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Intelligent Energy Networks – Application scenarios, requirements and projects

Digital transformation of a critical infrastructure

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CEPT Workshop on Machine-to-Machine-Communication

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Agenda

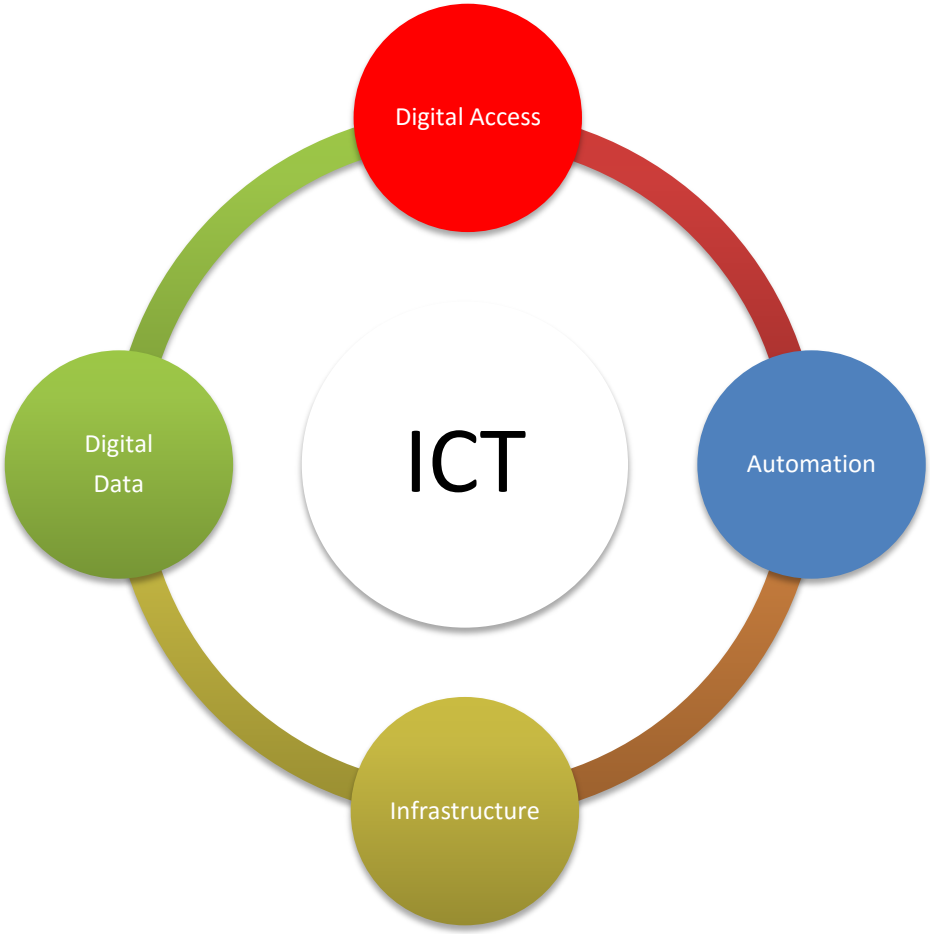
- Where do we come from?
- Digital transformation
- Categories of M2M
- Intelligent Energy Network: Players, legal background of Smart Grid and applications
- Technical Requirements
- Wireless technologies
- Pilots
- Conclusion

Where do we come from?

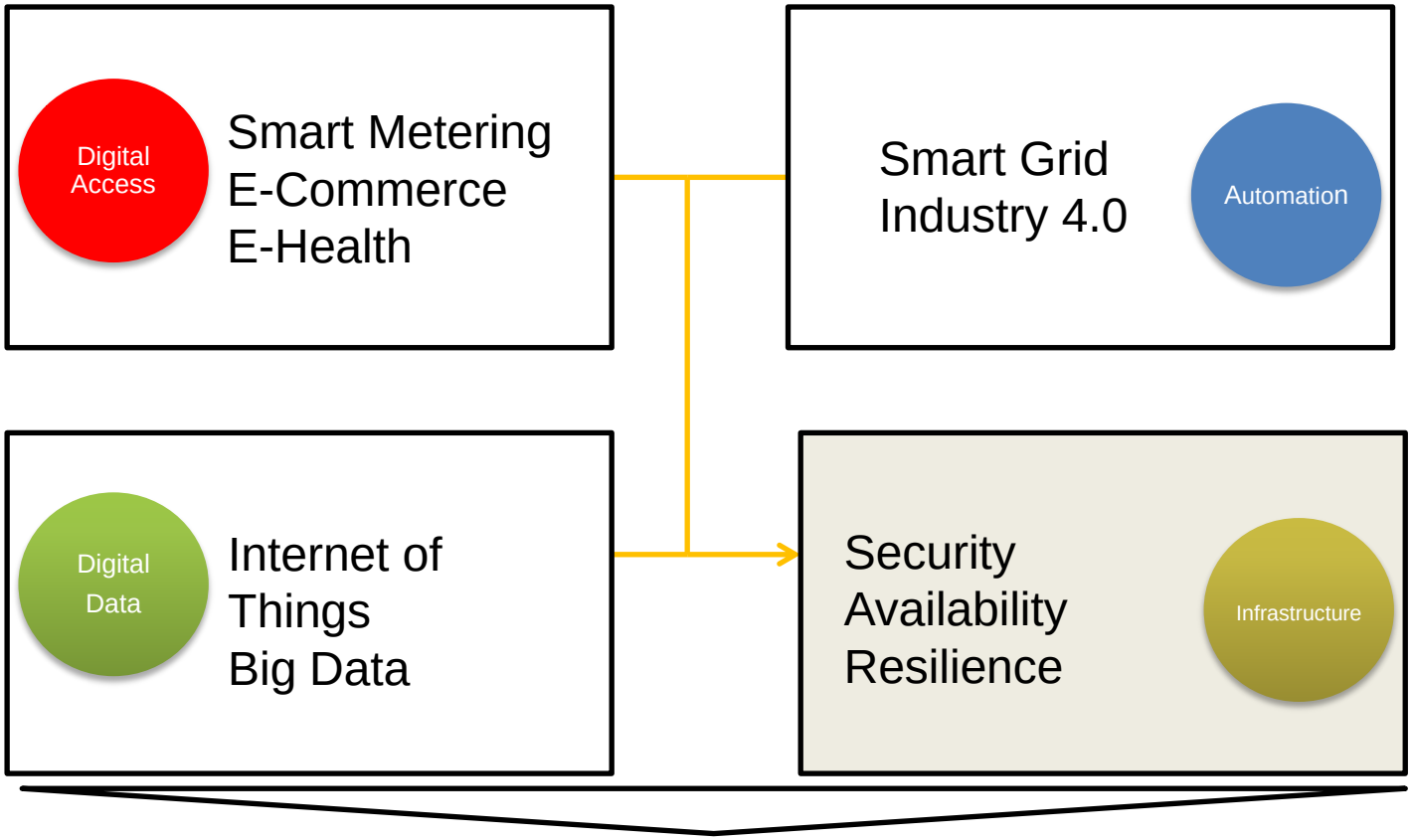
- B2C markets: domination of platform players („Over The Top“) with scalable platforms
- Mass markets applications (e.g. video) accelerate demand for high bandwidth
- Current wireless technologies and networks designed and deployed for mass market appliances
- Digital transformation of B2B and B2B2C markets (e.g. energy, healthcare, automotive, logistics) will increase Machine-2-Machine communication
  - Volume of data generated by M2M applications is relatively small compared to mass market of mobile applications, however: the number of connections will exceed the number of other connected mobile data devices (same applies to number of data transactions)
  - If M2M applications rely on public mobile 2G, 3G and 4G networks, the transaction volumes are problematic because these networks are not well suited to carrying large volumes of small data transactions
- Digital transformation of economy is the opportunity for Telcos, platform providers (OTT) and new entrants
- Questions
  - New B2B or B2B2C-platforms? Or isolated, fragmented solutions?
  - Which kind of technologies/cellular networks/standards support specific M2M efficiently?

  ➢ Example of energy market

Digital transformation: 4 key areas



New applications lead to new requirements (use cases)



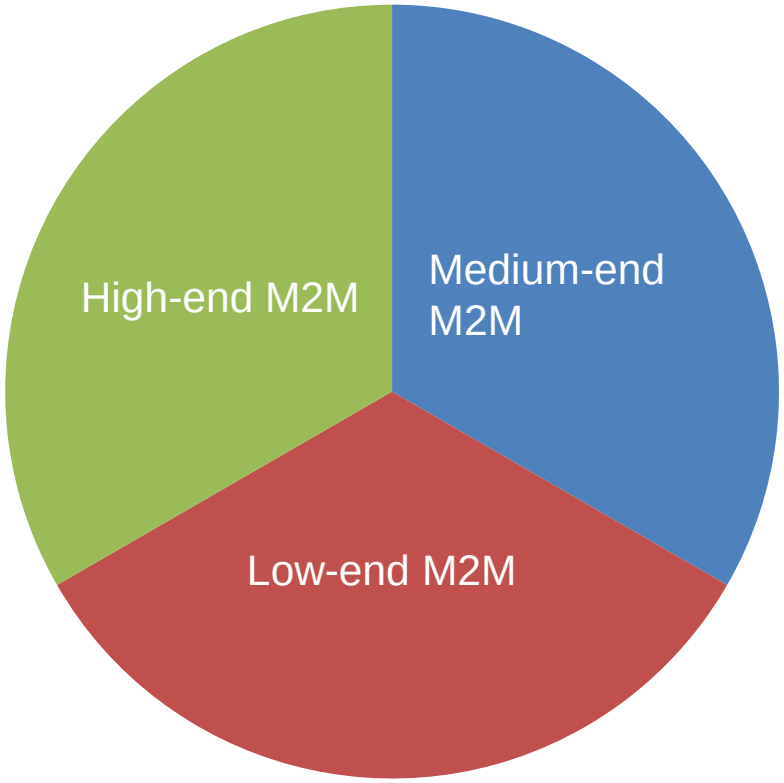
IoT connections: from 1.8 billion in 2013 to 6 billion in 2020 (in EU)

IoT are distributed assets than can only be connected via wireless technologies

Largest sectors (by volume) are intelligent buildings, utilities and automotive

Three different types of M2M-connections (different use cases)

- Infrastructure enables mission-critical applications
- High Quality of Service
- Dedicated coverage
- Resilient network
- High Security
- Scope: local, regional, national market
- Examples: PPDR, E-Health, Smart Grid,…



- Infrastructure enables applications with global scale
- Medium Quality of Service
- Mobility important
- Not mission-critical
- Economies of scale
- Scope: national and international market
- Examples: Logistics, connected car,….

- Focus on low cost
- Low Quality of Service
- Not mission-critical
- Scope: national markets, in future international (?)
- Examples: Theft protection, animal tracking,…

Intelligent Energy Networks

Energy market: It‘s time for change!

- Players
  - Retailers
  - Distribution network operators (e.g. in Germany more than 800)
  - Transmission network operators
  - Metering operators

➢ Digital Transformation (Digital Access and Automation) is driven and confined by external factors (energy policy, regulation)

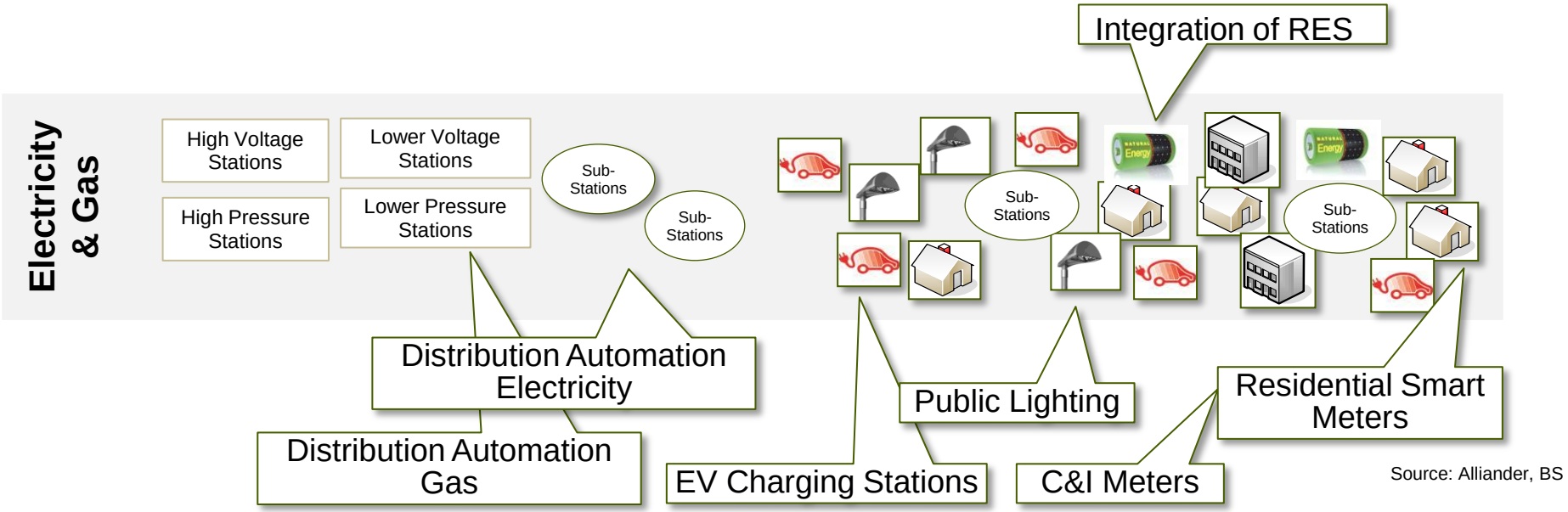
- Communication infrastructure
  - Historically DSO preferred to use their own networks (e.g. PMR) to ensure high quality of service
  - But: PMR technology outdated, not suitable for MSM
  - DSO left with two options for distributed assets (Smart Grid, Smart Metering)
    - Use of public mobile infrastructure
    - Sharing dedicated wireless network

Intelligent Energy Networks: legal background

- Third Energy Package requires Member States to ensure implementation of intelligent metering systems
- Implementation may be conditional on a positive economic assessment
- Without Cost-Based-Analyse there is a target of rolling out at least 80% by 2020
- 16 Member States with nation-wide deployment
- Some member states combine metering with integration of RES (e.g. Germany)
- RES lead to an automation in low voltage networks (Smart Grid)
- Deployment of both „Smart Grid“ and „Smart Metering“ must be cost efficient (regulation)

- ➢ Communication technology must be available to meet roll-out deadlines (e.g. 2017 in Germany)
- ➢ Market players are forced to make use of economies of scale
- ➢ Smart Grid is mission-critical

Intelligent Energy Networks – What is connected?



Source: Alliander, BS

Smart Grid is about connecting assets that are widely distributed in the field. Since Smart Grid management relies on communication infrastructure, the security and efficiency of the Smart Grid M2M communication is essential for the success of Smart Grid! Convergence of Telecommunication and Energy networks!

Technical requirements

- Availability (e.g. no interference)
- Resilient wide are communication (power autonomy, redundancy)
- Bandwidth (< 1 Mbit/s)
- Latency
- Deep indoor coverage
- Security (e.g. protection profile)
- Cost efficiency
- Standardised and proven technology
- Future proof
- Enduring access to spectrum

Three prelimenary remarks about frequencies

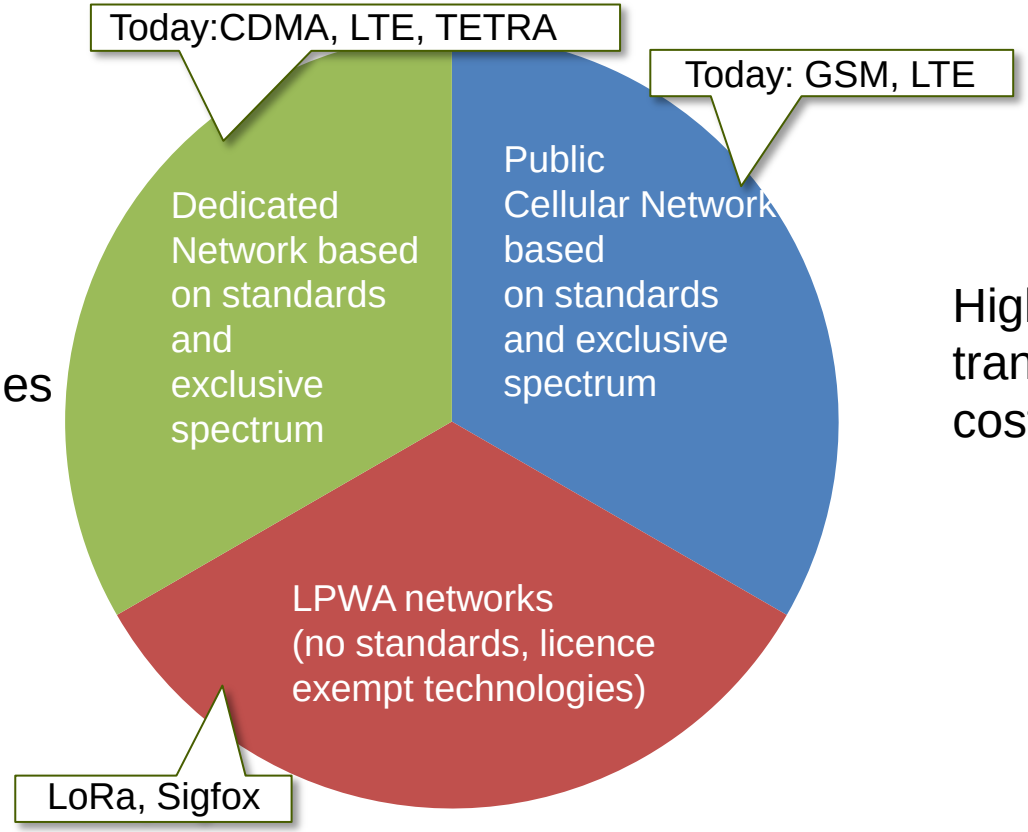
1. From a technical viewpoint, lower frequency spectrum enables wider area coverage and better penetration deep into buildings (frequencies below 1 GHz, 450MHz much better than 800MHz)

2. Only licensed spectrum assures long-term interference free network operation and therefore reliable delivery of data connectivity (and future proof investment). Unlicensed spectrum is typically for uncoordinated use for multiple use case (e.g. 868MHz for short range devices, Wifi spectrum in 2.4 and 5.8GHz)

3. European harmonization of frequency use is helpful to allow use of latest (e.g. LTE) technology in all relevant spectrum bands. However, spectrum use case may differ from country to country depending on topography, existing telecom infrastructure and new market developments

Relevant wireless technologies

Low recurring transaction costs for utilities

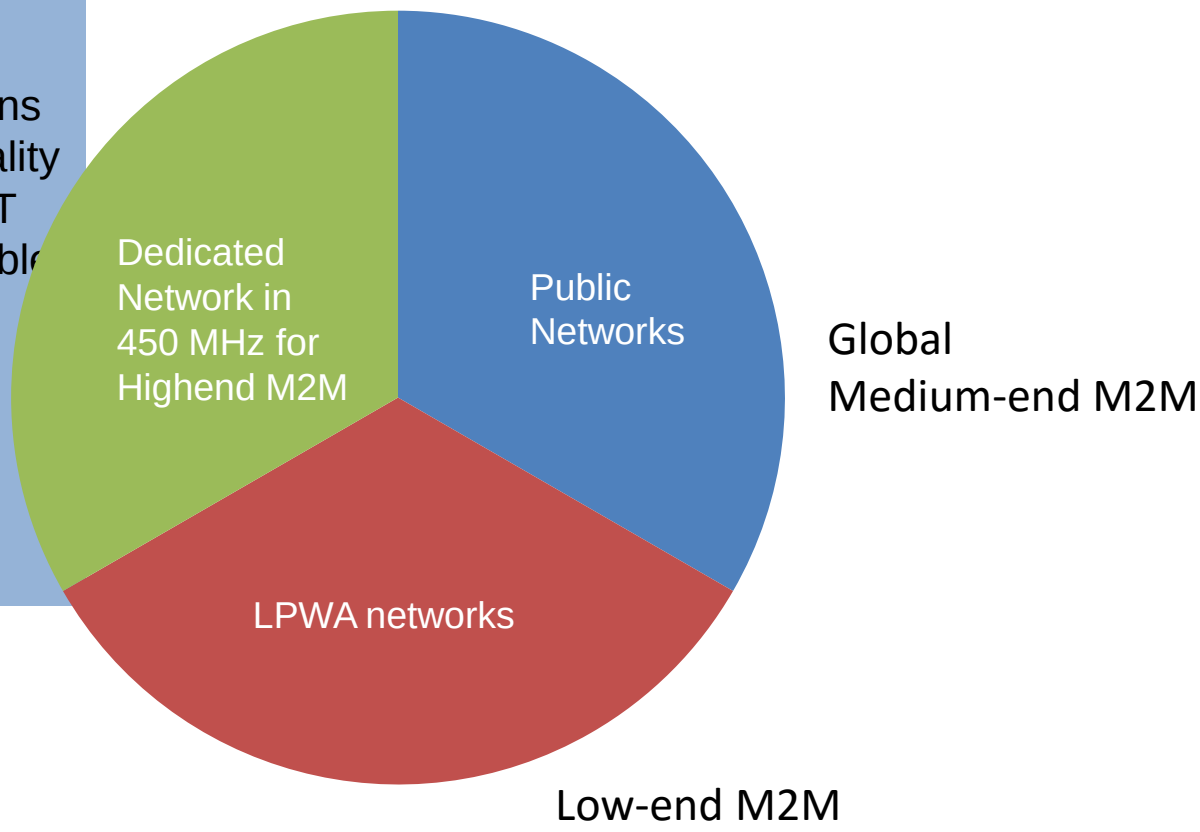


Higher recurring transaction costs for utilities

High recurring transaction costs for utilities

Efficient solution for intelligent energy networks: dedicated cellular network using standardised technology

- Low transaction costs because no competition with mass markets applications or compliance with net neutrality
- Standardised technology (IMT band (new standards applicabl
- Cost efficient
- Requirements are fulfilled
- Nation-wide platform for mission-critical applications possible



New wireless standards coming in midterm perspective will not change the pricture!

- New wireless standards
  - LTE MTC (machine type communication) evolution is based on amending LTE to support MTC. The first version was released with 3GPP Release 8 based on CAT 1 → it does not meet the IoT requirement (battery/cost/range)
  - LTE-M (optimized for M2M available with Release 13)
  - Narrow band IoT (NB-IoT) (Standard to be frozen in 2016)
  - Purpose of NB-IoT:
    - improved indoor coverage
    - support for massive number of low throughput devices,
    - low delay sensitivity,
    - ultra-low device cost,
    - low device power consumption
- New wireless standards will
  - be available for all standardized mobile IMT bands, i.e. public mobile operator networks but also 450MHz
  - further drive IoT business case by substantial reducing connectivity cost on both network and device side
  - substantially reduce the cost advantage of LPWA networks
  - Not change the case for dedicated 450MHz networks for utilities (and other critical communication users) as the (i) proportional coverage benefit remains and (ii) as only dedicated networks allow for resilience and control

Smart Grid Pilots: Whereas others in Europe have made up their minds, in Germany still ongoing discussions

CDMA 450

Deployment Netherlands
Pilots Germany

LTE 450

Pilots Germany

German business associations recommend dedicated cellular network at 450 MHz (VDE, BDEW)

Hybrid CDMA 450 and powerline

Deployment Austria
Pilots Germany

RF-Mesh / GPRS

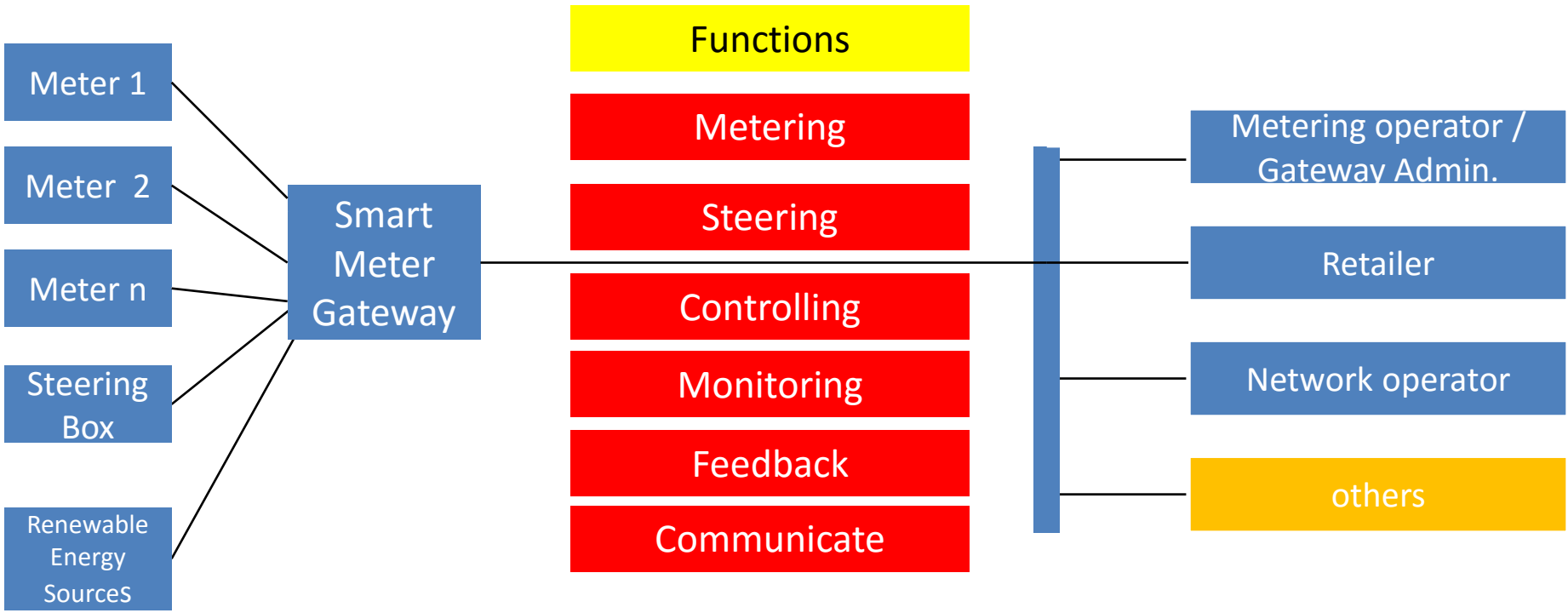
Pilots Germany

Conclusion

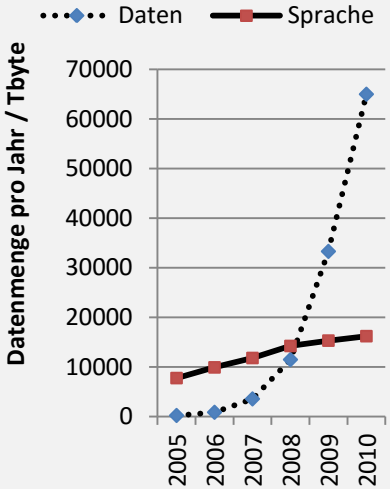
- Intelligent Energy Networks are mission-critical
- Intelligent Energy Networks need mature communication technology
- In public cellular networks managed services are required (if Smart Grid and Smart Metering comes together)
  - Competition with mass markets services/less focus on M2M as very small share of total revenues
  - Not able to provide network resilience or control
- 450 MHz provides opportunity to deploy the new mission-critical infrastructure (for energy and others)
- New wireless technologies drive IoT applications without changing the economics / reasoning for dedicated 450MHz platform for critical M2M communications
- Platform for intelligent energy applications can make use of economies of scale
- Platform can provide M2M connectivity for other critical sectors

Back up

Intelligent Energy Networks – Metering infrastructure



What drives mass markets? Scalable platforms
What about B2B markets?

	Platform (OTT)	Appliance	Impact
Mass Market (B2C)	Apple (IOS) Google (Android) Amazon Microsoft (Windows) ….	Audio / Video Voice E-Mail Online shopping Communication ….	
Business Market (B2B, B2B2C)	?	Smart Grid E-health Smart Home Industry 4.0 ….	• New requirements (e.g. latency) • IoT connections: from 1.8 billion in 2013 to 6 billion in 2020 (in EU)

Key obstables with regard to M2M

- Market fragmentation and complexity
- A lack of regualtory clarity
- Net neutrality and managed connectivity regulations
- New players
- Costs
- Network migration
- New business models

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