "Add...", "Remove", and "Edit..." buttons, and a "Down Stream:" section with a table and "Up Stream:" section with a dropdown menu set to "STM1".

A "Link Element - Rlink" dialog box is also open, showing configuration parameters:

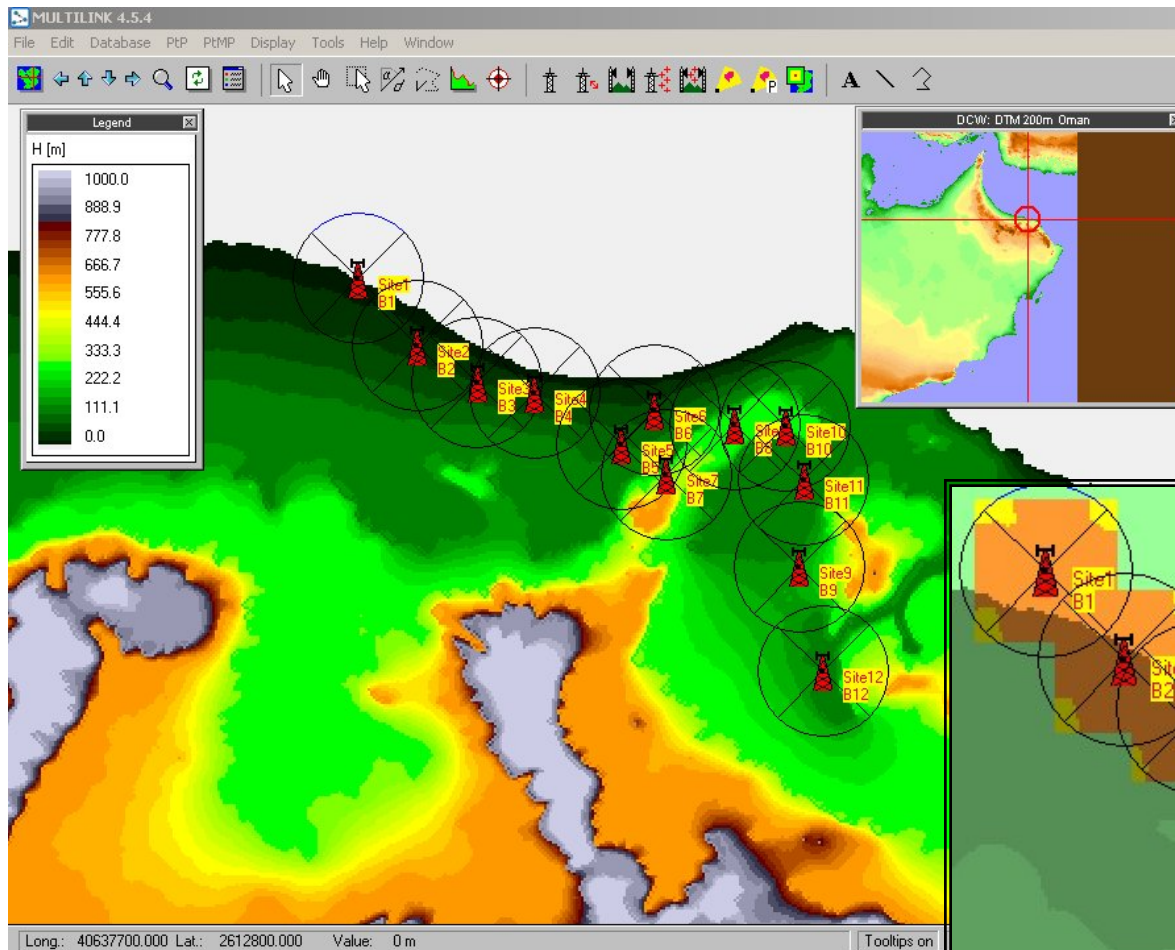
- Maximum Length: 5000 m
- Detour Factor: 1
- Link Model: Star

The background map shows geographical features and network elements, with labels for "Alzair Dayi", "Alailla", "As Sifa", and "Alaqisi". The status bar at the bottom indicates coordinates: X=650618.09 and Y= 2605257.19.

Case study Oman - Planning process :

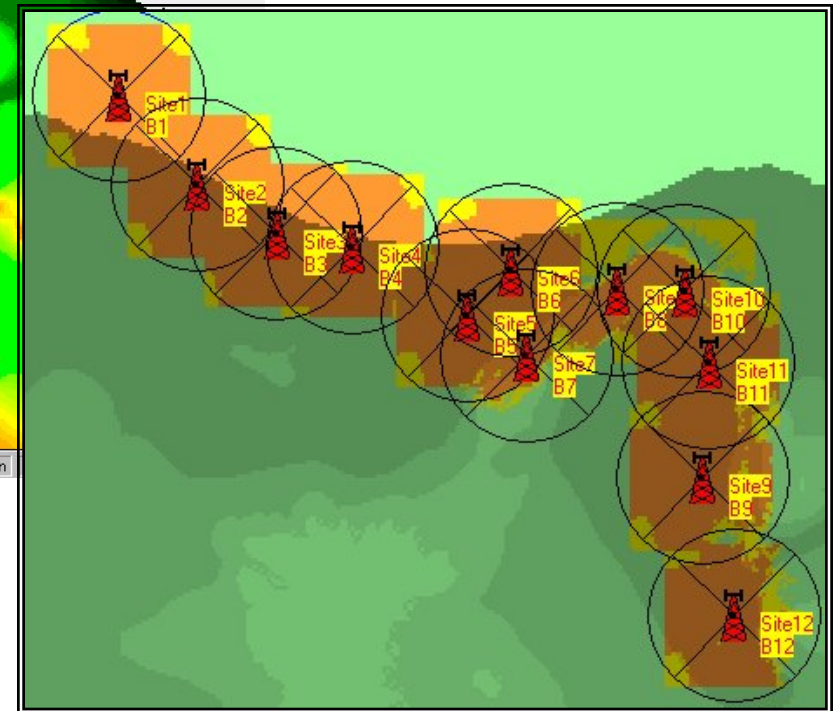


Case study Oman - Planning wireless :



*BS coverage
calculation*

*Max server
coverage*



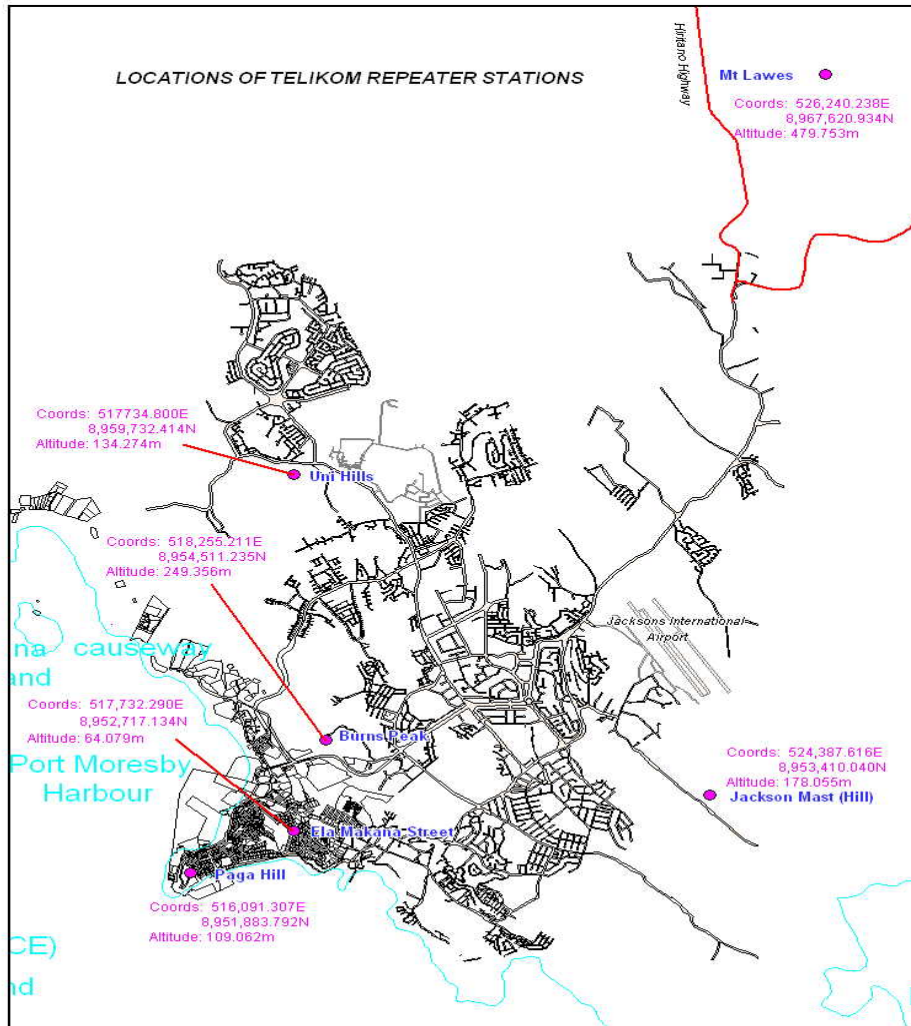
Case study – Papua New Guinea :



TELIKOM planning team



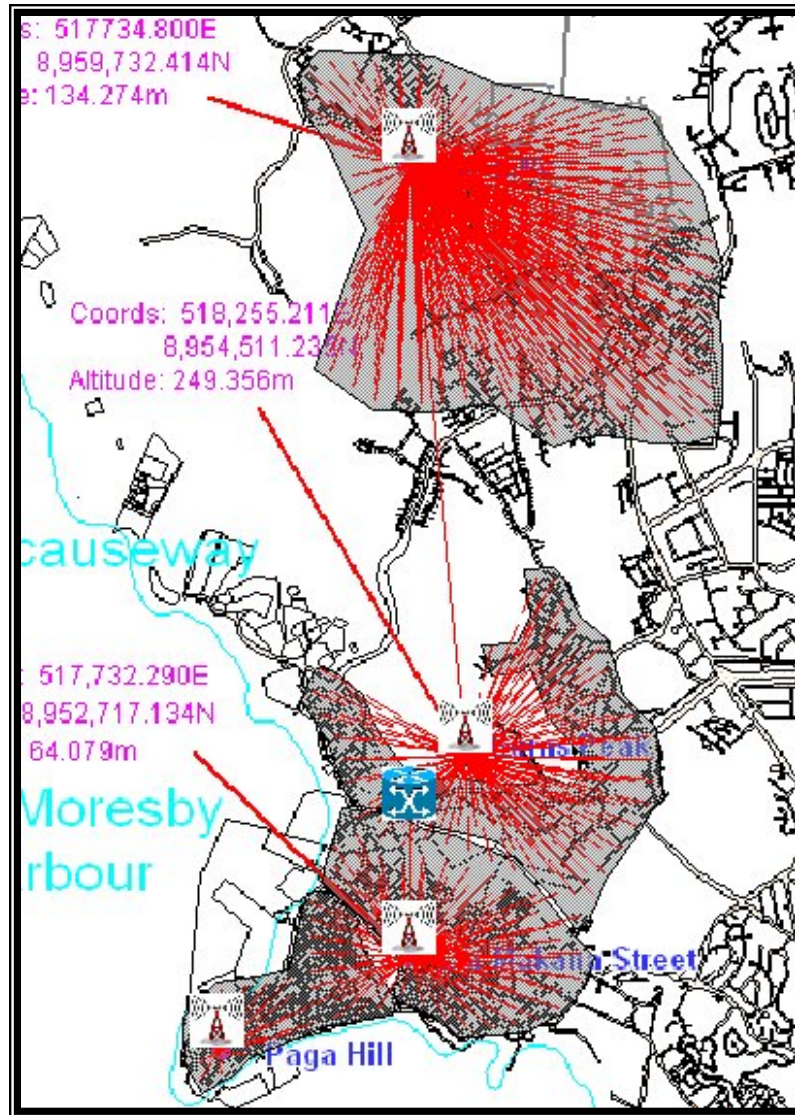
Case study Papua New Guinea – Suburban and rural area :



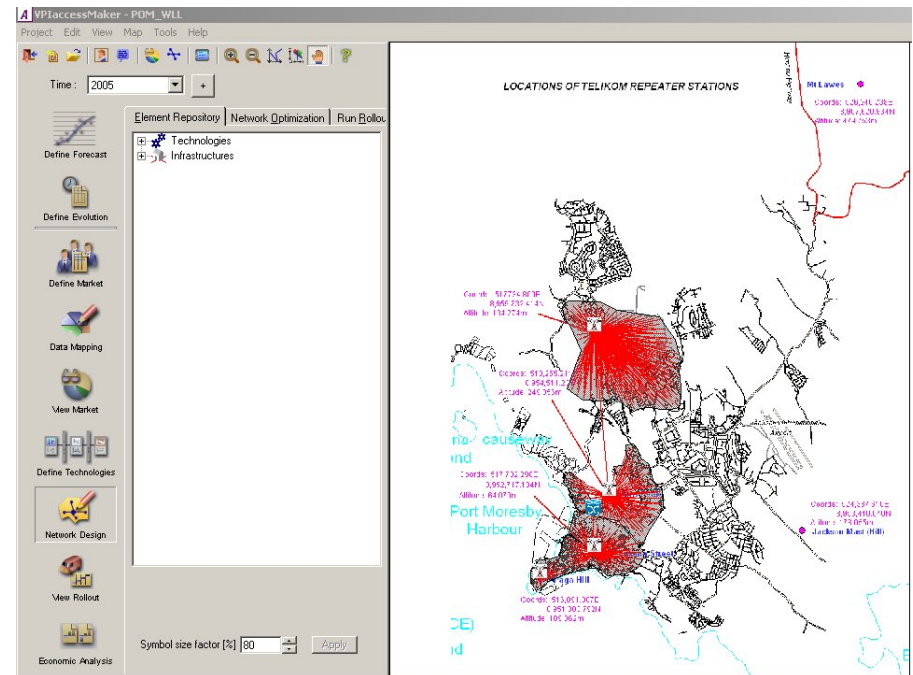
User per sector: **254**
Sector payload: **18 Mbps**
Radius per BS: **3 KM**
Frequency of Operation: **2.3,
2.4 GHz**
Bandwidth: **3.5 MHz**

*TELIKOM planning -
wireless BB access*

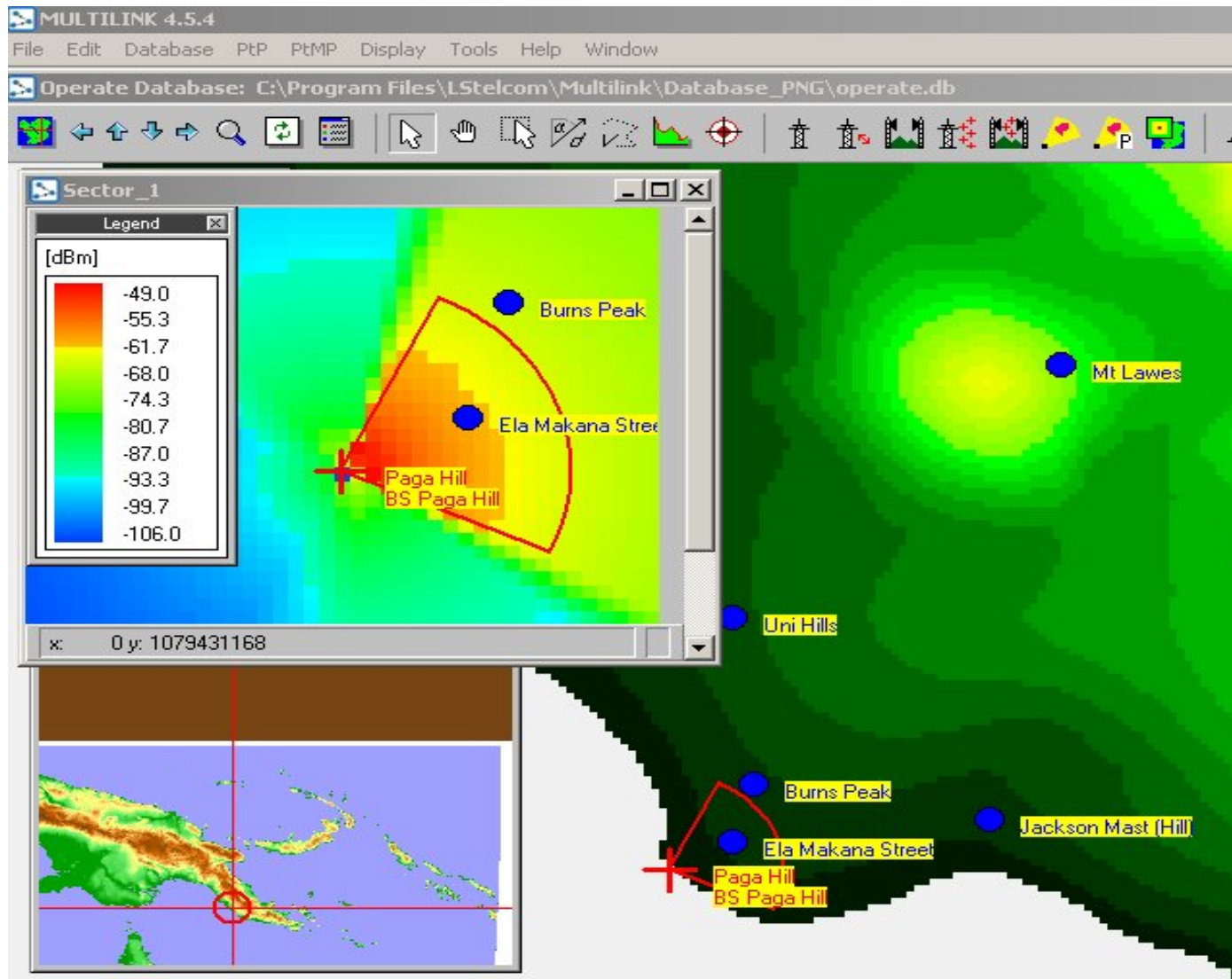
Case study Papua New Guinea – Planning process :



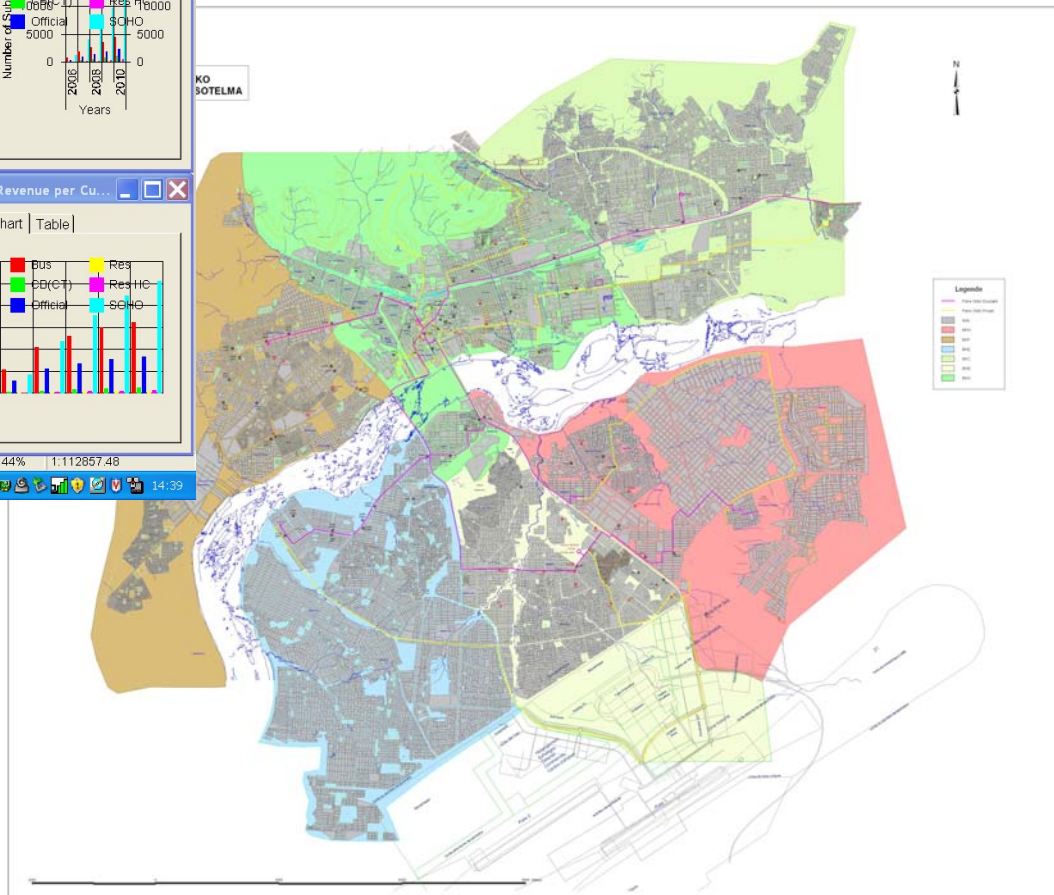
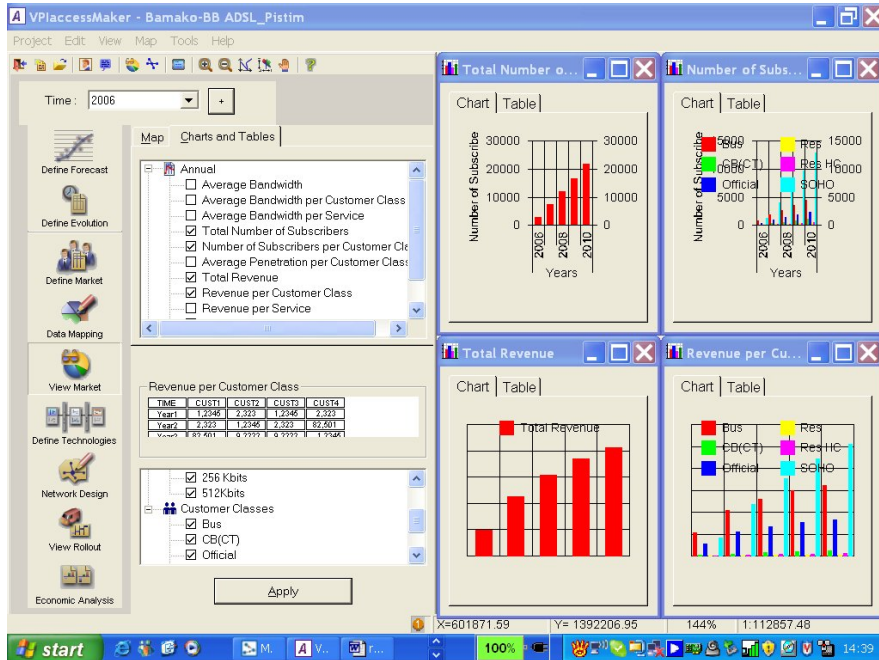
optimization of service areas



Case study Papua New Guinea – Planning wireless :



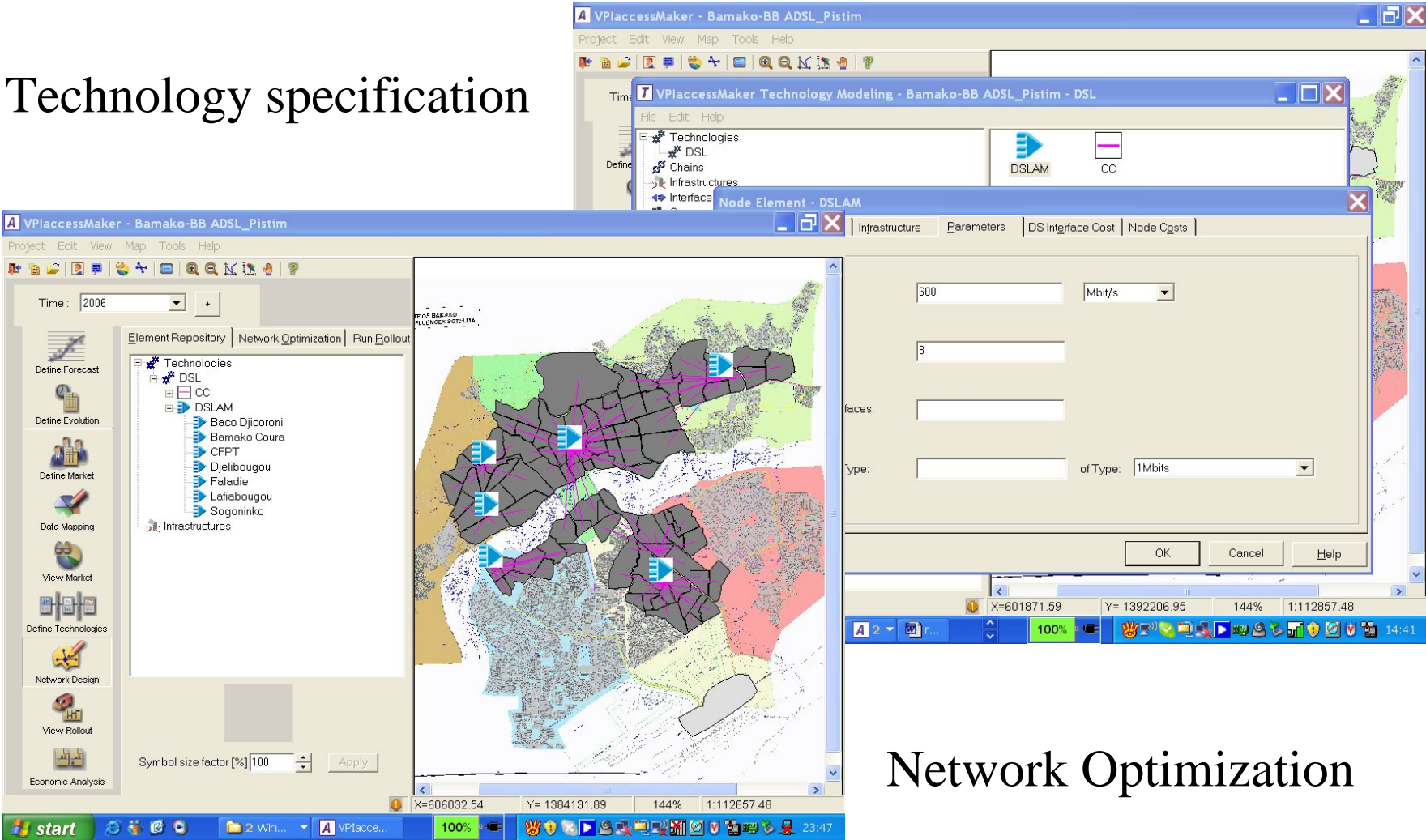
Case study Bamako - suburban area :



Wireline xDSL
and
WiMAX overlay

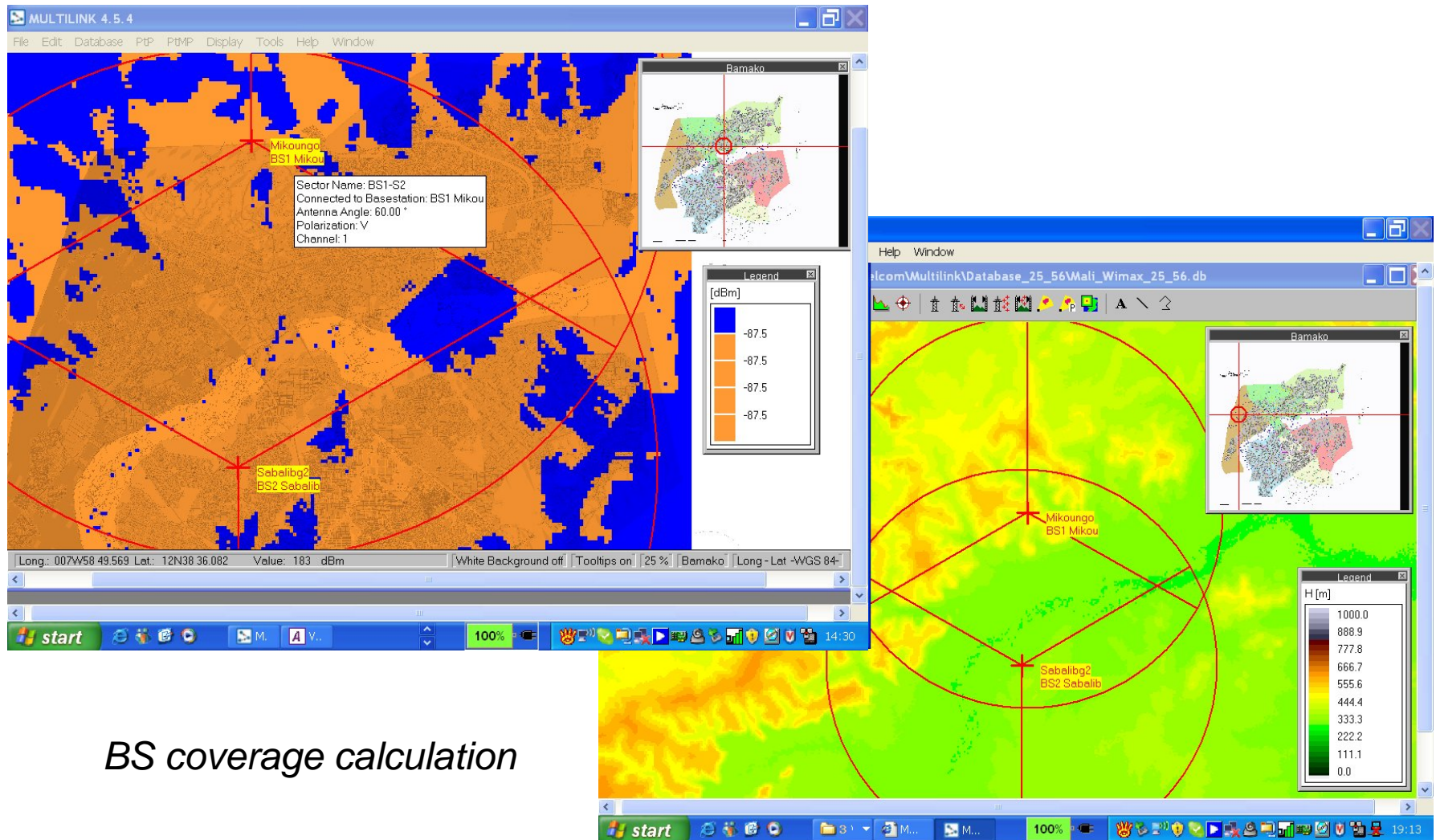
Case study Bamako - Planning process :

Technology specification



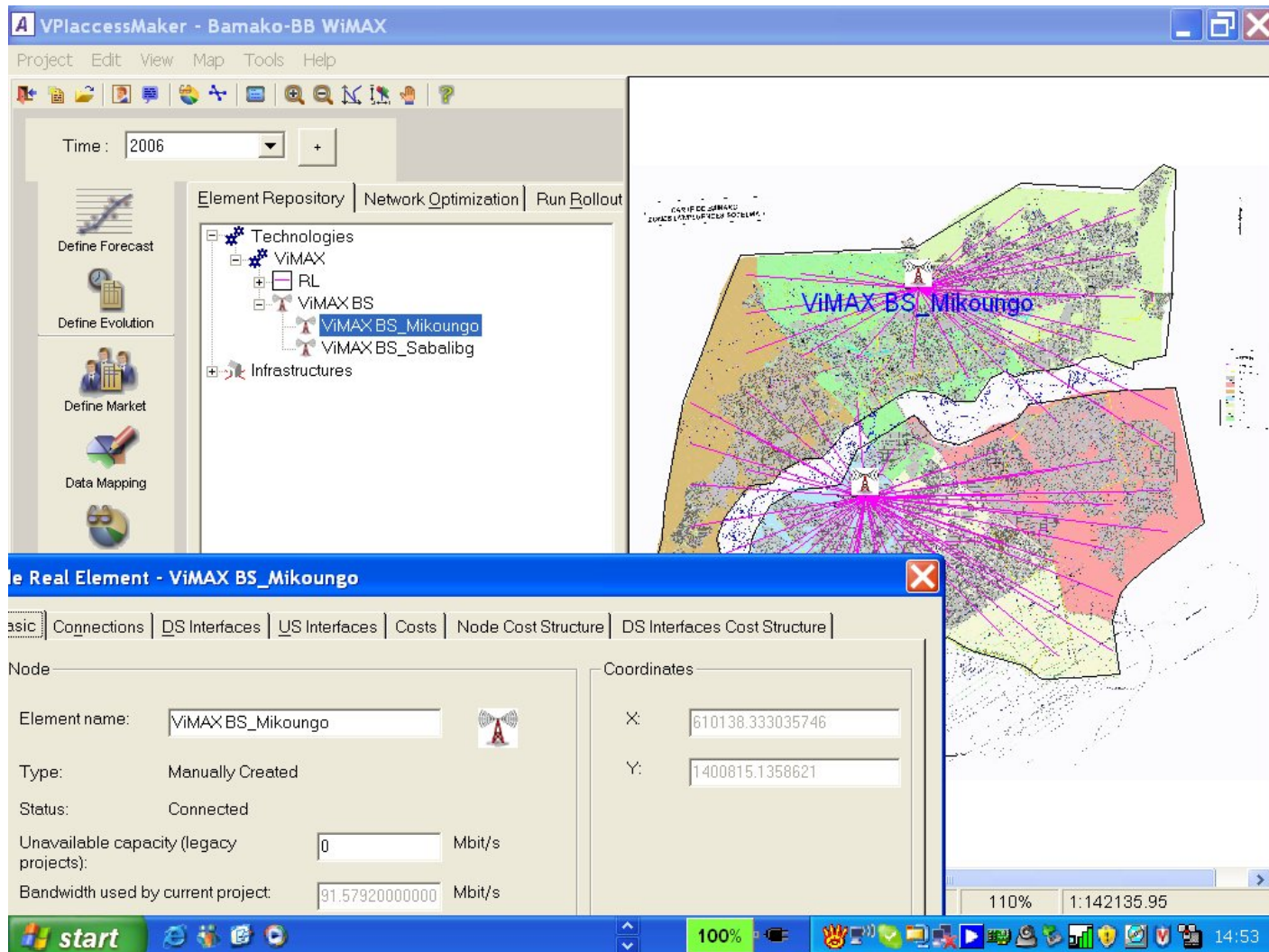
Network Optimization

Case study Bamako - Planning wireless :

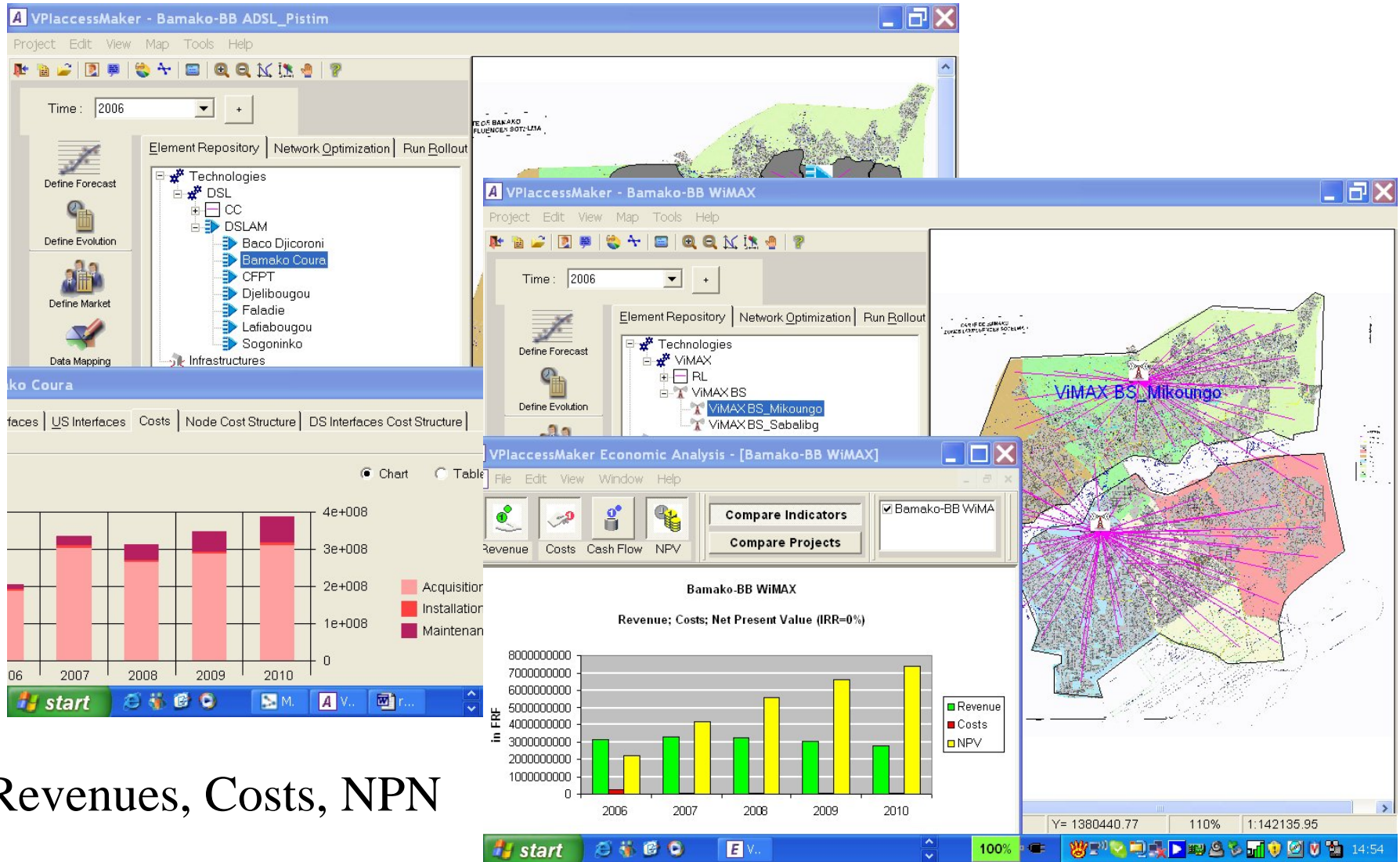


BS coverage calculation

Case study Bamako – Wireless access network :



Case study Bamako - Economic Analysis :



Revenues, Costs, NPN

Case study Tbilisi suburbs - mountain rural area :

Wireline xDSL

vs.

Wireless WiMAX



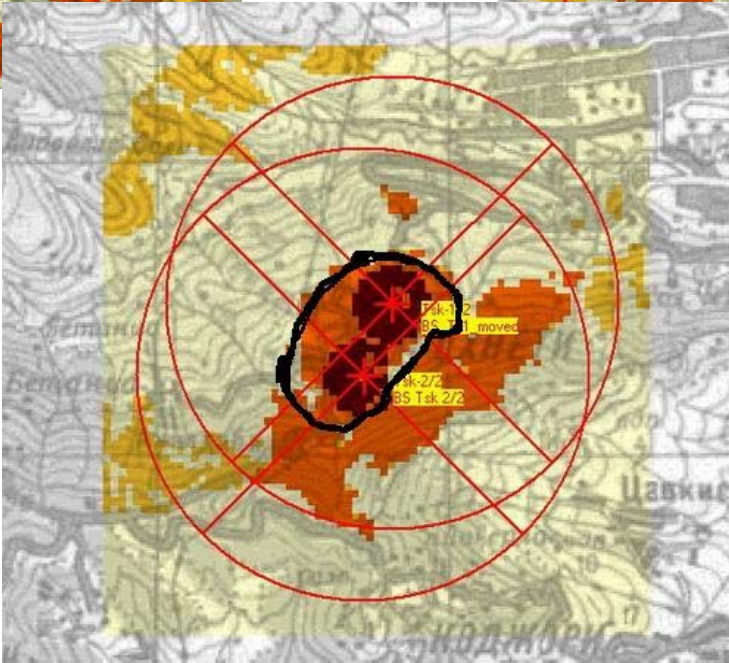
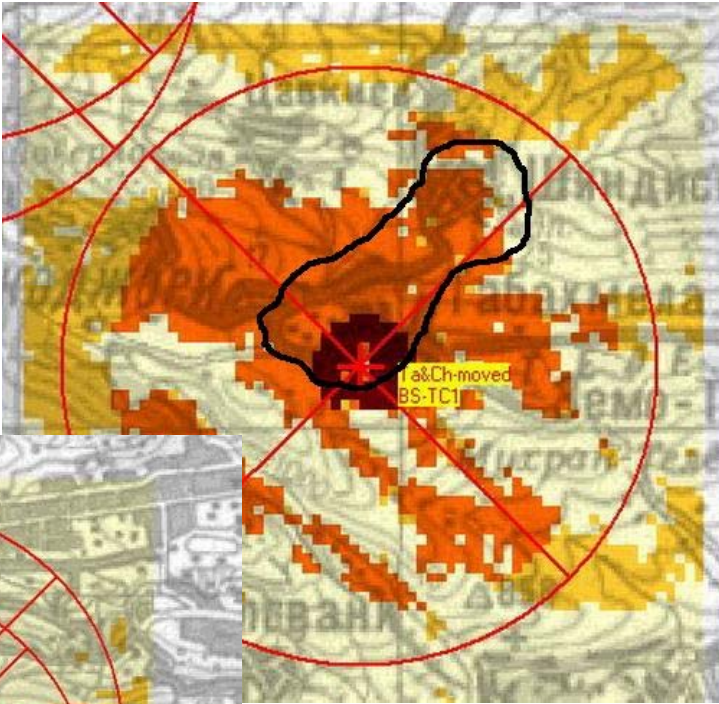
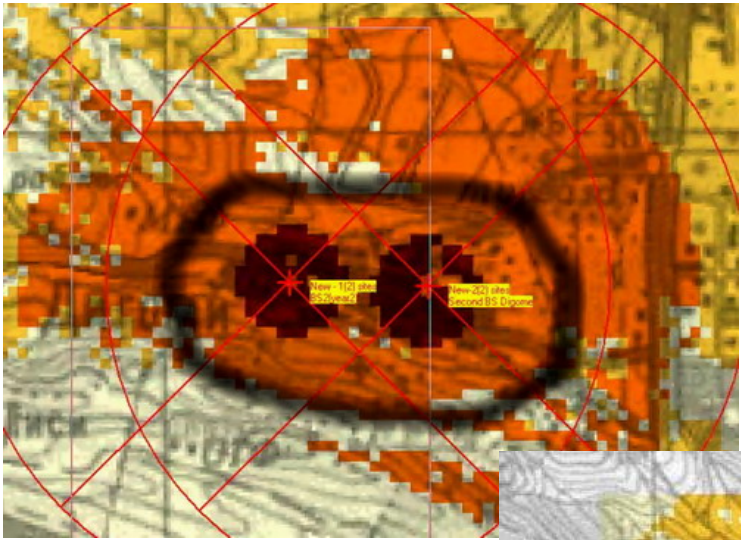
Results for xDSL

Case study Tbilisi suburbs – Wireless access network :



Results for
wireless
(WiMAX)

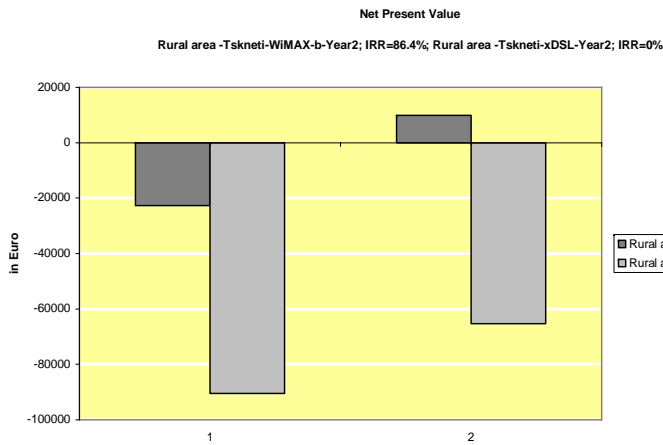
Case study Tbilisi - Planning wireless :



BS coverage calculation

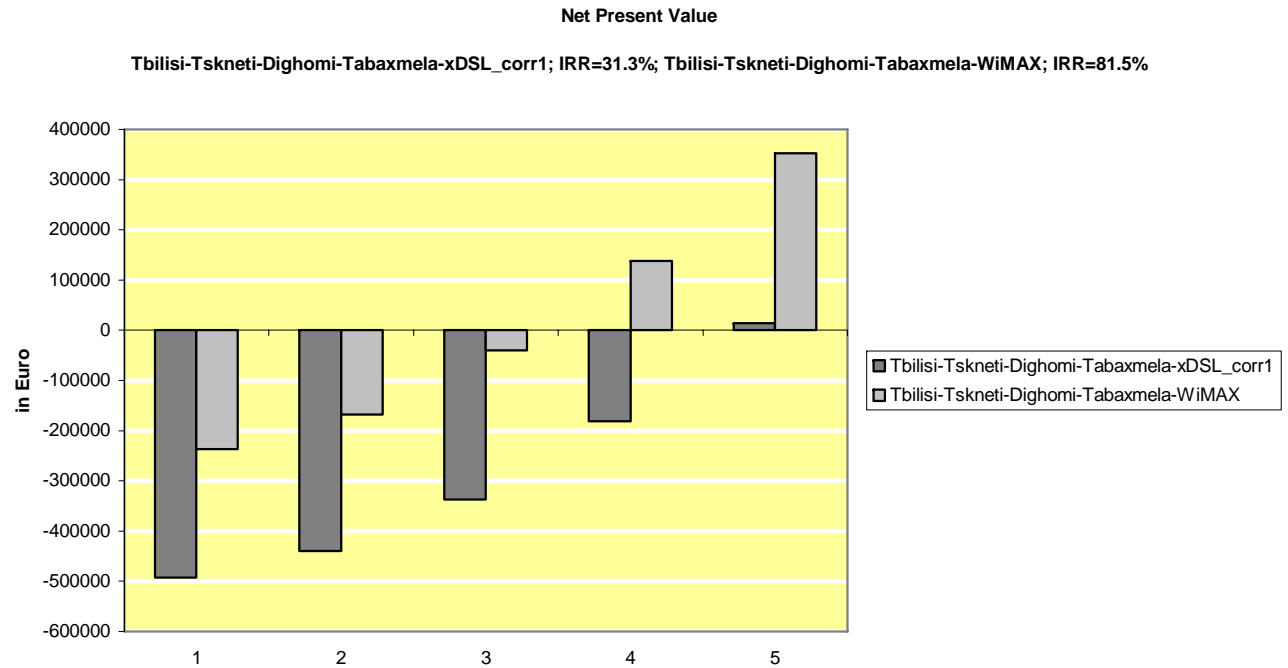
Results for Year +2

Case study Tbilisi - Economic Analysis :



*Results for 2
year period*

Revenues, Costs, NPN

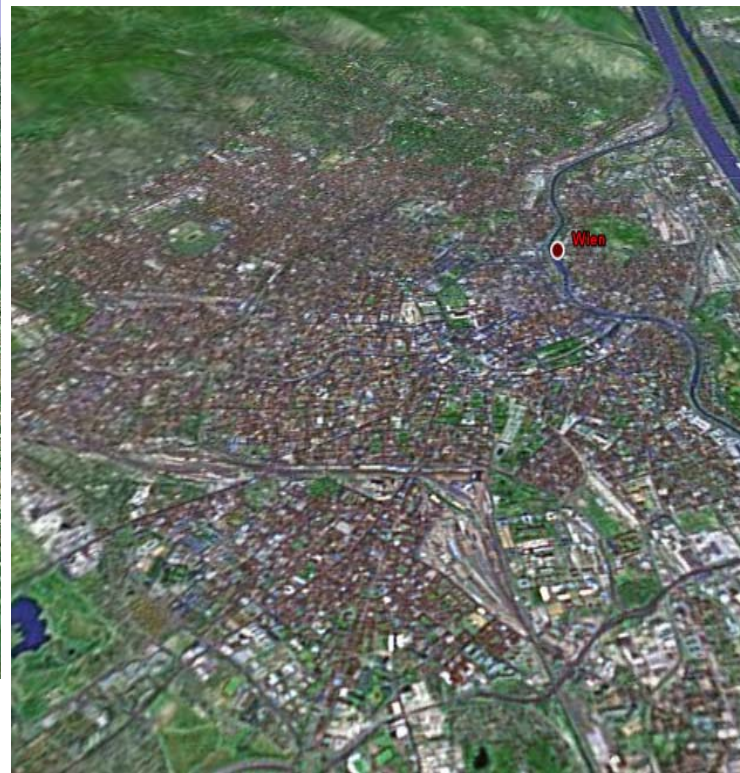
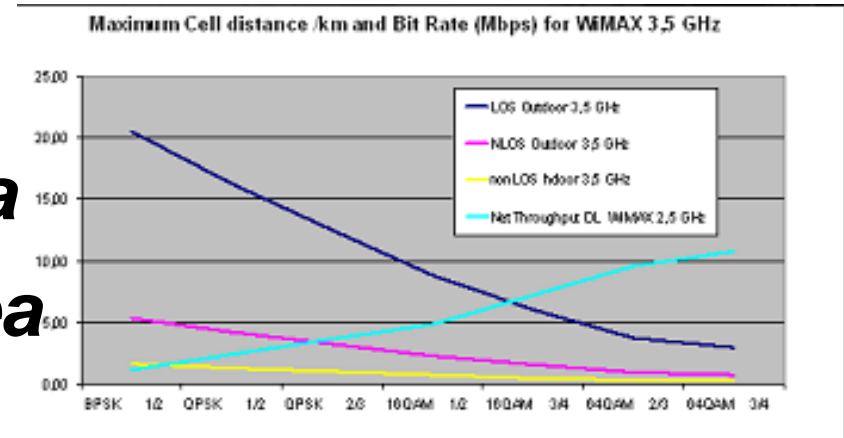


*Results for 5
year period*

Case Study on BWA for rural and urban areas

Two different Scenarios

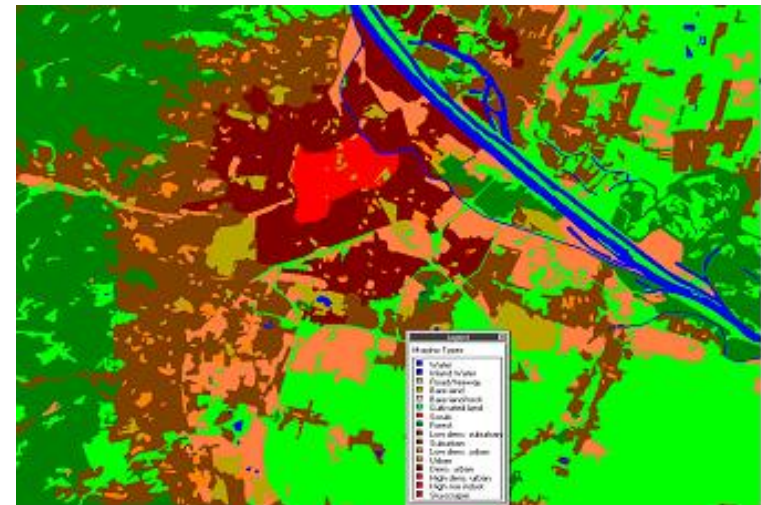
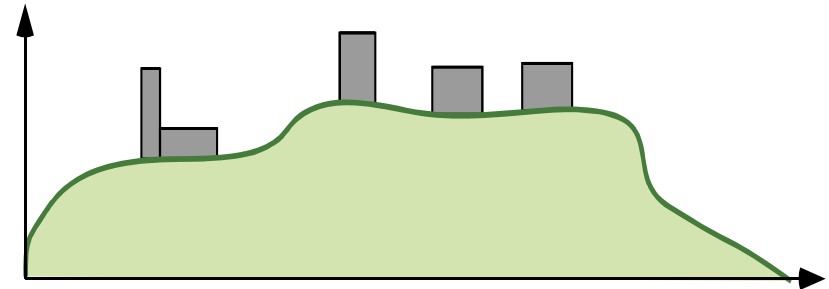
- Scenario 1: *Rural Area*
- Scenario 2: *Urban Area*



**Presented on ITU
Regional Network
Planning Workshop
with Tool Case
Studies for the
Arab Region Cairo,
Egypt, 16 – 27 July
2006**

Planning Guideline Parameters - “Rural Area”

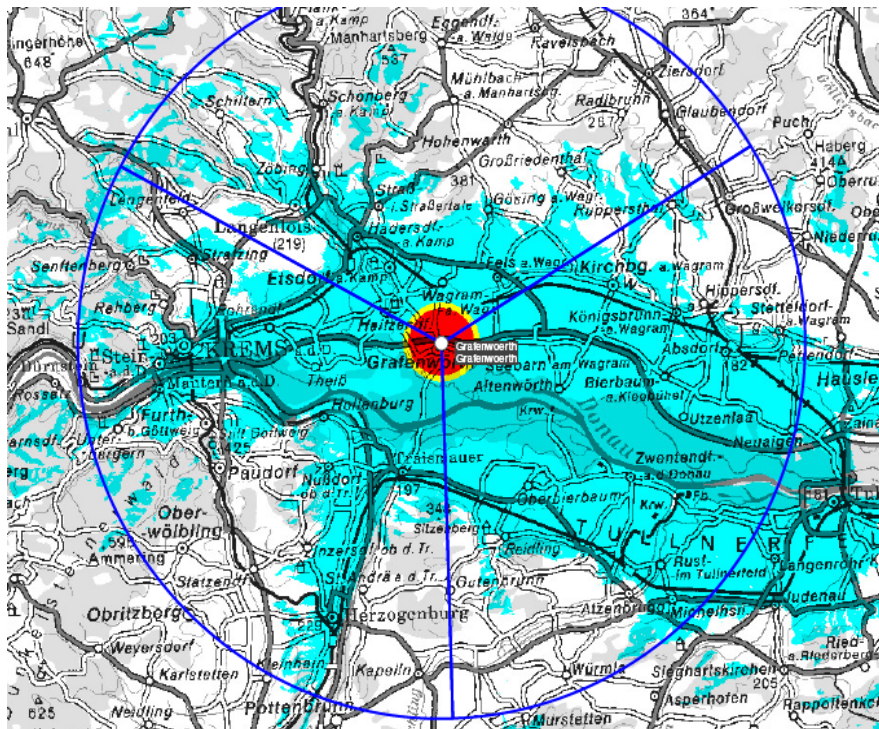
- Valley, villages
- Lower average income
- Lower penetration of home computers
- Fewer business
- No DSL via cable available, “no competition”
- Residential-dominated market
- Outdoor coverage (using outdoor antenna)
- Large cell sizes
- Existing core network / microwave link for backhaul
- Data Rate: **>1.0 Mbit/s**



Planning Fixed BWA - “Rural Area”

Rural Scenario

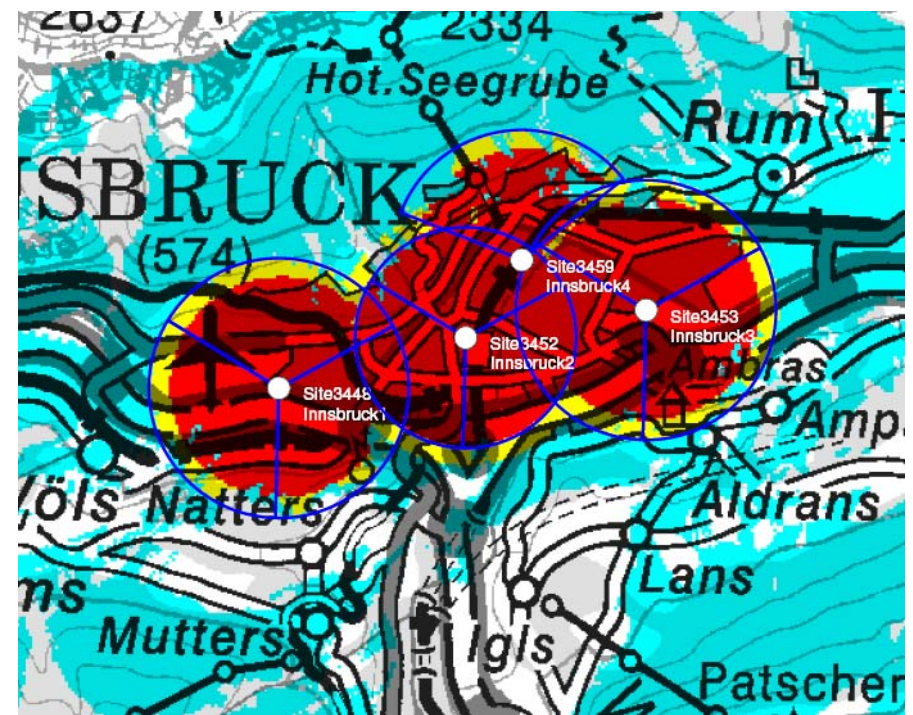
Coverage Plot



blue: outdoor 1Mbit/s
yellow: indoor 1Mbit/s
red: indoor 2,5 Mbit/s

Suburban Scenario

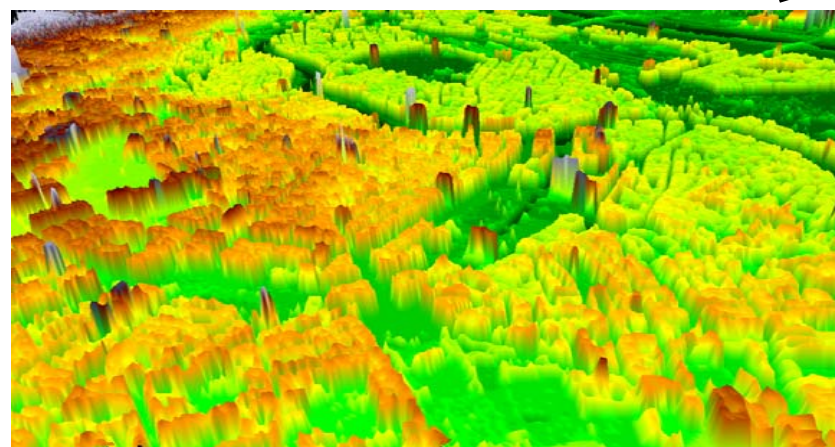
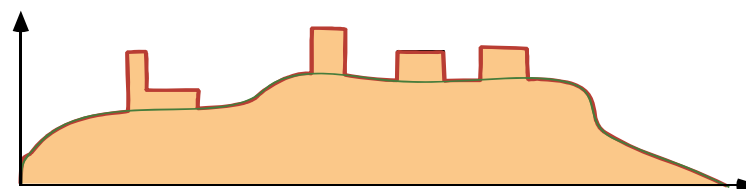
Coverage Plot



blue: outdoor 1Mbit/s
yellow: indoor 1Mbit/s
red: indoor 2,5 Mbit/s

Planning Guideline Parameters - ” Urban Area”

- Major city, high-rise buildings
 - Many potential broadband customers
 - High penetration of home computers
 - Many business users
 - Cable and/or DSL available, strong competition
-
- Residential & business market
 - Indoor coverage dominant
 - Small cell sizes
 - Extension (more capacity) of existing or new core network necessary
 - Data Rate: **>2.5 Mbit/s, 1Mbit/s**



Planning Fixed BWA - "Urban Area"



Urban Scenario

*Sub-Scenario 1:
Basic coverage*

*Sub-Scenario 2:
Extended indoor
coverage*

	Base- Stations	Covered Households		
		Indoor	Outdoor	Total
Scenario 1	16	34 %	36 %	70 %
Scenario 2	60	65 %	30 %	95 %