Telecommunication 4.0 – Investment in Very High Capacity Broadband and the Internet of Things

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- Internet of Things
- Telecommunication 4.0 – Two challenges
  - Transformation of telco industry
  - Investment in gigabit networks
    - Empirical approach
    - Pragmatic approach
- Conclusions

Internet of Things

Internet of Things

- Basics
  - Digitisation
  - Internet protocol/packet-switched
  - Layered structure of the Internet
  - Software-applications
  - Virtualisation
  - Smart networks

Internet of Things

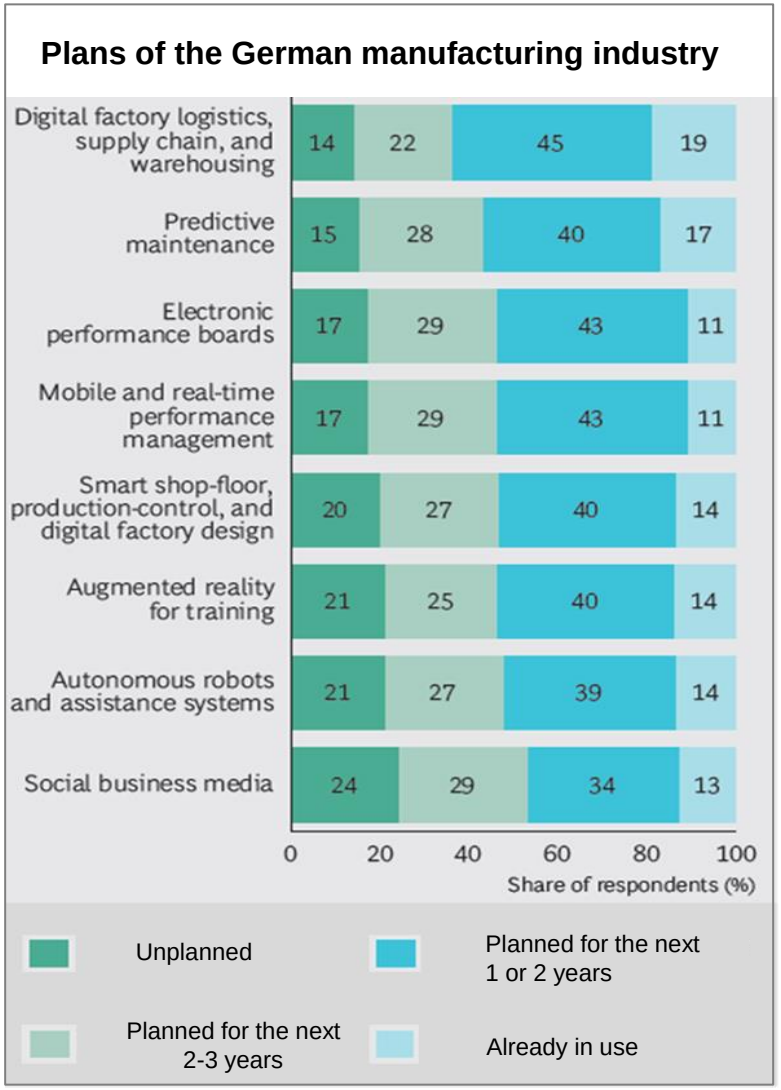
- Cisco forecast 2020
  - M2M-communication 26,4% of global mobile data traffic (2015: 7,7%)
  - Annual growth rates 38%

Internet of Things

Drivers

- Economical reasons
  - Competitive pressure
  - Cost reduction
  - Development of future proofed business cases
- Regulatory obligations (e.g. eCall, smart meter)

Internet of Things

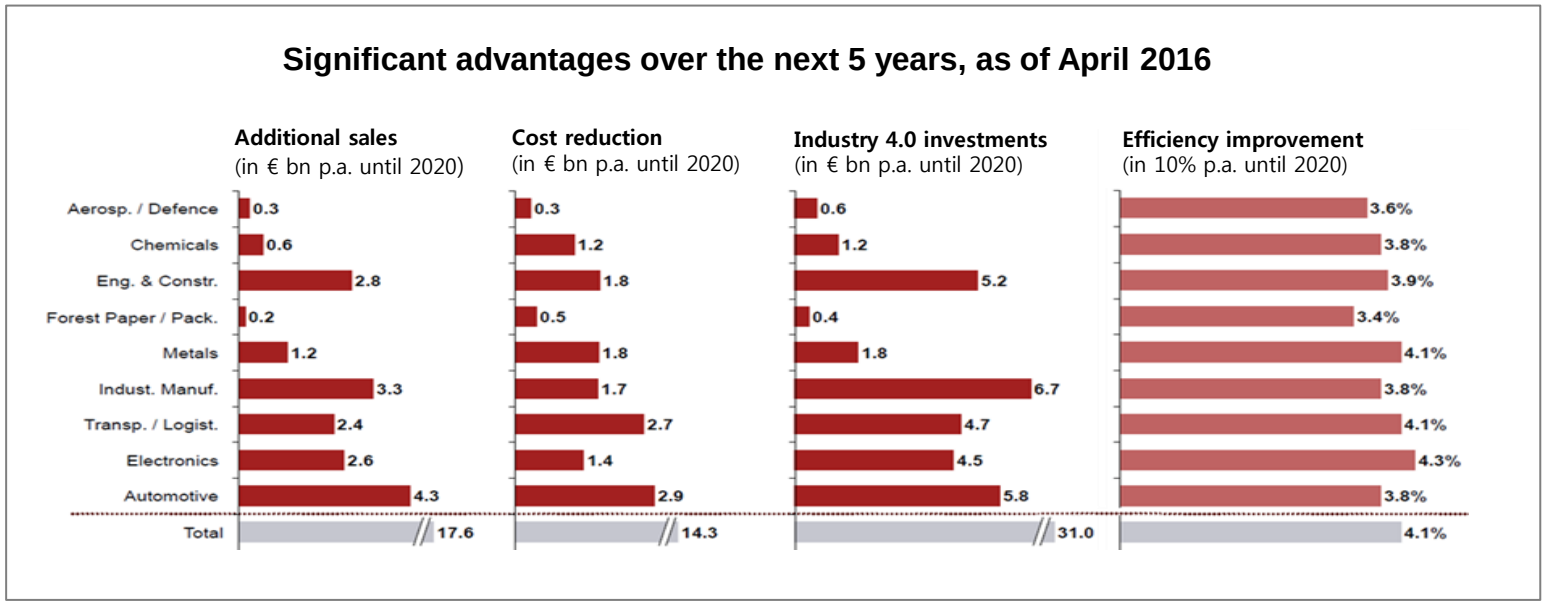


Source: In accordance with BCG (2016).

Internet of Things

Economic implications

- Roland Berger: Until 2025 additional annually value added of 250 Mrd. € in Europe
- Cisco: Additional annually German growth of 2% in the next 10 years
- PwC: Investment plans of annually 31 Mrd. € for the next 5 years



Source: In accordance with PwC (2016).

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Telcos' two challenges to foster IoT

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1st challenge
Transformation of telco industry

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Transformation of telco industry

Chances

- Broadband communication networks basic infrastructure
- Demand growth beyond voice and today's Internet
- Realization of better economies of scale
- New business cases

But

IoT, especially M2M, a difficult market

- Single customers with huge amounts of connections (e.g. cars) instead of consumer mass market
- No voice, but data traffic
- Specialised solutions for each customer (e.g. car manufacturer)
- Each individual user (e.g. car owner) with small business volume (IDATE: 1-10 € instead of 40 €)

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Transformation of telco industry

Also

- Highly attractive for newcomer (also using alternative technologies)
- Speeding up of innovation cycles reflecting the innovation speed of applications
- Becoming only one part of new complex clusters of production and value added
- Reallocation of value added from mobile operators to fixed network operators (fibre as basis for 5G-standard)
- High performance standards (no best effort, but agreed qualities, real time, security, high availability of nearly 100%, symmetry of traffic between up- and download)
- Potential of software-defined networks and loss of network control
- New calibration of net neutrality and specialised services

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Transformation of telco industry

Chances and risks

- Future challenges for telecommunications markets, huge changes of a whole ecosystem
- Need to cope with the challenges as starting point to profit of IoT
- Infrastructure key for innovation and new ecosystem
- First step: Investments in very high capacity broadband
- Very high capacity networks as precondition for very high capacity broadband (gigabit networks for gigabit society)
- Future economic and societal competitiveness

How much risk is commitment to CAPEX?

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2nd challenge
Investment in gigabit networks

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Investment in gigabit networks

*“Very high-capacity network" means an **electronic communications network** which*

- *either consists **wholly of optical fibre elements** at least up to the distribution point at the serving location or*
- *which is capable of delivering under usual peak-time conditions similar network performance in terms of*
  - *available **down- and uplink bandwidth**,*
  - ***resilience**,*
  - ***error-related parameters**, and*
  - ***latency** and **its variation***

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Investment in gigabit networks

	Downstream (Mbit/s)	Upstream (Mbit/s)	Packet loss	Latency
Basic Internet	≈20	≈16	o	o
Homeoffice/VPN	≈250	≈250	+	+
Cloud Computing	≈250	≈250	+	++
Conventional TV (4K/Ultra-HD)	≈90	≈20	++	+
Progressive TV (8K/…)	≈300	≈60	++	+
Communication	≈8	≈8	++	+
Videocommunication (HD)	≈25	≈25	++	++
Gaming	≈300	≈150	++	++
E-Health	≈50	≈50	++	+
E-Home/E-Facility	≈50	≈50	o	o
Mobile-Offloading	≈15	≈12	o	o

O = Low importance/significance
+ = High importance/significance
++ = Very high importance/significance

Source: WIK.

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Investment in gigabit networks

Transmission technology	FTT...	Bandwidth	Length limitation	individual/ shared	symmetr./ asymmetr.	Standard	Maturity	ODF unbund.	VULA (L2)
Copper pair		[Gbit/s]	[m]						
ADSL2+	FTTC	0,01	2.600	i	a	y	y	n	y
VDSL2	FTTC	0,05	400	i	a	y	y	n	y
VDSL2 Vectoring	FTTC	0,09	400	i	a	y	y	n	y
VDSL2 Supervect.	FTTC	0,25	300	i	a	y	y	n	y
G.fast	FTTS/dp	2 x 0,5	250	i	a	y	y	n	y
XG.fast	FTTB	2 x 5	50	i	a	n	+ 2 Y	n	y
Coax									
Docsis 3.0	fibre node	1,2	160.000	s	a	y	y	n	n
Docsis 3.1	fibre node	10	160.000	s	a	y	y	n	n
Docsis 3.1 FD/XG-Ca.	deep fibre	10	160.000	s	s	y	+ 4 Y	n	?
Fibre									
GPON (PMP)	FTTB/H	2,5	20.000	s	a	y	y	n	y
XG.PON	FTTB/H	10	40.000	s	a/s	y	y	n	y
XGS.PON	FTTB/H	10	40.000	s	s	y	y	n	y
TWDM GPON	FTTB/H	4 - 8 x 10	40.000	s	a/s	y	y	4 - 8 Ops	y
DWDM GPON	FTTB/H	1000 x 1	100.000	i	s	n	+ 4 Y	y	y
Ethernet P2P	FTTH	n x 100	80.000	i	s	y	y	y	y

Source: WIK.

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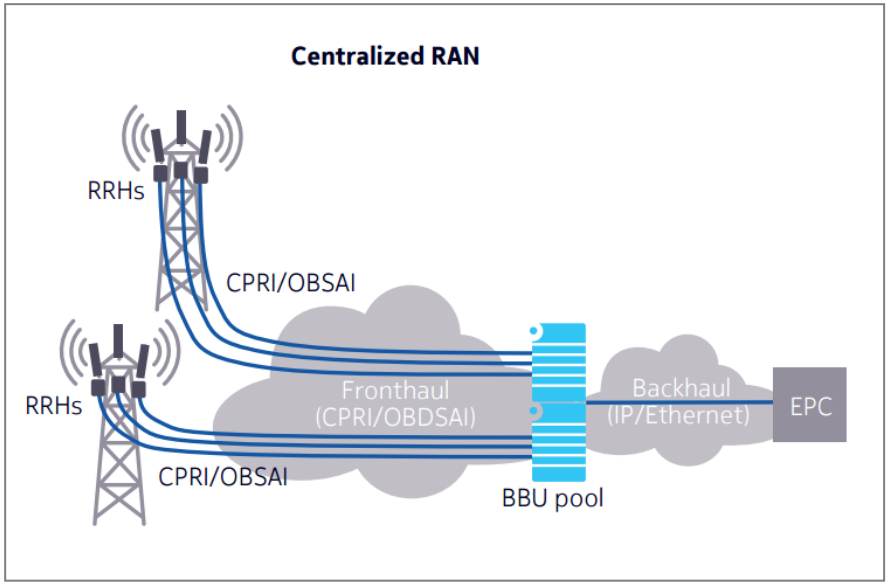
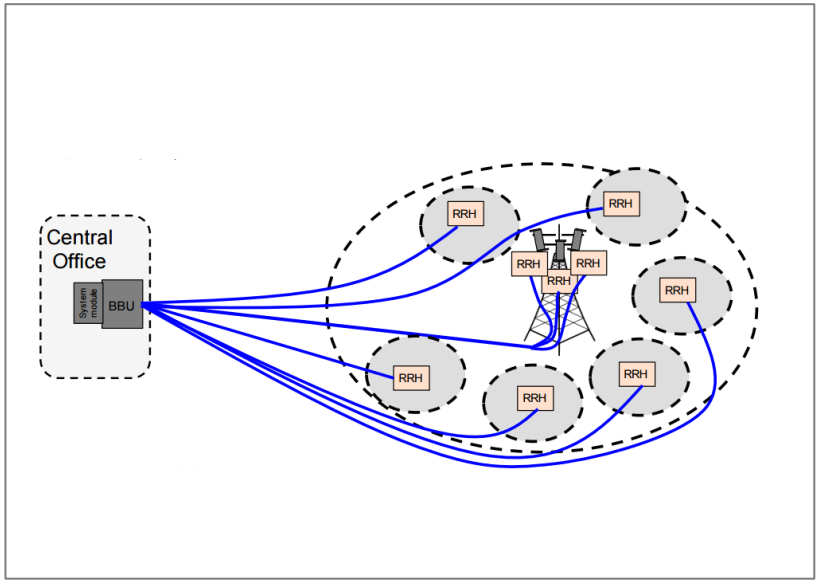
Investment in gigabit networks

5G mobile network „Fronthaul“ and „Backhaul“

- Mobile „Fronthaul“ (MFH)
  - Connection of „Remote Radio Heads“ (RRHs) and „Base-band Unit“ (BBU) pool
- Mobile „Backhaul“ (MBH)
  - Connection of BBU-pool and core network



Source: Nokia (2016).



Source: Orange (2014).

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Investment in gigabit networks

Future proofed scenario

- More fibre coverage urgently needed in Germany - nationwide
- Copper, coax and wireless only in use for short/very short distances

Empirical approach to a battlefield:

Investment in broadband, competition and regulation

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Investment in gigabit networks

Two conflicting theses

- Regulation prevents misuse of SMP and thus fosters competition and efficient investment
- Regulation hinders SMP-operator to earn sufficient revenue and thus prevents effient investment

Quite a few studies around these theses, Briglauer (2017) sees results of a majority for the second thesis

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Investment in gigabit networks

Problems of theory and empirical work, e.g.

- Investment in all technologies which provide 30 Mbit/s or more included in often used data for NGA-networks, short time series
- Extremely short time series for investment in very high capacity networks (gigabit networks), especially not comparable for a couple of countries, as deployment started mostly only some years ago
- Take-up rates often used proxy for investment, Neumann et al. (2016) annual growth of fibre access
- Indicators to measure grade of competition achievable, to measure grade of regulation not yet convincing

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Investment in gigabit networks

- Modelling complex as regulation addresses
  - multiple communication markets
  - with different wholesale-levels
  - interdependent offers
  - changes in regulation over time and among countries.
- Evaluating and comparing different effects on different market players (incumbent, competitors)
- Comparable greenfield situation not existing
- Difficulties to define impartial indicators (UMTS-auction 2000 a desaster because of high spectrum prices, or a step for liberalising spectrum early?)
- Transformation in concrete regulatory decisions (Briglauer 2017: If full deregulation is not feasible due to monopolistic market structure …)

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Investment in gigabit networks

Result of WIK's empirical work mixed

- e.g. for Ofcom: No solid result for simple relations, neither yes nor no
- Neumann significant effect of price for LLU on investment, but no simplistic relations

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Investment in gigabit networks

Quite a lot of empirical work (see Briglauer, Vogelsang ...)

An often result U-shaped curve (Briglauer, HSBC also WIK)

- More effective regulation fosters investment (or other performance indicator)
- Until reaching a special level (peak)
- Hereafter negative impact

Often explained by (e.g. ZEW-Meta-Studie, WIK-Ofcom)

- Schumpeter-effect
- Escape competition effect

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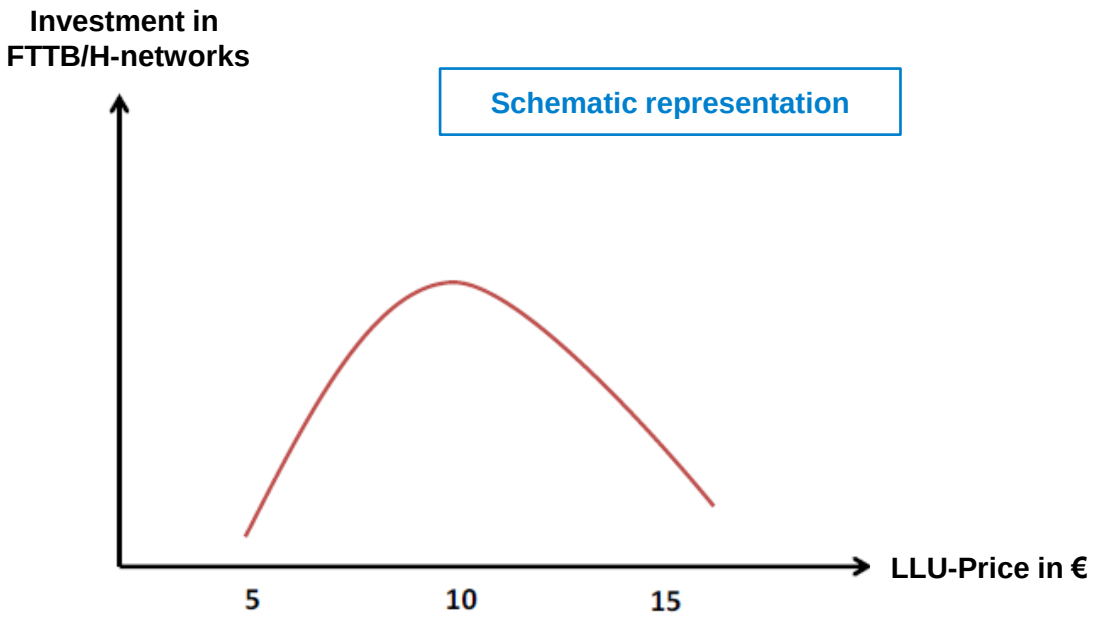
Investment in gigabit networks

Relationship between LLU-price and investment in FTTB/H connections



Source: WIK.

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Investment in gigabit networks

- Problem: Reliable deduction of peak point
  - Left/right side of the peak?
  - Essential for the market players, e.g. at which price of last mile the peak is reached? (Neumann between 10,89 € and 11,43 € in his international sample, current regulated German price 10,02 €)
  - Essential for regulators calibrating competition and investment goals
  - Blur of empirical deduction

Pragmatic approach:

The core problem rural regions

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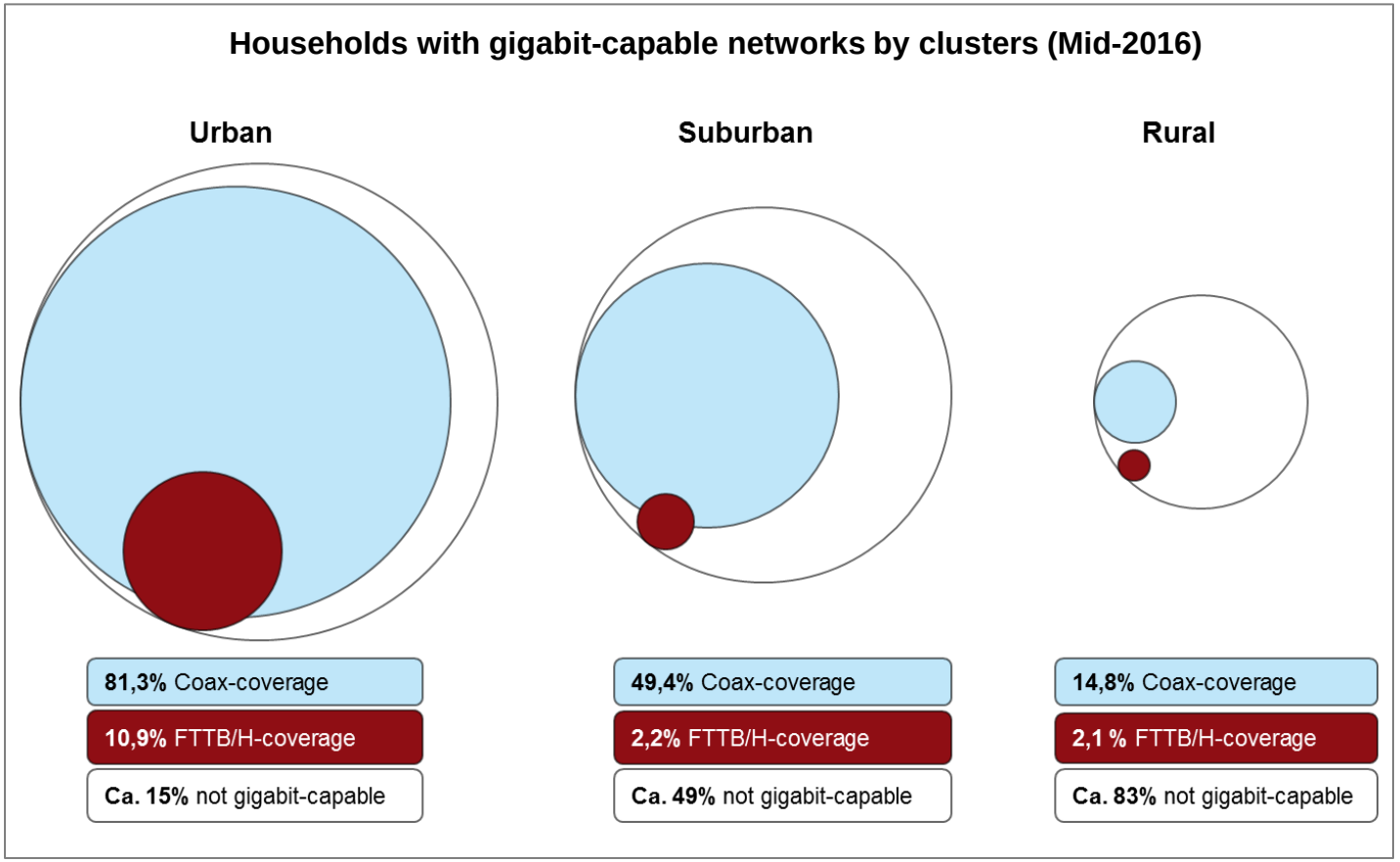
Investment in gigabit networks



Source: WIK.

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3 cases

1. Cities: Competition at the enduser level and no need for further regulation
2. Suburban areas: Dilemma between level of regulation and investment
3. Rural areas with high burdens to investors: Looking for solutions beyond regulation

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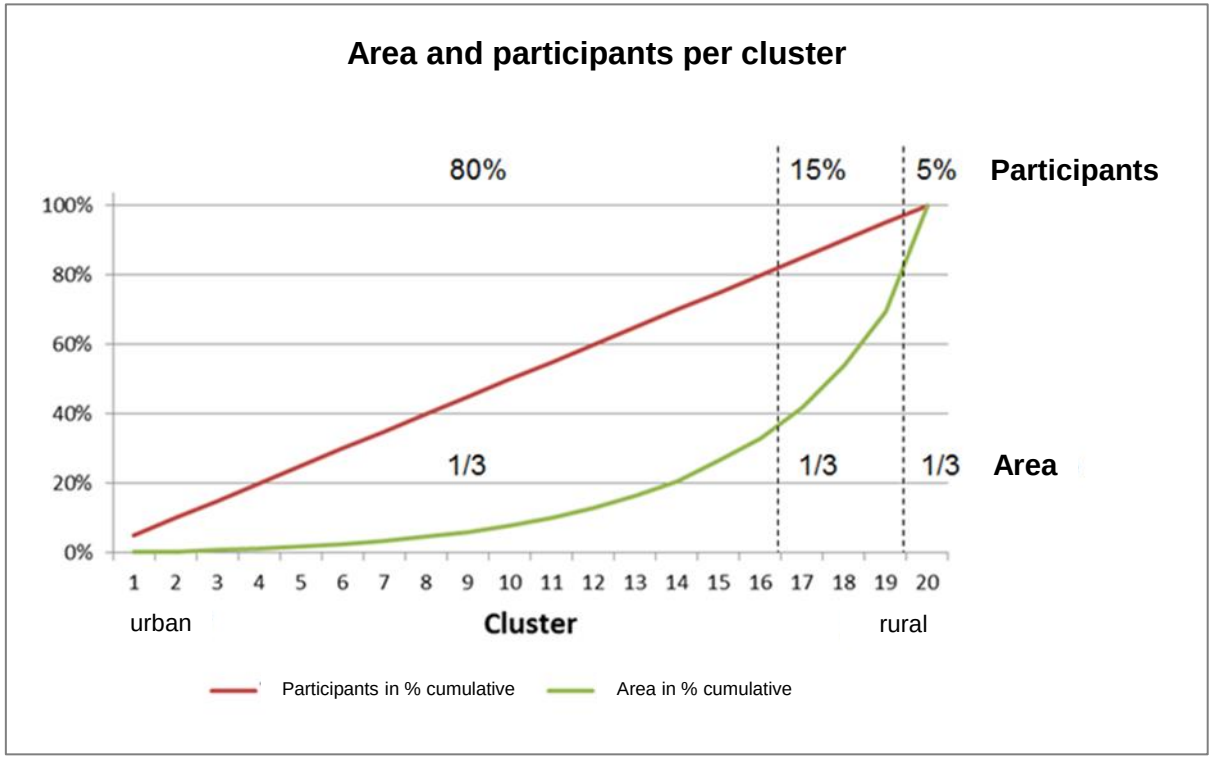
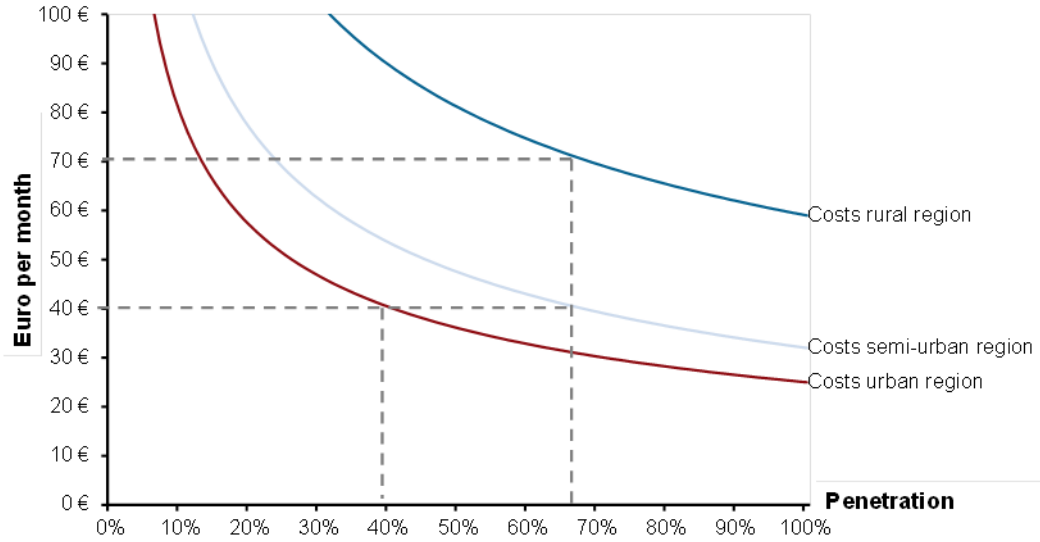
Investment in gigabit networks



Source: WIK.

Schematic representation of the cost of broadband deployment per customer depending on the penetration



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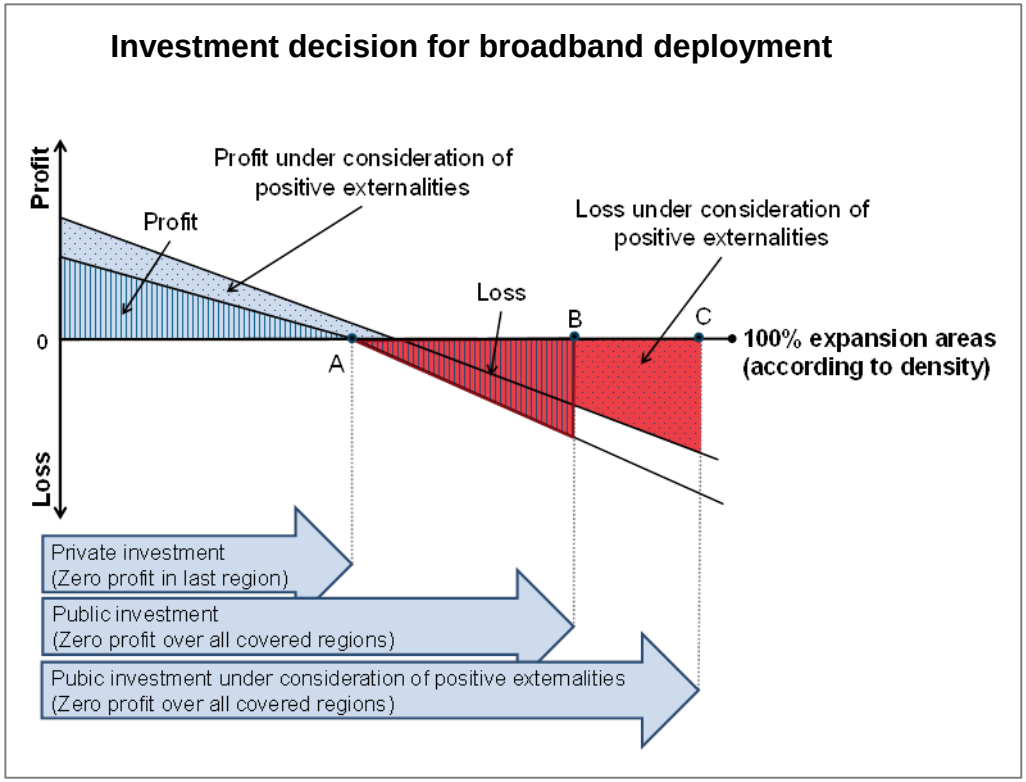

Source: WIK.

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In rural areas

- Regulation of fibre networks minor role, when at all
- No king‘s road, as international benchmarks show (e.g. Switzerland, Australia, Sweden)
- Commercial conditions key (e.g. deployment costs, depreciation rates, time horizon)
- Another cost-benefit-analysis than at the theoretical level:
  - Theory often: Infrastructure investment vs. regulatory intervention
  - In practical relevant situation: Acceptance of inefficiency of a monopoly as result of non-regulation vs. inefficiency by spending tax payers money to „buy“ infrastructure with open access

Choice between the devil and the deep blue sea

Conclusions

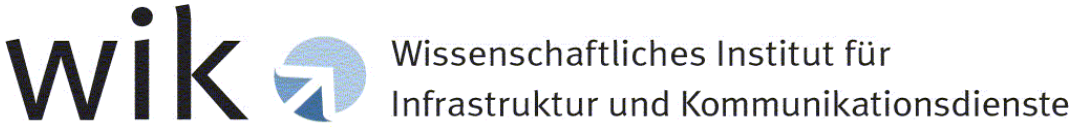
Conclusions

- IoT is part of industrial and societal ambitions.
- IoT requires ubiquitous fibre networks.
- IoT provokes enormous effort to invest in Gigabit networks.
- Whereas we can expect their privately financed deployment in densely populated areas, we see huge problems in rural areas.
- Regulation might be pro-investment, but the fundamental business case cannot be changed.
- We have to go a step beyond: regulation holidays (e.g. by concession models) or subsidies.
- Telcos are facing an additional challenge: Finding their role in the IoT-ecosystem at least as enabler, defining new business models, streamlining processes.
- If they fail to deliver in regard to both challenges, IoT in Germany starts with a handicap.

Essence

To make IoT a success telcos have to deliver

- fibre based infrastructure
- service quality
- innovation in products and processes.



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