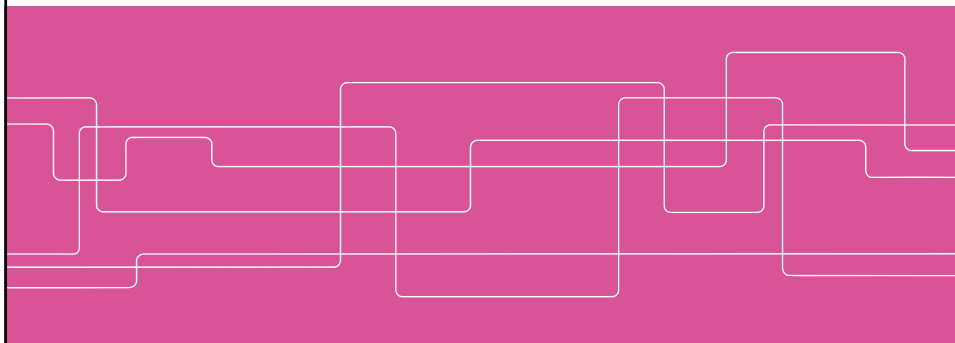




Analysis of regulatory, market and cost structure aspects for private or shared mobile networks for high quality M2M communications

Jan Markendahl, Amirhossein Ghanbari, Mårten Sundquist
Royal Institute of Technology, Stockholm, Sweden



Power grid and substation automation



Substation density

Urban area:
20 per km²

Rural area:
1 per km²





Network options for utility companies to control their power networks

- Mobile network operators (MNO) offer specific service classes to be used for traffic with “high” requirements within the traditional mobile (LTE) networks.
- Energy companies themselves acquire spectrum and deploy an “own” network. This can be a network for a single energy company for multiple cooperating energy companies
- A new type of “M2M traffic” operator offers high quality services to companies and organizations with special requirements, e.g. utility companies, railway companies and public safety.



New types of operators

“Texas Energy Network (TEN), a provider of communication services to the oil and natural gas industry, has announced that it has purchased an allocation of 700 MHz A and B block wireless spectrum in the south Texas region known as the Eagle Ford Shale, from Verizon Wireless”



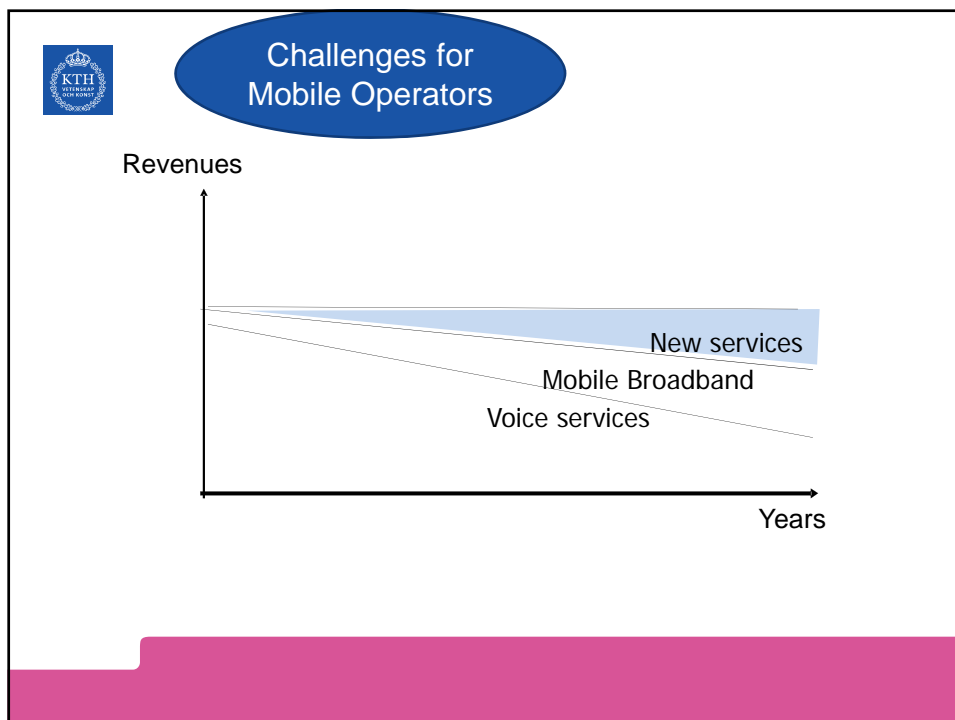
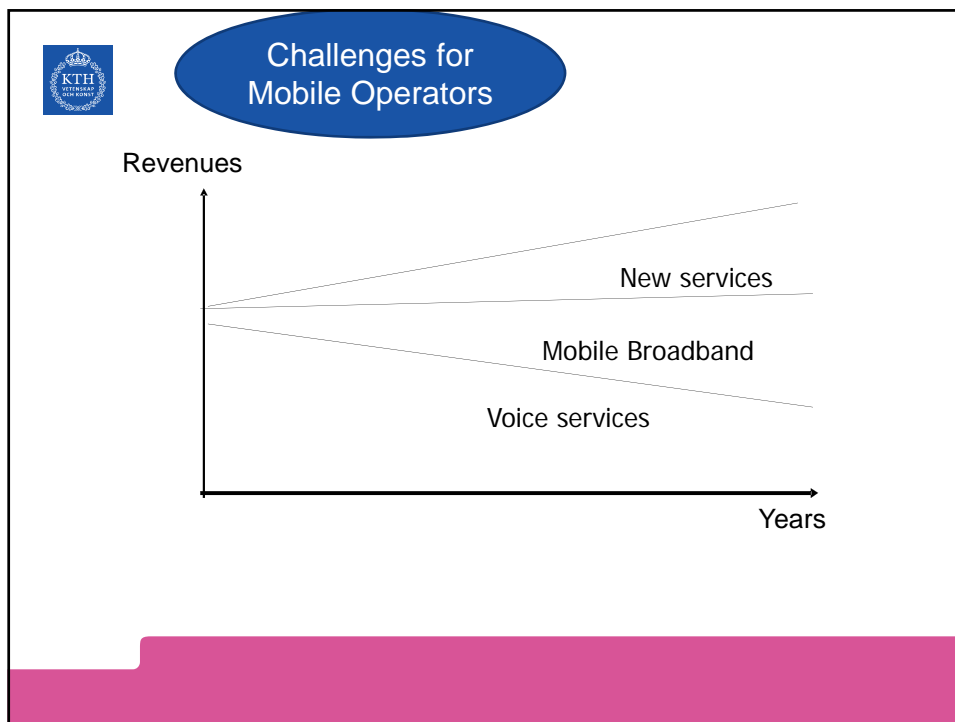
Research questions

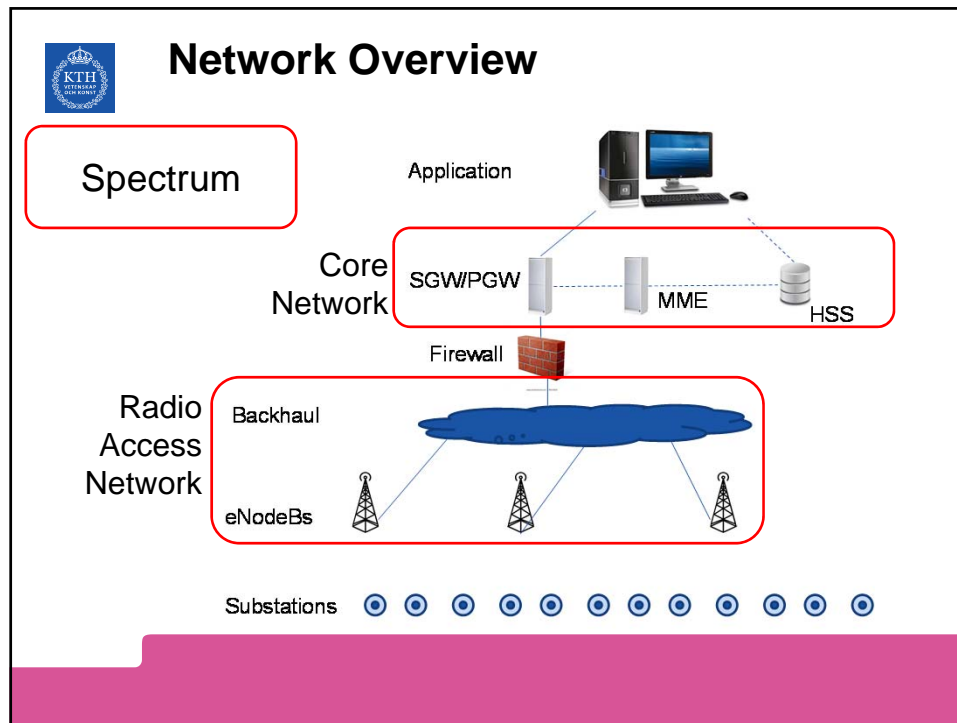
1. What are the main limitations for energy companies to deploy and operate an own mobile network for own applications only? And why is it a limitation?
2. Is there a business case for mobile operators offering special services classes for M2M traffic with special requirements
3. Is there a business case for a new type of operators operating special mobile networks carrying M2M traffic with special requirements?



Research approach

- The analysis of the network options (MNO, OWN, M2M) is based on an analysis of the costs to deploy an *own network* assuming that spectrum can be acquired.
- The level of the estimated costs of an *own network* on one hand provides insights about what is required by the energy company.
- On the other hand it provides information what can be gained by the energy company by sharing with others and also what energy companies would be prepared to pay when using a network of another operator.





Network complexity - what to consider?

Radio access network

- The number of sites, coverage of sites,
- Bit rates, traffic pattern
- Costs of sites, radio, transmission

Spectrum

- Number of MHz,
- Spectrum prices

Core network

- What is needed and not compared to mobile broadband
- Costs for CN elements



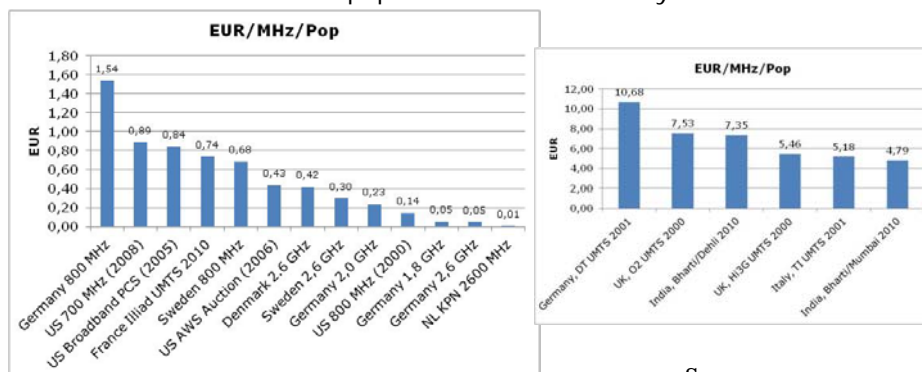
Overall cost structure analysis

- Spectrum prices – Auction data
 - Auction in Germany 800 MHz: 120 M€/MHz
 - Auction in Sweden 800 MHz; 7 M€/MHz
- Radio access network – Assumptions
 - Site cost 50- 200k€
 - Radio cost 10k€
 - Rough capex estimate for radio and site: 100 k€
 - Opex: 10 k€ per site per year
- Core network and service platforms
 - In general a small part, typically 10% of radio access
 - In our case less due to reduced functionality



Prices paid for spectrum (€/MHz/population)

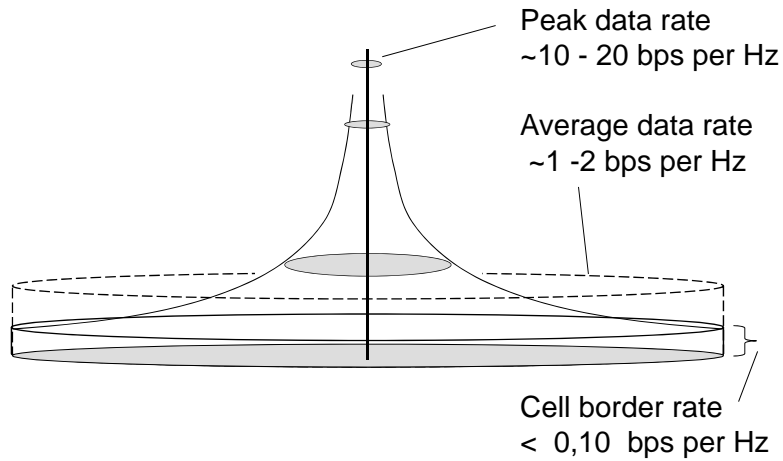
Based on a calculation of EUR paid per MHz (only downlink)
divided with the population of each country



Sources:
NRAs, Mölleryd (ITS 2011)



Coverage, bit rates and spectral efficiency



Dimensioning of mobile network

SWEDEN	rural	urban	Sum
Coverage area	202332 km ²	5672 km ²	208 004 km ²
Number of nodes	202332	113440	315 772
Number of sites (coverage limited)	1349	38	1384

Germany	rural	urban	Sum
Coverage area	343 353 km ²	13 815 km ²	357 168 km ²
Number of nodes	343 353	276 300	619 653
Number of sites (coverage limited)	2289	92	2381

Density of substations: Rural area: 1 per km²; Urban 20 per km²



Core network

- The standard Core network for LTE is used – the EPC (Evolved Packet Core)
- Since it is a dedicated network to be used fby one or a small number of trusted companies some simplifications can be made
 - No voice functionality
 - No subscribers or handling of subscriber data
 - No charging or end-user billing
 - No SMS or multimedia services
 - No roaming or mobility support



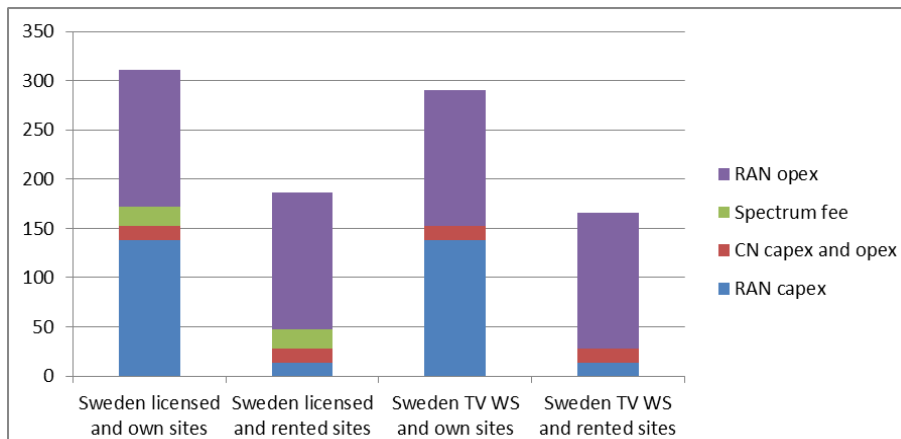
Options to build an OWN network

- To use licensed spectrum and build own sites
- To use licensed spectrum and rent site space by others
- To make use of TV white spaces and build own sites
- To make use of TV white spaces and rent site space



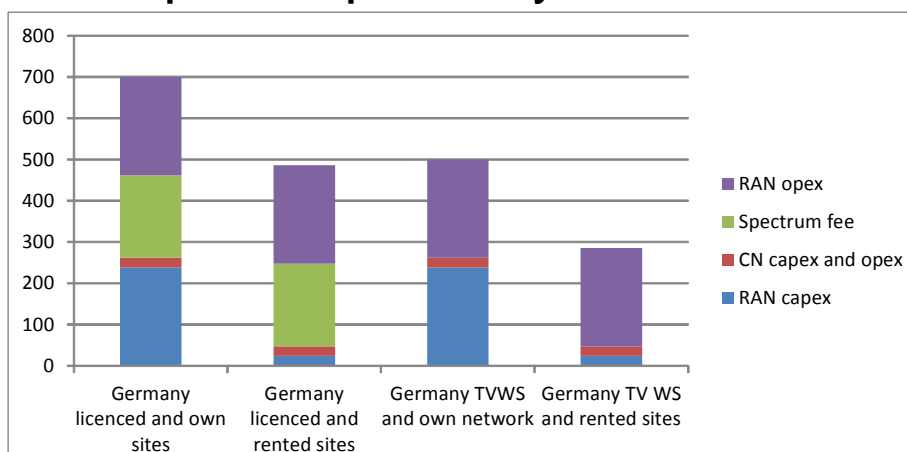
Cost estimates – Sweden

Capex and Opex for 10 years



Cost estimates – Germany

Capex and Opex for 10 years





Answers to research questions

RQ1.

*What are the main limitations for energy companies to deploy and operate an own mobile network for own applications only?
And why is it a limitation?*

- To deploy and operate an own mobile networks is costly
- These costs cannot be recovered by new sources of revenues like a mobile operator can do.
- In addition an energy company may not be able to acquire and "own" license.
 - The prices at an auction may be very high
 - the regulator may not allow energy companies to acquire spectrum for "own" use only ("spectrum should be used for public access").



Answers to research questions

RQ2.

Is there a business case for mobile operators offering special services classes for M2M traffic with special requirements?

- We would say YES - due to the cost analysis of mobile networks owned by an energy company.
- Operators need to consider the savings and value offered to energy companies and not base the pricing on the data volumes (as for consumers and "human" traffic)
- This would be considered as a new source of revenue
 - Traditional revenues (voice) are declining
 - Other actors offer "connectivity"
 - For free
 - With some level of guarantees



Answers to research questions

RQ3.

Is there a business case for a new type of operators operating mobile networks carrying M2M traffic with special requirements?

- Also here we would say YES - due to the cost analysis of mobile networks owned by an energy company,
- This is especially the case if mobile operators are reluctant to provide good offers to energy companies.
- A new actor focusing on machine type of communication can also offer tailor-made solutions to multiple utility and transport companies with special needs.

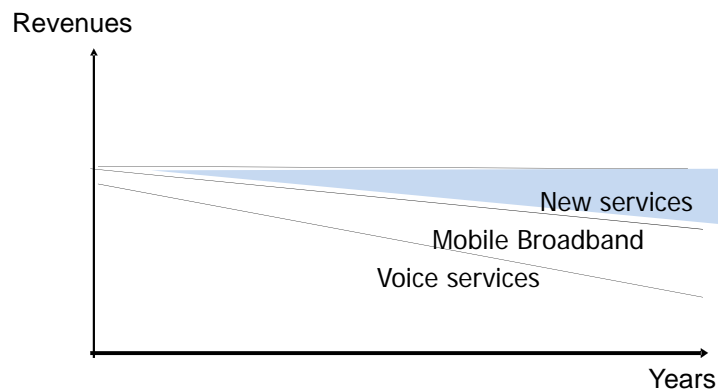


Conclusions

- We think that there many business opportunities to offer high quality M2M traffic connectivity to qualified users with special needs
 - It is costly for energy companies to build own networks
- The services can be offered by existing MNOs or by new specialized M2M traffic operators
 - MNOs need to go from B2C thinking to B2B thinking
- Energy/utility companies would be good customers
 - long term relations and revenues



Challenges for Mobile Operators



Thanks for your attention

Check web pages for our EIT ICT labs projects
On techno-economic and business aspects of M2M/IoT

- M2MRise
 - Ericsson, Nokia, Orange, Aalto University and KTH
 - <http://wireless.kth.se/blog/projects/m2mrise/>
- LTE4SmartEnergy
 - Ericsson, Siemens and KTH
 - <http://wireless.kth.se/blog/projects/lte-4-smart-energy-lte4se/>