



B3G technology competition in Europe

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Outline

- **Case study introduction and objectives**
- **Network architectures**
- **Modeling of network operator and service operator businesses**
- **Results and conclusions**



Case study introduction

- **Big incumbent operator business in large W/E country**
- **Study period: 2006 -2013**
- **To deploy own 3G network to survive in the new 3G and beyond service competition**
- **With UMTS license or not**
- **Service operator and Network operator businesses separated - with clear wholesale interface**
- **The study is based on the work within the EUREKA CELTIC initiative project ECOSYS, started in the beginning of the year 2004**



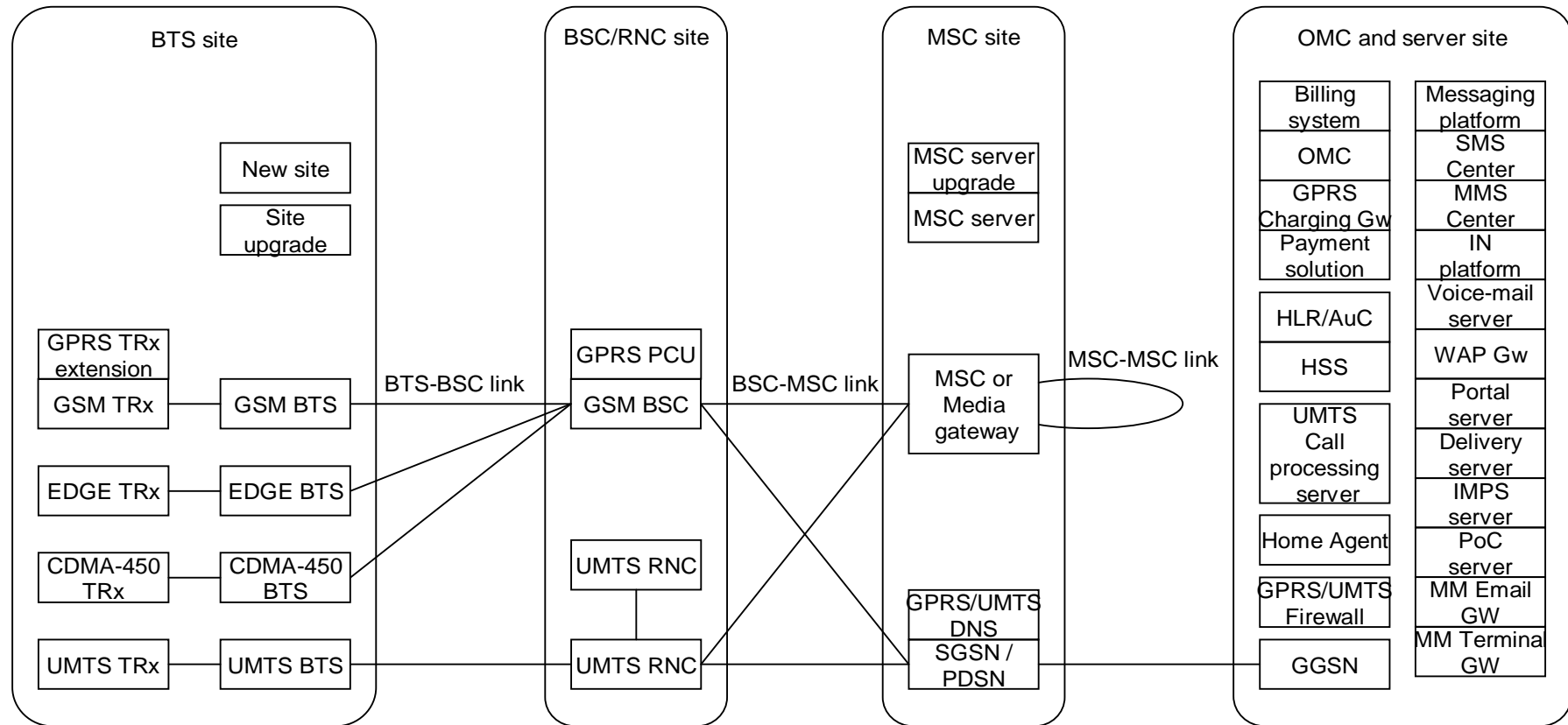
Case study objectives

- **This study aims to find answers to questions like:**
 - **Is it possible in the Western European context for some players to utilize alternative technologies to compete with UMTS?**
 - **How will the business situation differ for the Service operator compared to the Network operator?**
 - **What are the differences, in respect to new services and their revenue potential, between the available radio technologies?**
 - **What impact would the differing cost structures generate?**
- **Three technology cases will be compared:**
 - **“UMTS with HSDPA”, “UMTS without HSDPA”, and “WiMAX”.**
- **All the cases are with complementing EDGE deployment**



Network architectures

- Generic network architecture:





Network architectures

- Radio network dimensioning:

Technology	Freq. band (MHz)	Channel bandwidth	Throughput per channel	Cell range*(km) (Dense/Urban/Suburb./Rural)
GSM	900/1800	200kHz	6.4 calls	0.73 / 2.51 / 3.21 / 6.36
GPRS	900/1800	200kHz	70.4kbps	0.73 / 2.51 / 3.21 / 6.36
EDGE	900/1800	200kHz	256kbps	0.73 / 2.51 / 3.21 / 6.36
WCDMA	1900/2100	5MHz (2 channels per sector)	96 calls / 800kbps	0.57 / 0.89 / 2.11 / 6.36
HSDPA	1900/2100	5MHz (2 channels per sector)	4Mbps	0.57 / 0.89 / 2.11 / 6.36 (not implemented)
WiMAX	3400	10MHz	10Mbps	0.40 / 0.60 / 1.10 (not impl.) / 3.00 (not impl.)



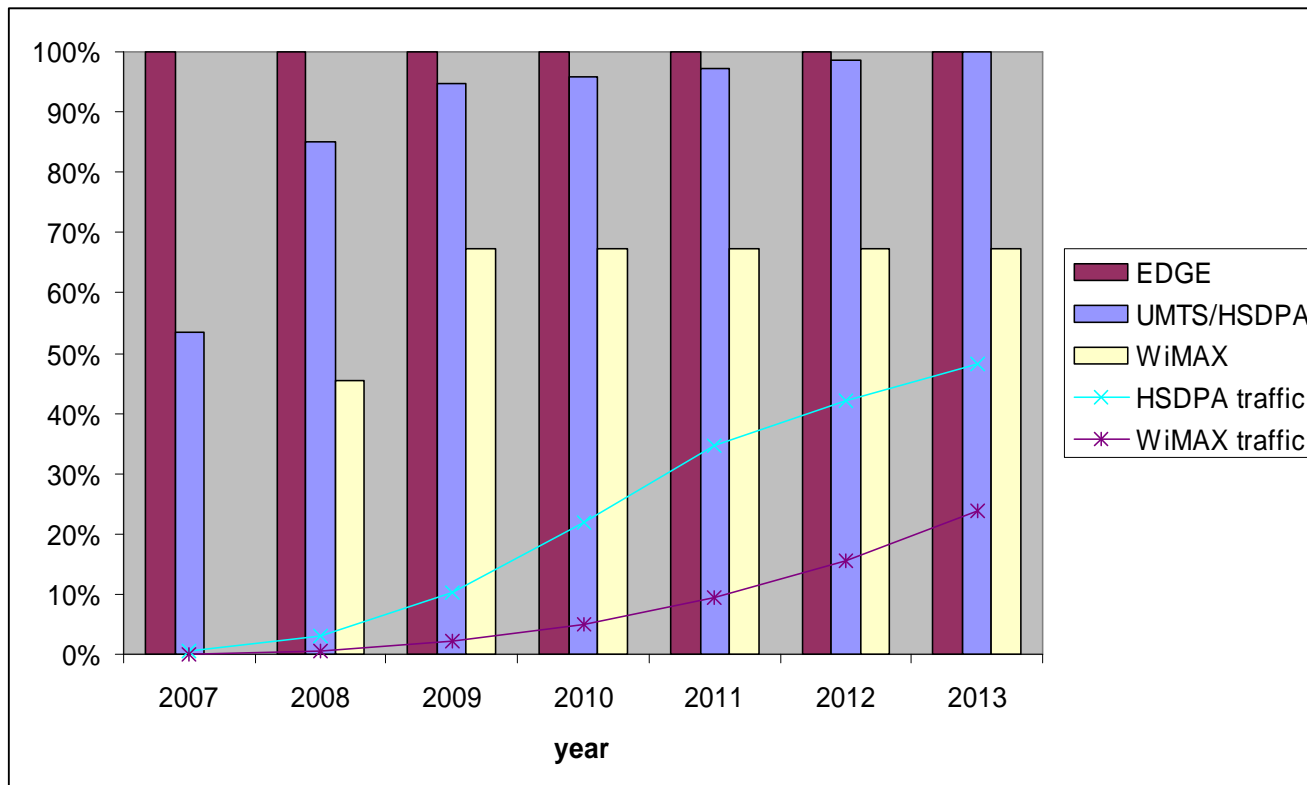
Network operator modeling

- UMTS is deployed with HSDPA capability from the beginning (year 2006) starting from the dense areas
- UMTS network is ready for use in dense areas 2007
- WiMAX network is deployed one year later
- Launched commercially in the beginning of 2008
- Worse availability of WiMAX handsets is reflected in the lower service take-up figures in the beginning
- Also the HSDPA capable handset penetration is assumed to grow gradually starting from 2006, so that the HSDPA extra capacity is utilized only according to this user penetration



Network operator modeling

Technology rollout schedules (population coverage):





Network operator investments

- The usage amounts of EDGE and UMTS or WiMAX are dependent on the network rollout
- Usage is calculated only if the user is in the coverage area of the networks
- Lack of high capacity technology leads to lower usage patterns
- Major part of the network operator investments are for the radio network (in all cases over 85%, when BSC/RNC part included)
- Note that Service related elements reside mostly in the service operator side, and the transport network costs are modeled as leased line costs (OPEX)



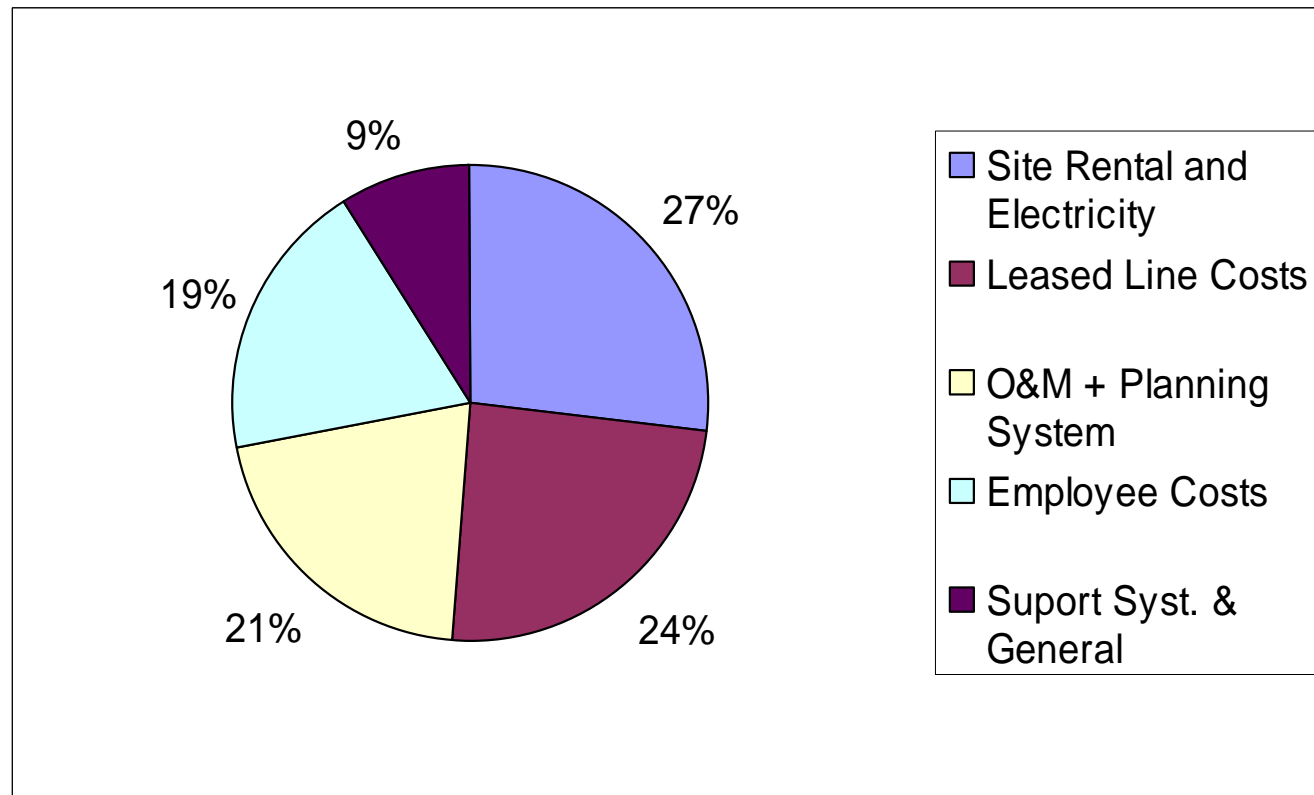
Network operator OPEX

- The termination and roaming costs as well as the related revenues are not modeled in this case study (mostly voice related and thus not the differentiators btw the cases)
- The operational expense profiles differ between technology solutions, but not so much as is the case with investments
- The differences originate mainly from the different BS site amounts and leased line capacity needs
- As the Network Operator is not selling to the end-users or supporting the end-user services, the operational costs are related mainly to site rentals, leased line costs, network operation & maintenance and support systems
- As interconnect costs to other networks are not counted here, the Network Operator share of the total OPEX is on the level of 25%, the rest being allocated to the Service Operator



Network operator OPEX

OPEX breakdown for the Network Operator (HSDPA):





Network operator revenues

Interconnection (whole sale) prices from the Service Operator starting from the year 2006:

Narrowband conversational (voice): 0.011 € / min
(inbound and outbound)

Wideband conversational (video telephony): 0.043 € / min
(inbound and outbound)

Data (both directions): 0.15 € / MB

15% yearly price reduction applied thereafter



Service operator modeling

- Demand modeling is based on penetration estimates for different technology subscribers in selected segments
- End-user modeling predicts the usage amounts for active users of each service, per each segment and each technology, for the selected tariff level
- Market size and market share of the operator, with technology rollout schedules and service penetrations in each segment, give the active user amounts for each service
- Combining the usage volumes of active users and the active user amounts for each service class, segment and technology, we get the total usage, traffic and revenue figures



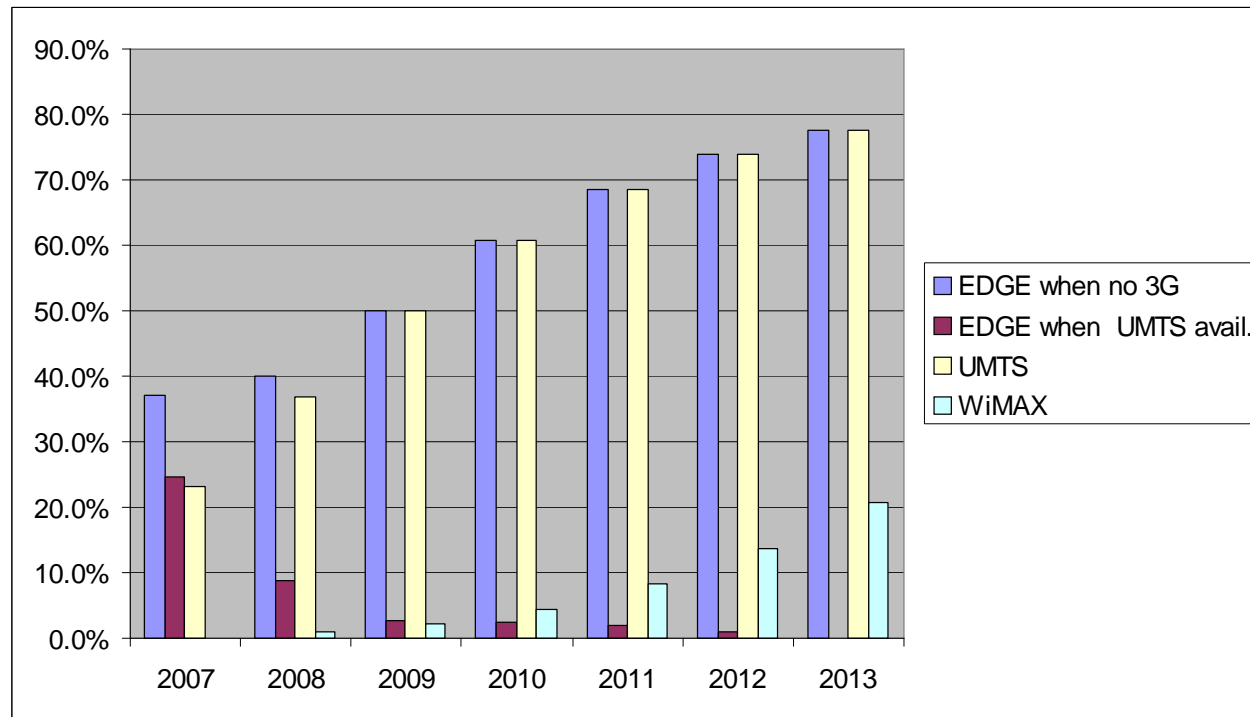
Service operator modeling

- Different technologies' subscriber penetrations are tracked as for operator who provides particular technology network, not as general technology penetrations
- Subscribers are presented according to the most advanced technology subscribed
- WiMAX user penetration is estimated to be clearly lower than UMTS, due to the terminal availability, form and price factors
 - E.g. potential laptop users are estimated to be much lower in number than pocket size Smartphone users



Service operator modeling

Potential users of different technologies:





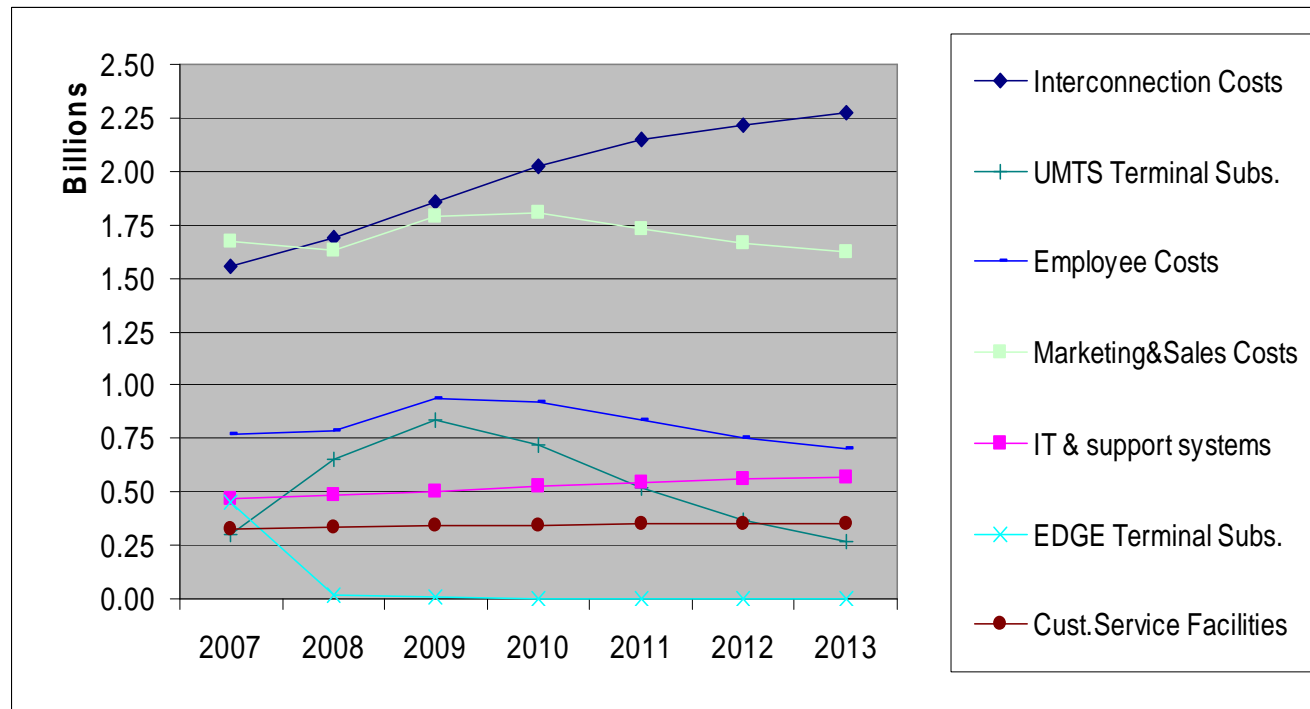
Service operator OPEX

- Service Operator's most important OPEX cost item is the wholesale charges paid to the Network Operator
- The second most important operational cost items are related to the service subscriptions, and are:
 - end-user support
 - sales and marketing
- The operational expense development differ somewhat between technology solutions
- The differences originate mainly from the different high capacity subscriber amounts (HSDPA and WiMAX) over the study range



Service operator OPEX

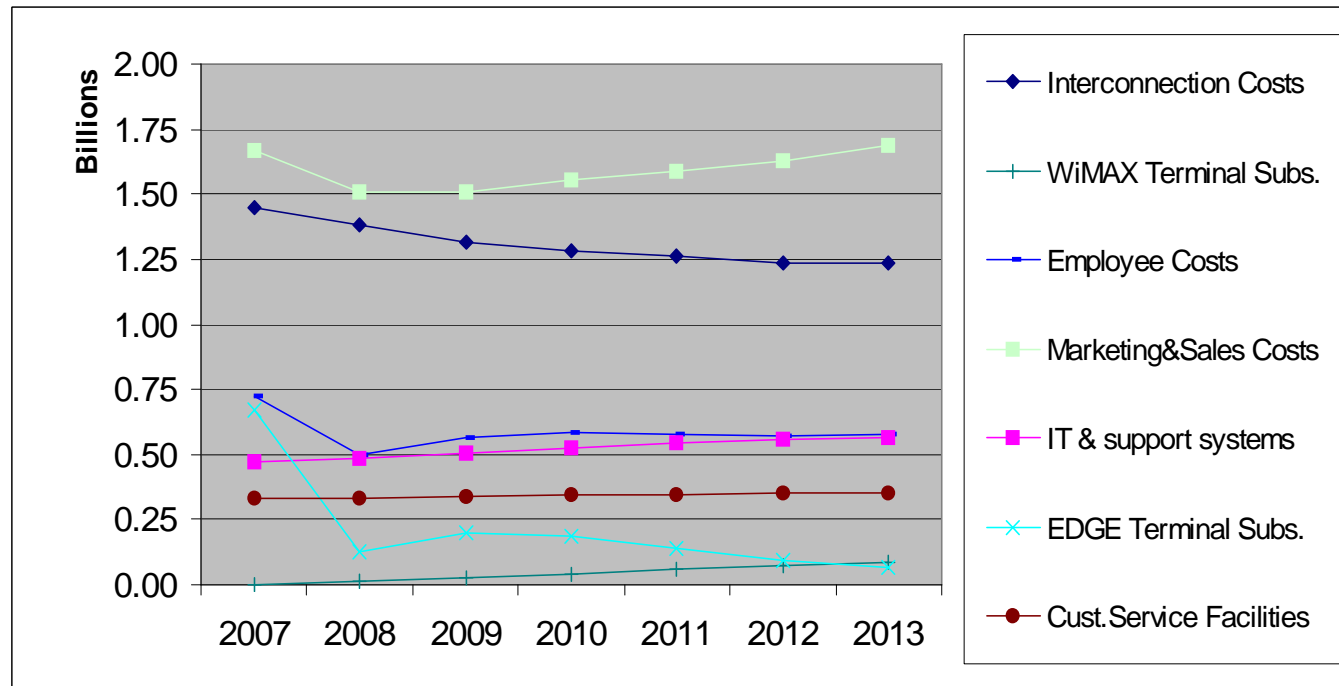
OPEX breakdown for the Service Operator (HSDPA):





Service operator OPEX

OPEX breakdown for the Service Operator (WiMAX):





Service operator revenues

- The Service Operator's revenues are calculated by combining the technology related user behavior from the End-user model, with segment sizes and related actual active service users
- The earlier the enhanced technology is deployed, the more traffic and revenue is generated - but only in the limits of general demand development and terminal availability
- On the other hand, also the costs are higher for early capacity provisioning
- The tariffs are assumed to be technology independent for both provided retail services and wholesale radio capacity
- Resulting ARPU figures provide a good "sanity check" for the combination of usage amounts and price level



Results

Technology (in addition to EDGE)	Service Operator		Network Operator		
	OPEX*	NPV	OPEX *	CAPEX **	NPV
UMTS with HSDPA	5.95 B€	5.15 B€	1.18 B€	0.28 B€	1.82 B€
UMTS w/o HSDPA	5.95 B€	5.15 B€	1.28 B€	0.36 B€	1.36 B€
Mobile WiMAX	4.60 B€	4.66 B€	1.06 B€	0.17 B€	0.34 B€

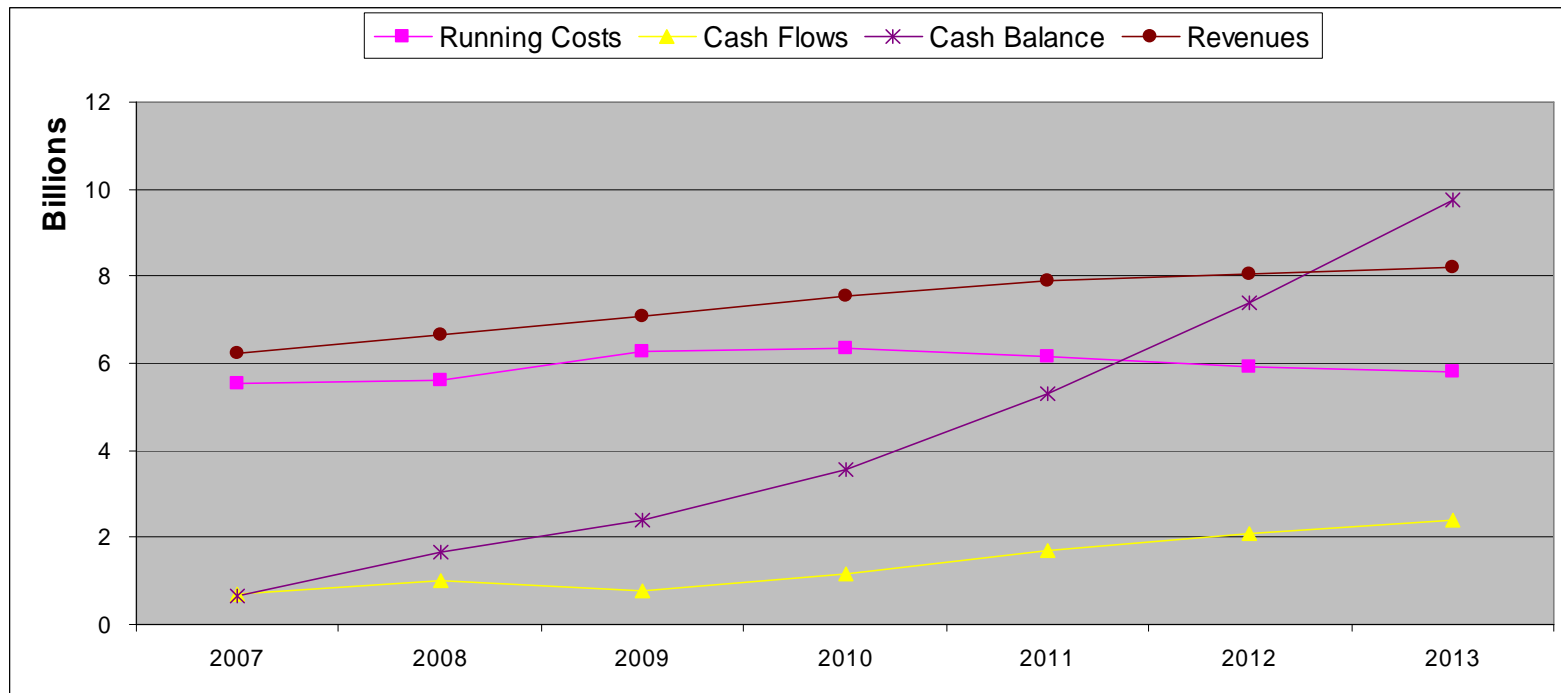
* yearly average 2007-13

** yearly average 2006-12



Results

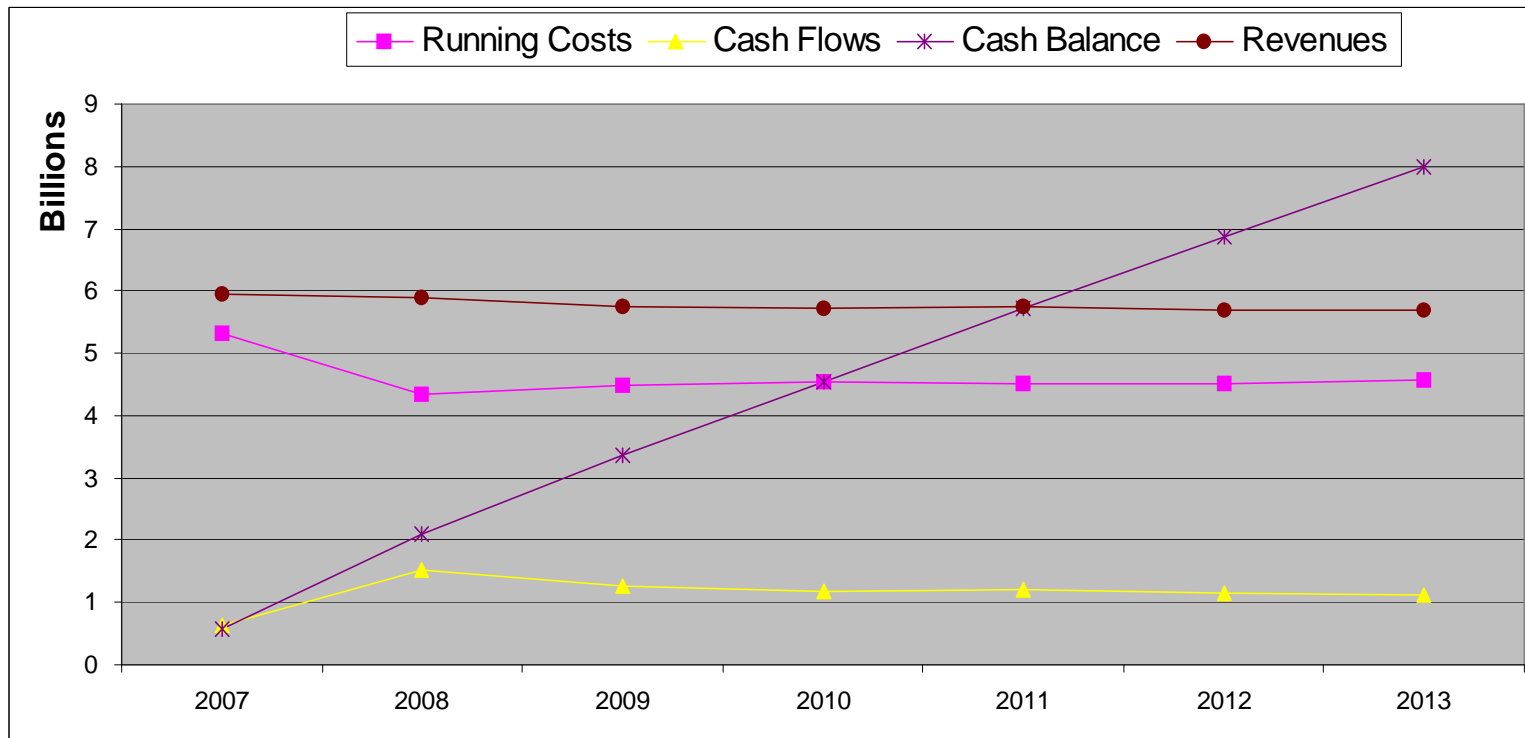
Cash flows of the Service Operator (UMTS+HSDPA):





Results

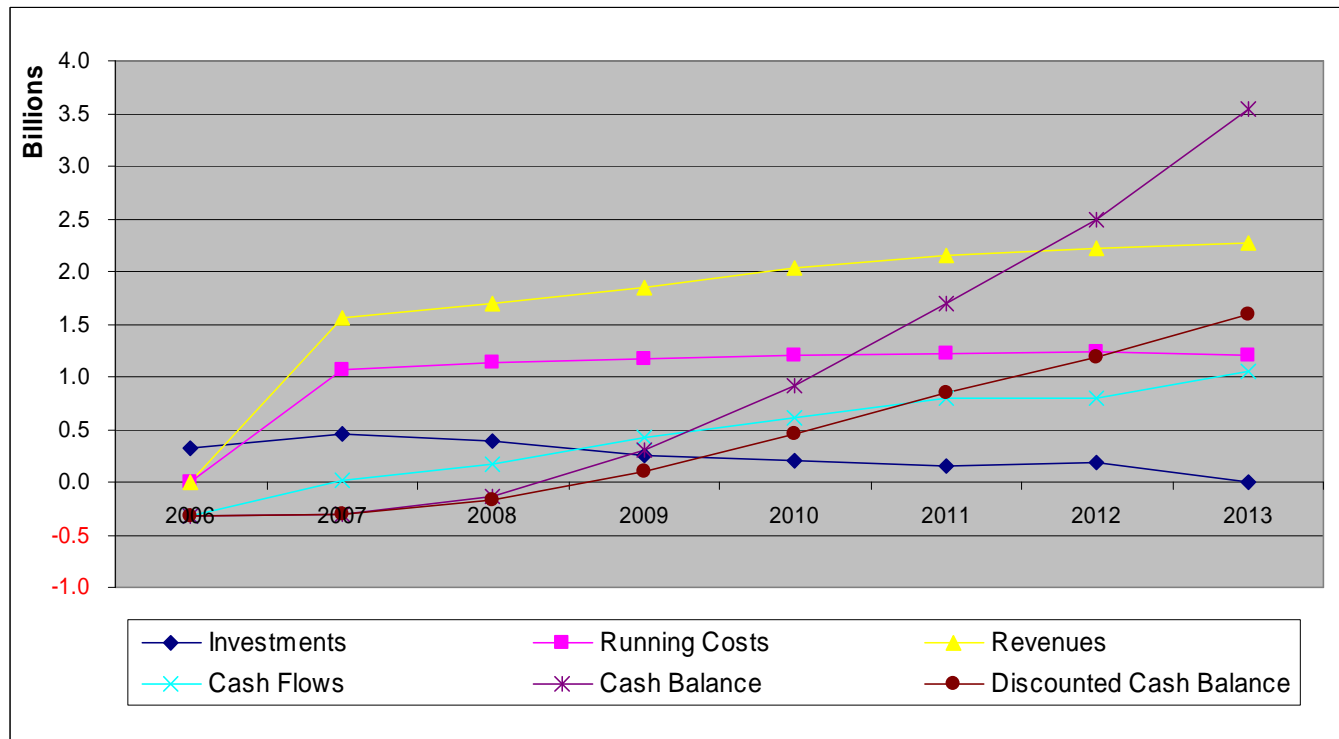
Cash flows of the Service Operator (WiMAX):





Results

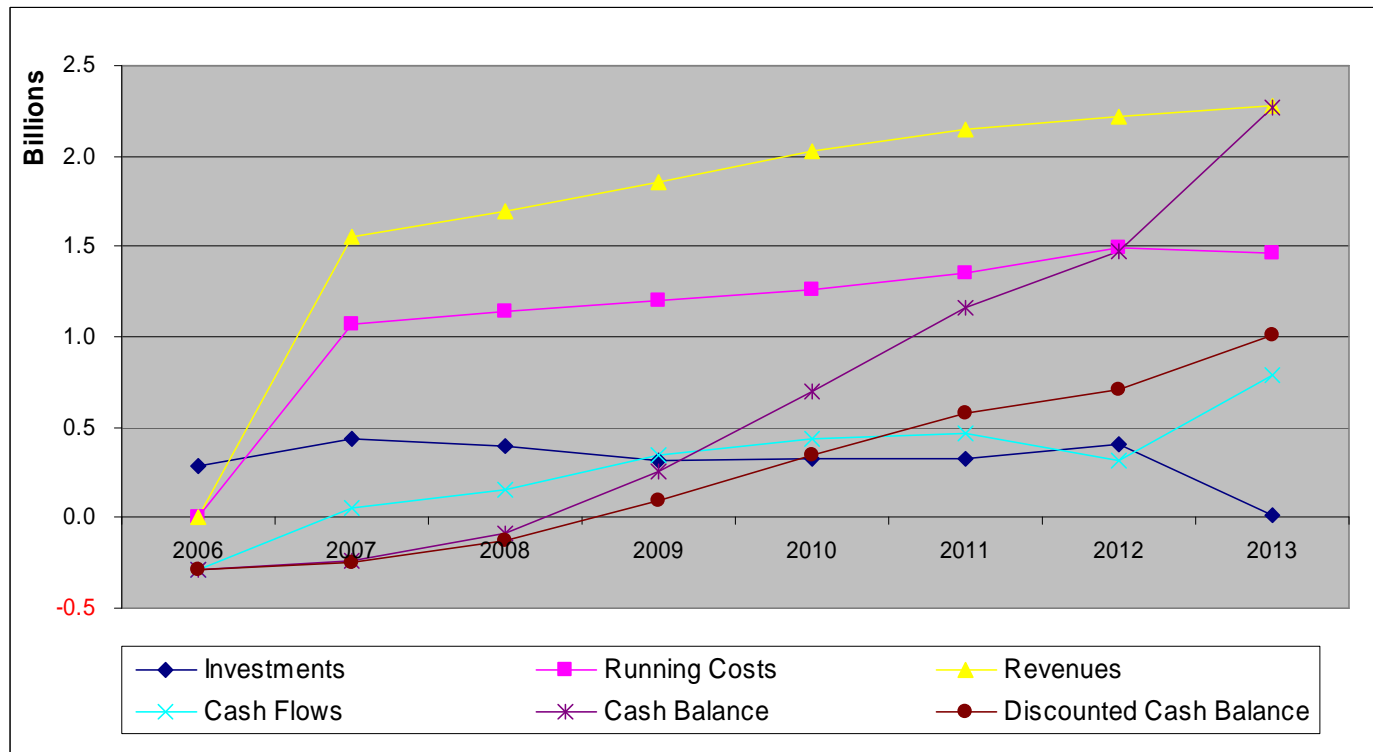
Cash flows of the Network Operator (UMTS+HSDPA):





Results

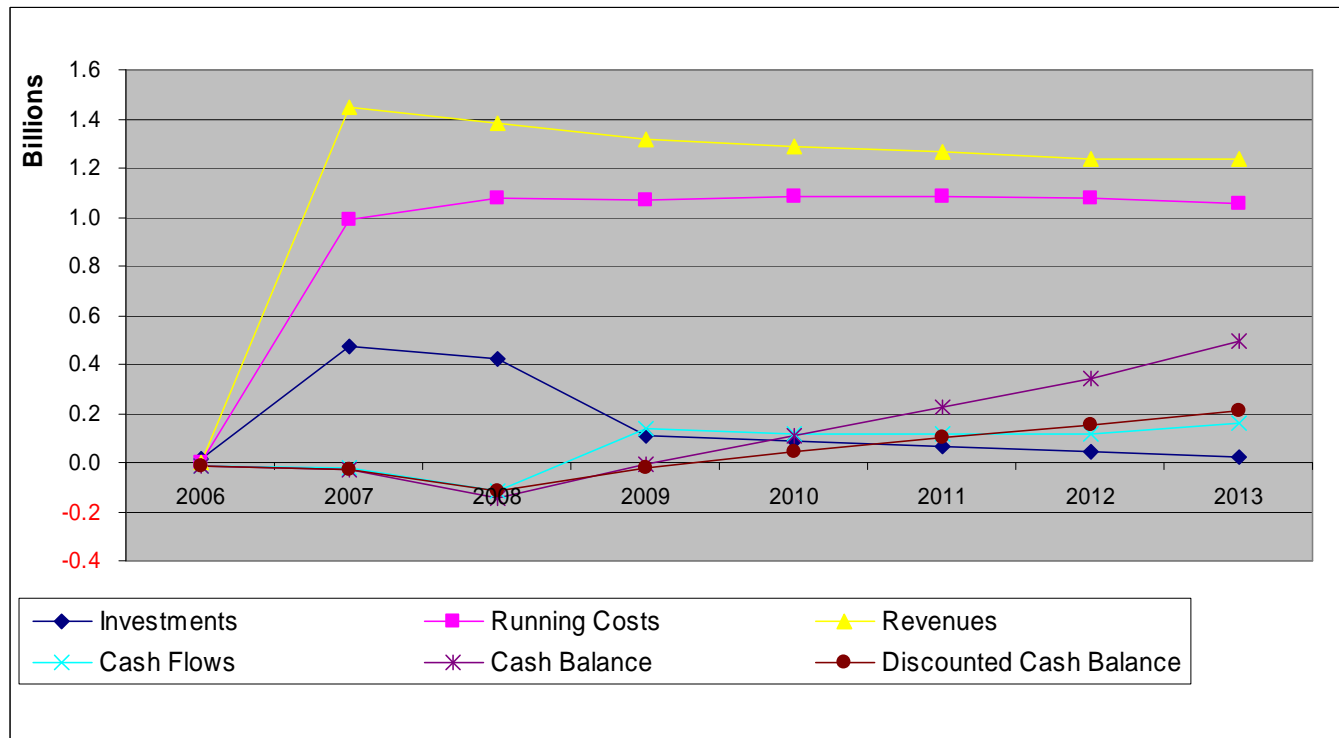
Cash flows of the Network Operator (UMTS w/o HSDPA):





Results

Cash flows of the Network Operator (WiMAX):





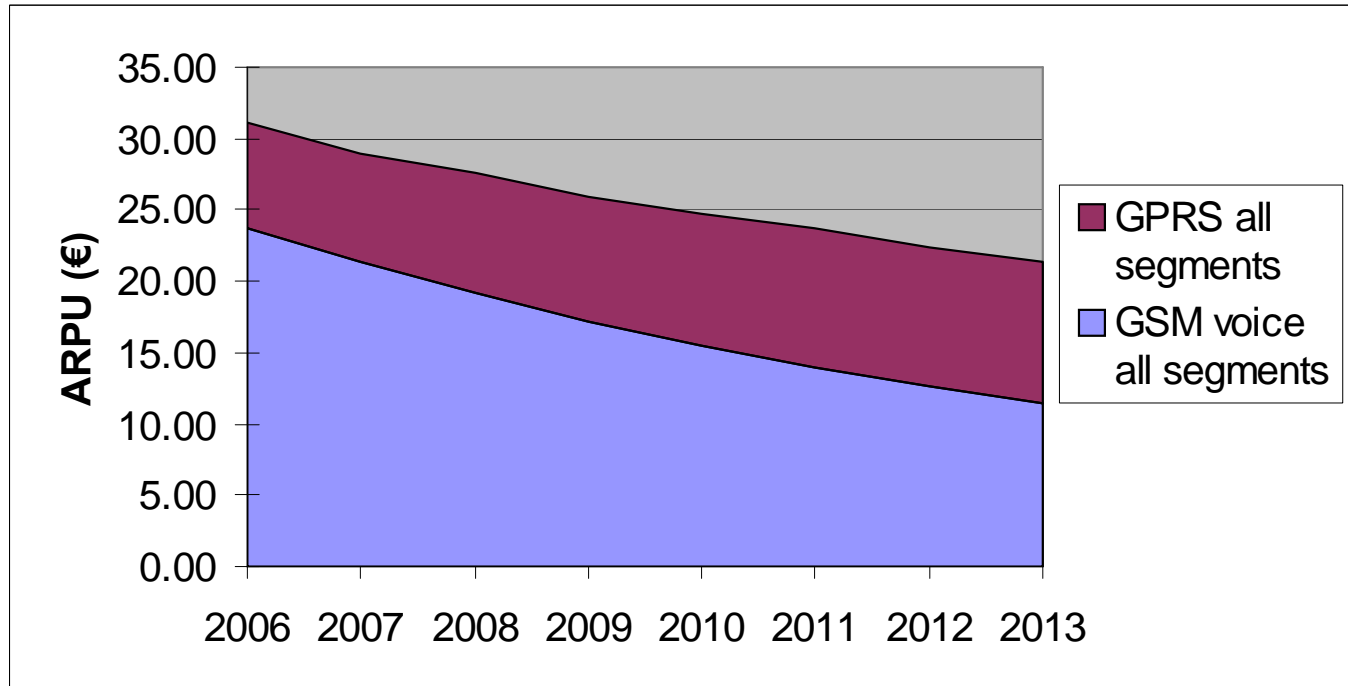
Results

- The operator revenues per user (ARPU) depend on the technology due to different quality of service (QoS) and thus end-user benefit and willingness to pay
- The voice service does not make much difference btw technologies
- For the data services, the QoS is estimated to create a clear difference in usage to the advantage of the higher bit rate and lower latency technologies
- We compare below the ARPU development, for plain GPRS users, and for those users who have UMTS in use
- It should be noted that as not all subscribers have the UMTS service, the UMTS ARPU is above the total ARPU of the operator



Results

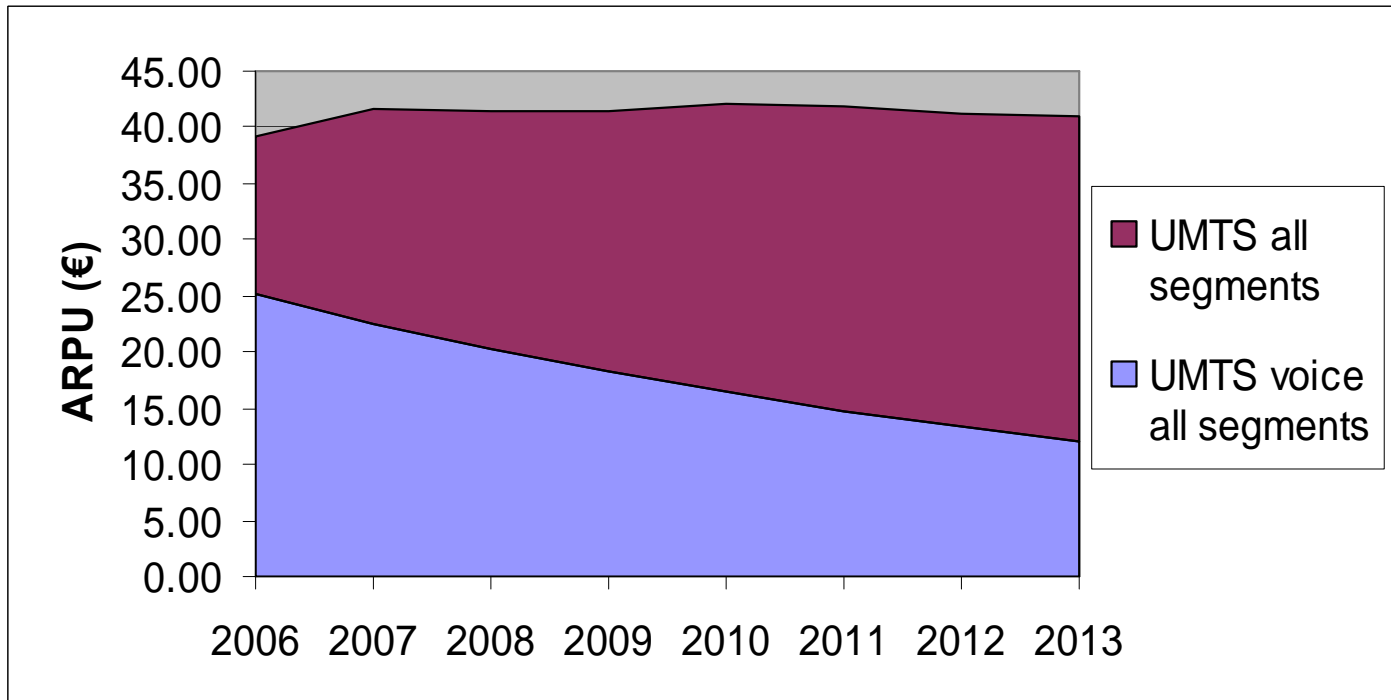
GPRS subscriber ARPU development:





Results

UMTS subscriber ARPU development:





Conclusions

- The presented results imply that for an operator with considerable market share and existing GSM (+EDGE) network, also other high bandwidth technology than UMTS have the potential to generate positive results
- Service Operator and especially Network Operator position is stronger with UMTS than with WiMAX
- Upgrading to HSDPA clearly improves the UMTS Network Operator results
- Uncertainties are still existing relating to the upcoming technologies like WiMAX, e.g.:
 - network technology maturing
 - terminal/handset (dual mode) mass market availability
- The presented study is restricted to certain cases, but give light to the generic dynamics of the business and competition