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UMTS-WLAN roaming in hot spot areas
A techno-economic study

Anne Cerboni – France Télécom R&D
Jarmo Harno, Ilari Welling – Nokia Research Center
Dimitris Katsianis, Dimitris Varoutas – University of Athens
Kjell-Ove Kalhagen - Telenor

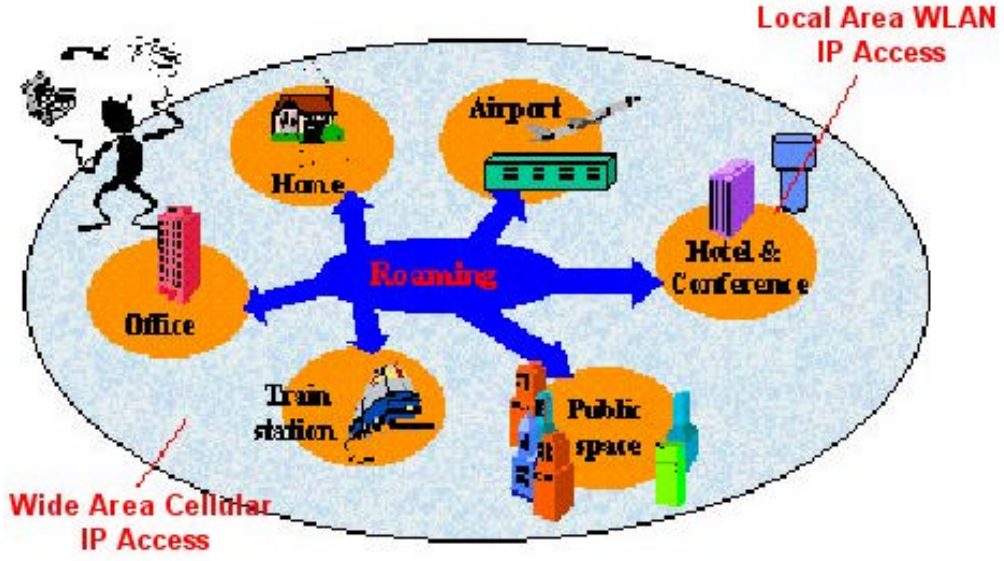
Work conducted within European R&D projet

- **Objective : Techno-economic evaluations of broadband fixed and mobile solutions for telecommunications services**

- **Partners: Telenor, Nokia, France Télécom, Deutsche Telekom, Universidade de Aveiro, University of Athens, Atlantide**

What is seamless mobile IP service provision?

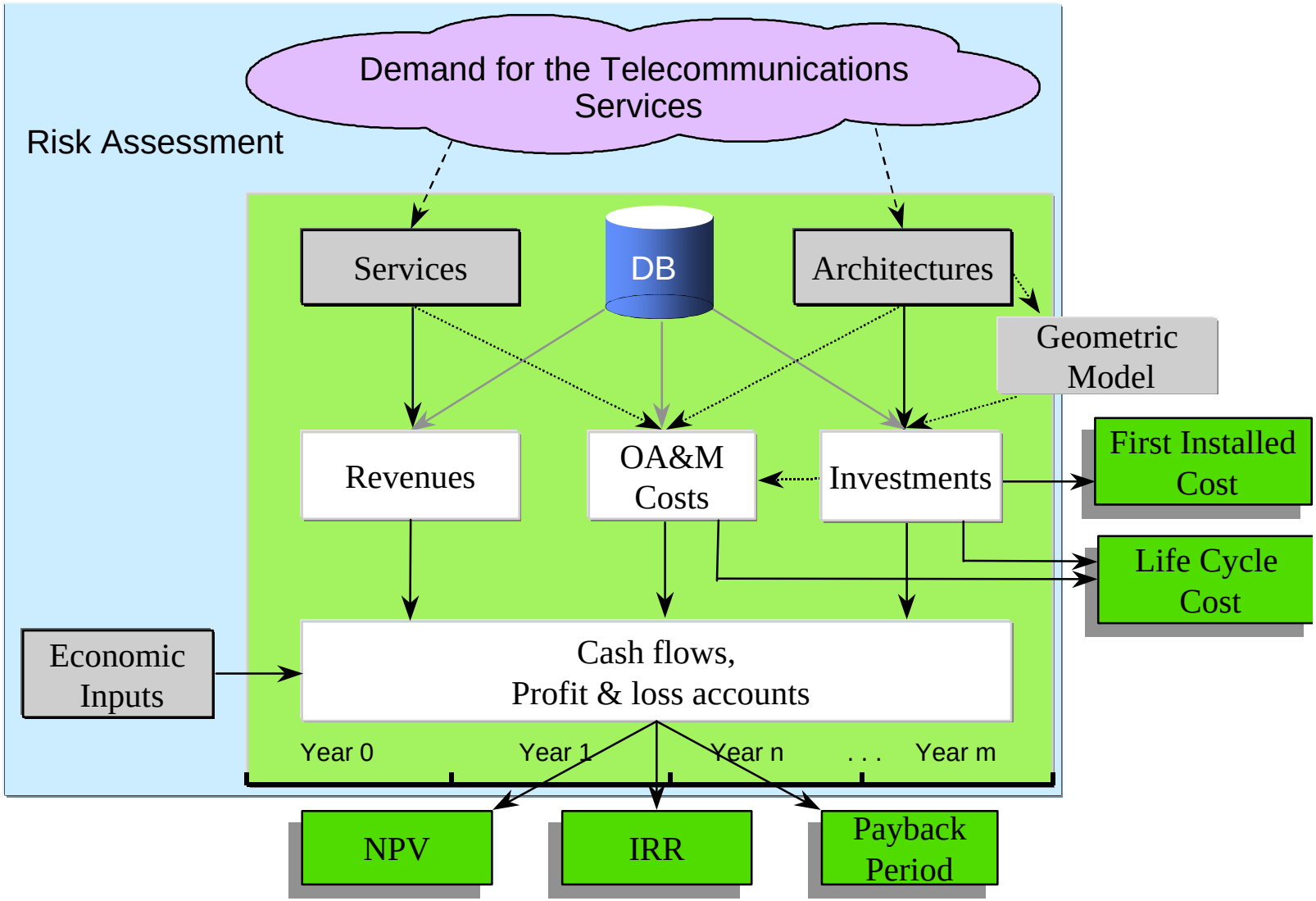
- Multimedia services offered via a 3G mobile network complemented with WLANs (Hiperlan/2) in hot spots; both networks belong to the same operator.
- The access networks ensure network discovery, seamless handover, quality of service requirements, and transparent roaming.
- The core network is IP.
- Architecture is that studied in the IST/MIND project.



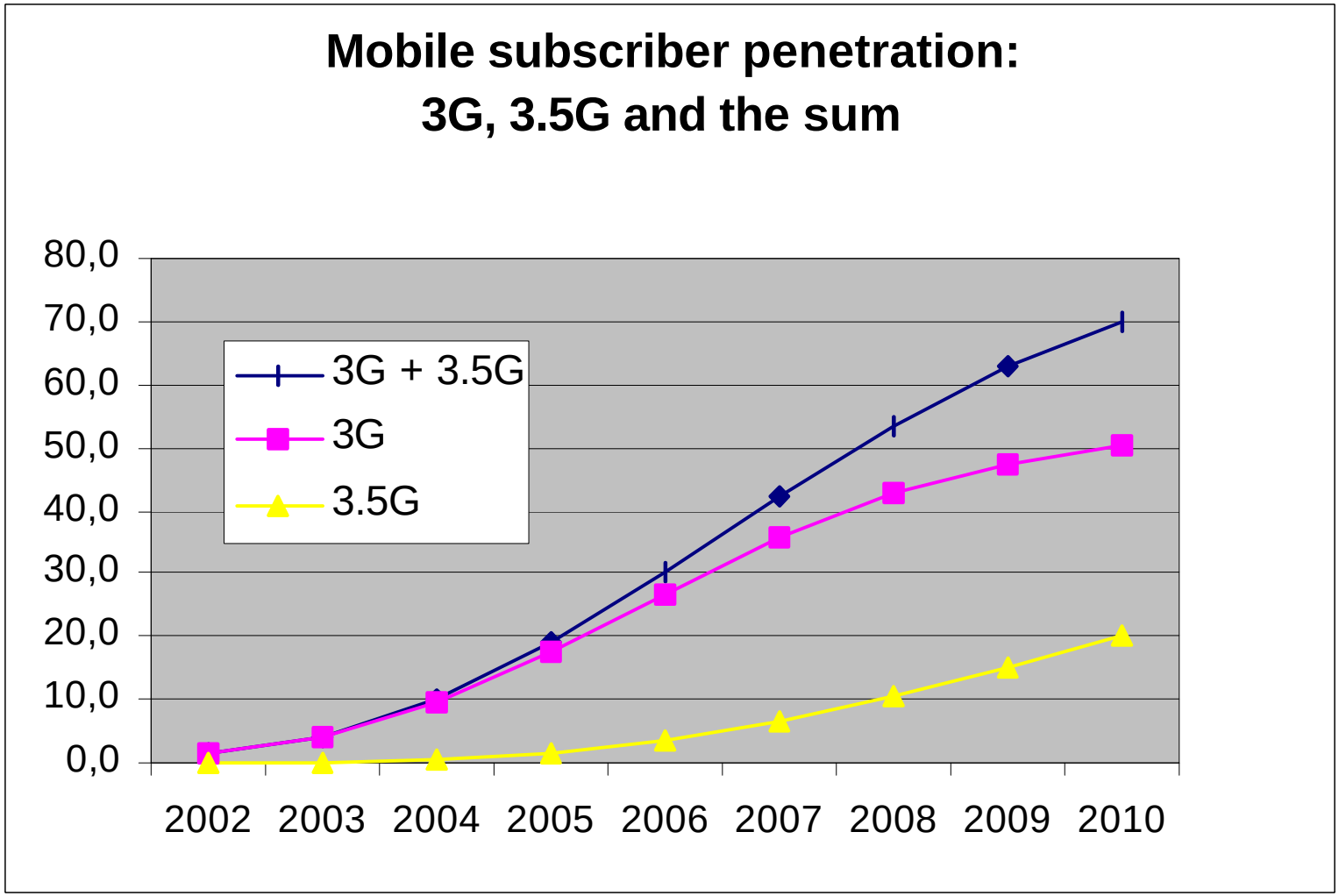
UMTS – WLAN business case Questions and challenges

- **Question: Is UMTS+Hiperlan2 worth the investment? Under what conditions?**
- **Goal: to construct a techno-economic business case simulator**
- **Demand forecasting**
  - Uncertainty in market uptake in a highly competitive context
  - Many services are currently unknown
- **Dimensioning rules**
  - Technical understanding of the target architecture and upgrades
  - Ability to model the architecture
- **Pricing**
  - Reference prices not available for broadband mobile services
  - New business models: advertising, 3rd-party pays, e-commerce commissions, volume or session based pricing
- **Confidentiality**
  - market data, costs, roll-out strategies are manufacturer and operator secrets

The business case approach: TONIC tool



3G and 3.5G demand curves

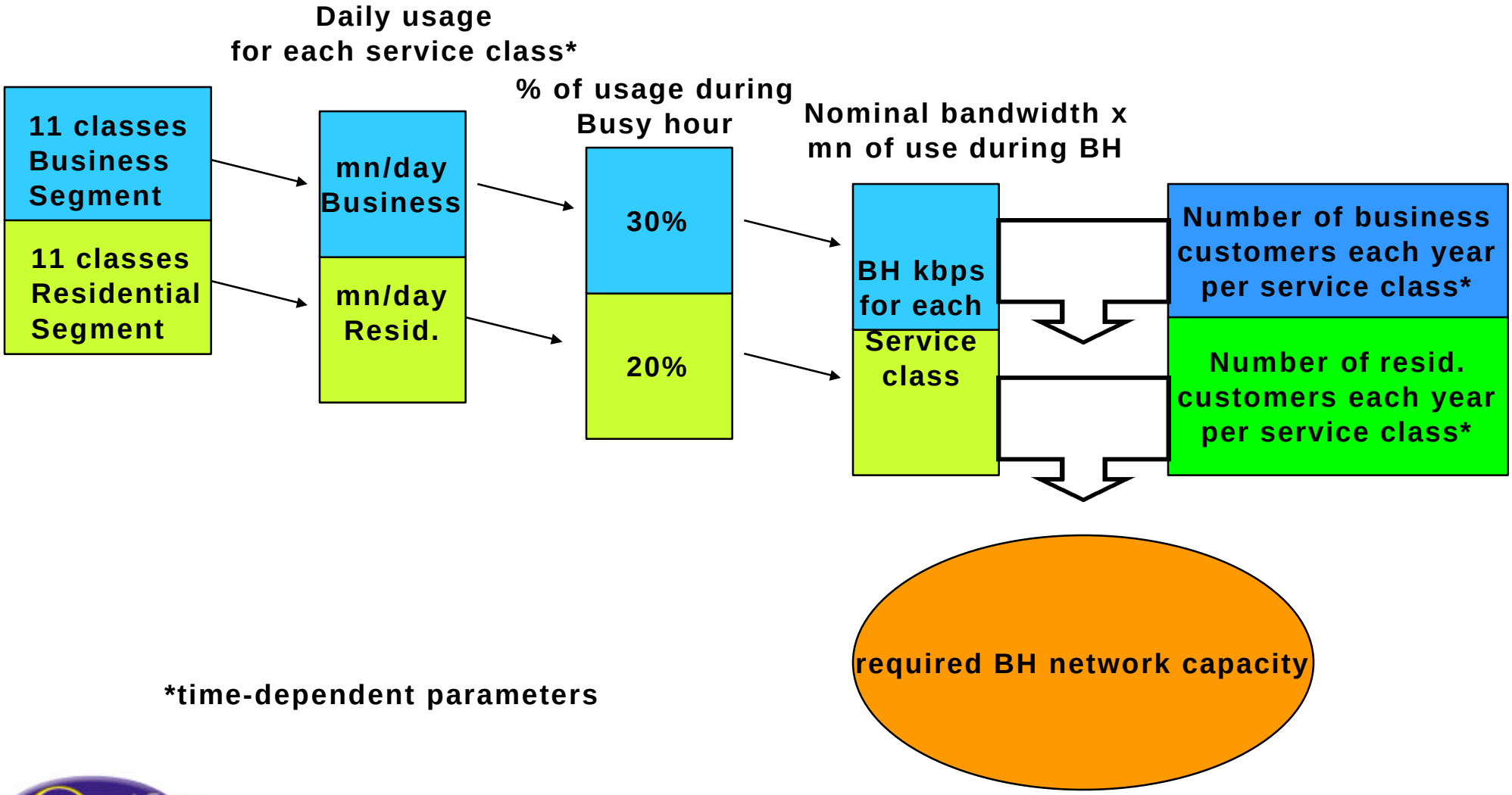


Service classes

Circuit/packet Switched	Bandwidth class	Quality of Service class	Sample services	Nominal data rate (kbps)*	Supporting network
Circuit	Narrowband	Conversational	voice call	33	UMTS
Circuit	Wideband	Conversational	video call, enhanced m-commerce	390	UMTS
Packet	Narrowband	Conversational	voice over IP	33	UMTS
Packet	Wideband	Conversational	video call, games	230	UMTS
Packet	Broadband	Conversational	video conf.	1227	WLAN
Packet	Narrowband	Streaming	on rich call (e.g.audio clips)	33	UMTS
Packet	Wideband	Streaming	rich call (incl. video clips)	230	UMTS
Packet	Broadband	Streaming	Near video-on-demand	1227	WLAN
Packet	Narrowband	Int_backgr	short msg., WAP	3.4	UMTS
Packet	Wideband	Int_backgr	E-mail, Internet	16.4	UMTS
Packet	Broadband	Int_backgr	Large file transfer, appl.	200	WLAN

*overhead included

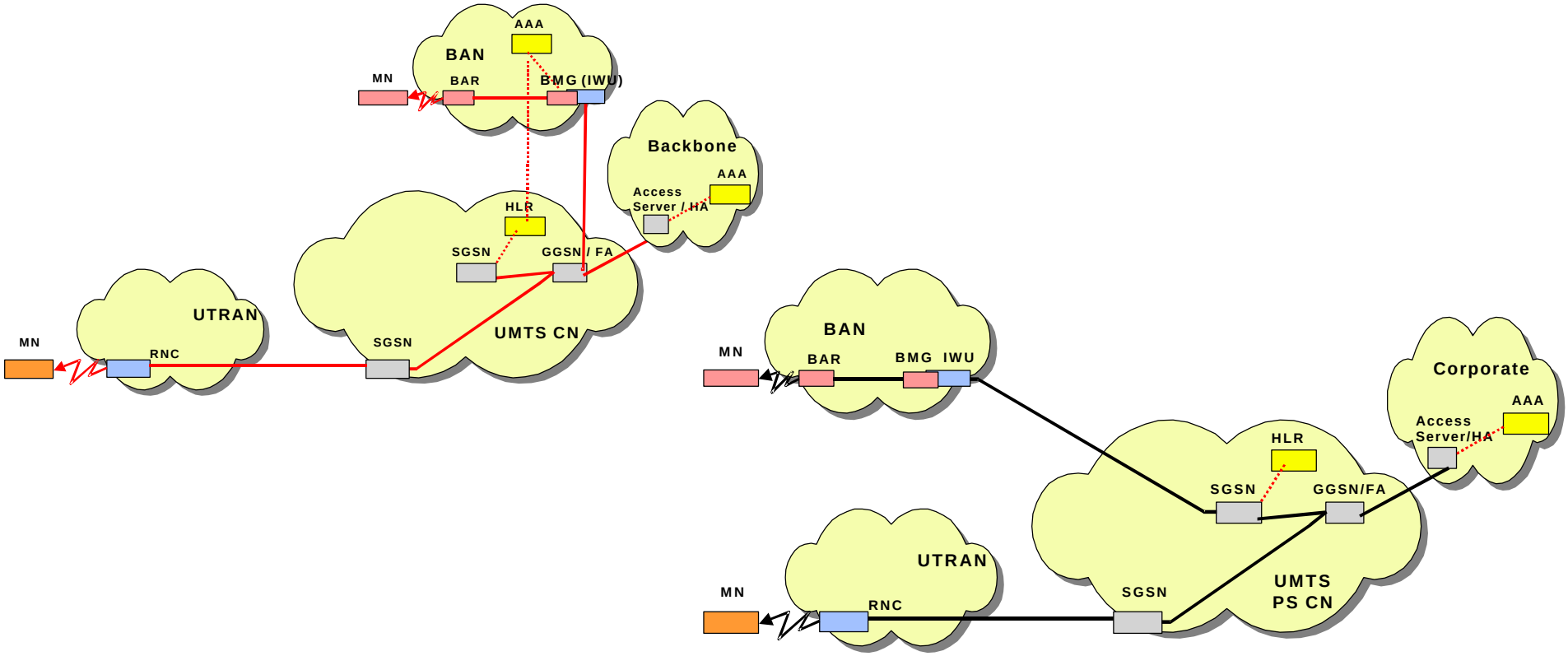
From service classes to network dimensioning



*time-dependent parameters

Network Investments (1)

GSM/GPRS to UMTS: new radio access network, some re-use of NSS
Hiperlan/2: Radio access points & controllers, routers and servers
Interworking (architecture developed within European IST/MIND project)



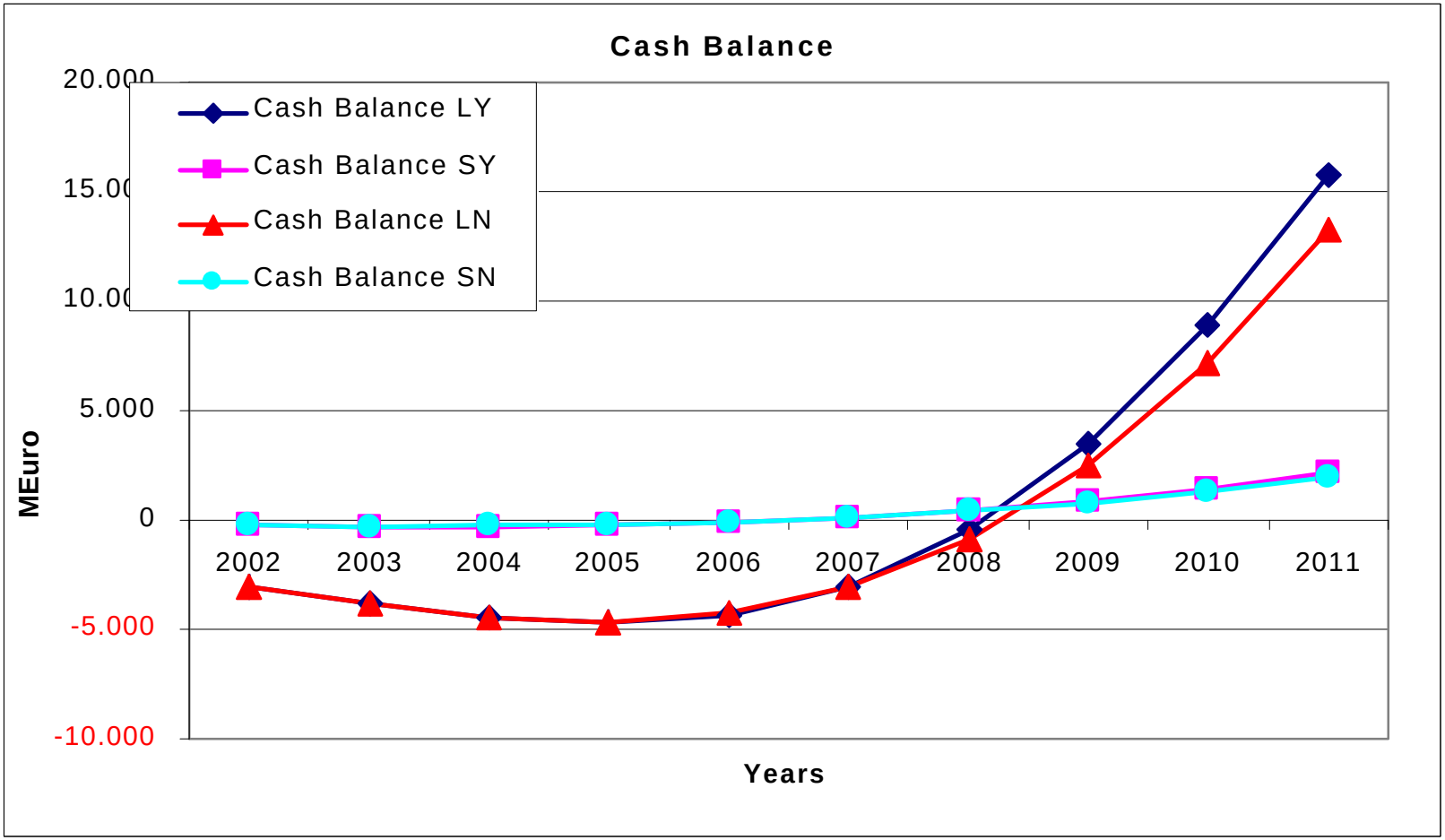
Network Investments (2)

- UMTS
  - Radio Access Network (RAN): Base stations (Node B) and radio network controllers (RNC)
  - Network Subsystem: SGSN, GGSN, HLR/AuC, MSC upgrades, MSS, MGW, CPS, HSS
- WLAN
  - Access Points, Access Point Controllers, Access Routers, Authentication server, Inter Working Unit
- Common equipment
  - Billing and customer care, Service platforms (service implementation, m-commerce, location servers, streaming servers, rich messaging servers, etc.)

Initial results

- Small country
  - With / Without WLAN
    - NPV = 948 / 859 M€
    - IRR = 38% / 37%
    - Payback = 5.6 / 5.5 years
- Large country
  - With / Without WLAN
    - NPV = 5597 / 4413 M€
    - IRR = 24% / 22%
    - Payback = 7.1 / 7.3 years

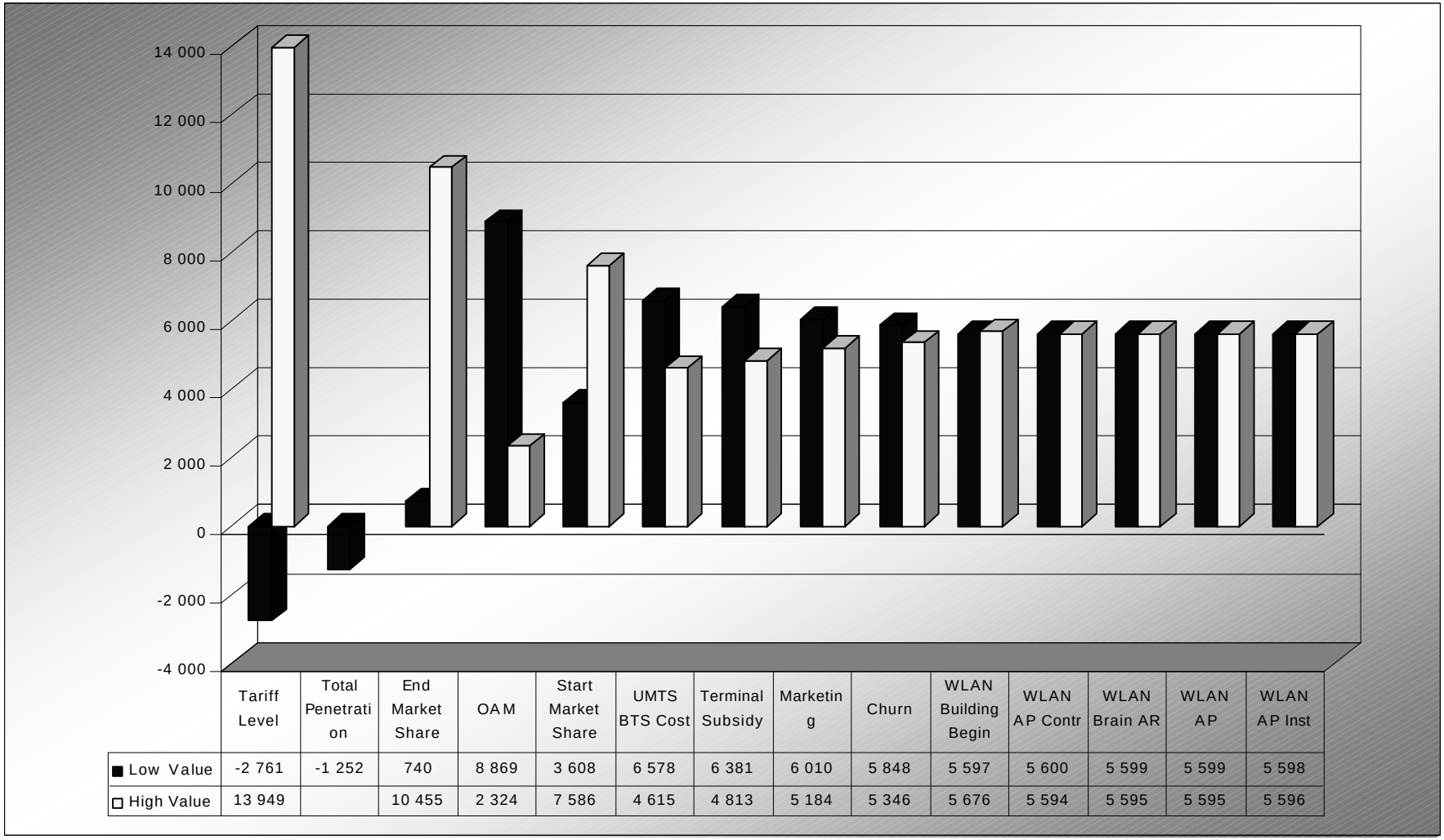
Initial Economic results



Sensitivity analysis

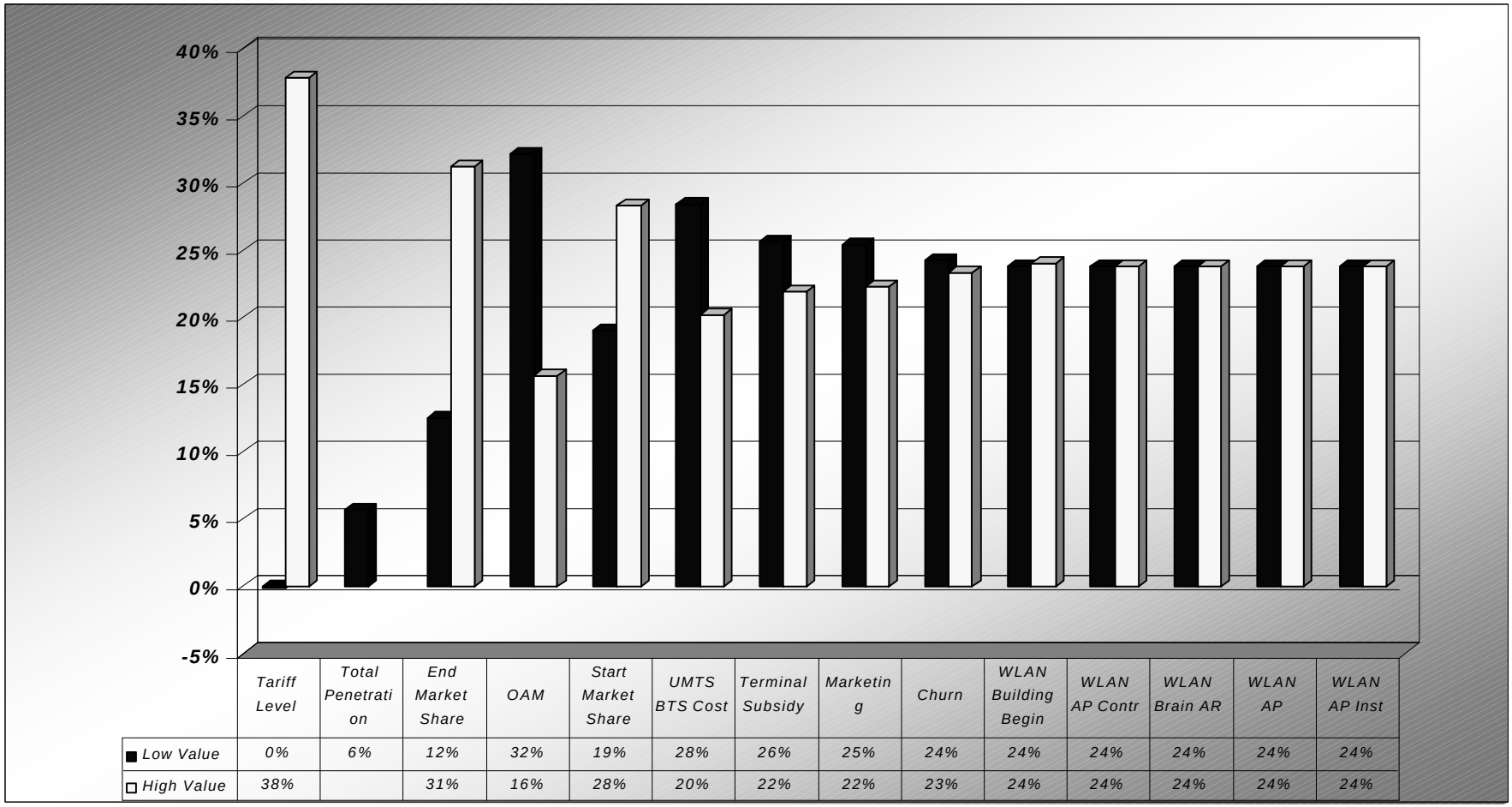
- What if…?
- Approach
  - Select critical input parameters
  - Set boundaries for their variation
- Results
  - Impact on Net Present Value
  - Impact on Internal Rate of Return

Large country NPV sensitivity



	Tariff Level	Total Penetration	End Market Share	OAM	Start Market Share	UMTS BTS Cost	Terminal Subsidy	Marketing	Churn	WLAN Building Begin	WLAN AP Contr	WLAN Brain AR	WLAN AP	WLAN AP Inst
■ Low Value	-2 761	-1 252	740	8 869	3 608	6 578	6 381	6 010	5 848	5 597	5 600	5 599	5 599	5 598
□ High Value	13 949		10 455	2 324	7 586	4 615	4 813	5 184	5 346	5 676	5 594	5 595	5 595	5 596

Large country IRR sensitivity



	Tariff Level	Total Penetration	End Market Share	OAM	Start Market Share	UMTS BTS Cost	Terminal Subsidy	Marketing	Churn	WLAN Building Begin	WLAN AP Contr	WLAN Brain AR	WLAN AP	WLAN AP Inst
■ Low Value	0%	6%	12%	32%	19%	28%	26%	25%	24%	24%	24%	24%	24%	24%
□ High Value	38%		31%	16%	28%	20%	22%	22%	23%	24%	24%	24%	24%	24%

Initial conclusions

- WLAN improves the NPV by 27% in the large country and by 10% in the small country.
- WLAN represents less than 5% of the whole investment cost, but contributes 9% of total revenues.
- Tariffs, market demand, and market share are shown to be the most critical factors for success.
- Further work will concentrate on capacity-driven dimensioning and more limited (eg campus-wide) WLAN deployment scenarios.
- For more information, see websites

http://www-nrc.nokia.com/tonic/

http://ist-mind.org