EUSERS SUMMER SCHOOL

Performance and Governance of Services of General Interest.

Critical perspectives on Energy, Telecommunications, Transport and Water Reforms in the EU

***June, 27th – July 1st* 2016**

Telecommunications in the European Union

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Ludwig-Maximilians-Universität Munich

Milan, 28 June 2016

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Introduction

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Agenda

- History & Definition of Telecommunication
- Basic Model of Telecommunication
- Selected Telecommunication Infrastructures
- Requirements on Future Broadband Networks
- Telecommunications Market Overview
- Regulatory Principles & the Role of the State
- Regulation on Telecommunications in Europe
- Competitor Access & Network Neutrality as Current Regulatory Issues
- Discussion

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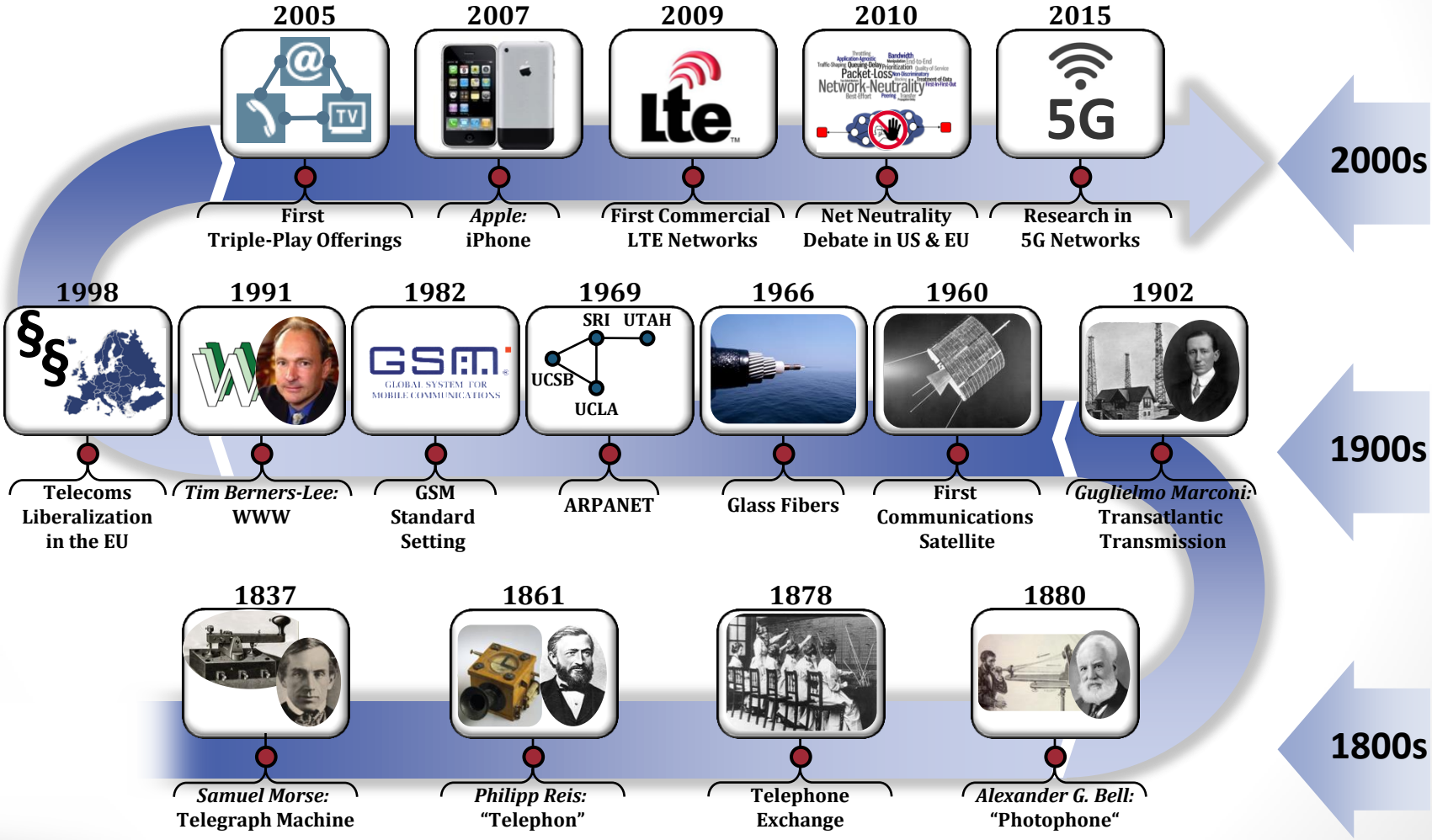
Telecommunication – Milestones



Source: Own illustration; telekom.com; telstra.com.au; computerwoche.de.

Telecommunication – What is it about?

- **com·mu·ni·ca·tion (kə-myūˈnĭ-kāˈshən)**

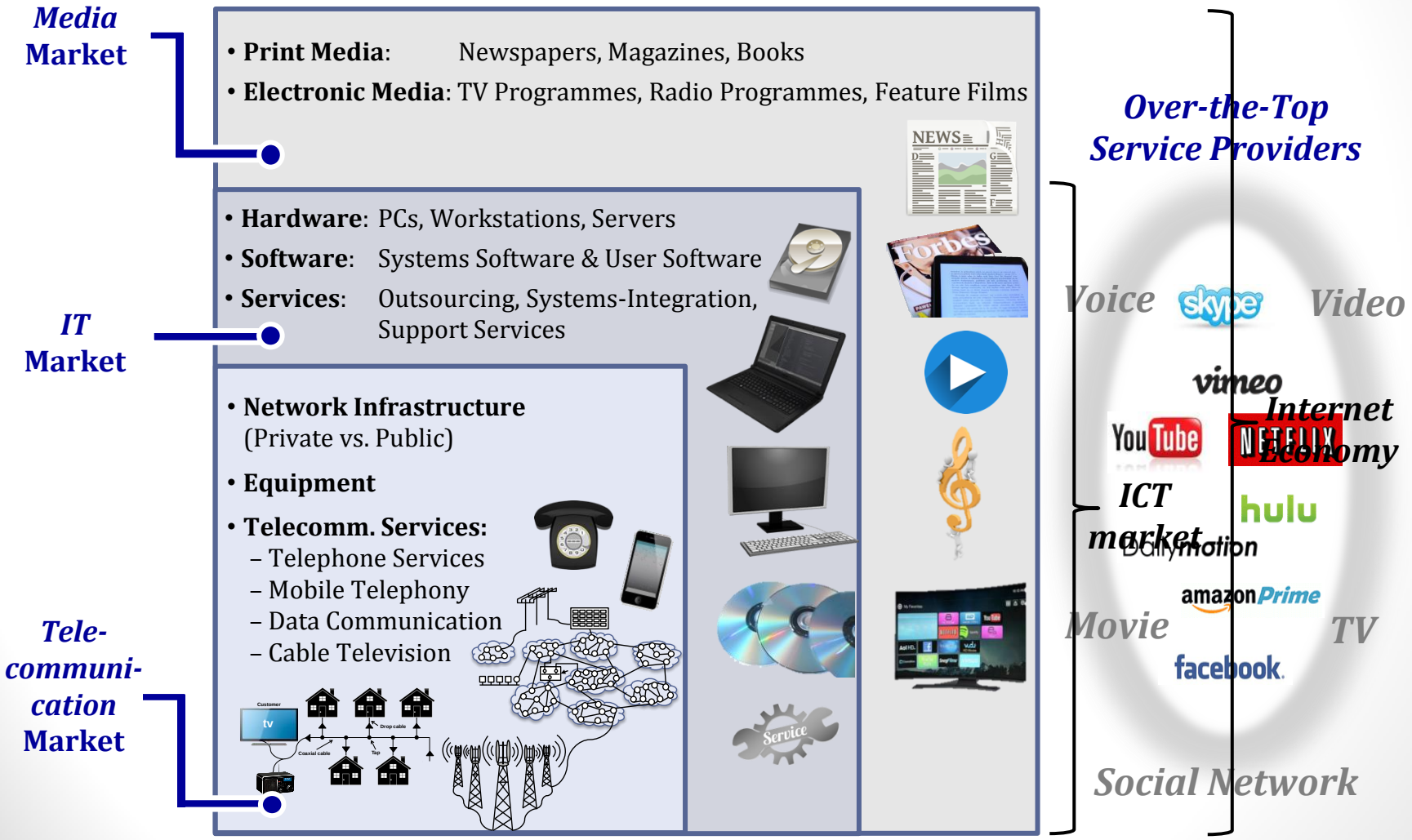
  The exchange of thoughts, messages, or information, as by speech, signals, writing, or behavior.
  [lat. *Communicare*]

  → The act of communication is understood as the transmission of information in the technological, biological as well as psychological sciences. The roles of transmitter and receiver represent the direction of the data and/or information flow.

- **tel·e·com·mu·ni·ca·tion (tĕlˈĭ-kə-myūˈnĭ-kāˈshən)**

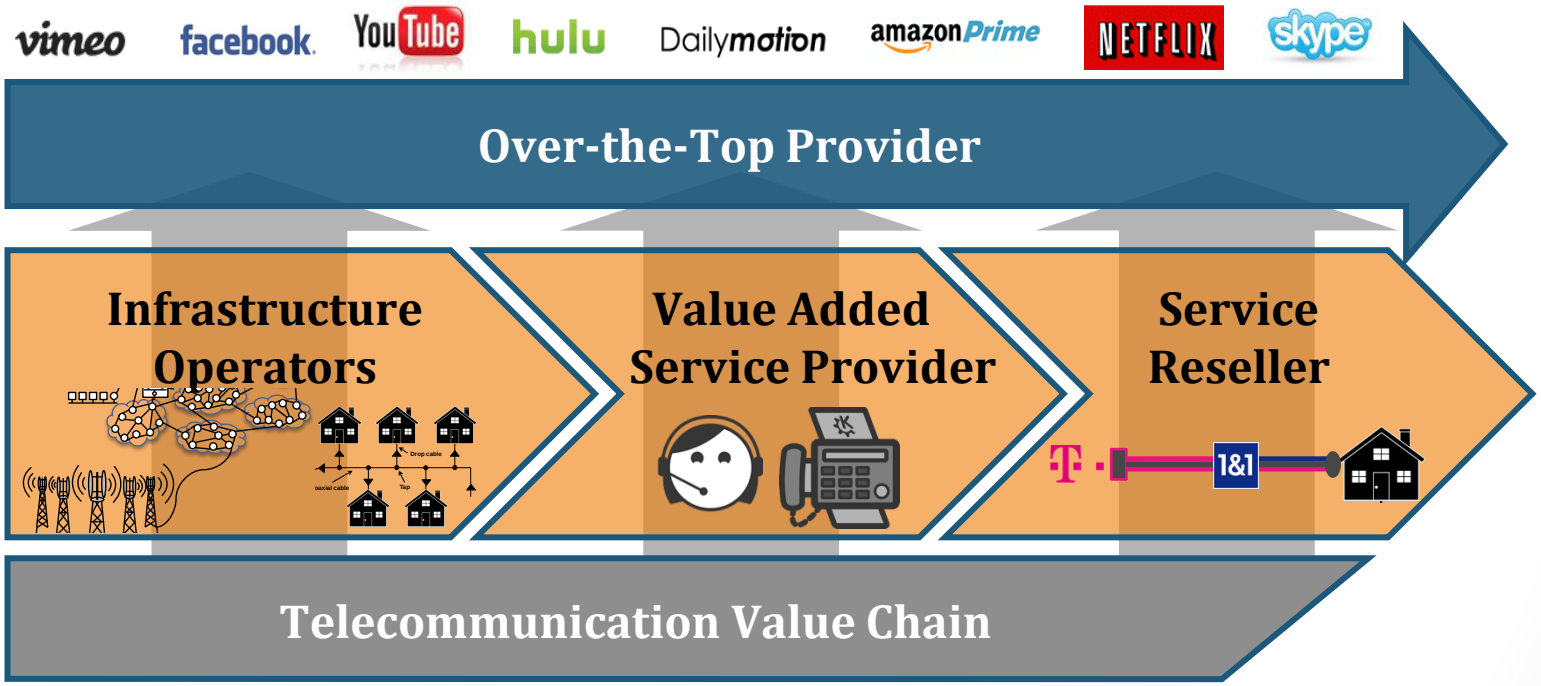
  The science and technology of communication at a distance by electronic transmission of impulses, as by telegraph, cable, telephone, radio, or television.

Telecommunication – Market Definitions



Source: Own illustration, based on Zerdick et al. (2000), S. 39 f., 64 f., 102 f., EITO (2009).

Telecommunications – Market Sectors



Source: Own illustration.

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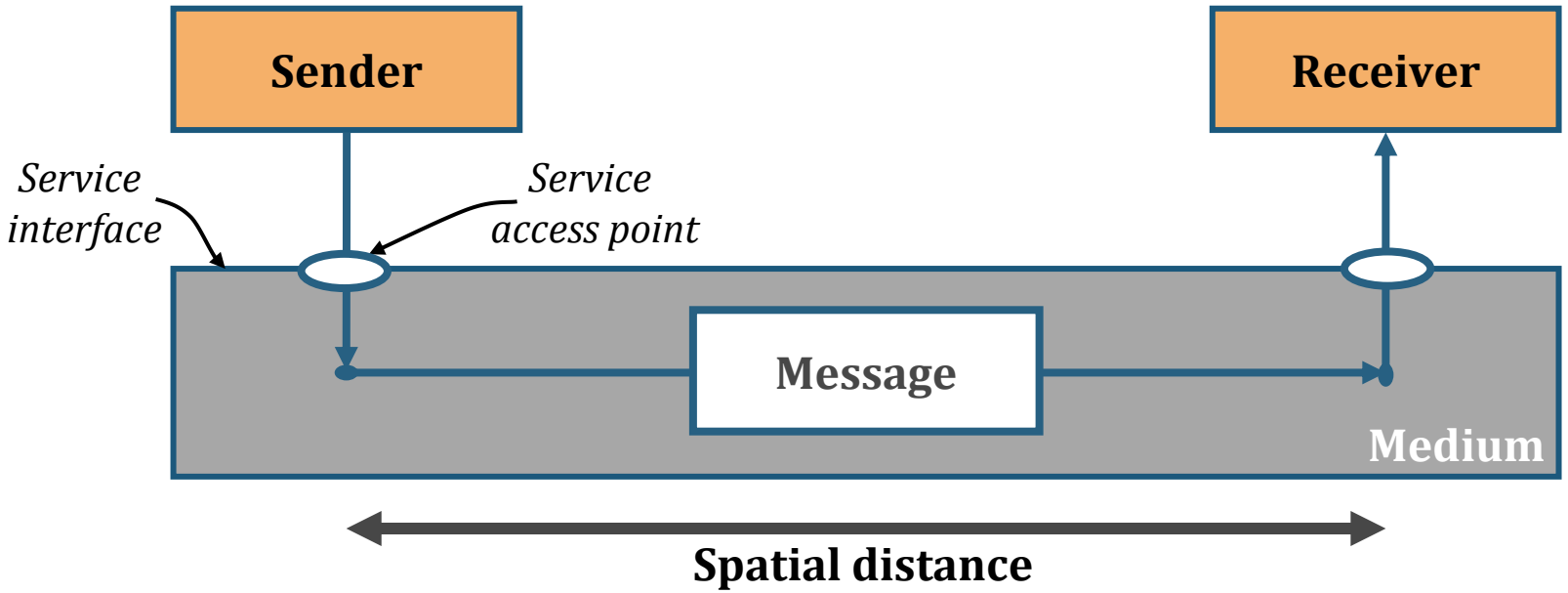
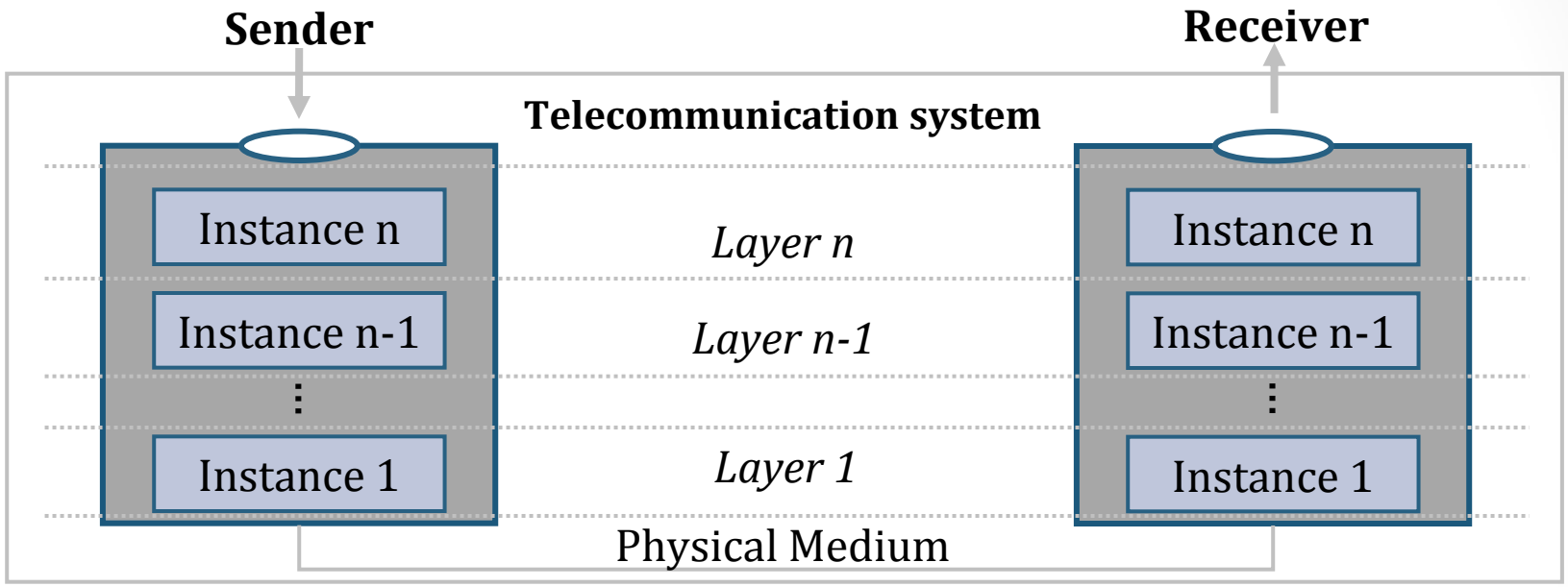
Basic Model of Telecommunication



- Users act as sender or receiver.
- A service can be demanded at a service interface, utilizing a service access point.
- The spatial distance is overcome by a medium.

Source: Own illustration.

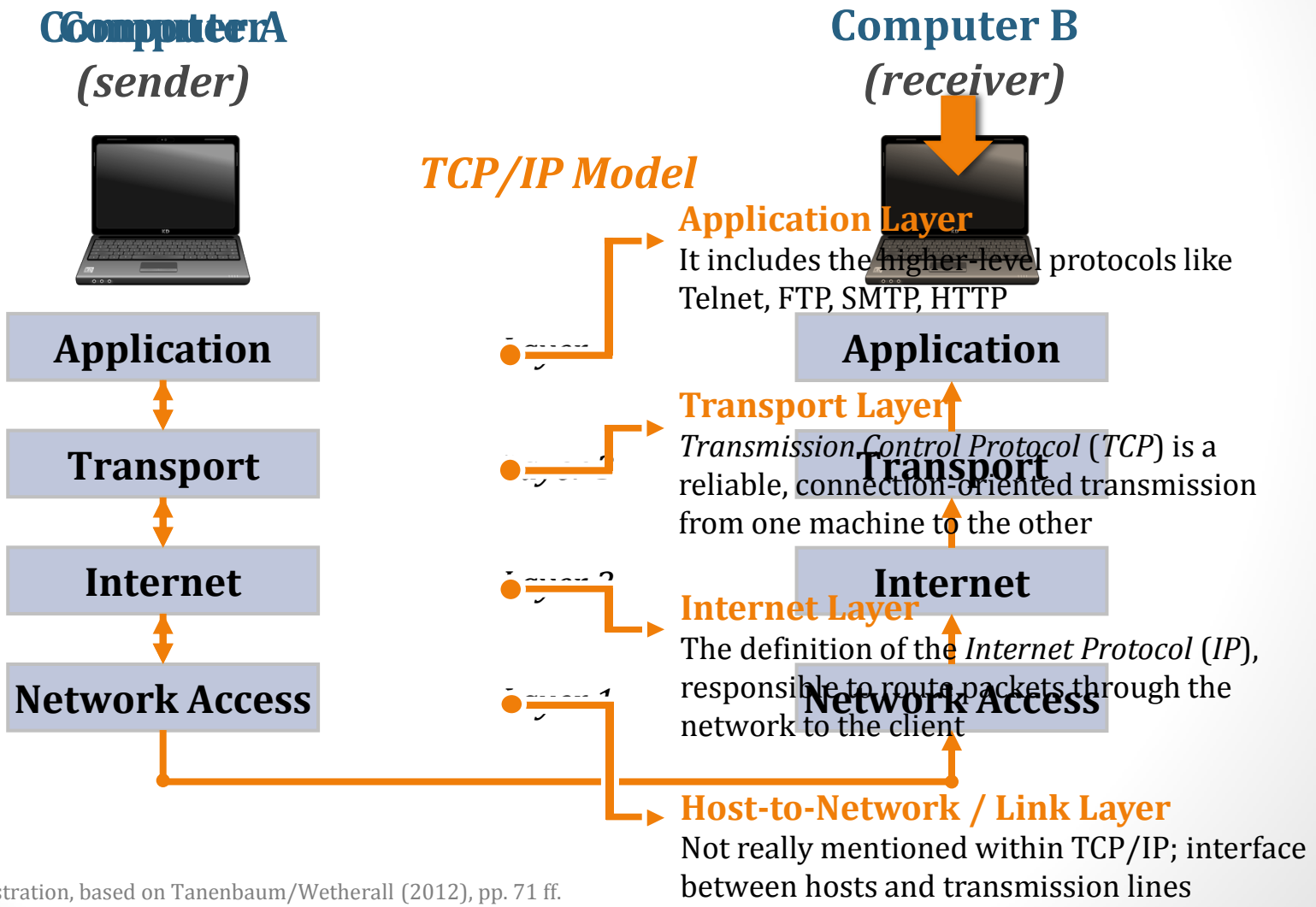
Network Architectures & Reference Models



- To reduce complexity, telecommunication systems are divided into layers
- A layer offers a services to the layer lying above and uses the services of the layer below
- Components of each layer are named instances
- Services are executed in using the specific protocols of layer instances
- Each layer extends the services which are located beneath by new functionalities

Source: Own illustration, based on Tanenbaum/Wetherall (2012), pp. 53 ff.

The TCP/IP Reference Model



Source: Own illustration, based on Tanenbaum/Wetherall (2012), pp. 71 ff.

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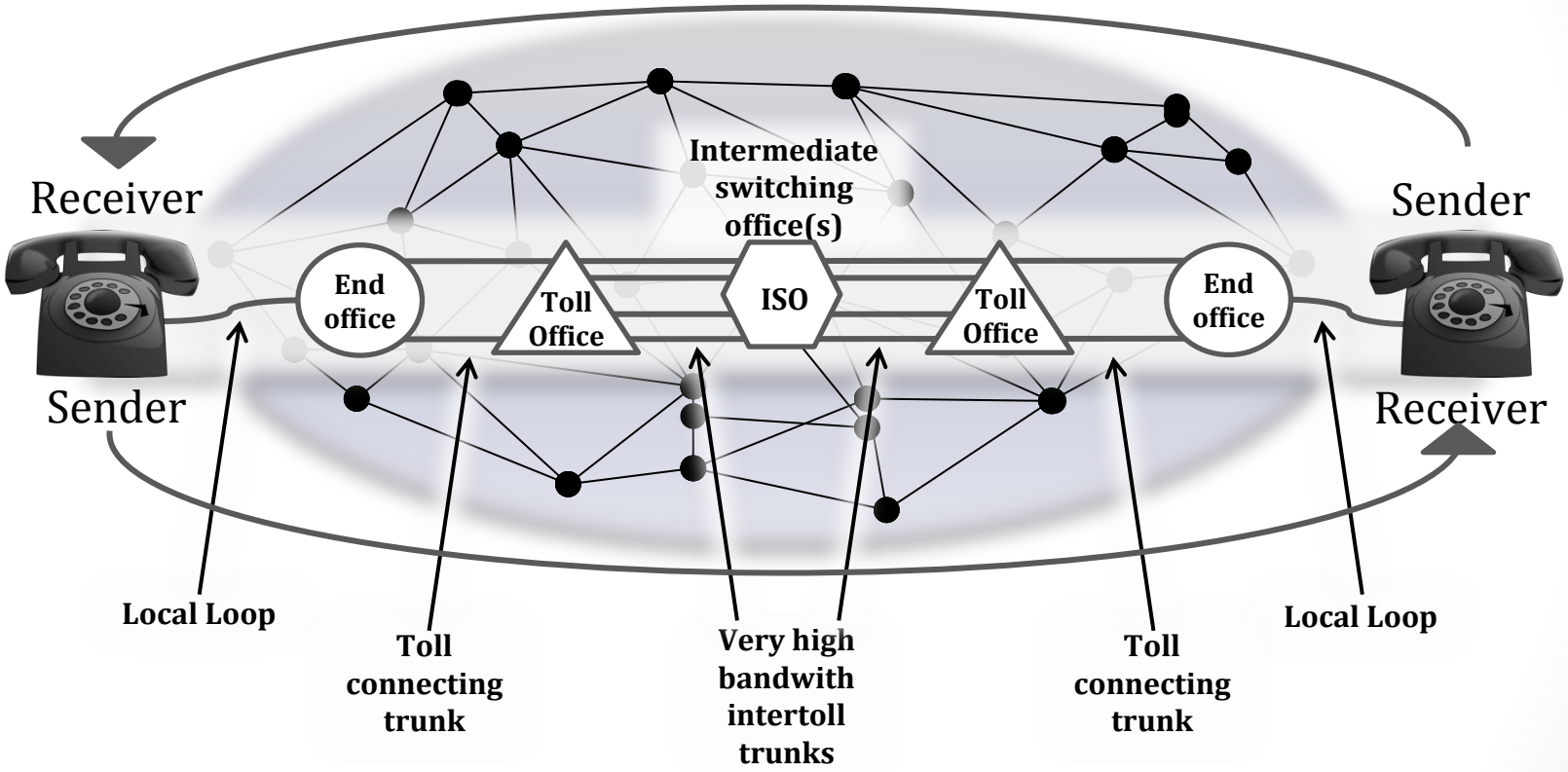
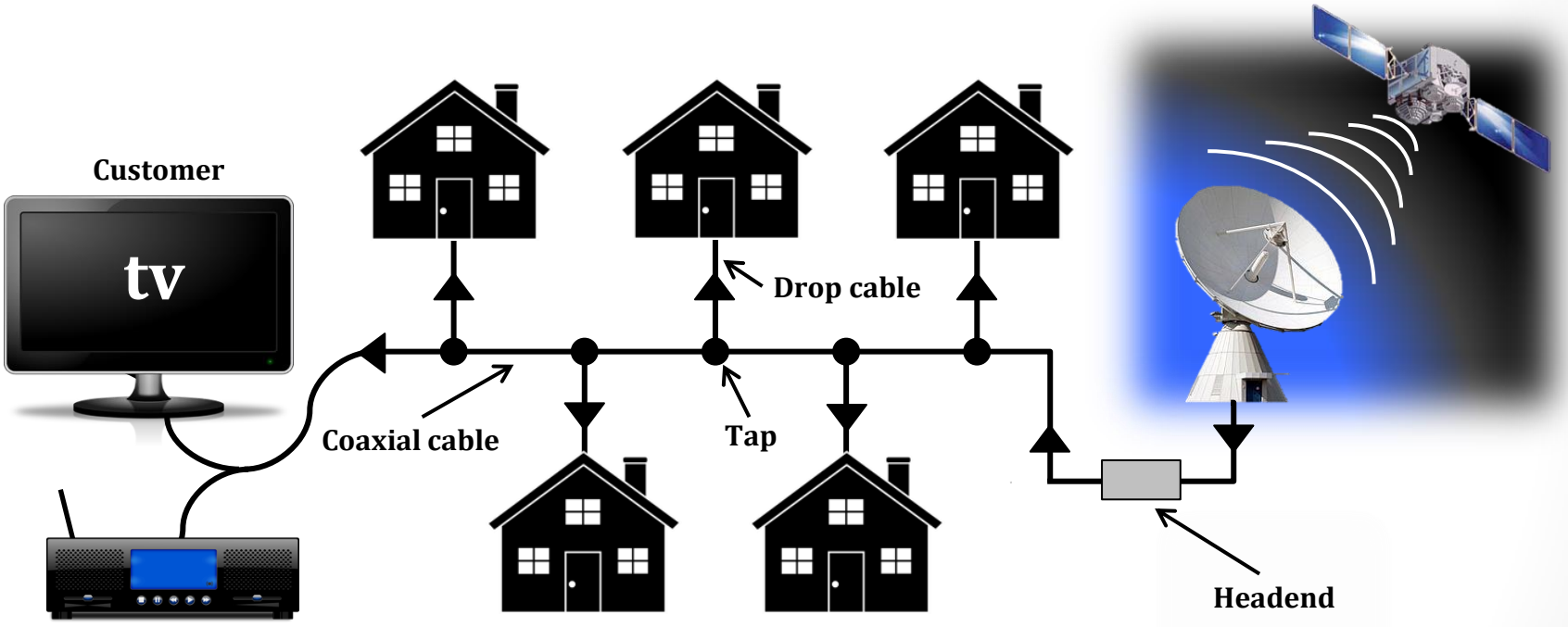
At the Beginning…the Public Switch Telephone Network (PSTN)



- Public owned, nationwide networks
- Liberalization process during the 90‘s
- Local loop in general owned by incumbent

Source: Own illustration, based on Tanenbaum (2003).

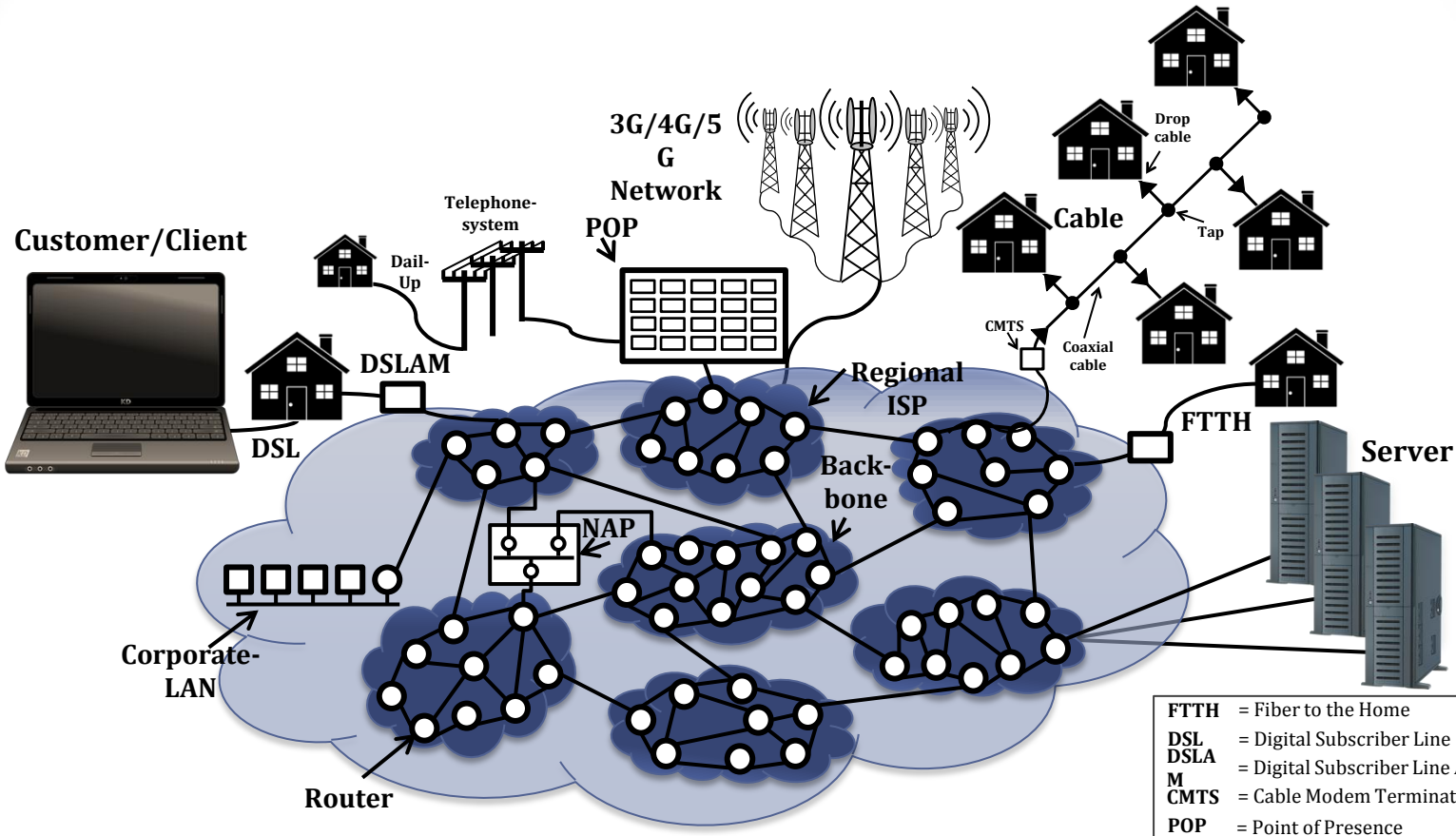
Broadcasting of Media – the Cable Network for Television and Radio



- Initially one-way proprietary Cable Networks: TV reception for inhabitants of remote areas
- Recent upgrade to two-way capability
- *Today*: Similar development as telco networks to fiber, local loop still dominated by coax

Source: Own illustration, based on Tanenbaum (2003); Tanenbaum/Wetherall (2012), pp. 47.

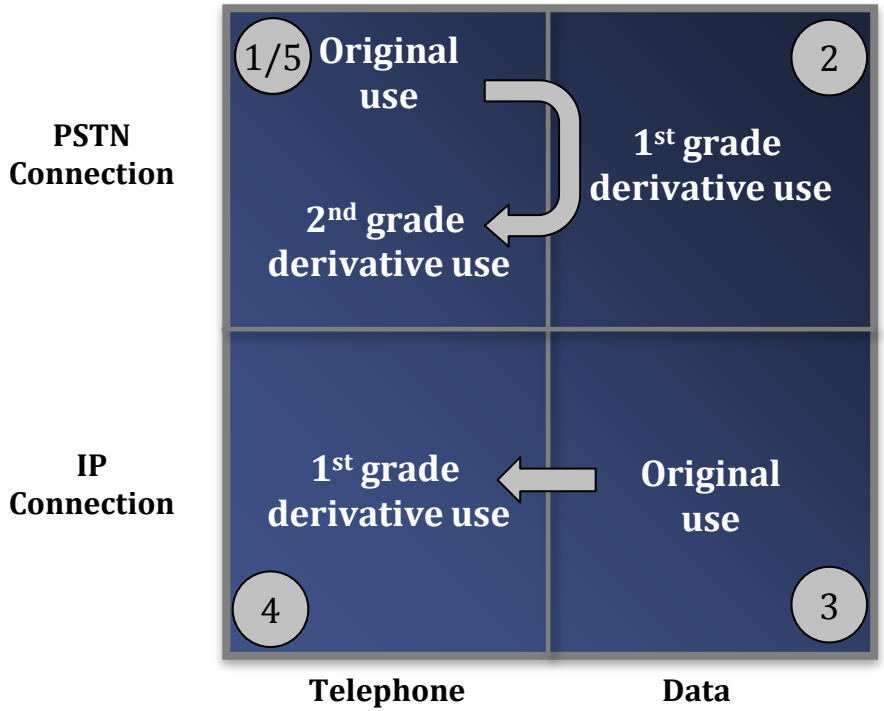
The Internet – the "Network of Networks"



- „The Internet" is based on a central protocol (IP) interconnecting other networks and subnetworks
- Broadband access as strategic issue

Source: Own illustration, based on Tanenbaum (2003); Tanenbaum/Wetherall (2012), pp. 88.

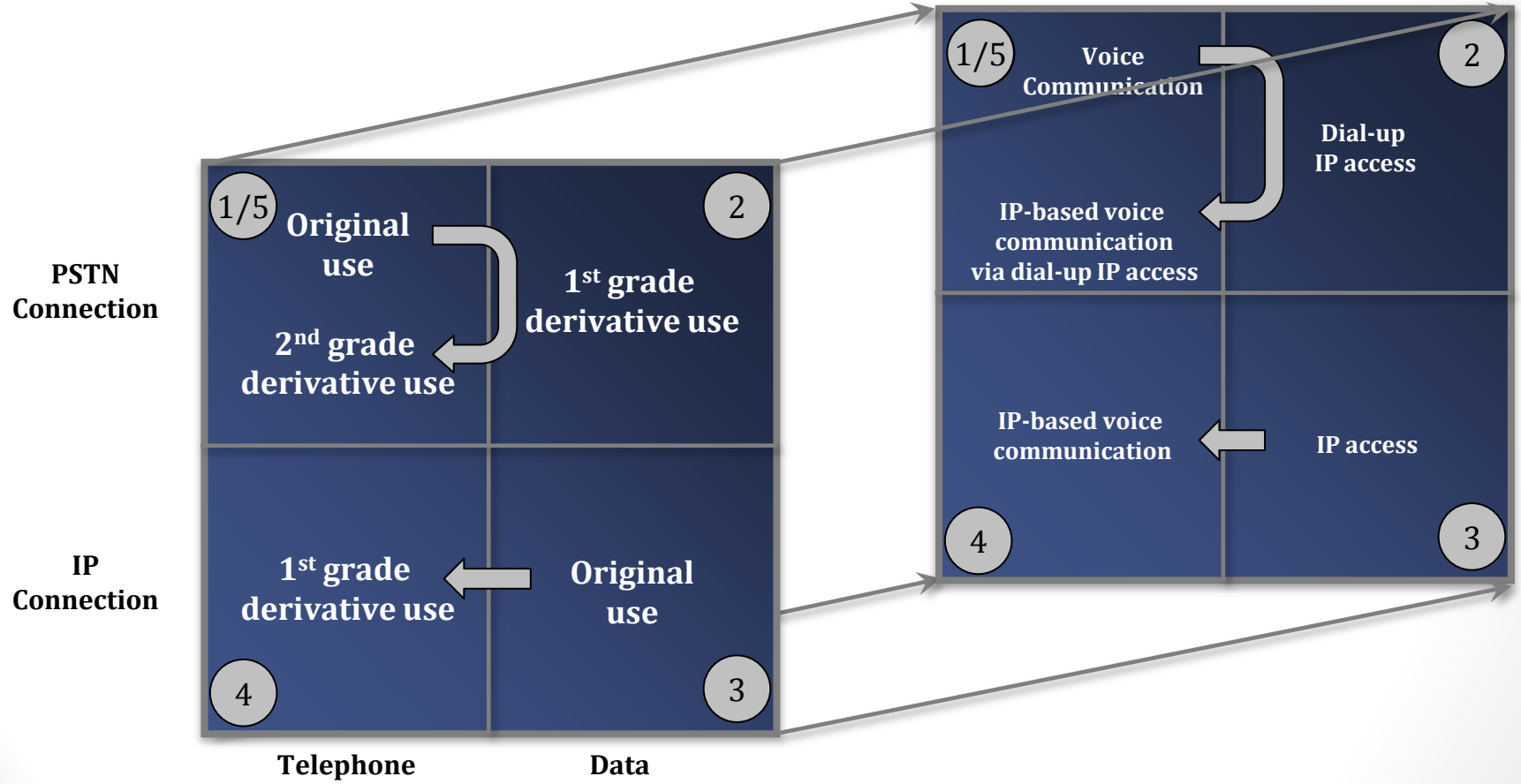
The Multiple use of Communications Infrastructure (I/II)



Complexity increase of the infrastructure(s)

Source: Grove (2005).

The Multiple use of Communications Infrastructure (II/II)



Complexity increase of the infrastructure(s)

Source: Grove (2005).

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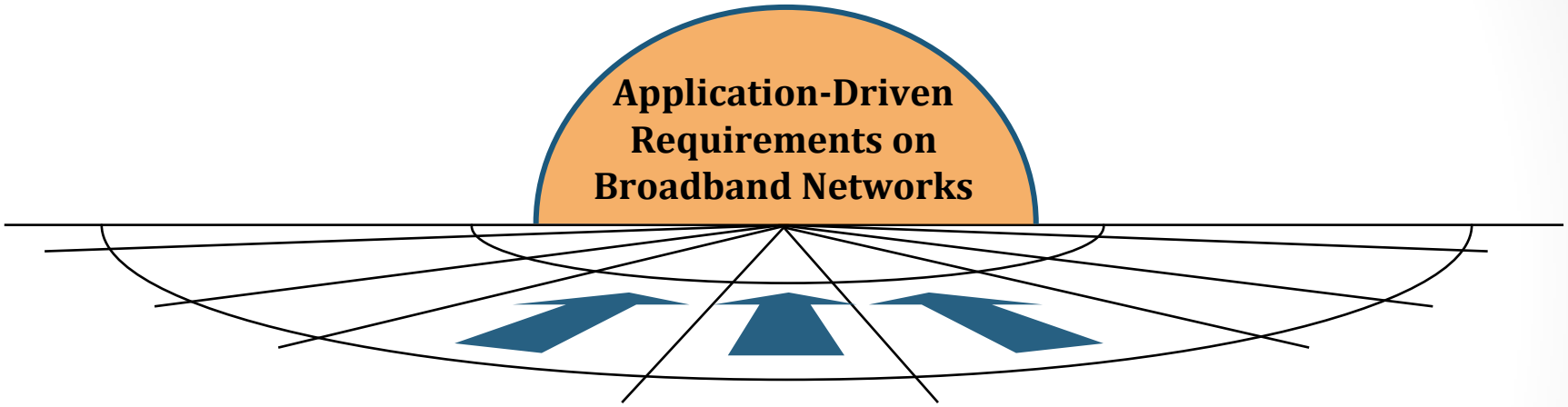
Application-Driven Requirements on Future Broadband Networks



Digitization of Processes, Products and Services

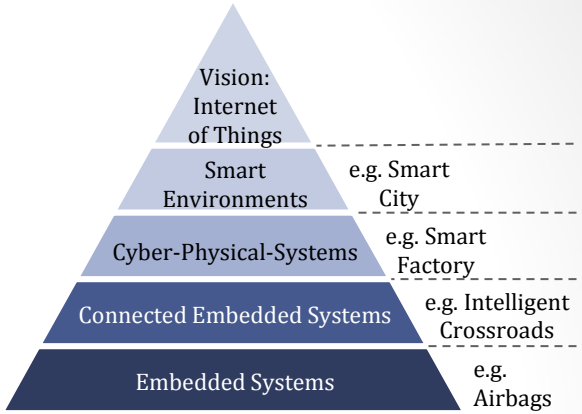
Interconnectedness of Services and Applications

Shift in Media Usage

Increasing Digitization in Value Creation – "from Atoms to Bits"

- **Digitization of Processes**
  - Increased overlapping of the Physical and Digital World, i. a. by Cyber-Physical-Systems (CPS)

  ➡ Flexible processes, real-time controlling, transparency in value creation



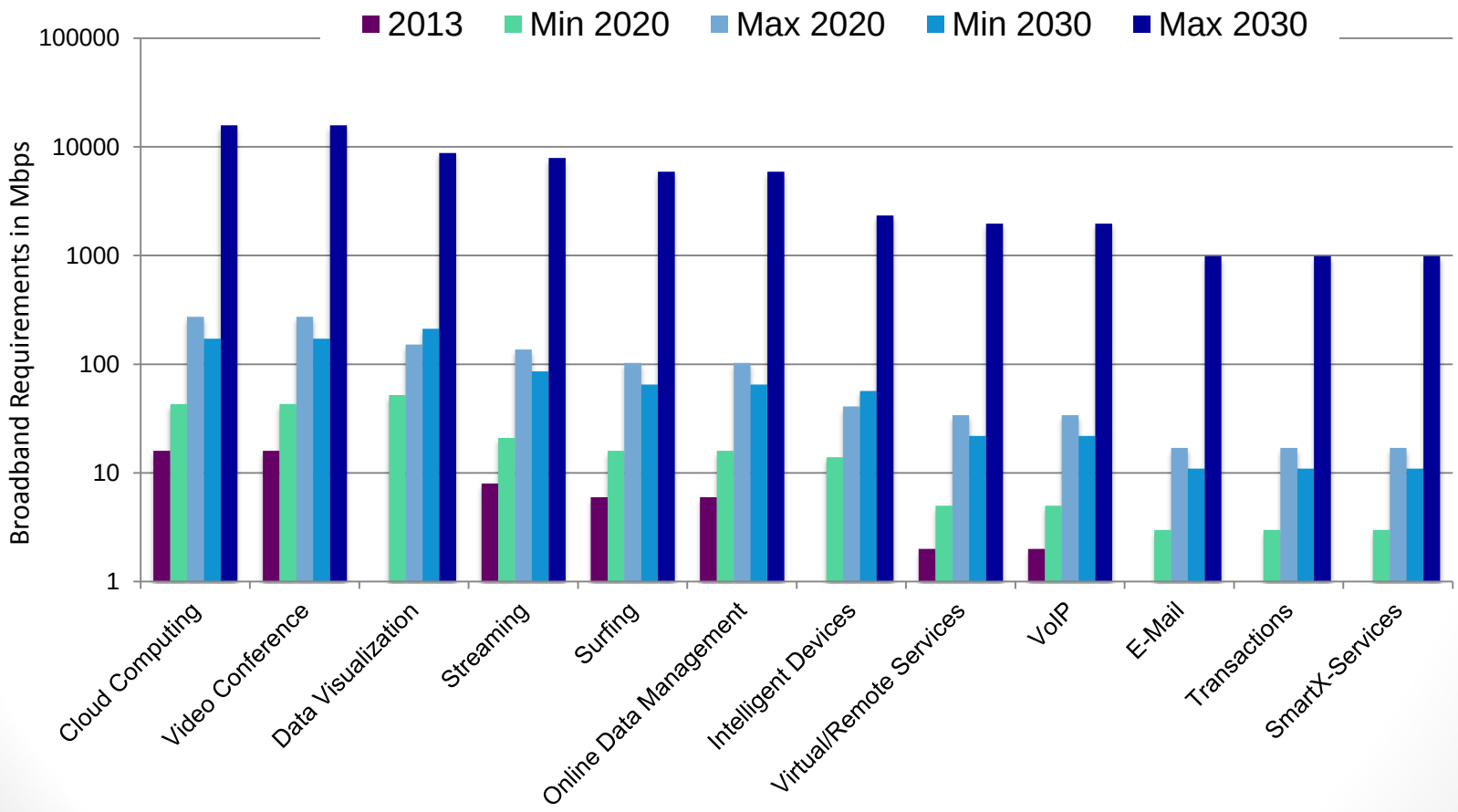
Evolution from Embedded Systems to IoT

- **Digitization of Products and services: "Software is eating the World"** (Marc Andreessen, 2011)
  - v1: Software will revolutionize the technology- and computer industry (the value of technology is in software, not in the hardware anymore)
  - v2: Software will change numerous industries (e.g. the declining importance of classic print media in the course of the process of digitization)
  - v3: Software will fundamentally change all industries (any kind of value creation will be represented by software)

➡ Potentially affected sectors in future: manufacturing industry, finance sector, health care system, education sector, legal system.

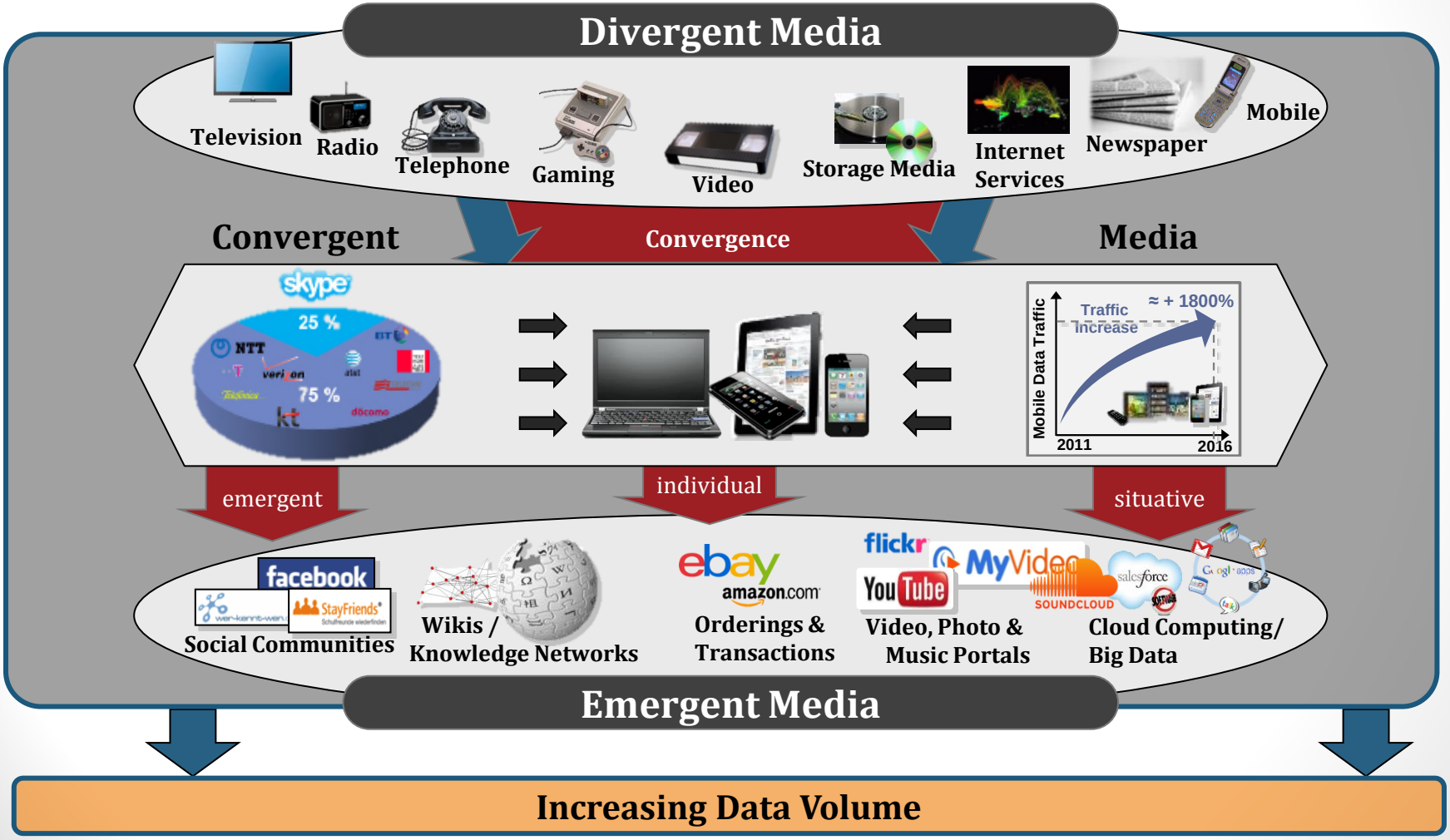
Source: Acatech (2012), Forschungsunion (2012), Picot/Reichwald/Wigand (2008).

Massive Increase in Data Volumes through Digitization in Value Creation – “from Atoms to Bits”



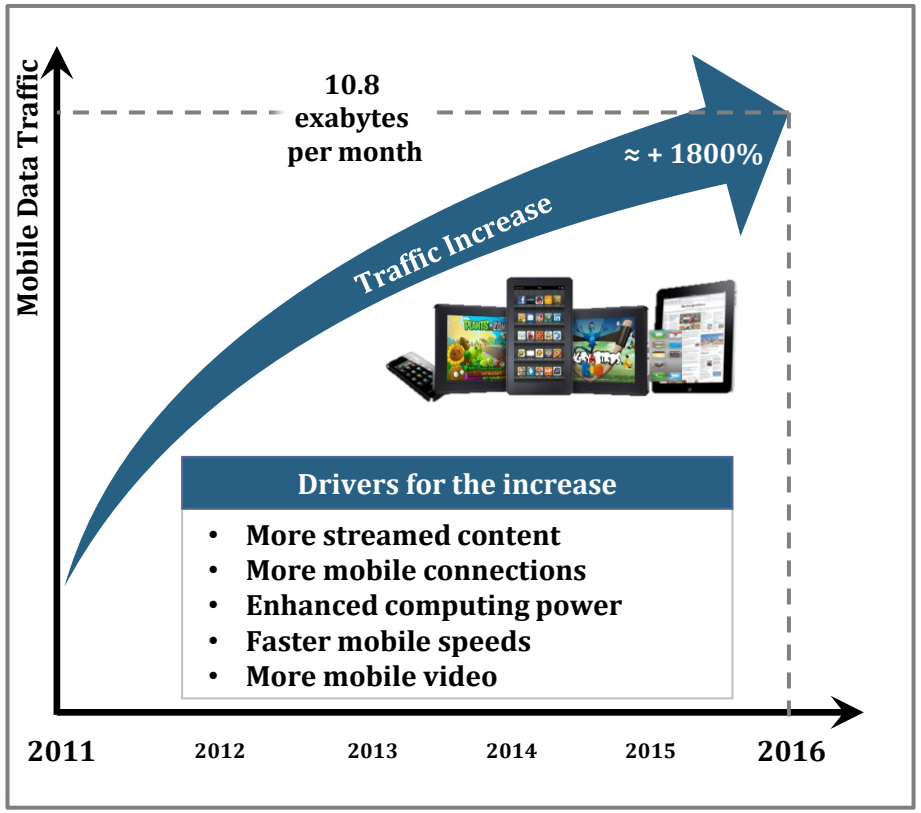
Source: vbw (2013) nach Stopka/Pessier/Flößel (2013) .

Massive Increase in Data Volumes through Shift in Media Usage – "All IP"



Source: Own illustration, based on JustIS (2011).

Massive Increase in Data Volumes through Shift in Media Usage – "All IP" & Mobile Data



From 2011 to 2016, the CISCO Visual Networking Index Forecast projects 18-fold growth in global mobile Internet data traffic.

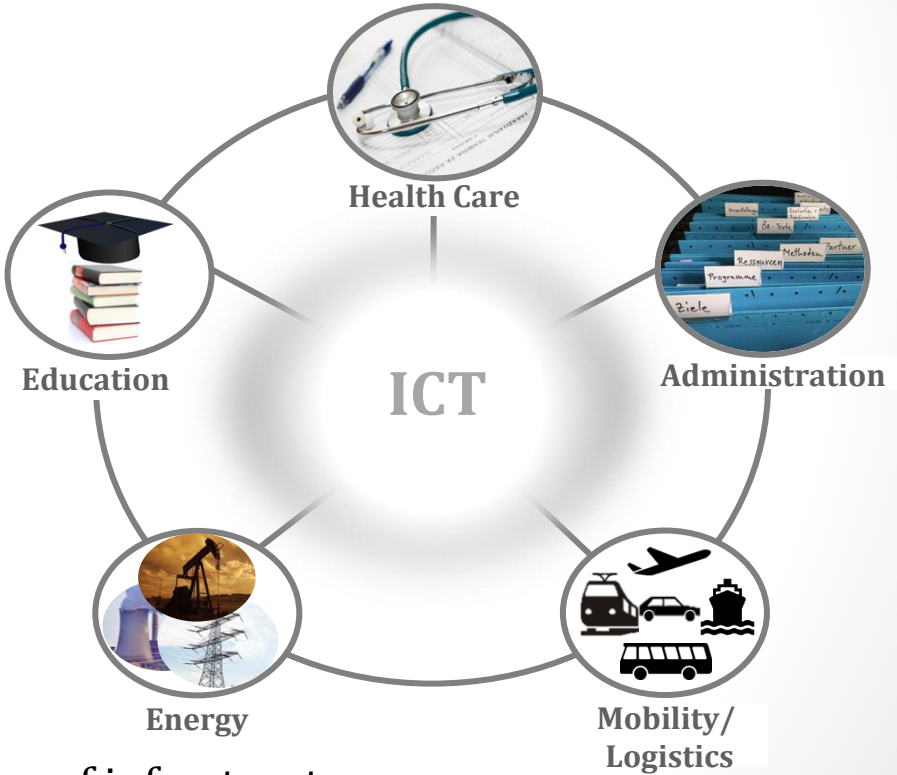
Source: Data based on Cisco® Visual Networking Index (VNI) Global Mobile Data Traffic Forecast for 2011 to 2016 (2012).

Convergence of Infrastructures and Applications – Interconnectedness

- **Increasing vertical and horizontal interconnection of infrastructures and services through smart/intelligent networks**

  - **Vertical convergence:** Interconnection *within* an application domain (e.g. intermodal traffic & transport management)

  - **Horizontal convergence:** Interconnection *across* different application domains (e.g. traffic & energy in the context of electro mobility)



- An all-encompassing interconnection of infrastructures and applications has to be guaranteed

Source: Own illustration.

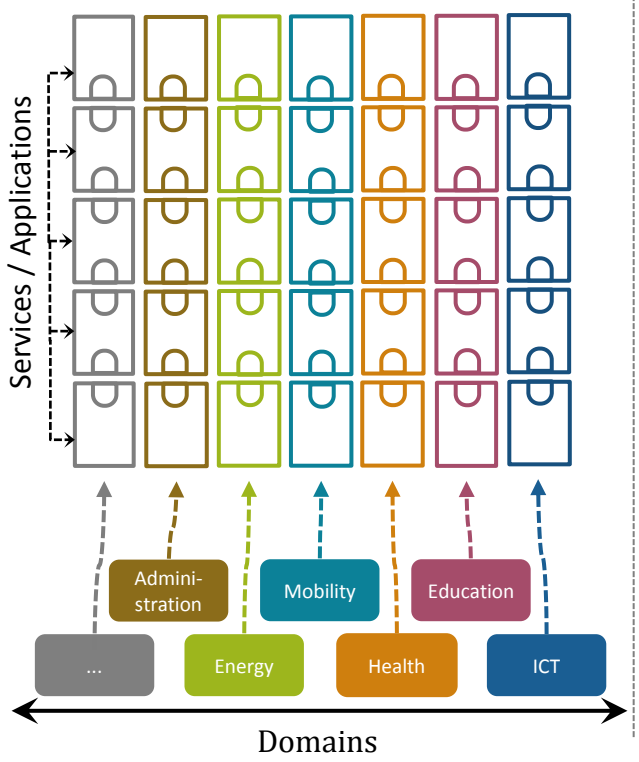
Convergence of Infrastructures and Applications – Interconnectedness

Digitization/Digitalization → ***Vertical Convergence*** → ***Horizontal Converger***

"*Digitalized networks*" by *domain-specific* ICT-solutions

"*Vertical integrated networks*" by *domain-specific* / generic ICT-convergence
→ new applications & synergies *within* domains

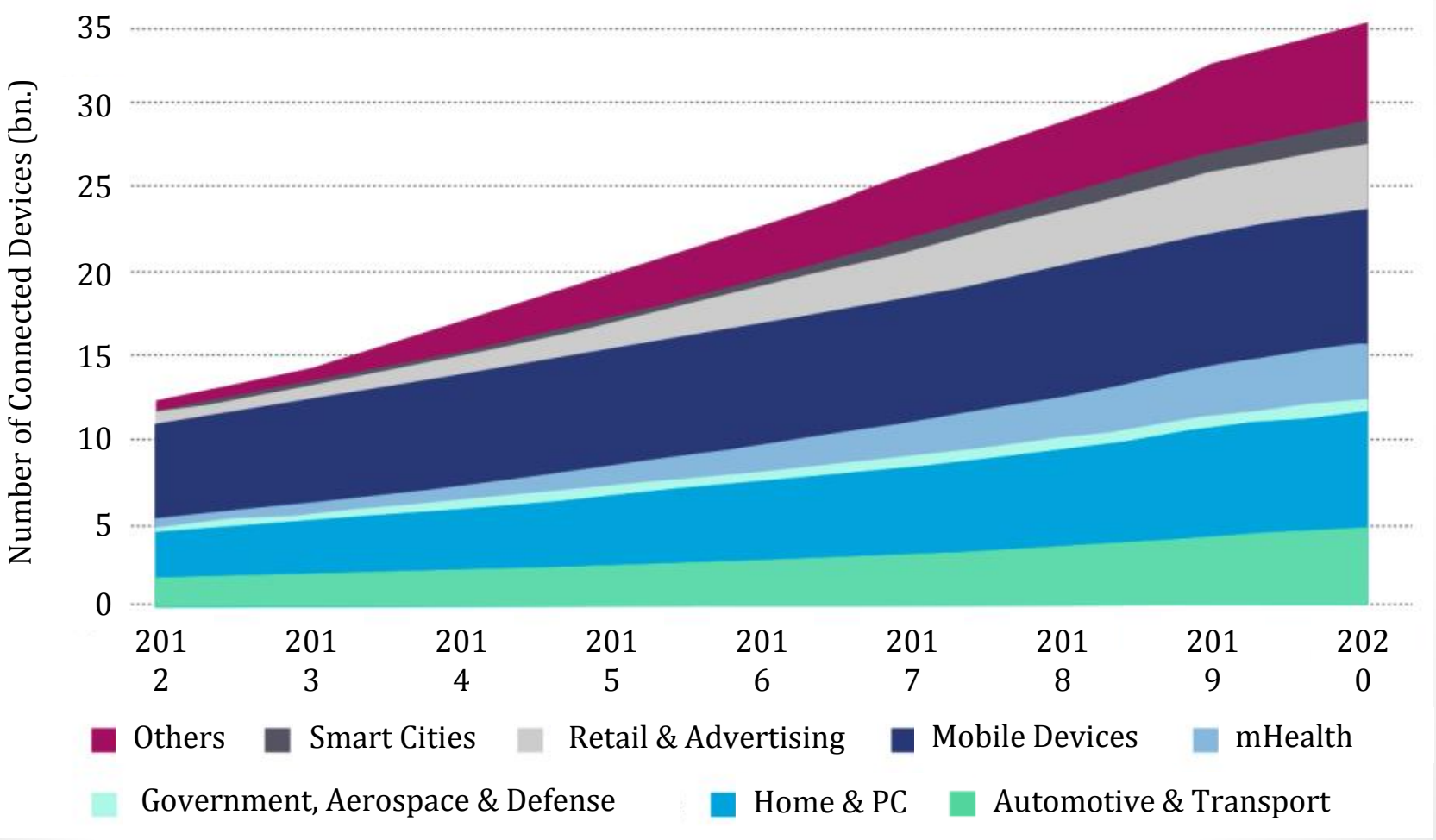
Integrative "*service networ*
inter-domain ICT-convergen
smart-service platform
→ Novel applications & syn
across domains



Source: Own illustration.

E V O L U T I O N

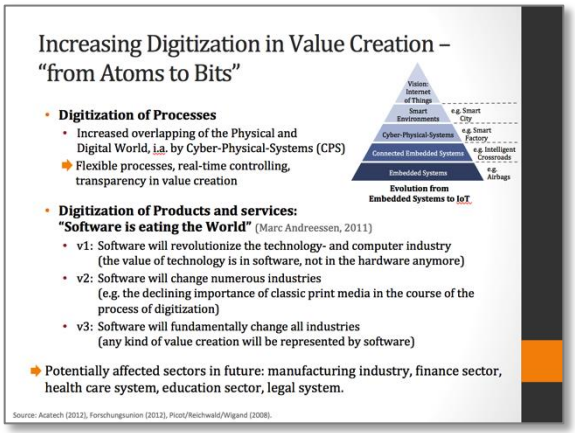
Massive Increase in Connected Devices Worldwide – "Interconnectedness"



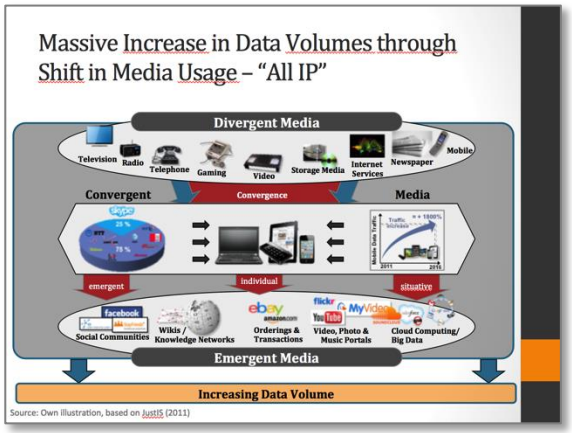
Source: Broadband Commission (2013).

Application-Driven Requirements on Future Broadband Networks

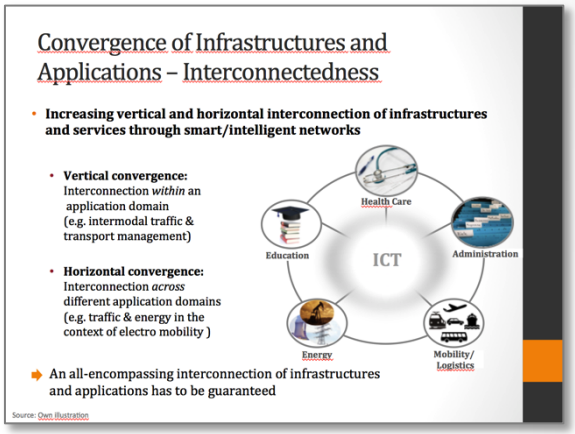
Digitization of Processes, Products and Services



Shift in Media Usage



Interconnectedness of Services and Applications



Requirements on Broadband Networks

Real-Time Capability

Symmetric Bandwidth (Gigabit)

Options for Virtualization (SDN and NFV)

Integration of SmartX-Services and M2M

...

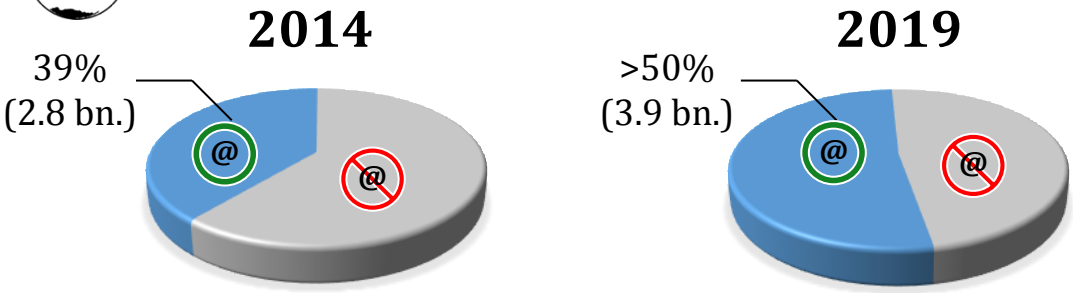
Security and Resilience

Declaration of Peak-Rates (Ranges of Usage-Intensity)

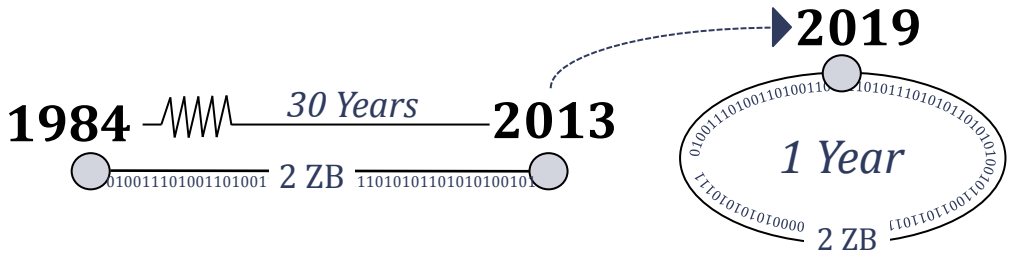
Source: VDE (2014), Zinner/Hossfeld/Tran-Gia/Kellerer (2013), Stopka/Pessier/Flößel (2013).

Exorbitant Growth in Data Volume transferred via the Internet – Increase in the Number of Subscriptions

Global View



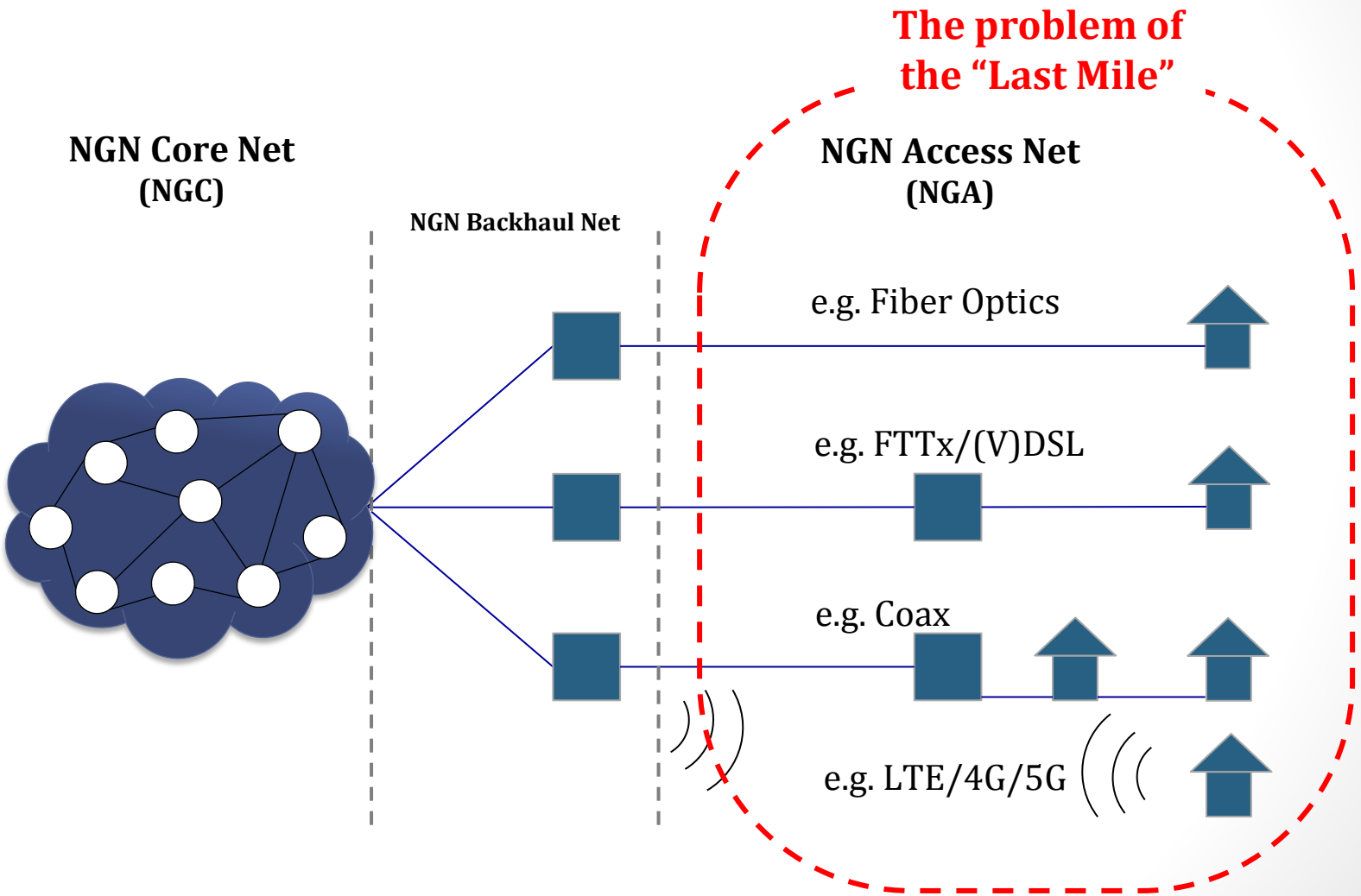
While in **2014**, **39%** of the global population (**2.8 bn. people**) were connected to the Internet, it is estimated that in **2019**, more than **50%** of the people on earth (**3.9 bn. people**) will be online in **2019**.



Even the speed of the growth rates is increasing massively.
From **1984** to **2013**, the total volume of globally transferred data took **30 years** to reach **2 Zettabytes**. This data volume is estimated to be transferred alone in **2019**.

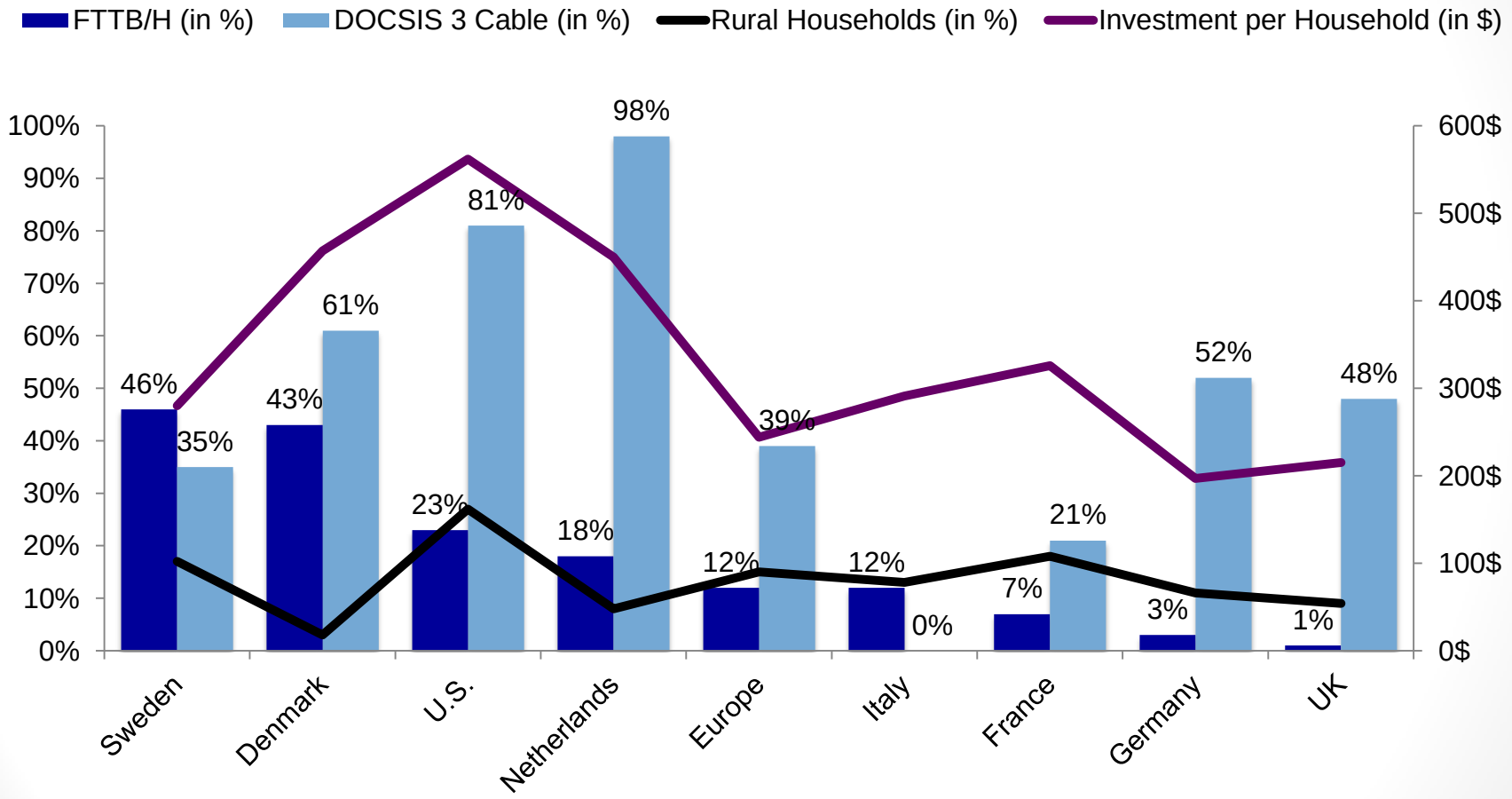
Source: Own illustration; data based on Statista (2015); OECD (2015); Lebourges & Saavedra (2011); Lyons (2013); Weller (2011).

Broadband Access Technologies – NGN Access Architecture



Source: Own illustration, based on Holznagel/Picot/Deckers/Grove/Schramm (2010).

Status Quo Broadband Penetration – NGN Access in a Global Perspective

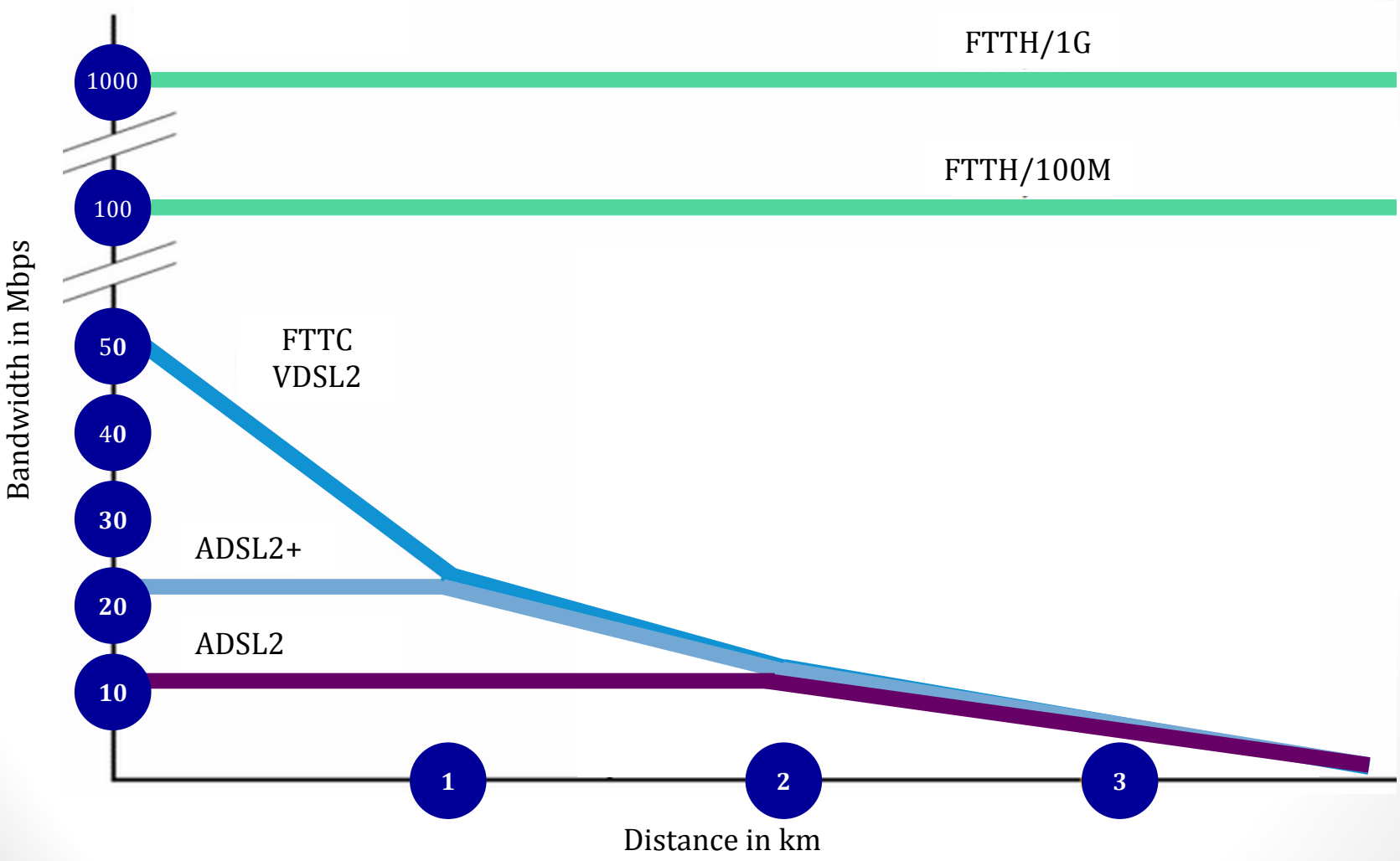


Rural HH: Population density less than 100 people per square kilometer

Investment per HH: Broadband investment per household

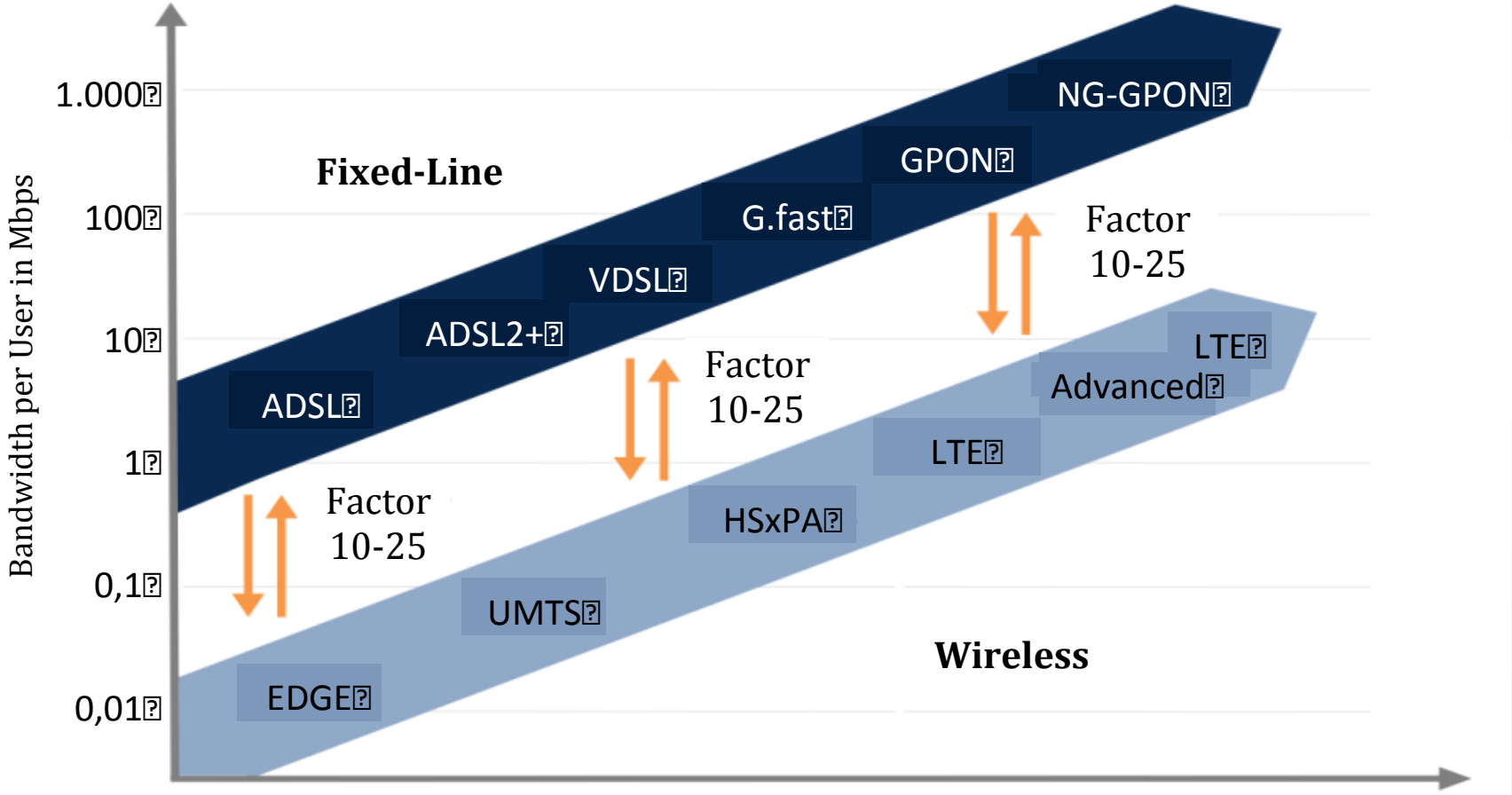
Source: You (2014).

Comparison of Broadband Technologies – Data Transmission Rates and Distance



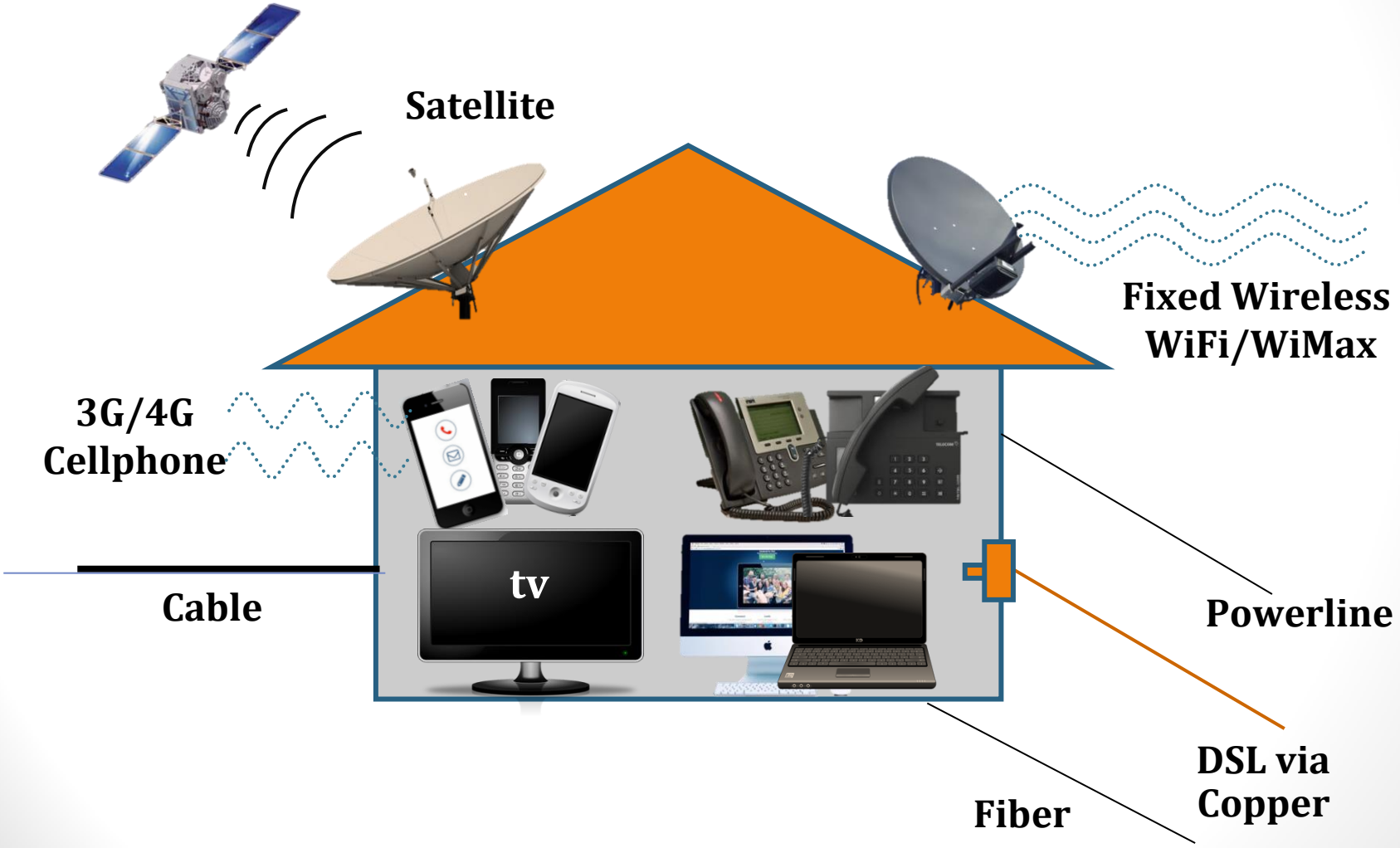
Source: FTTH Council Europe (2010).

Comparison of Broadband Technologies – Difference of Fixed-Line and Wireless Technologies



Source: Stopka/Pessier/Flößel (2013), based on Deutsche Telekom (2012).

Broadband Access Technologies



Source: Own illustration, based on Noam (2003).

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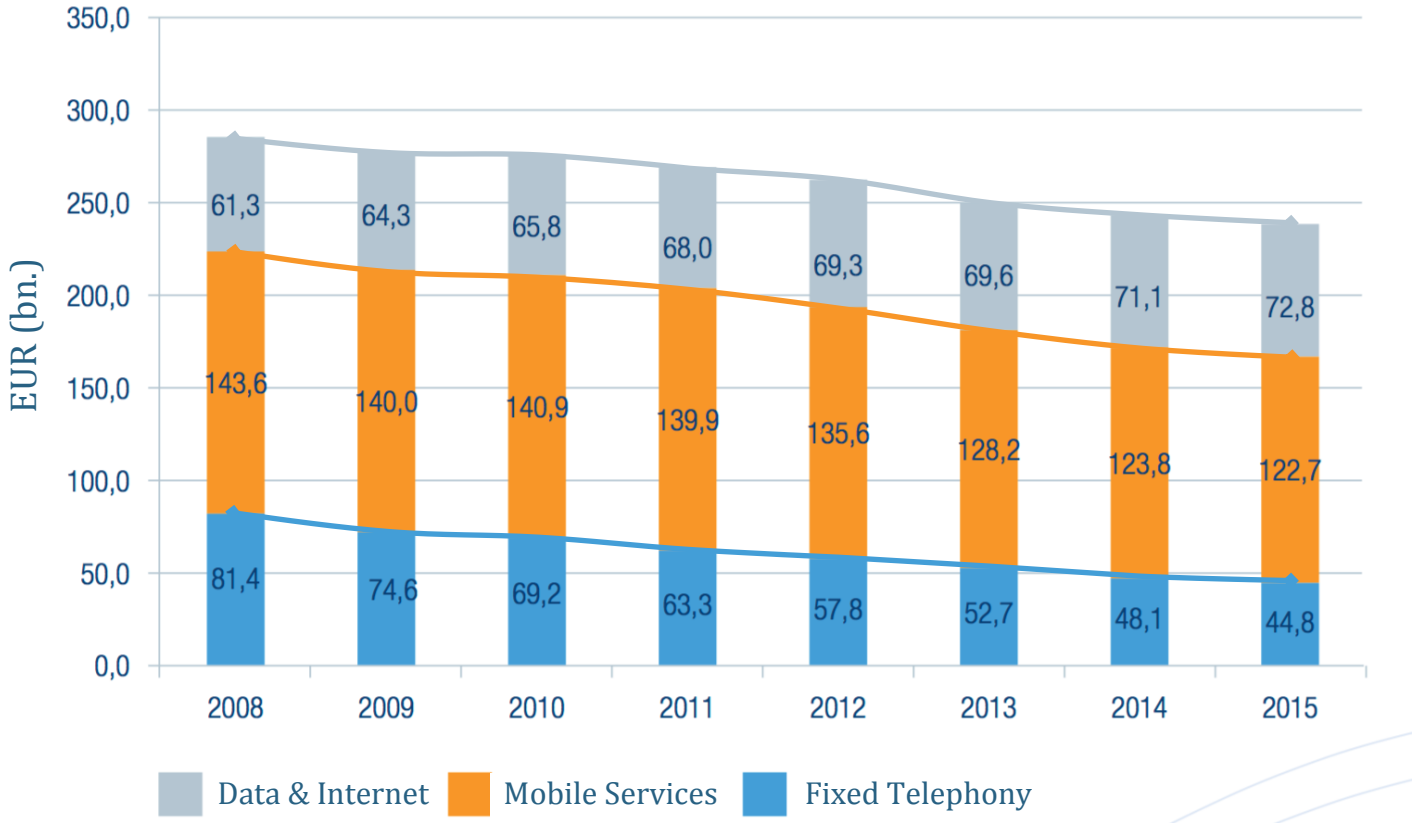
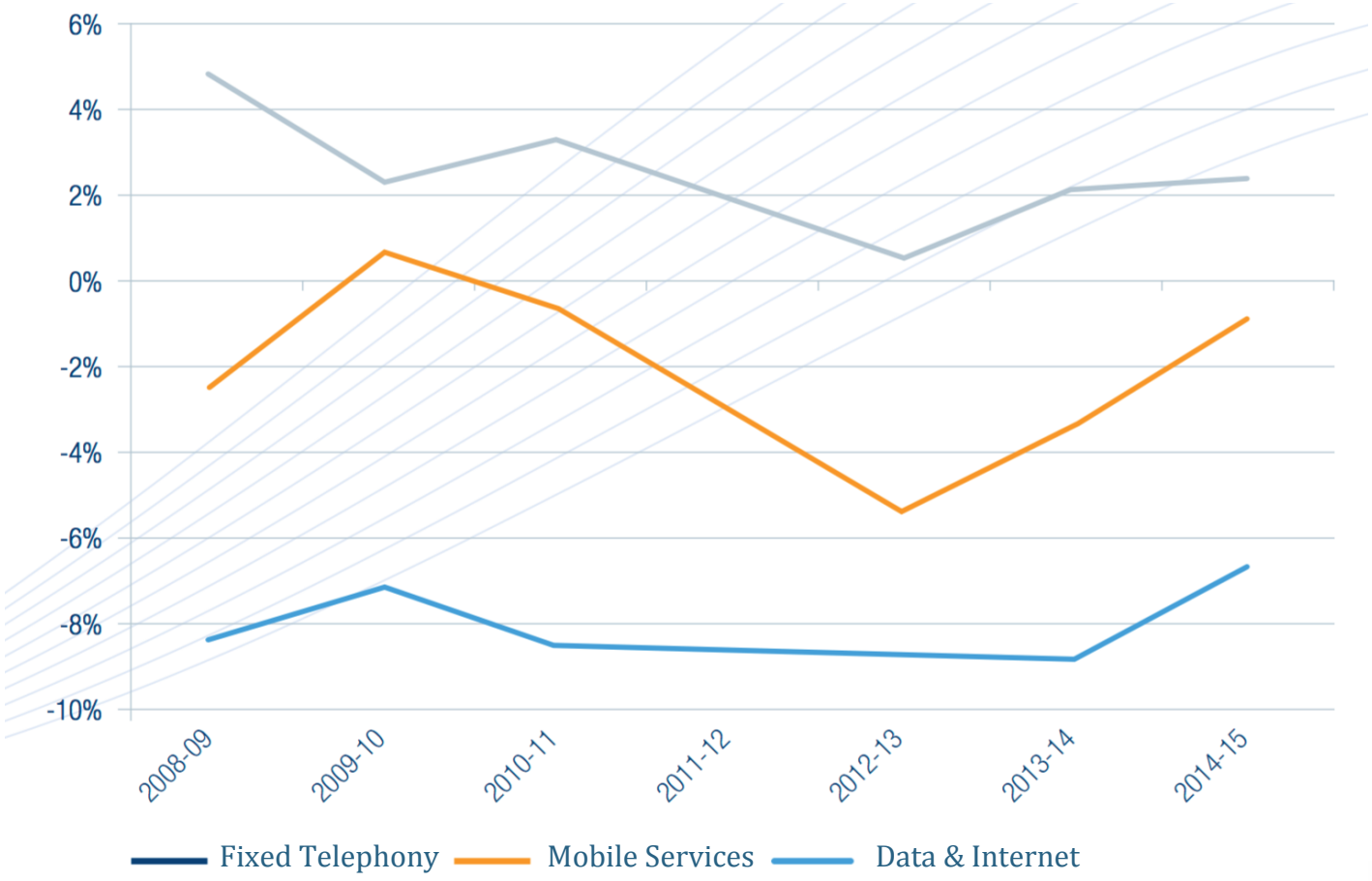
Telecom Service Revenues in Europe*



* incl. Turkey, excl. Georgia, Russia, Ukraine

Source: ETNO Annual Economic Report (2015), based on IDATE.

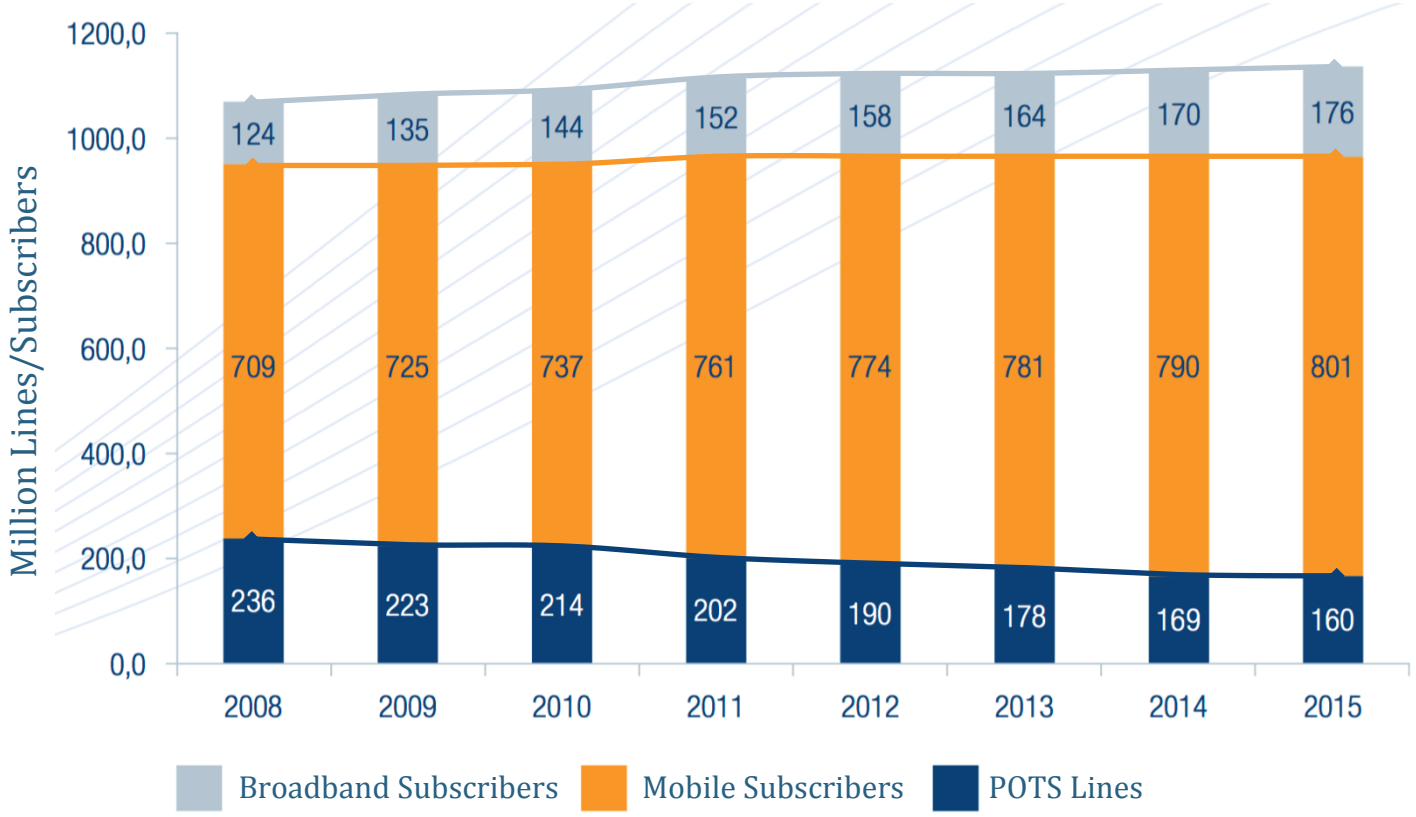
European Telecom Revenue by Service*



* EU 28

Source: ETNO Annual Economic Report (2015), based on IDATE.

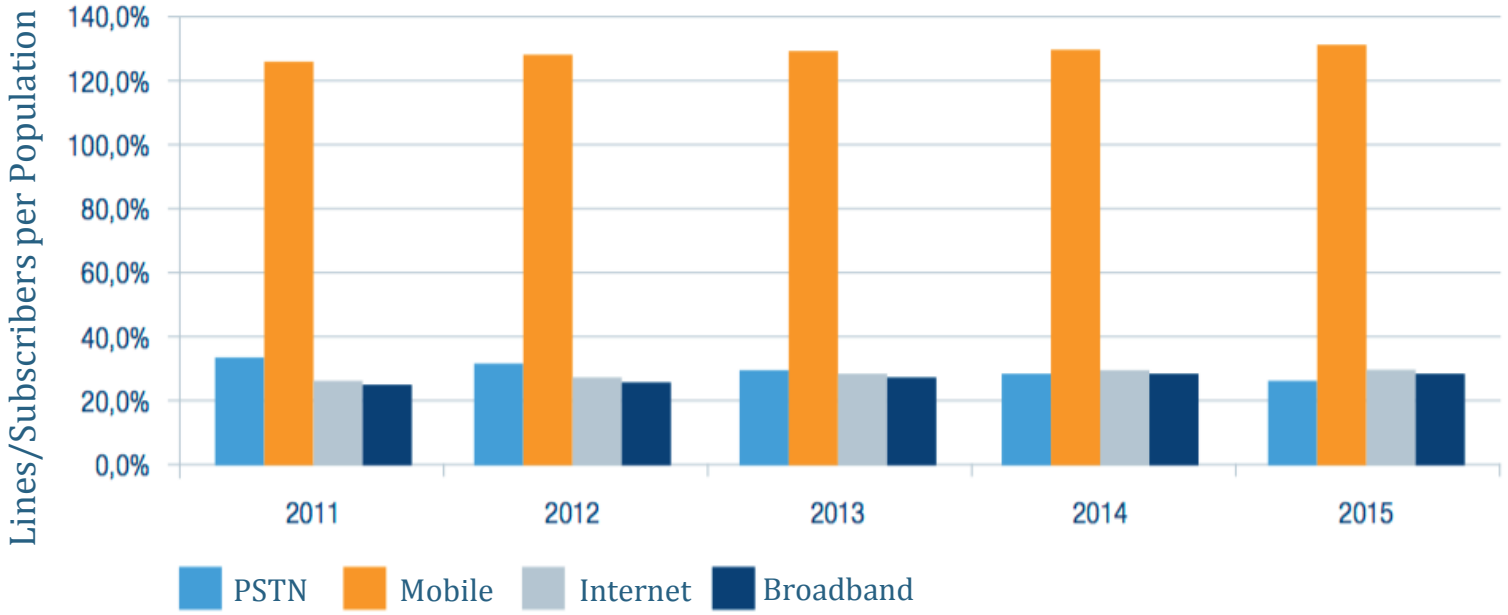
Access to Telecom Services in Europe*



* incl. Turkey, excl. Georgia, Russia, Ukraine

Source: ETNO Annual Economic Report (2015), based on IDATE.

Teledensities in Europe*

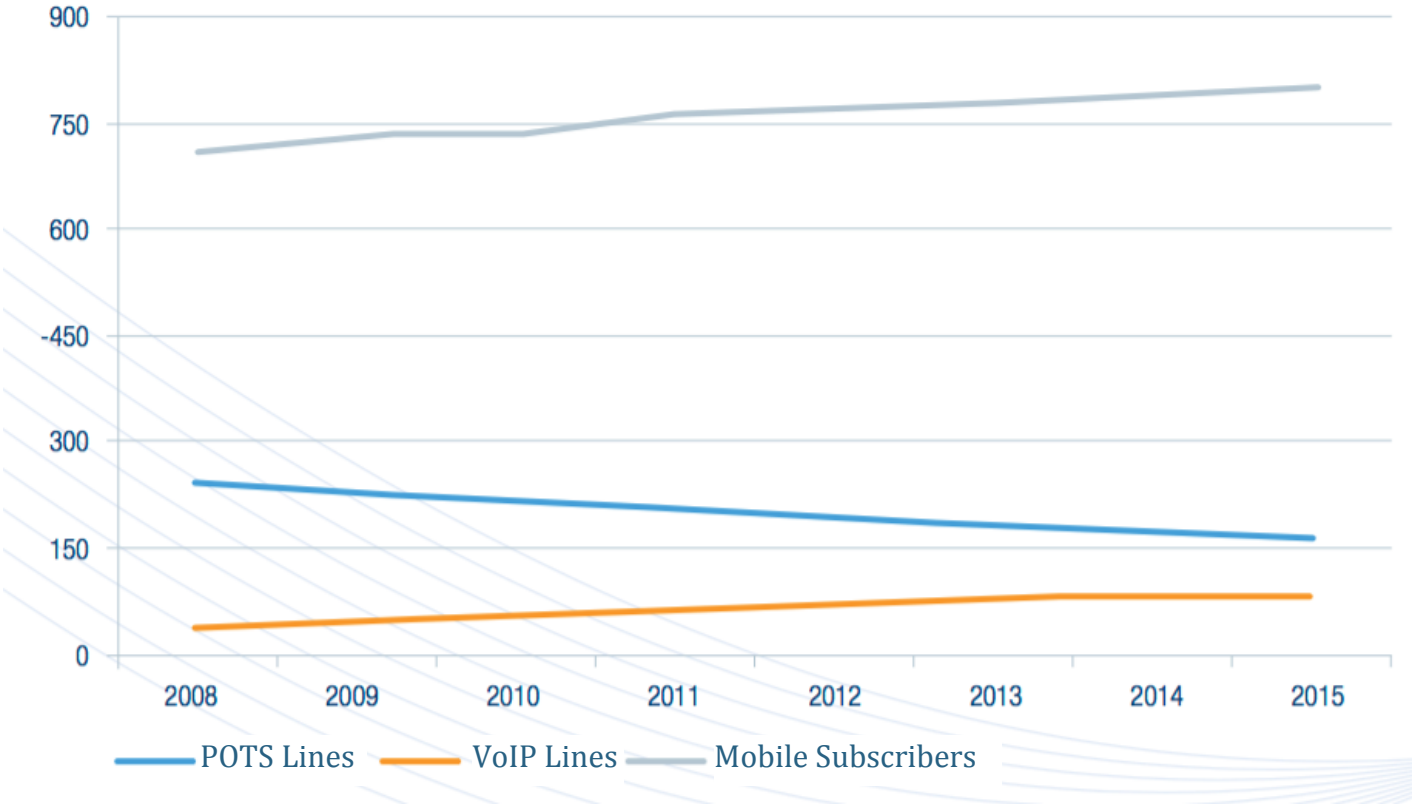


	2011	2012	2013	2014	2015
PSTN	33,6%	31,5%	29,5%	27,8%	26,3%
mobile	126,7%	128,3%	129,1%	130,0%	131,4%
internet	26,8%	27,4%	28,1%	28,9%	29,7%
broadband	25,2%	26,1%	27,1%	28,0%	28,8%

* incl. Turkey, excl. Georgia, Russia, Ukraine

Source: ETNO Annual Economic Report (2015), based on IDATE.

European Telecom Revenue by Service*

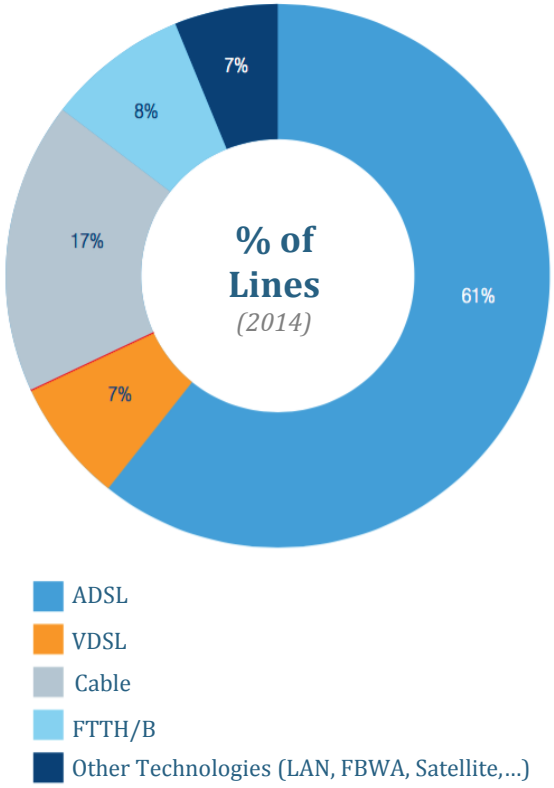


* EU 28

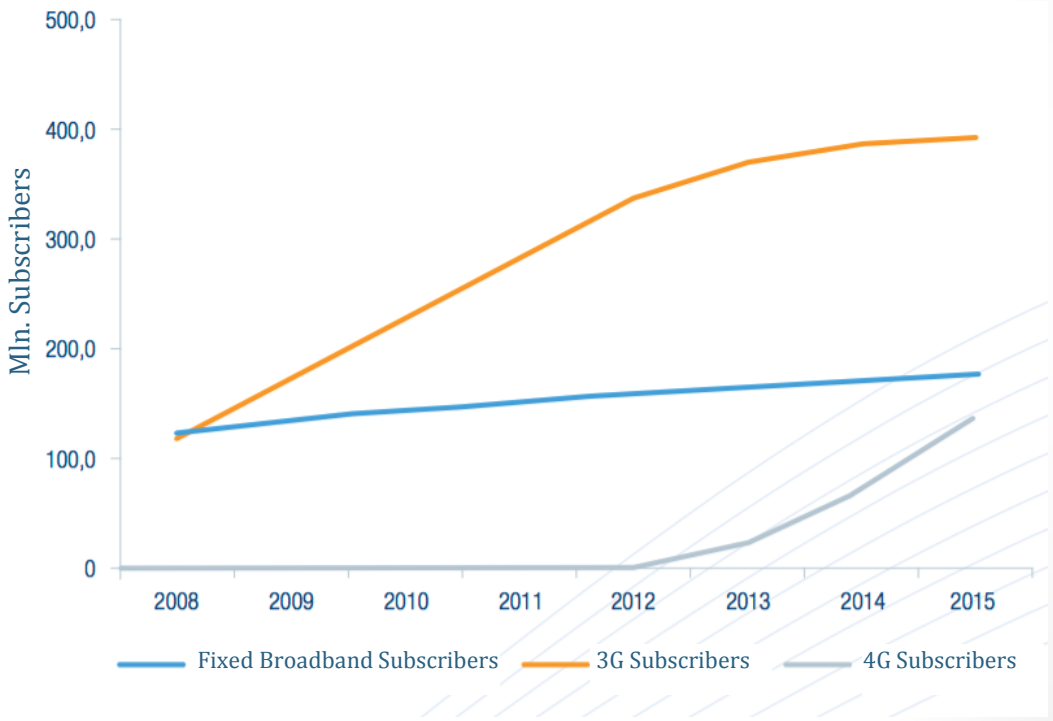
Source: ETNO Annual Economic Report (2015), based on IDATE.

Fixed Broadband and Mobile Broadband Take-Up

Fixed BB Connections by Technology
(ETNO Perimeter)



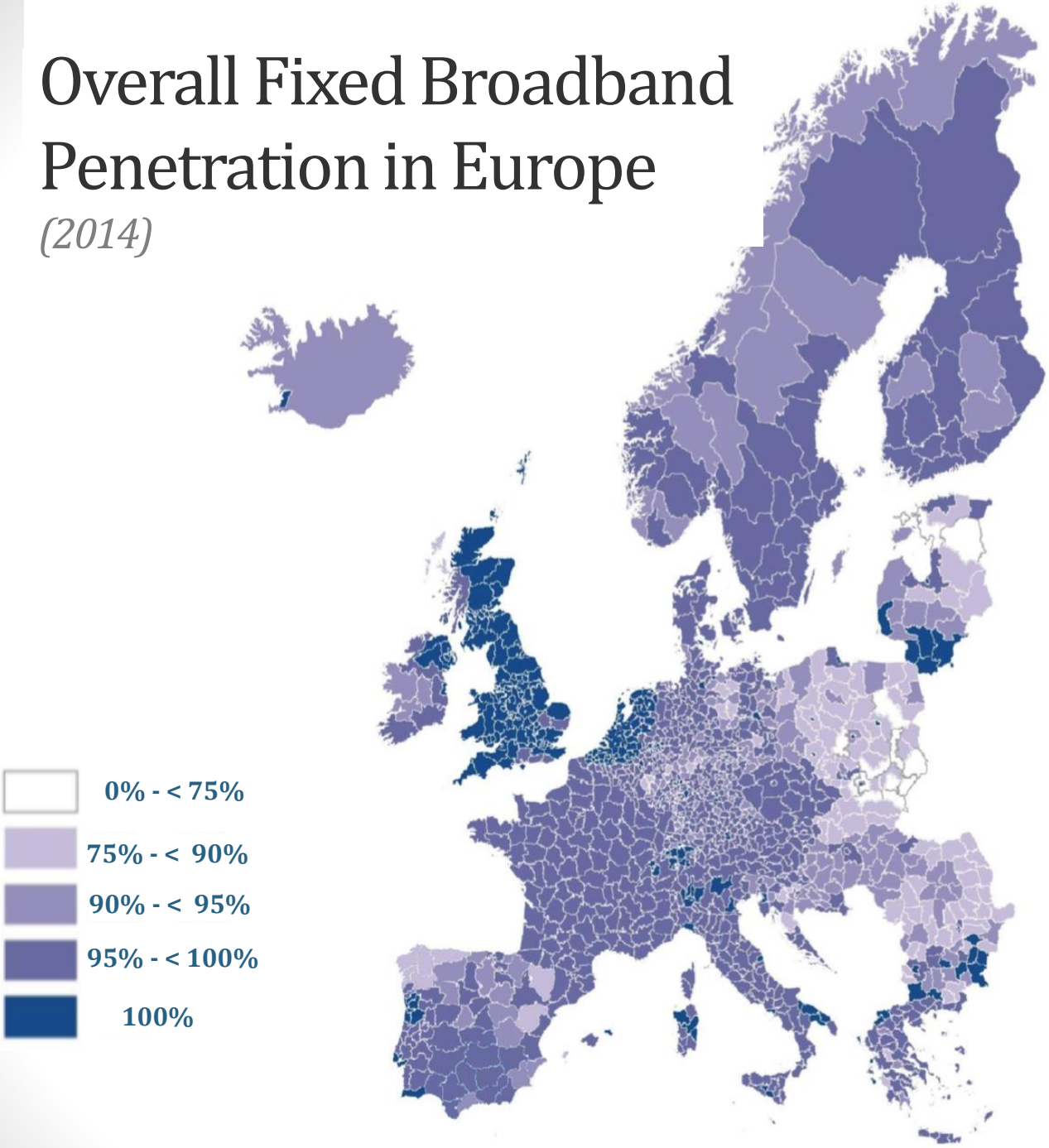
Fixed Broadband vs. Mobile Broadband Take-Up
(ETNO Perimeter)



Source: ETNO Annual Economic Report (2015), based on IDATE.

Overall Fixed Broadband Penetration in Europe

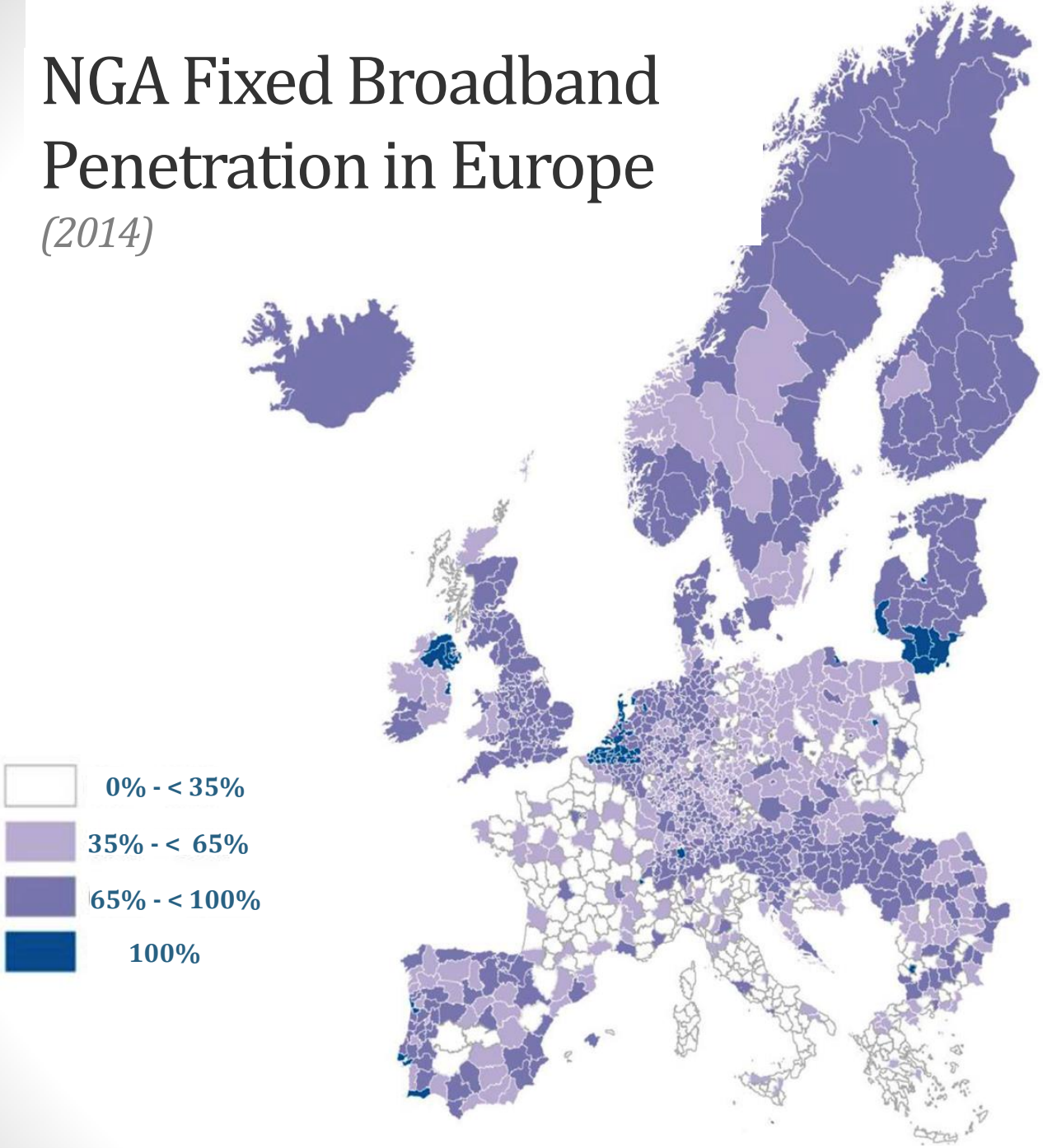
(2014)



Source: Broadband Coverage in Europe 2014, a Study by IHS & VVA for the European Commission.

NGA Fixed Broadband Penetration in Europe

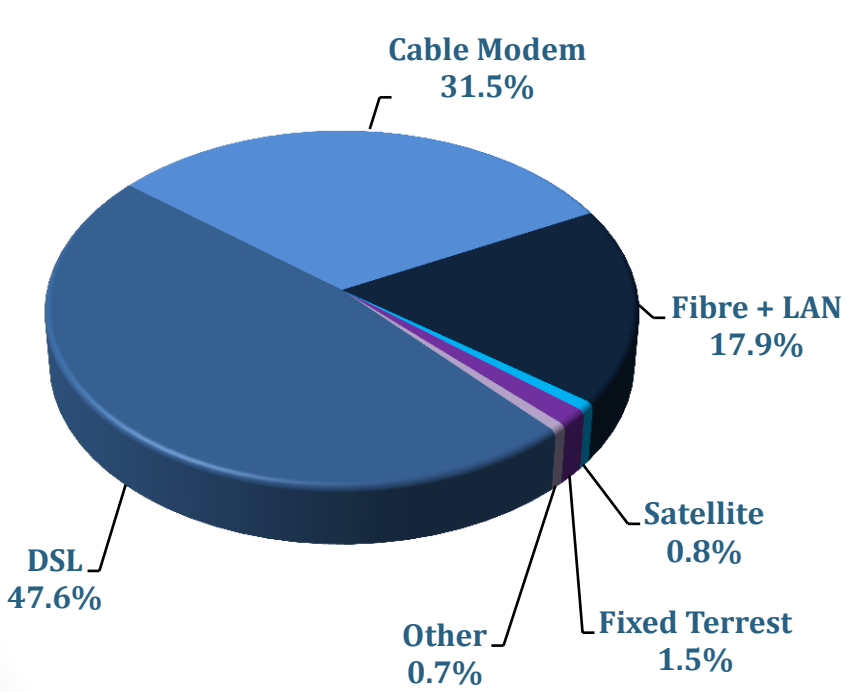
(2014)



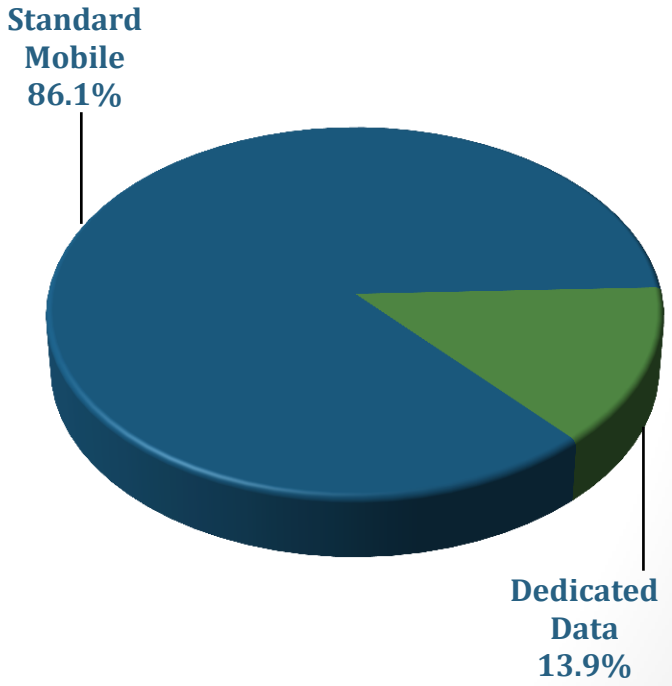
Source: Broadband Coverage in Europe 2014, a Study by IHS & VVA for the European Commission.

Broadband Subscriptions by Technology in OECD Countries

OECD Fixed BB Subscriptions by Technology
(Total Subscriptions: 365.2 Million; June 2015)

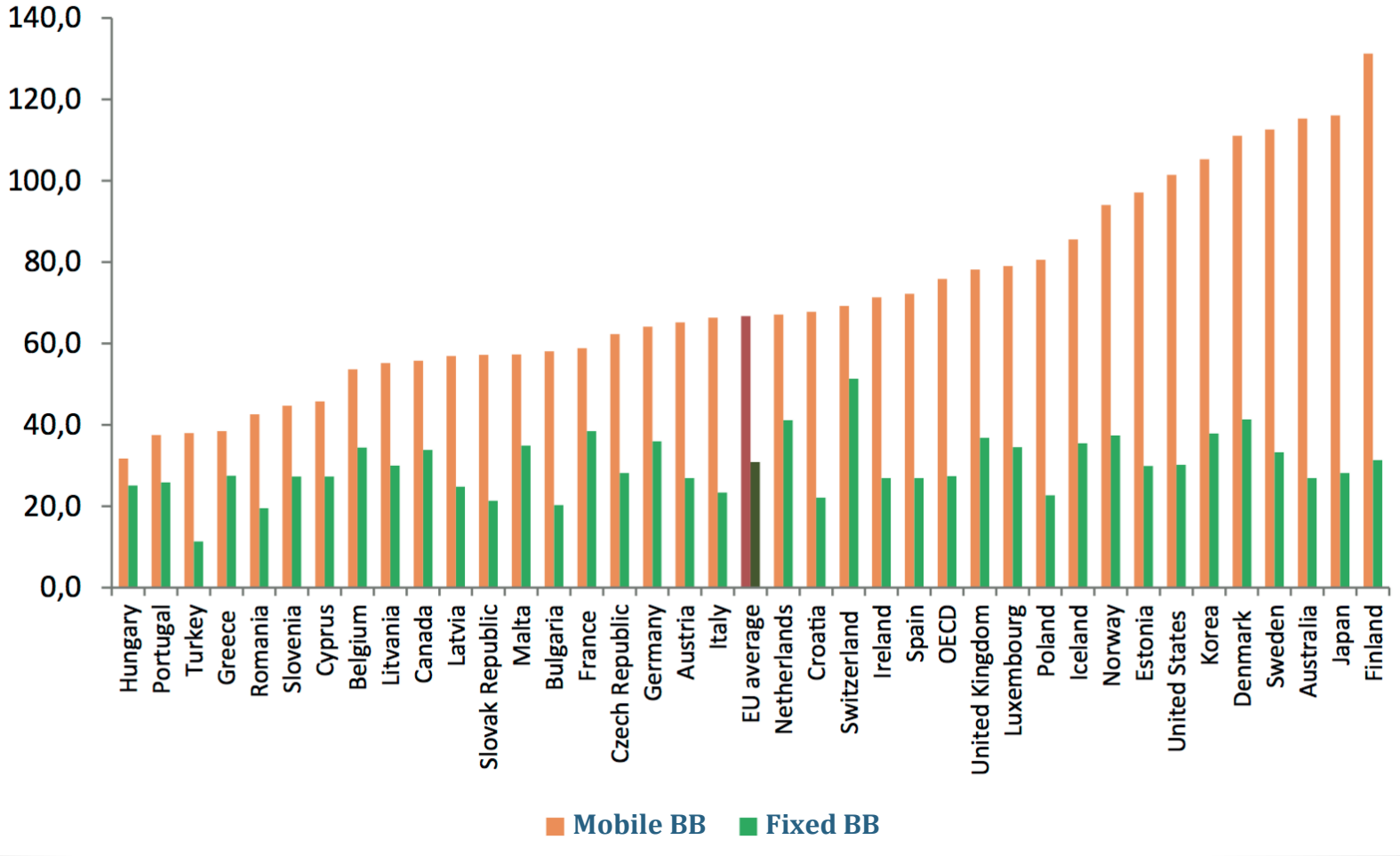


OECD Mobile BB Subscriptions by Technology
(Total Subscriptions: 1 084 Million; June 2015)



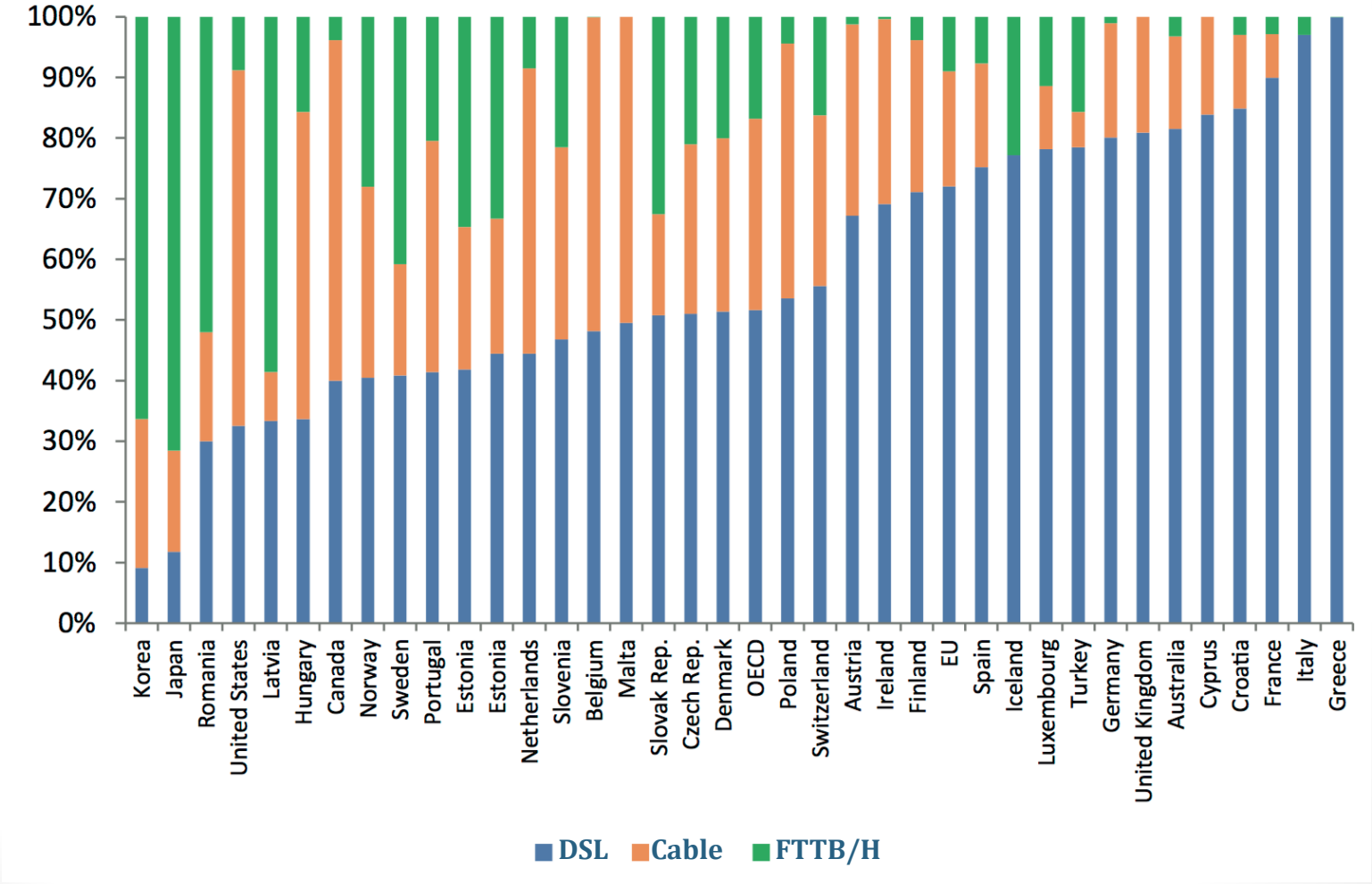
Source: OECD, Broadband Portal, www.oecd.org/sti/broadband/oecdbroadbandportal.htm, February 2016.

Fixed and Mobile Broadband Penetration (as Lines per 100 Inhabitants) in the EU and some OECD Countries, June 2014.



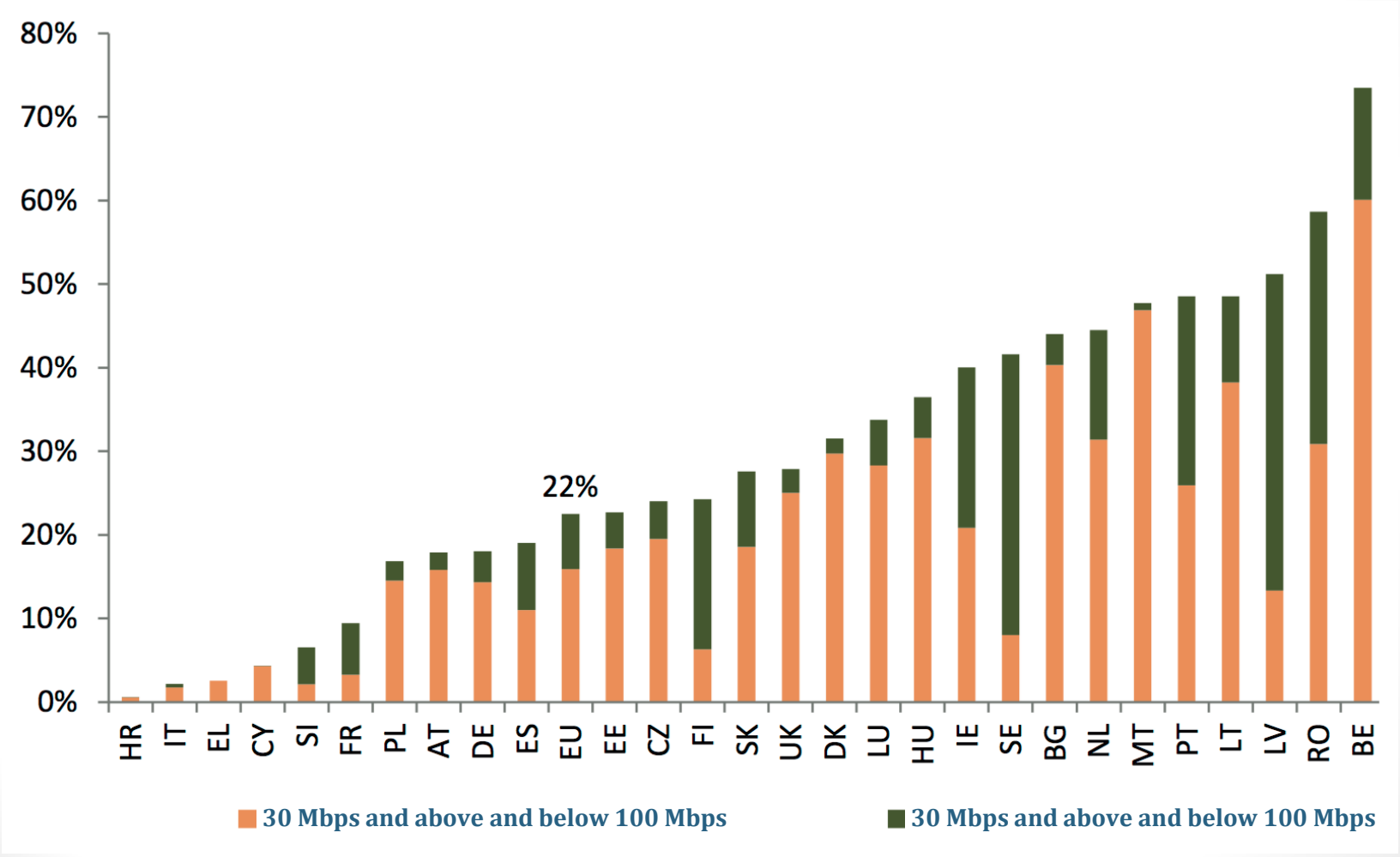
Source: BEREC (2015), based on European Commission & OECD.

Distribution of Broadband Lines by Underlying Technology in the EU and some OECD Countries, June 2014



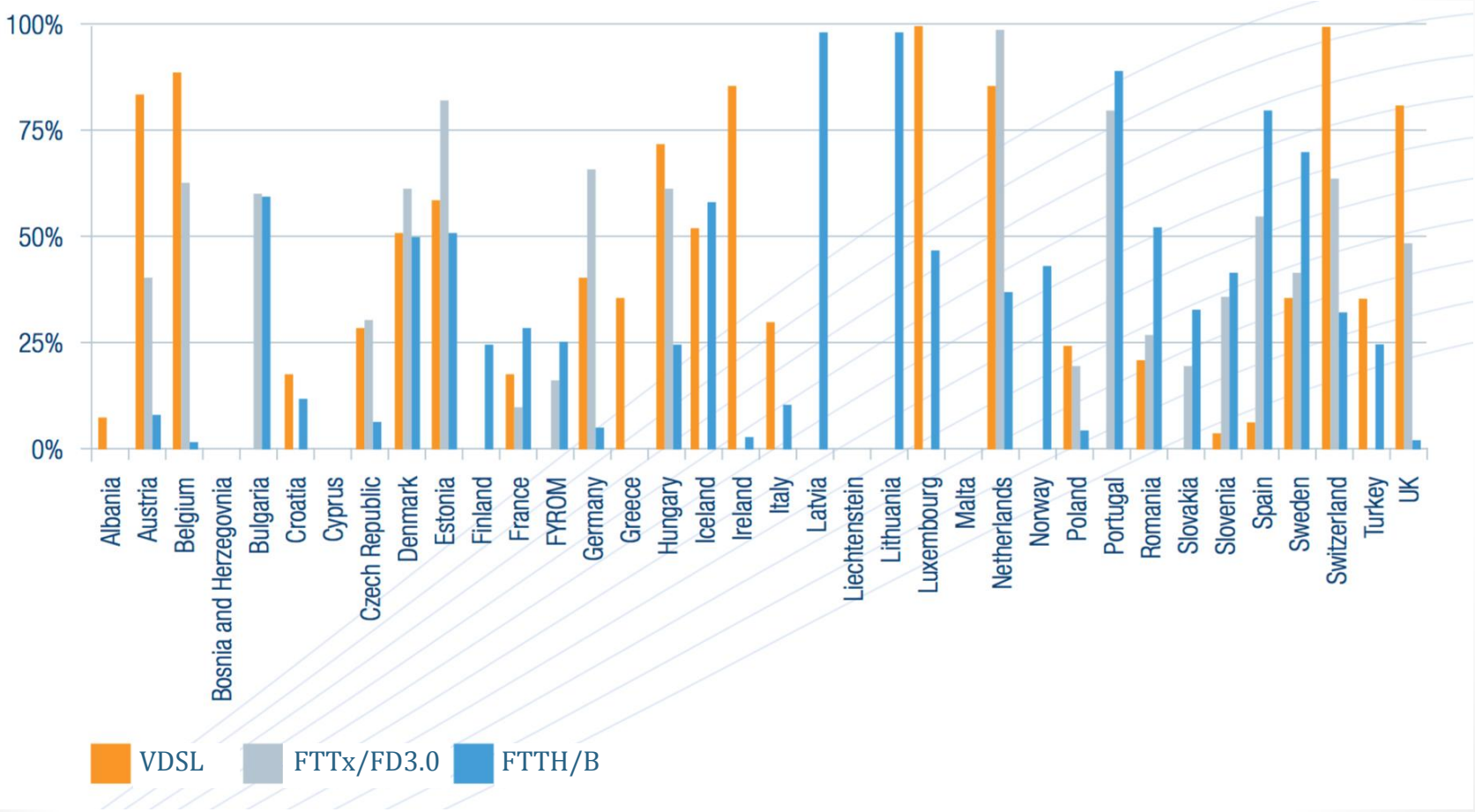
Source: BEREC (2015), based on European Commission & OECD.

Very High-Speed Broadband Subscriptions in the EU (Speed of 30 Mbps or Higher) as a Proportion of Total Broadband, June 2014



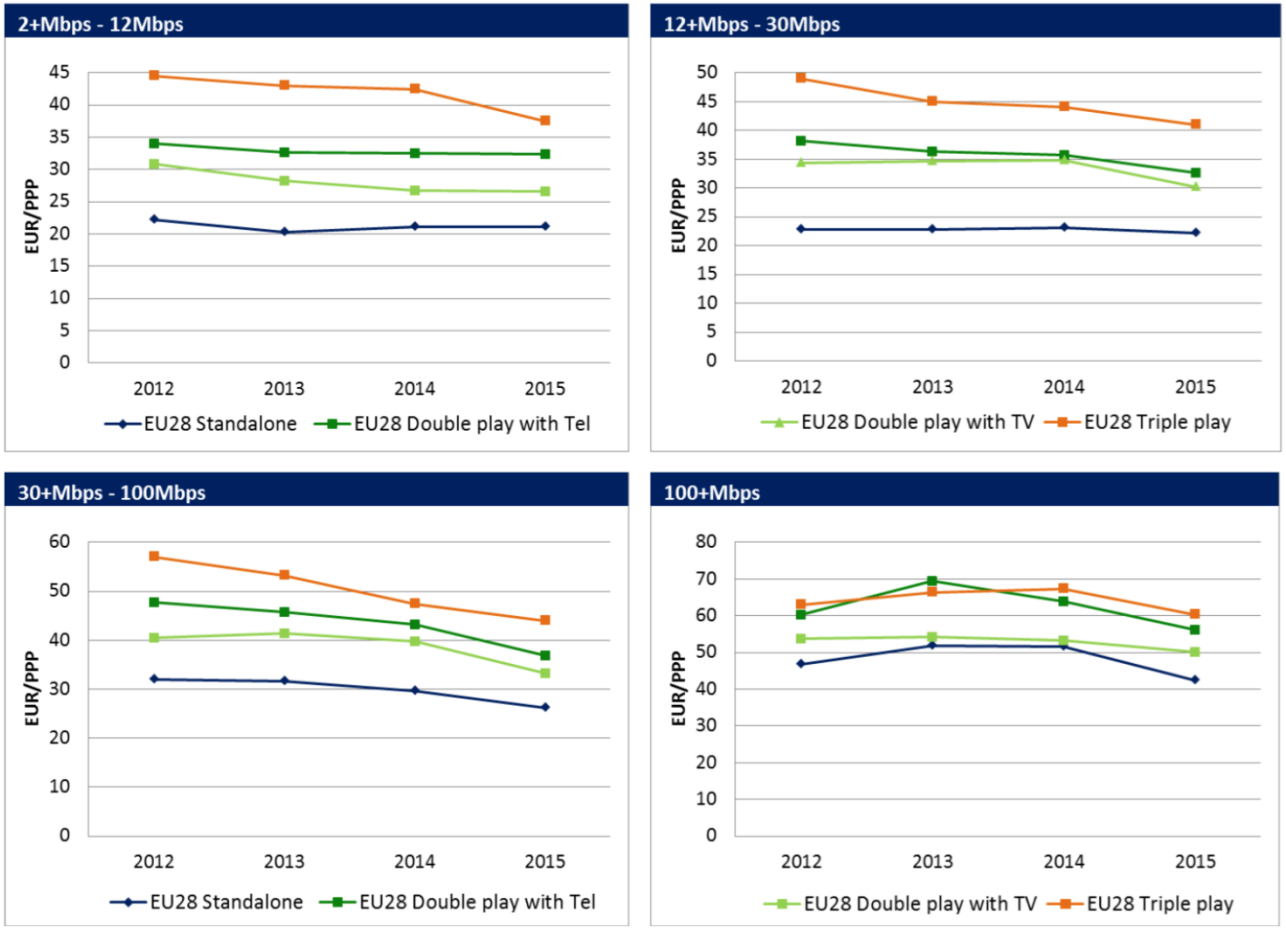
Source: BEREC (2015), based on European Commission & OECD.

NGA – VDSL & FTTx Homes Passed



Source: ETNO Annual Economic Report (2015), based on IDATE.

Evolution of EU28 Fixed Broadband Prices between 2012 and 2015 *(based on least expensive prices and expressed in EUR/PPP, VAT included)*

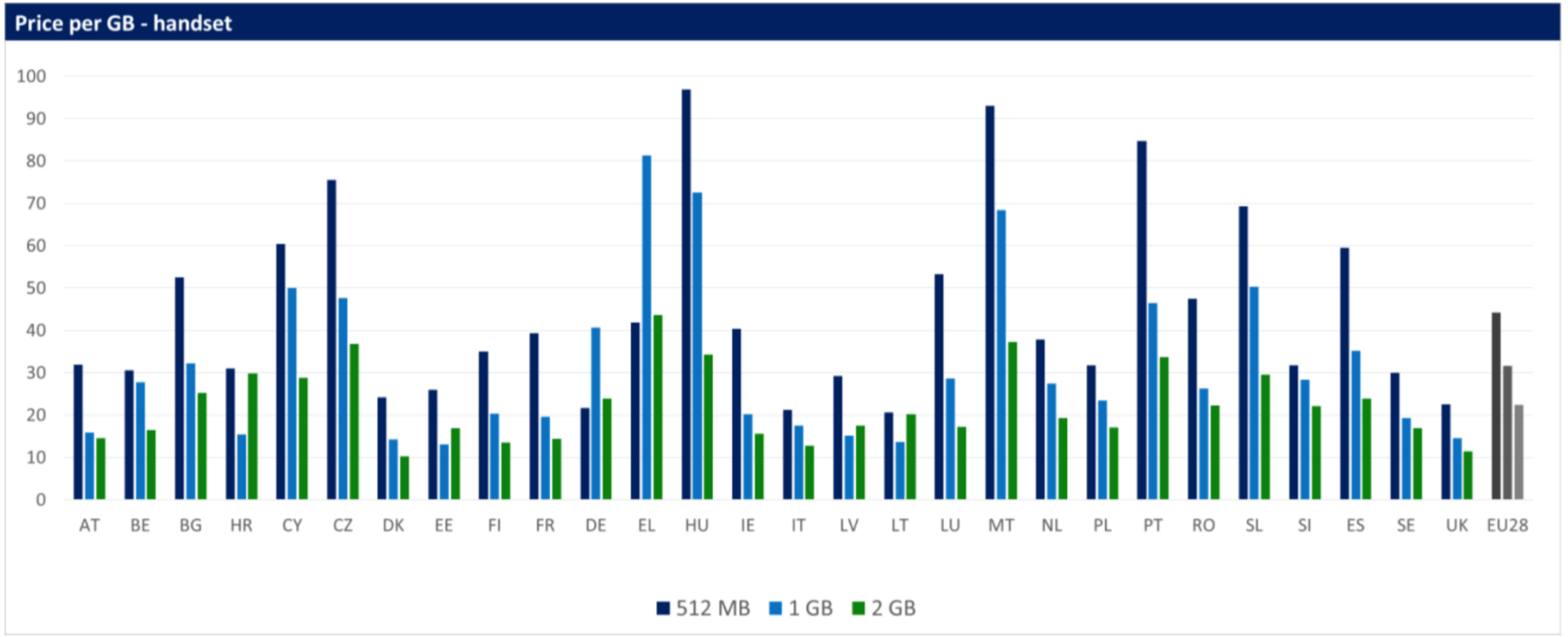


Overall, from 2012 to 2015, prices for broadband in the EU28 have fallen by 2.4%* to 22.8%**

* For Standalone offers with speeds between 12 Mbps and 30 Mbps ** For Triple play offers with speeds between 30 Mbps and 100 Mbps

Source: European Commission (2015): Broadband Internet Access Cost (BIAC) 2015, p. 17.

EU28 Fixed Mobile Broadband Prices in 2015 - Is more Mobile Data more expensive?



- **The price per GB in most cases drops 30% between two adjacent handset usage profiles (from 512 MB to 1 GB and from 1 GB to 2 GB)**

Unit cost (per GB) of the least expensive handset offer for 512MB, 1 GB, 2GB and 5GB baskets (expressed in EUR/PPP, VAT included,)
Price per GB is defined as the price of the least expensive offer divided by the data allowance of the basket

Source: European Commission (2015): Mobile Broadband Prices - Prices as of February 2015, p. 23 f.

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What is Regulation?

Governmental interventions concerning the individual freedom of contract beyond rules that are obligatory for all economic actors (i.e. sector specific intervention)

Types of Regulation

1

Sector-specific regulation regarding **public goods** in that sector (e.g. telecommunications)

2

Regulation aimed at **enabling** and **securing competition**:

- Surveillance and control of companies with **significant market power** (SMP)
- Surveillance and control of (natural) **monopolies**

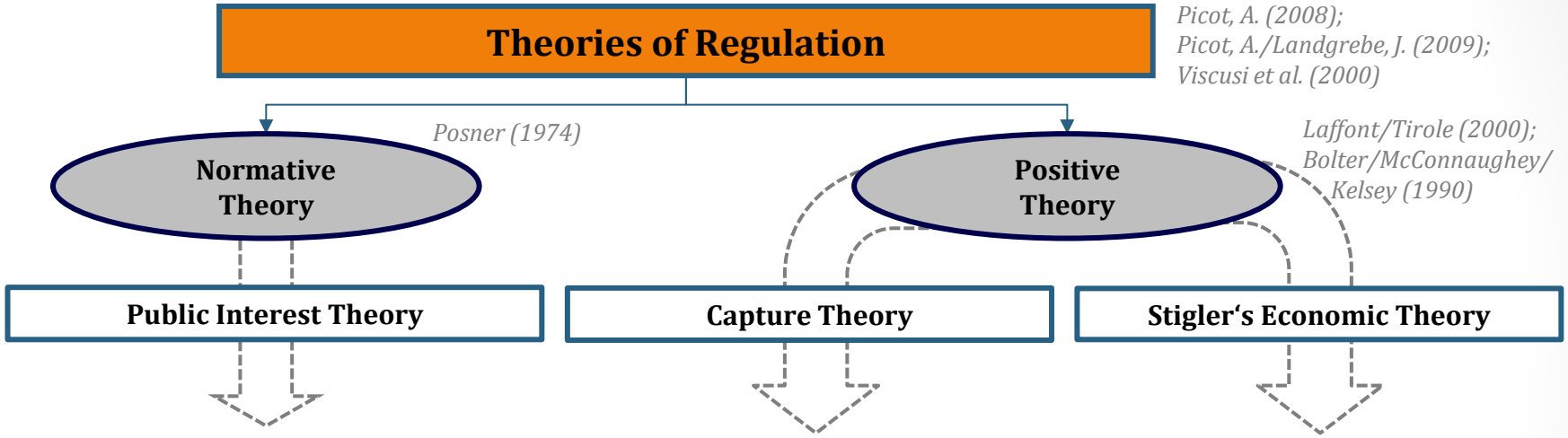
Regulation Theory

Science

- The appearance of regulation has been dealt with by scholars from various disciplines
- Three approaches have become popular in explaining this phenomenon:
- **Public Interest Theory**
- **Capture Theory**
- **Economic Theory of Regulation**

Source: Kleindorfer/Pedell 2007 Sp. 1564.

What is Regulation? – Theoretical Background



When *should* regulation occur?

- Regulation as response to the public's demand for the correction of a market failure
- The public will demand the industry to be regulated if a first-best solution is not achieved in the absence of regulation
- By regulating the industry, net welfare gains result, and this potential for welfare gains generates the public's demand for regulation

When *does* regulation occur?

- Regulation is supplied in response to the industry's demand for regulation
- The regulatory agency comes to be controlled by the industry over time
- Regulators are captured by the industry

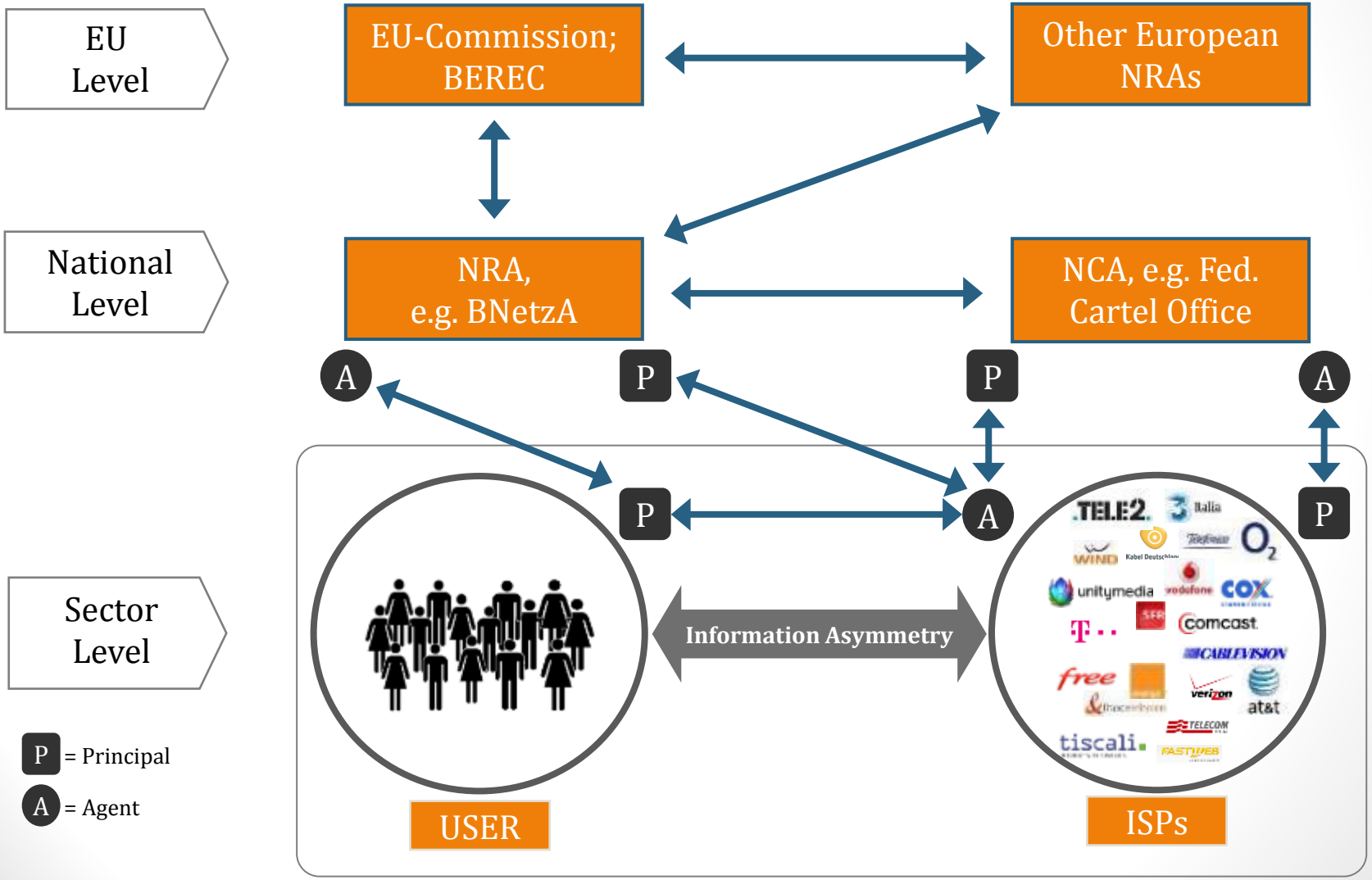
When *does* regulation occur?

- "(…) regulation is acquired by the industry and is designed and operated primarily for its benefit."

  Stigler (1971), S. 3

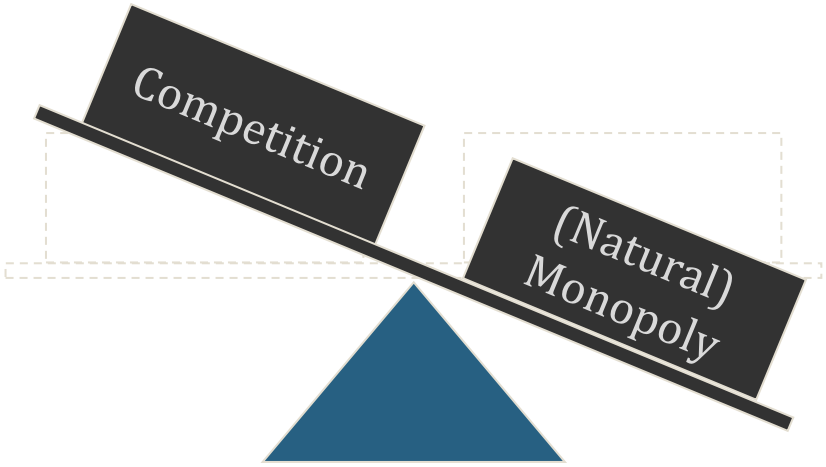
Source: Own illustration.

Theoretical Background of Regulation – A multiple Principal-Agent Relationship



Source: Own illustration; Jensen/Meckling (1976); Eisenhardt (1989); Picot et al. (2012).

Infrastructure based Network Industries is a Major Challenge for Regulation



Stability of natural monpolies

- Market participants with (traditional) high market share
- Theory of the stability of natural monopolies (contestable markets):
  Market can be entered by competitors, if
  - Market entrance without costs
  - Market exit without costs

Network Industries

- Network industries (railway, gas, energy, post, water) characterized by
  - High infrastructure investments
  - Low degree of competition
  - Specificity of investments
    (sunk costs – e.g. gas pipeline can be used for other purposes than gas transport at prohibitively high costs only)
  - High barriers for market exit
    (constitution high market entry barriers for new entrants)
  - Investment in infrastructure secures monopoly position and earnings, as potential market entrance is threat by price competition (P = MC)
- Subadditivity and market irreversibility create monopolistic structures

Regulation tries to Overcome the Gap between Infrastructure and Service Competition.

Infrastructure Competition

Incentives of Infrastructure Competition

- Access to network components of the dominant company for new market entrants
- Regulated usage fees
- Example: Telecommunications

Service Competition

Incentives for Service Competition based on the incumbent's network

- Guaranteed access for competitors
- Regulated access and usage fees
- Example: telecommunications

Competition

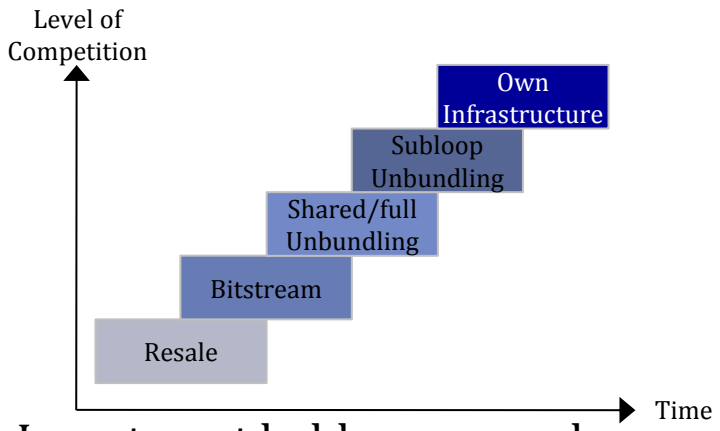
Control of monopolistic behavior

- Surveillance of cross-subsidization
- Separate business areas
- Approval of specific (access) prices)
- Abuse control due to dominant position

Abuse

Infrastructure vs. Service Competition

Investment Ladder Approach



- Investment ladder approach transfers existing monopolistic markets into market based competition

The right Approach?

- Investment Ladder Approach of *Cave/Vogelsang (2003)*:
  - Low access prices at market opening
  - Access prices are increased over time in order to set incentives to invest into own infrastructure
- Research by *Höffler (2005)*:
  - Within emerging markets with high importance of own infrastructure, competition takes place from the beginning
  - Service competition only would decrease incentives to invest

Broadband Access – A public Good?

Broadband Access

Two Perspectives

Rivalry \ Excludability	high	small
high	***Private Goods***	***Collective Goods***
small	***Club Goods***	***Public Goods***

Public Good

→ The state guarantees the citizen of a region a specific speed level of broadband access

Competition

→ Particularly in rural regions, the broadband coverage can't be guaranteed by competition forces

→ Public goods are characterized by "non-rivalry" and "non-excludability"

→ For public goods, general circumstances should exist, that guarantee the supply of products and services without any governmental intervention

→ If this is not possible, the government has to ensure the general availability (BB as universal service in Switzerland)

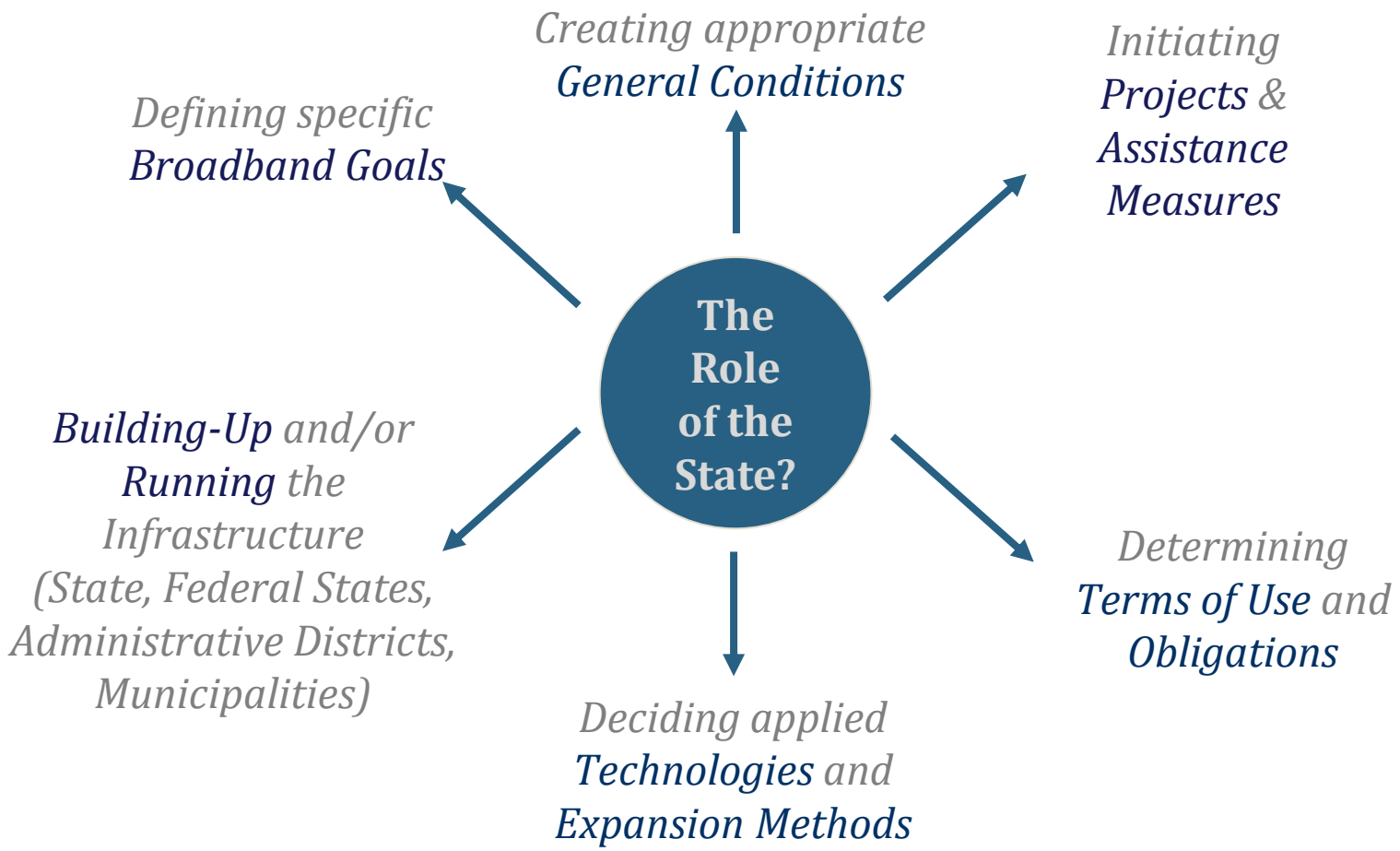
Broadband Access as "Merit Good"

→ The concept of "merit goods" declares, why specific goods have to be financed by governments, that otherwise wouldn't be offered in a free economy

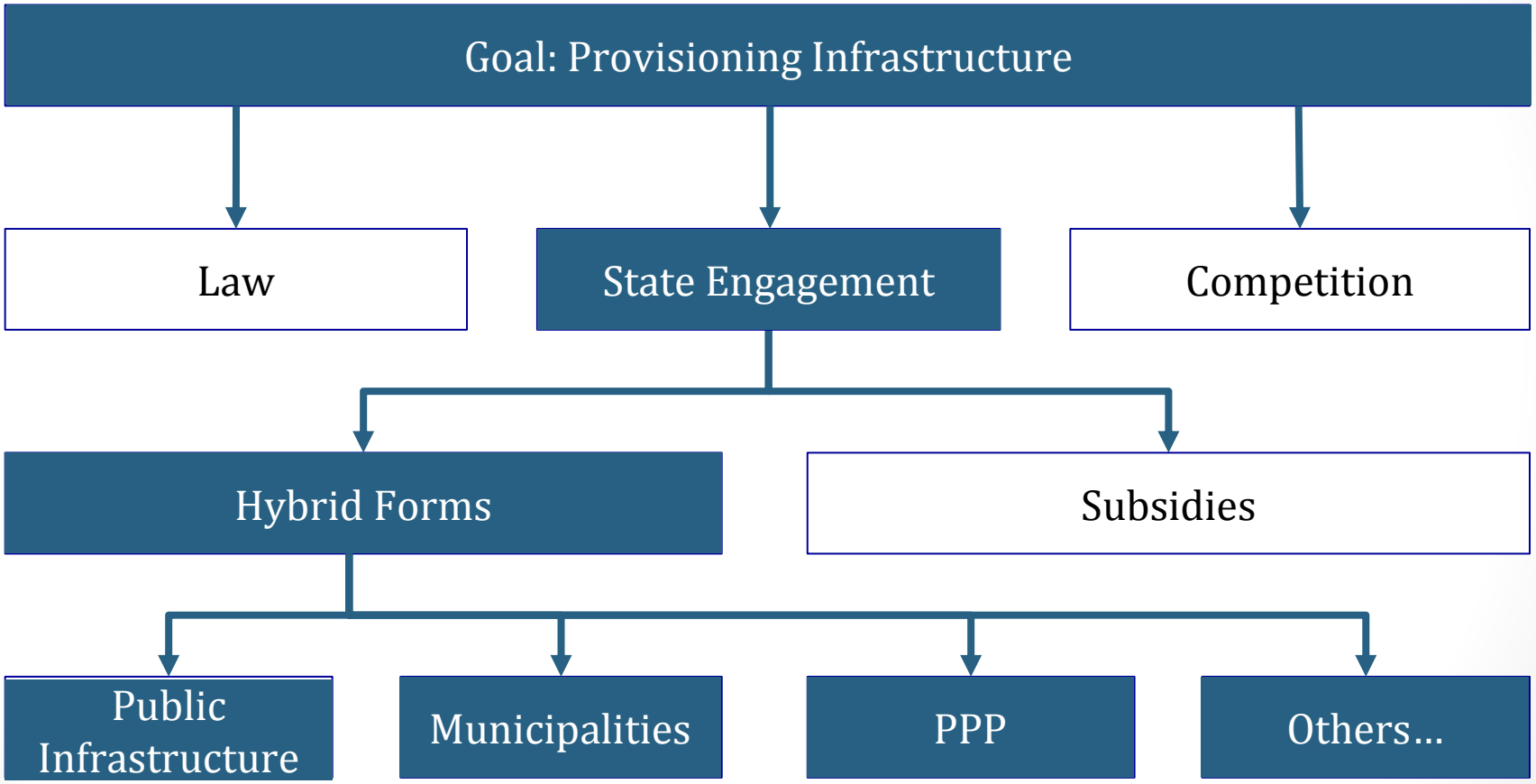
→ Assumption: Individuals underestimate the value/utility of a specific good →smaller demand & supply compared to the social optimum

Source: Musgrave (1959); Olson (1965); Holznagel/Picot/Deckers/Grove/Schramm (2010).

The Role of the State in the Roll-Out of Broadband



Broadband Roll-Out Strategies



Source: Holznagel/Picot/Deckers/Grove/Schramm (2010).

Focus of Broadband Investments and the Involvement of the Public Sector

Focus of Broadband Investment Concerns

Network Coverage *Expansions*

- projects deploying fibre or cable access networks
- High-Speed Mobile Access
- Support infrastructures to areas that are currently not covered by any access

Network Coverage *Improvements*

For example: DSL → FTTH

→ Enabling higher access speeds that increase the penetration rate of those services that require high bandwidth (e.g.. Video Streaming)

Four Levels of Involvement of the Public Sector

Public-Run Municipal Network Model

- Public authority (PA) builds & operates acbroadband network
- Collaboration with the market possible (e.g. PPP)
- Ownership remains with the PA
- „Public Design, Build and Operate“ (DBO)

Private-Run Municipal Network Model

- Public authority: Building & owning the passiven IS
- Private actor: Operation of the active layer; IRU
- „Public Outsourcing/Concession“

Community Broadband Model

- BB Investments: Private initiative (Bottom-up approach)
- Public authority: Supporting (co-financing, counselling, etc.)

Operator Subsidy (Gap-Funding) Model

- PA is not intervening → just subsidizing one market actor
- Passive & active IS: Private property
- Risks associated with building new infrastructure are borne by the recipients of the funding

Source: European Commission.

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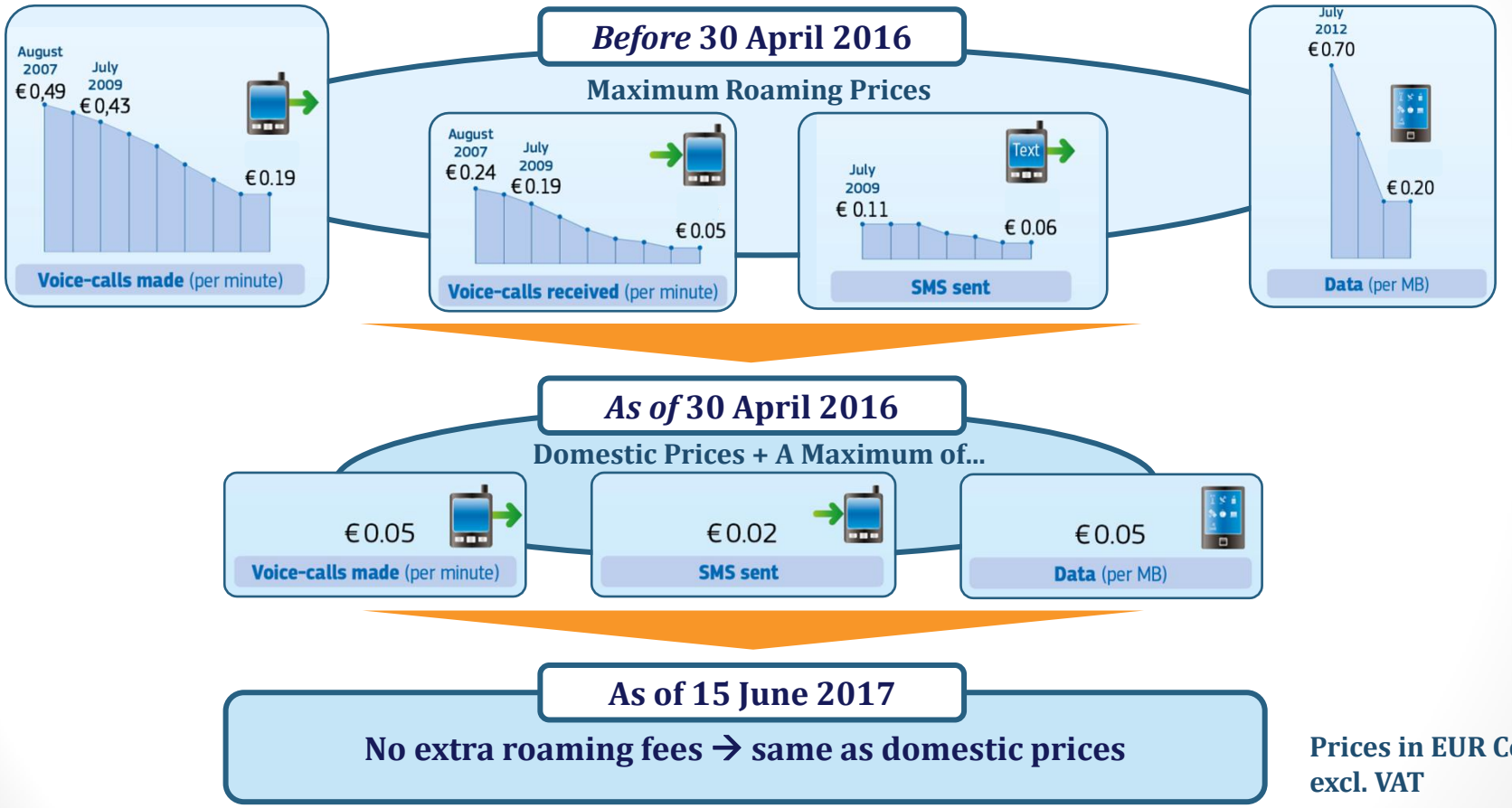
Downloading Content, Surfing the Web, Writing Text Messages and Making/Receiving mobile Phone Calls in foreign Countries

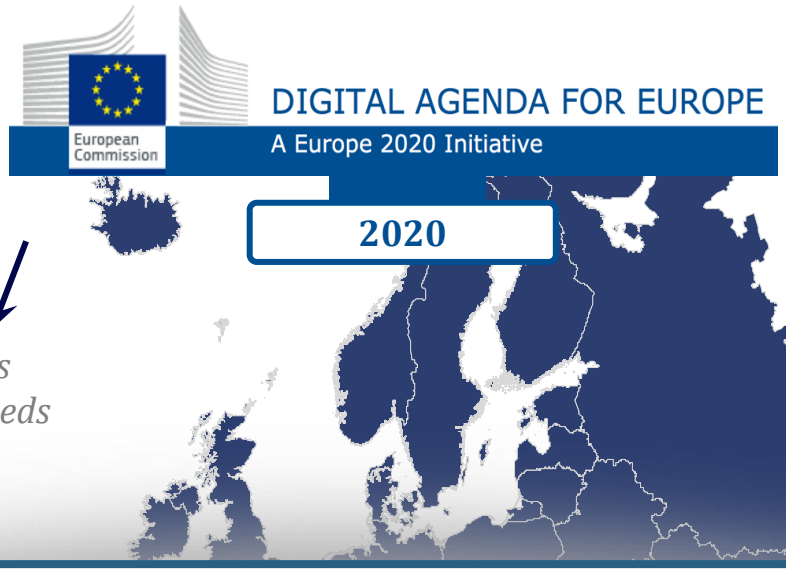


Prices in EUR Cents, excl. VAT

Due to regulation on roaming, mobile services are getting cheaper abroad

Source: European Commission (2016).

Broadband Expansion in European Context



All Europeans *have access to broadband connection speeds above* ***30 Mbps***

At least ***50 %*** *of European households having* ***100 Mbps*** *subscriptions or higher*

- ***Next generation access networks*** take the ***priority***
- Investments involve both ***passive*** and ***active components*** of the infrastructure
- Expansion/Upgrade of ***backbone/backhaul***, ***area networks*** and ***last-mile connections***

The Digital Agenda for Europe – The Digital Agenda for Europe – Driving European growth digitally (Mid-term Review) Telecom Single Market Connecting Europe Facility European Broadband: investing in digitally driven growth [COM(2010) 472] Better access for rural areas to modern ICT [COM(2009) 103 final] and Commission Staff working document [SEC(2009) 254 of 3.3.2009] Future networks and the Internet [COM(2008) 594 final] Bridging the Broadband Gap [COM(2006) 129] Mobile broadband services [COM(2004) 447 final] The eEurope 2005 action plan: an information society for everyone [COM(2002) 263 final] A European Information Society for growth and employment [COM(2005) 229 final]

Source: www.ec.europa.eu.

Broadband Expansion in European Context

Measures to reduce the cost of deploying high-speed electronic communications networks

Euro… Development Fund (ER…F)

…al Fund for Rural Development (EAFRD)

DIRECTIVE 2014/61/EU

Access to & transparency of existing physical infrastructure

- "Creating a *market for physical infrastructure* such as ducts, poles, manholes without covering cables, or dark fibre"
- "*Any* electronic communications / utilities *operator may enter* this market & *offer access* to its physical infrastructure"
- "*Any* network *operator* has the *obligation to give access* to its *physical infrastructure for high-speed broadband*"

Permit granting

- "All *relevant information* on procedures for *granting permits* for civil works must be *available via a Single Information Point*"
- "In *any event*, unless national law specifically provides otherwise, any *permit decision* should be *made* in general *within 4 months*"

Coordination & transparency of planned civil works

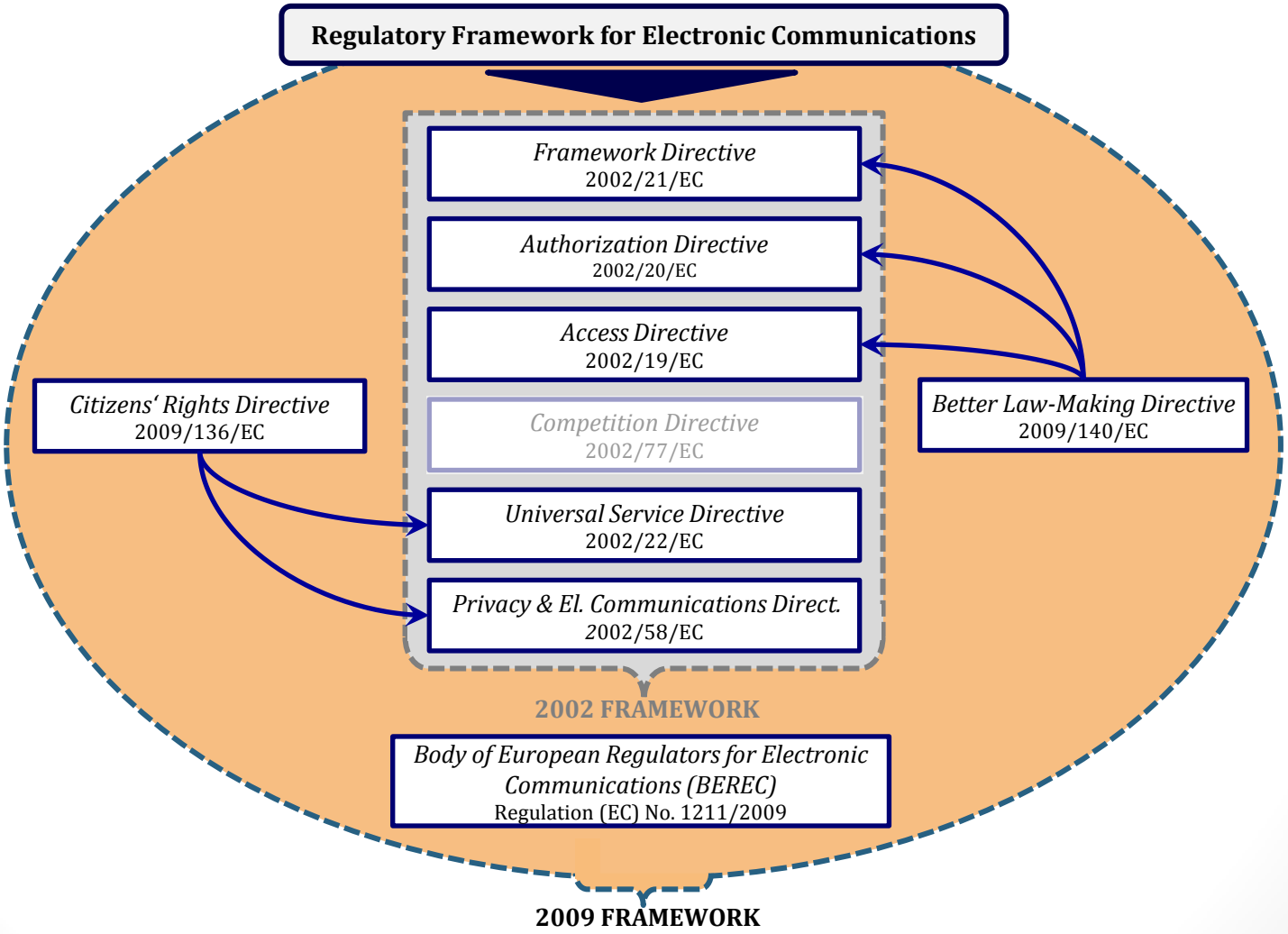
- "*Any* network *operator may negotiate coordination of civil works with electronic communications providers*"
- "In order to *enable agreements* on *coordination* of civil works, *planned civil works* have to be *made public 6 months* in *advance*"

In-building infrastructure

- "All *new buildings* shall be *equipped* with *physical infra-structure*, such as mini-ducts, *capable of hosting high-speed networks* and with an *access point*, which can be easily accessed by the providers of public communications network"
- "*Providers* of public communications networks *have* the *right* to *access the access point* at their *own cost* and, through it, *any existing in-building physical infrastructure*"

Source: www.ec.europa.eu; www.bmwi.de; www.bmel.de; www.eur-lex.europa.eu.

European Regulatory Framework for Electronic Communications



Source: Own illustration.

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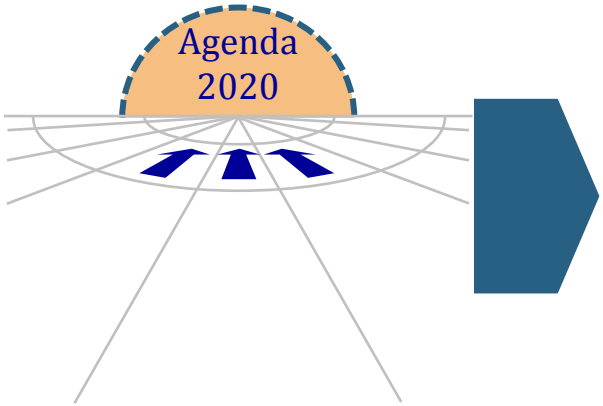
Selected Regulatory Issues – Broadband Roll-Out



Potential Regulatory Issues

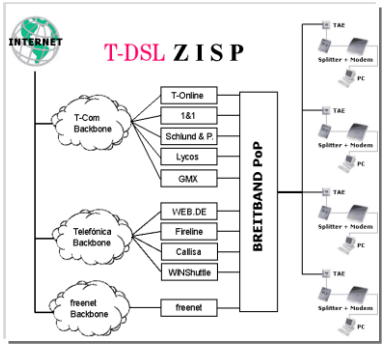
- Policy decision
  - Is access to broadband a public good of general interest or not?
  - European common position?
- Regionalization
  - Local supply advantages?
  - National monopolization?
- Technology neutrality
  - Sustainable technology selection?
- Profitability gap
  - Existence?
  - Extent?
- Quality
  - Definition sufficient?
  - Mechanisms for determination applicable?

?

Selected Regulatory Issues – Competitor Access

Line Sharing

- Line Sharing characterizes a technology, which separates narrow frequency band from high frequency range of local loop (twisted pair copper)
- Line Sharing enables competitor to lease high frequency part of local loop to offer broadband services via DSL
- Voice telephony is still available via the Incumbent



Unbundled Local Loop

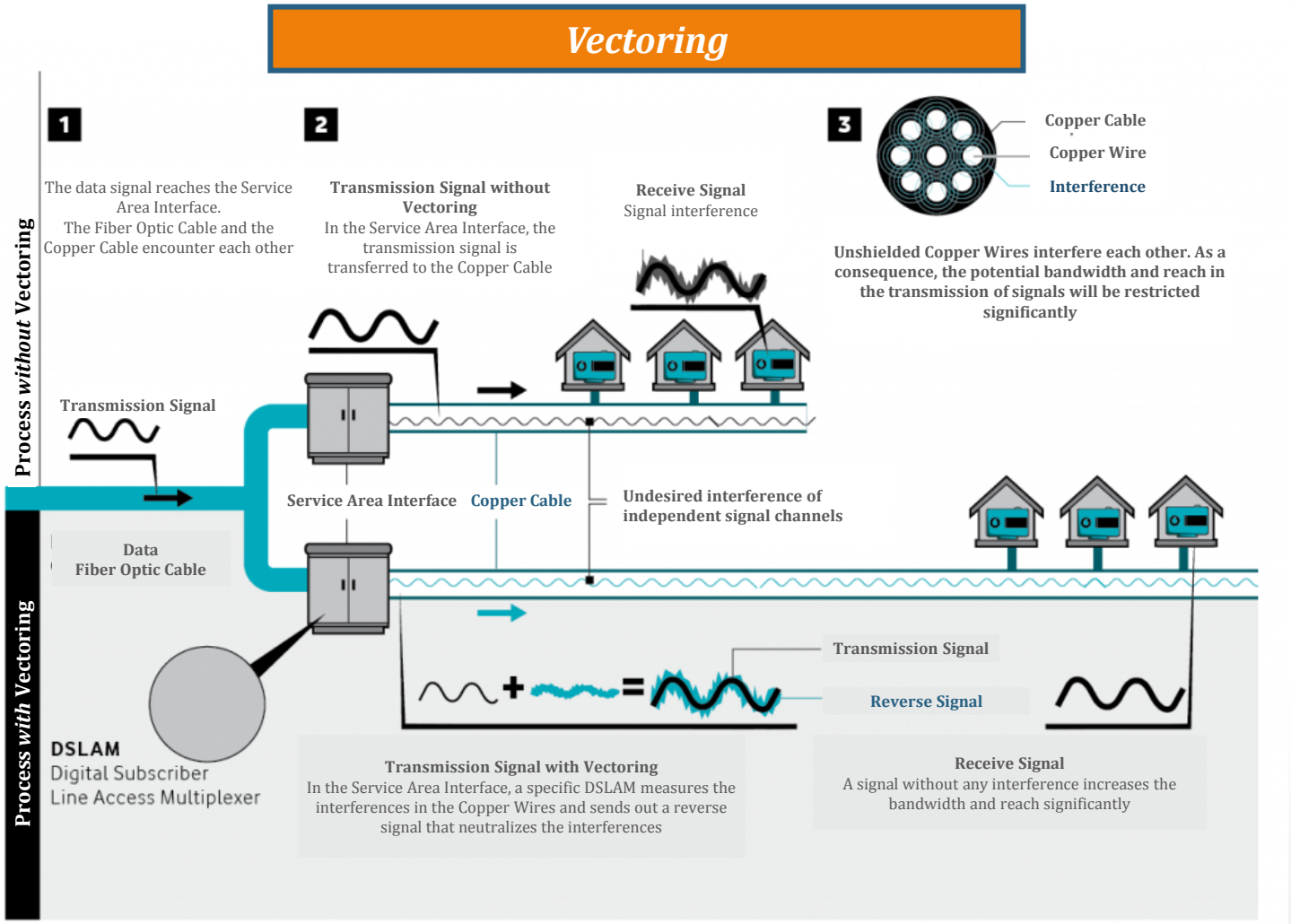
- Technically the physical part in twisted pair copper, between HVT within the switching station and the telephone access device at customer's home
- Competitors can rent this part "unbundled" – which means without technological parts from the incumbent – to offer an separate DSL-service for customer.

- Bitstream depends in part on PSTN and may include other networks such as ATM network
- Wholesale product
- Resale offers not a substitute for Bitstream access

Bitstream Access

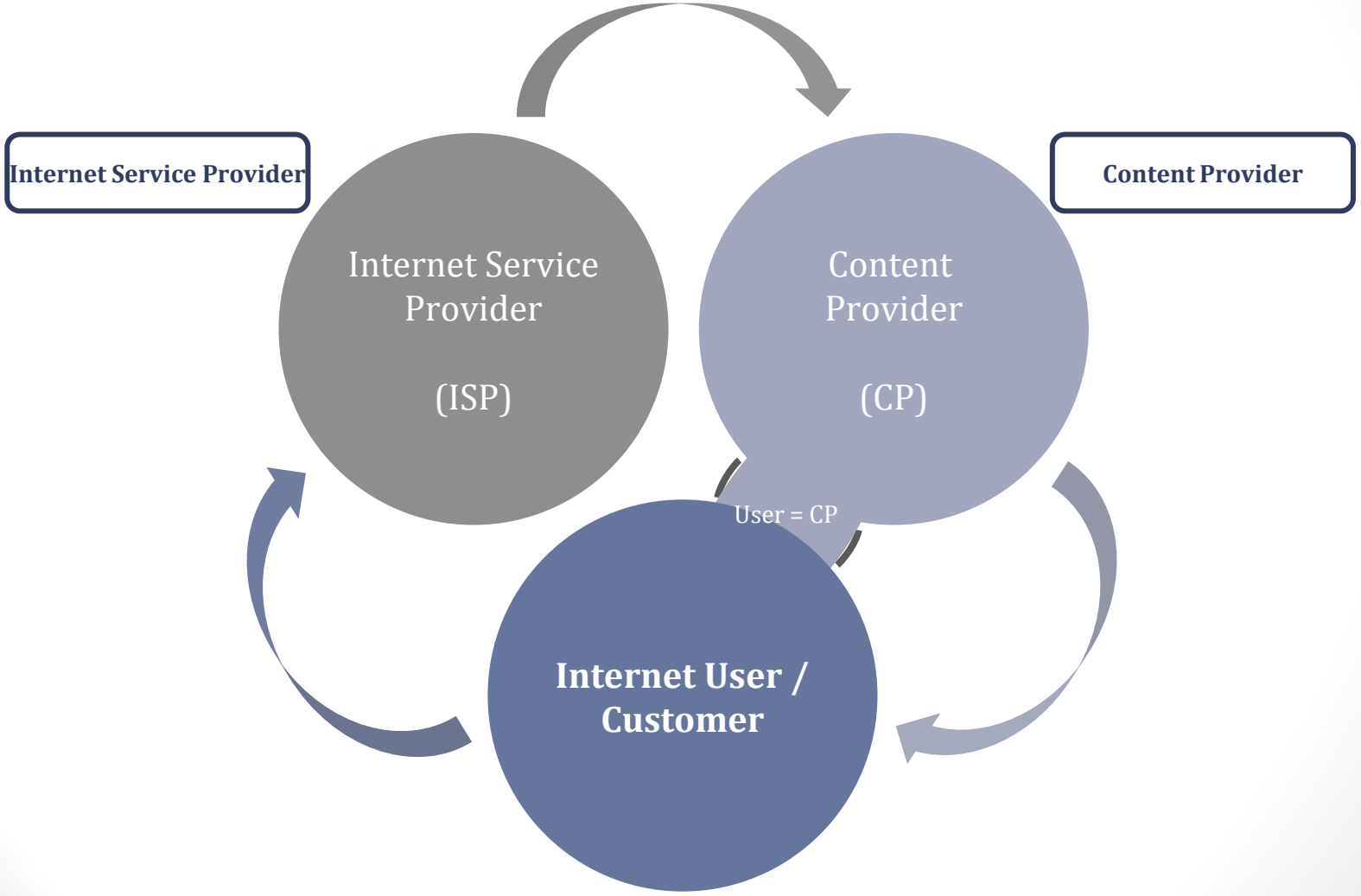
Source: Picture: onlinekosten.de

Selected Regulatory Issues – (Avoiding) Competitor Access



Source: Vodafone (2014).

Selected Regulatory Issues – Network Neutrality: Market Players



Source: Own illustration.

Selected Regulatory Issues – Network Neutrality: Definition

Starting point 2003

Tim Wu

"a neutral network – that is, an Internet that does not favor one application (say, the world wide web), over others (say, email)"

Wu (2003): Network Neutrality, Broadband Discrimination

Variety of different definitions & interpretations

Differentiation between extreme and moderate views on Network Neutrality

Extreme Interpretations

- Strictly equal treatment of all bits in the entire Internet
- Regardless of content, platform, origin, destination or type of the service or application
- No censorship, discrimination or prioritization

Moderate Interpretations

- Equal opportunities of competition between CPs & ISPs in the broadest sense
- Prioritization and price discrimination should be explicitly permitted if objective criteria are provided
- No efficient competitor should be hindered or excluded

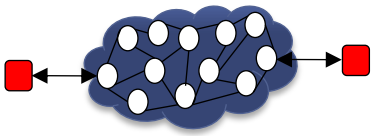
Source: Wu (2003) p. 145: Vogelsang (2007), p. 220; van Schewick (2010), p. 85; Kafka (2011), p. 35; Picot/Grove/Sedlmeir (2012), p. 44.

Selected Regulatory Issues – Network Neutrality: Basic Principles

Principles of Network Neutrality

1 "End-to-End" Principle

- "Intelligence" of network at its endpoints
- The network's one and only task is data transmission

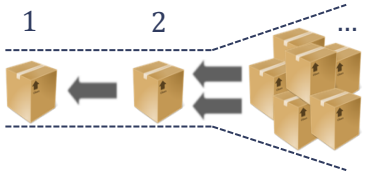


2 "Best-Effort" Principle

- Transfer of data in a content-blind manner
- No grading, prioritization or discrimination
- Transmission under the same conditions and regardless of origin at the best possible way ("a bit is a bit")
- No guarantee for an absence of error, delay, loss or speed
- Occurrence of packet delays or losses is possible
- Each data packet with same possibility to be delayed, or to get lost

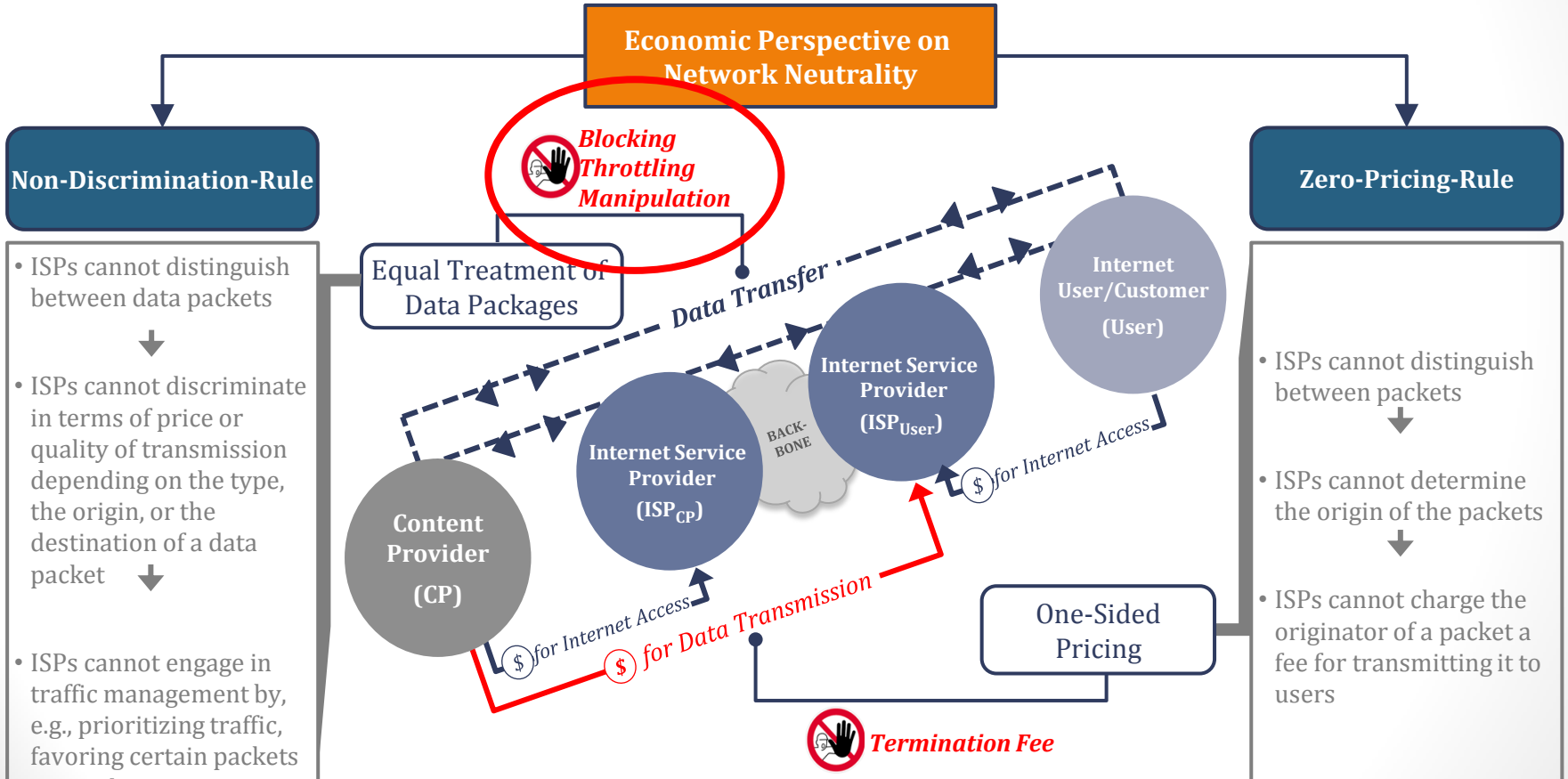
3 "First-In-First-Out" Principle

- In case of capacity constraints, first sent packets are always transmitted first
- Speed of the data transportation solely focused on the available bandwidth



Source: See Picot/Grove/Sedlmeir (2012), pp. 45f.; Schlauri (2010), pp. 28f.; van Schewick (2010), p. 85; Felten (2006), p. 2; Vogelsang (2007), p. 220; Lessig, (2002), p. 1789.

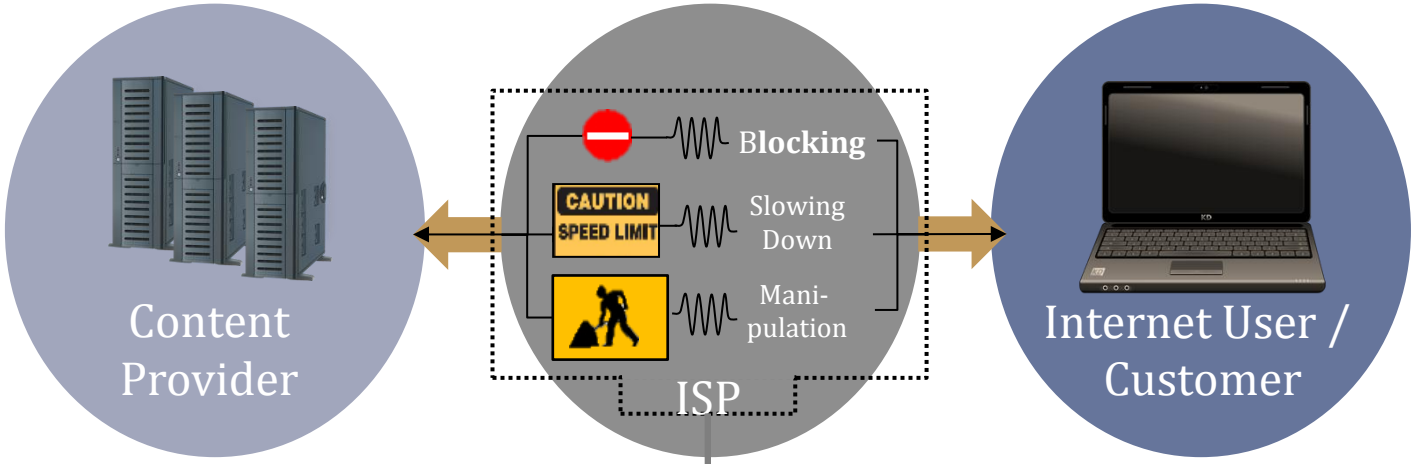
Selected Regulatory Issues – Network Neutrality: An Economic View (I/II)



Source: Own illustration; Schuett (2010); Fetzer et al. (2012); Grove et al. (2012); Dewenter (2009); Crocioni (2011); Rochet & Tirole 2006; Lee & Wu (2009); Lessig (2001); Singer (2007); Grove & Agic (2012); Mochalski & Schulze (2009); Mueller (2011); Picot et al. (2012).

Selected Regulatory Issues – Network Neutrality: An Economic View (II/II)

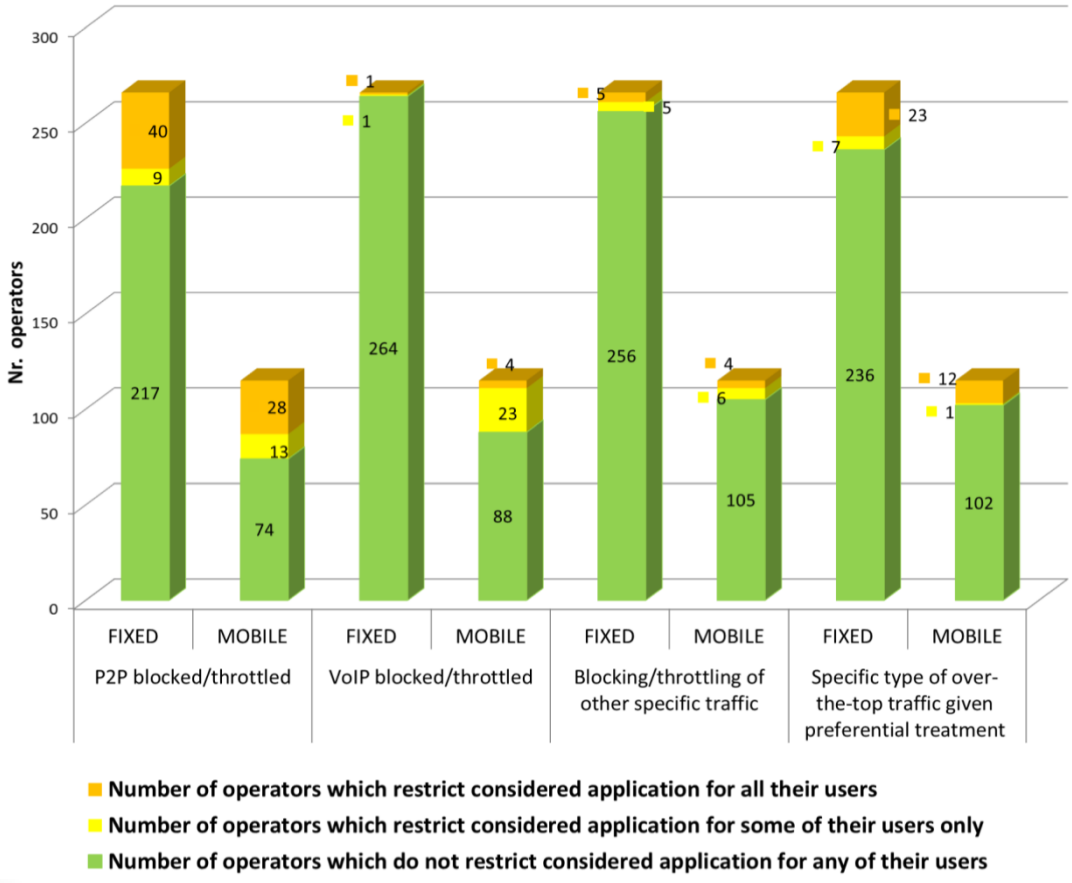
Three main cases of network discrimination can be distinguished:



Blocking	Slowing Down	Manipulation
• Used by vertically integrated network providers • Primarily due to economic reasons → Network operators are willing to exclude certain services and applications of competing market players to maximize profits • Example:	• Quality degradation of data transmission / prioritization of specific services according to provider´s preferences • Main argument: Necessary in situations of high capacity utilization of their networks • Some applications are more affected than others (e.g. VoIP relies on steady streaming) • Example: comcast	• Manipulation & blocking of content • Some ISPs have blocked specific websites for providing controversial and critical content of itself • Example: freenet

Source: Own illustration, based on: Holznagel/Picot/Grove (2010), p. 4; Felten (2006).

Selected Regulatory Issues – Network Neutrality: Number of Operators Applying some Level of Restriction in Europe (2012)



Body of European Regulators for Electronic Communications

BEREC OFFICE

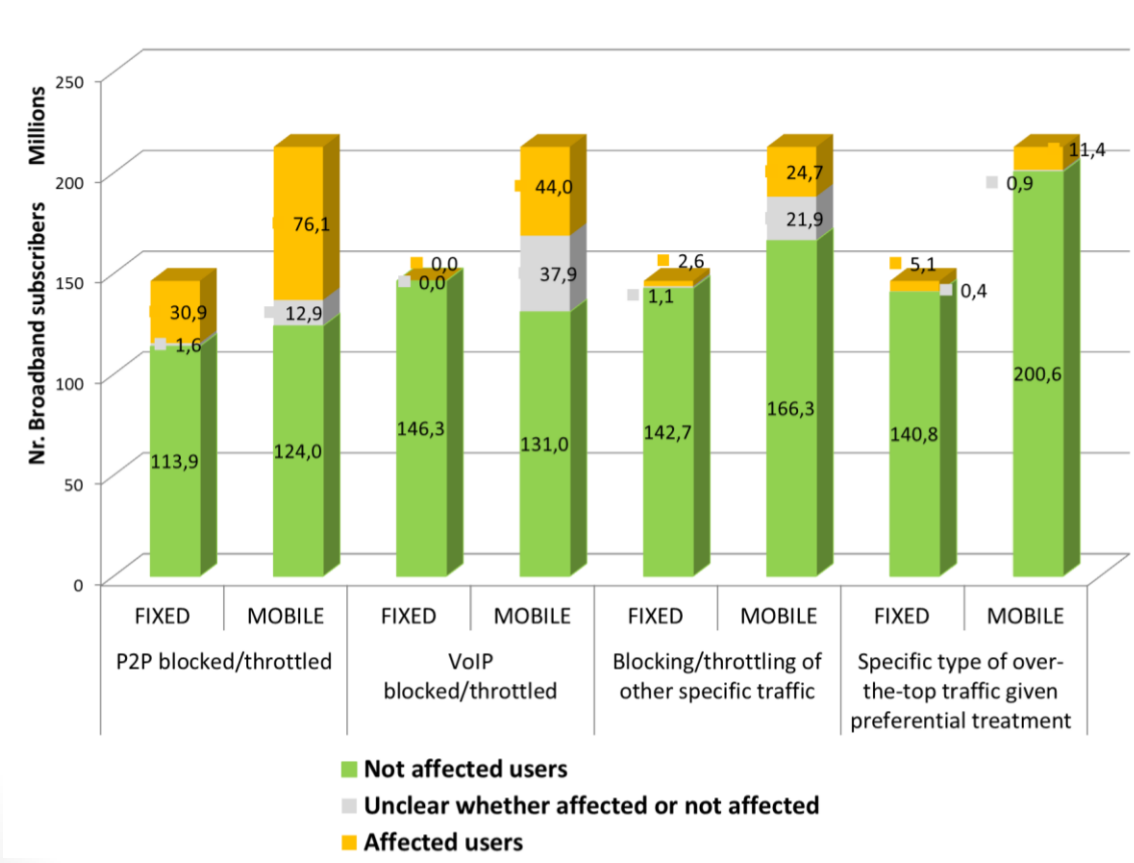
Notes

- Data intense P2P networks are epecially subject to interventions
- The VoIP traffic is affected nearly exclusive in the area of mobile communication

N = 381
266 fixed nework operators
115 mobile network operators

Source: BEREC (2012), p. 15.

Selected Regulatory Issues – Network Neutrality: Number of Internet Access Subscribers Affected (2012)



Body of European Regulators for Electronic Communications

BEREC OFFICE

Notes

- In the fixed market, while at least 78% are not affected by those restrictions, at least 21 % of broadband users are affected by P2P related restrictions
- In the mobile market, while at least 58% are not affected by those restrictions, at least 36 % of broadband users are affected by P2P related restrictions
- In the mobile market while at least 61 % are not affected by those restrictions, at least 21 % of broadband users are affected by VoIP related restrictions.

Source: BEREC (2012), p. 21.

Selected Regulatory Issues – Network Neutrality: Potential Approaches to Implement Rules on Network Neutrality by Law

van Schewick Approach

Proposed Network Neutrality Rule:

- ✘ ban application-specific discrimination (based on application or class of application)
- ✓ allow application-agnostic discrimination

Grove/Holznagel/Picot Approach

Proposed Network Neutrality Rule:

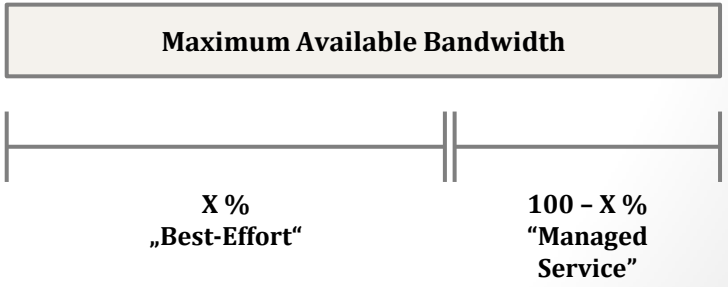
- ✓ Discrimination allowed for technical reasons
- ✓ Discrimination allowed for business reasons only, if specific percentage level X is guaranteed under best effort principle

✘ Not allowed

✓ Allowed

Normal Service: → High Latency

$: → Lower Latency



Source: van Schewick (2010); Holznagel/Picot/Grove (2010).

Selected Regulatory Issues – Network Neutrality: Institutional Debate on Network Neutrality in the International Context

Steps toward rules on Network Neutrality in the European Union

NN within the EU

EU Regulatory Framework

- NN = Regulatory Aim *(Art. 8 Framework Directive)*
- NN by Change of Operator *(Art. 30 Universal Service Directive)*
- NN by Transparency *(Art. 20 Universal Service Directive)*
- NN by Minimum Standard in Service Quality *(Art. 22 Universal Service Directive)*

! CRITICISM ! → TAC hinder User to change the ISP

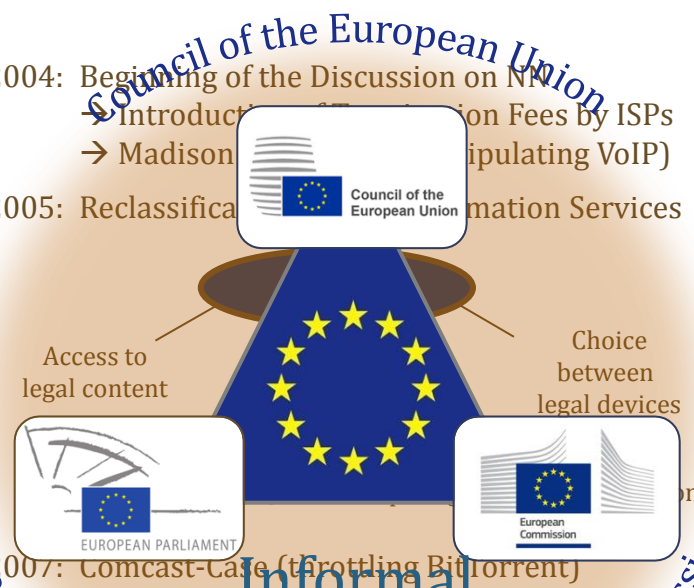
- 2013: Proposal for an *"European single market for electronic communications"* by the European Commission →2-Lane-Model
- 2014: Amendments concerning the proposal of the Commission by the European Parliament
- 2015: The presidency of the Council of the EU has a mandate to start negotiations with the Parliament on new rules to safeguard open internet access
- 2015: Informal Trilogue → Compromise

! CRITICISM !
→ Definition NN / Classification Specialized Services / technical need

Steps toward rules on Network Neutrality in the United States

NN in the United States

- 2004: Beginning of the Discussion on NN
  → Introduct… …on Fees by ISPs
  → Madison … …ipulating VoIP)
- 2005: Reclassifica… …mation Services



- 2007: Comcast-Case (throttling BitTorrent)
- 2010: Lawsuit: Comcast (Title I of Fed. Comm. Act 1934)
- 2010: FCC: Open Internet Rules
- 2014: Lawsuit: Verizon (Title I of Fed. Comm. Act 1934)
- 2015: Re-reclassification: ISPs = Telecommunic. Services
- 2015: Strict rules on NN:
  No blocking, throttling, prioritization for $

Agenda

- History & Definition of Telecommunication
- Basic Model of Telecommunication
- Selected Telecommunication Infrastructures
- Requirements on Future Broadband Networks
- Telecommunications Market Overview
- Regulatory Principles & the Role of the State
- Regulation on Telecommunications in Europe
- Competitor Access & Network Neutrality as Current Regulatory Issues
- **Discussion**

Discussion

?

You are encouraged
to ask ***questions***
or
comment
this lecture on
telecommunications....!

!

Discussion: Economic Impact of Broadband Access & Network Neutrality

Fixed Broadband and Economic Growth: Industy-Level Evidence from the OECD

(Fretz, S., 2015)

15 Fixed Broadband and Economic Growth: Industry-Level Evidence from the OECD

Stephan Fretz

15.1 Introduction

With the rise of the Internet, information exchange has undergone a fundamental transformation over the last two decades. A key enabler of this process was the deployment of fixed broadband infrastructure at the end of the 1990s and beginning of the new millennium. Broadband infrastructure is commonly defined as a fixed line with a download bandwidth of 256 kbit/s or more. Today the average advertised download speed in the OECD has reached 40 Mbit/s, and penetration ranges from 10 subscriptions per 100 inhabitants in Turkey, to 40 in Switzerland.

While the impact on individuals' lives is beyond debate, the identification of broadband's impact on output and productivity has proved challenging. A number of empirical studies have tried to estimate the magnitude of broadband's impact on economic output variables over the last years. Overall, the results are "not quite conclusive," as the International Telecommunication Union (ITU (2012: 2) states in a recent literature survey. Studies conducted at the macro level generally report a positive impact on GDP per capita, but estimates differ considerably across studies.[1] Evidence from industry- and firm-level analyses is even weaker, with the majority of studies finding no positive effect of broadband on productivity.[2] Given the multitude of methodologies applied and research challenges involved, these discrepancies do not come as a surprise; they demonstrate the need for a better understanding of the role of broadband in economic growth.

Meanwhile policy makers almost unanimously continue to advocate further government efforts to foster the rollout of broadband technologies. The European Commission (2012: 13–14), for instance, states that "[w]ealth triggered by broadband may create two million additional

Net Neutrality: A Progress Report

(Krämer, J; Wiewiorra, L.; Weinhardt, C., 2013)

Telecommunications Policy

Net neutrality: A progress report

Jan Krämer*, Lukas Wiewiorra, Christof Weinhardt

Institute of Information Systems and Management, Karlsruhe Institute of Technology, Karlsruhe, Germany

ARTICLE INFO

ABSTRACT

1. Introduction

Discussion:

- Besides the potential effects broadband access can have on traditional output or productivity measures, there is also a social dimension that has to be kept in mind when discussing the broadband coverage. Please discuss potential social effects of broadband access.
- ...

- What are potential pros and cons of a regulatory intervention to safeguard Network Neutrality in Europe? (Please do also refer to the different interests of ISPs, Content Providers and Users)
- ...