Fakultät für Bauingenieurwesen
Faculty for Civil Engineering

Technische, ökonomische und rechtliche Randbedingungen für ein künftiges Internet

Clean Slate & the Network Neutrality Complex
NMI 2012

Prof. Dr. Nico Grove

Assistant Professor
Institute for Infrastructure Economics & Management
www.infrastructure-economics.com

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Agenda

- Network Effects & Public Goods
- Telecommunications Value Chain
- Network Neutrality & Consumer Discrimination
- Conclusion and Outlook

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- **Network Effects & Public Goods**
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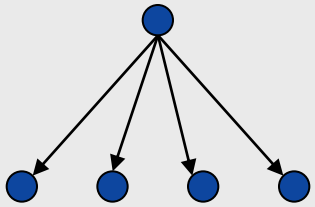
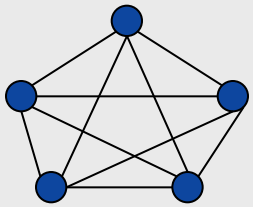
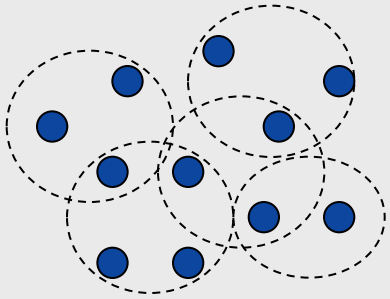
Value of a Network is related to its fundamental structure.

Sarnoff‘s, Metcalfe‘s and Reed‘s Law

	Sarnoff's Law	Metcalfe's Law	Reed's Law
Structure of Network			
Example	Analogue broadcast: ▪ Radio ▪ Television	Interconnection of peers: ▪ PSTN ▪ E-mail	Social groups: ▪ Ebay, ▪ Chat-Rooms
Value of Network	**N** (recipients)	$N*(N-1)/2 \sim \mathbf{N^2}$ (connections)	$2^N-N-1 \sim \mathbf{2^N}$ (groups)

Public Goods are provided to the public without exclusion and without restriction in use.

Public Accountability for Infrastructure Resources

Diminishability (rivalry) in consumption \ Excludability from consumption	high	low
high	***Private goods*** **(e.g. food, cars)**	***Collective or common goods*** **(**e.g. Road System, natural resources)
low	***Club goods*** *(e.g. private schools, pay TV)*	***Public goods*** *(e.g. national security, public TV)*

Public goods are characterized by non-rivalry and non-excludability in consumption[1)]

1) Vgl. Olson (1965); Musgrave (1969)

Reason for regulatory market interference: Market failure

Economic and Social Effects

Public Goods

- Availability an access to important public goods e.g. like national security, trust into financial markets or health
- Example:
  Ensuring a functional, trustworthy monetary system

Competition

- Introduction and preservation of competition in markets with monopolistic tendencies
- Example:
  Regulation of monopolistic markets introducing competition in e.g. infrastructure based network industries

Limitation/Avoidance of external Effects

Health, environment, consumer protection

The supply of merit goods has to be increased by the government, whereas demerit goods have to be reduced.

Merit Goods

Merit Goods

- Closely related to public goods are merit goods
- Musgrave in 1959 :
  - Individual underestimates the value of a specific good
  - Merit goods tend to be under consumed.
  - Lower demand will lead to lower production capacity in the free market economy
  - Therefore, this good has to be supplied in a higher amount by the government or with governmental financial aid in order to fulfill social desirable higher supply of that good
- Examples:
  - Compulsory education
  - Compulsory health insurance
  - Public schools
  - Public culture and freedom of opinion

Demerit Goods

- The opposite of merit goods are demerit goods (or “demerit bads”)
- Unhealthy and socially undesirable for individual consumers and hence the entire society
- Examples:
  - Diseases
  - Famine
  - Flues
  - HIV
  - Pollution
  - Gaps in the society
- Free market does not lead to the social optimum, as at market equilibrium more of these demerit goods are produced or generated than desirable.
- Governments have to fund elimination of demerit goods in order to increase overall social welfare

Source: Picot (2009); Musgrave (1959); Mendoza (2008)

Public goods can either be supplied by the market, the government or under governmental control.

Provisioning Mechanisms

Supply of public and merit goods

Government based

- Provided by the state directly
- Requirements:
  - Independence
  - Sustainability
  - Long time commitment
- Examples:
  - Public safety via military defence
  - Police jurisdiction

Market based

- Government buys at market
- Provides below cost or for free to population
- Not providing these goods to the public outweigh the costs by a massive multiplier
- Examples:
  - Flu vaccine
  - Libraries
  - Culture

Regulated market based

- Market does not lead to social optimum price quantity combination
- In general the case for (former) monopolies
- Subadditivity (Baumol) increases problematic
- Examples:
  - Telecommunications
  - Post, etc.

Sector specific regulation

Quelle: Baumol (1977); Picot (2009)

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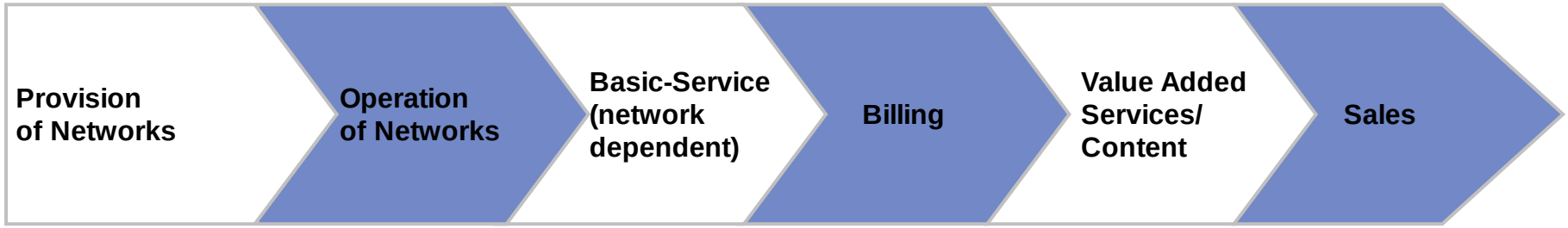
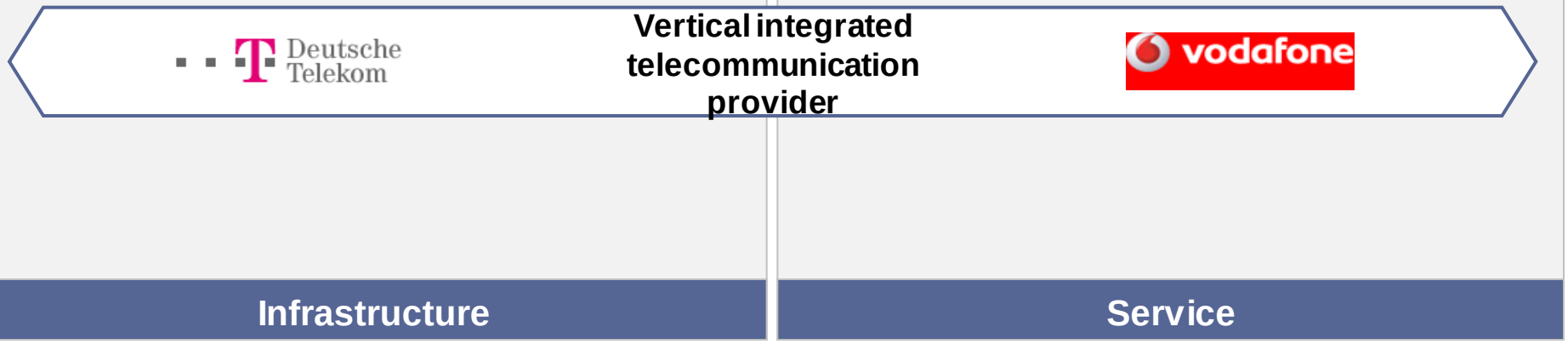
Traditional services of telecommunications are located along the entire value chain towards the end customer .

Complexity in Telecommunications I/IV

Old Telco Value Chain

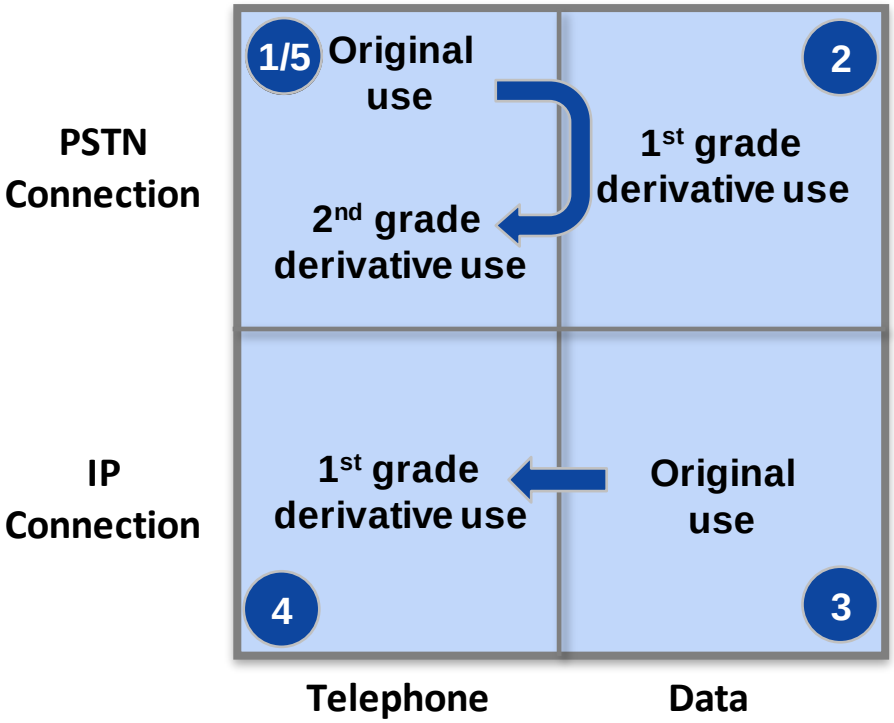




Source: Picot/Wernick/Grove (2008);

The multiple use of communications infrastructure originated in a transmission of IP over PSTN.

Complexity in Telecommunications II/IV

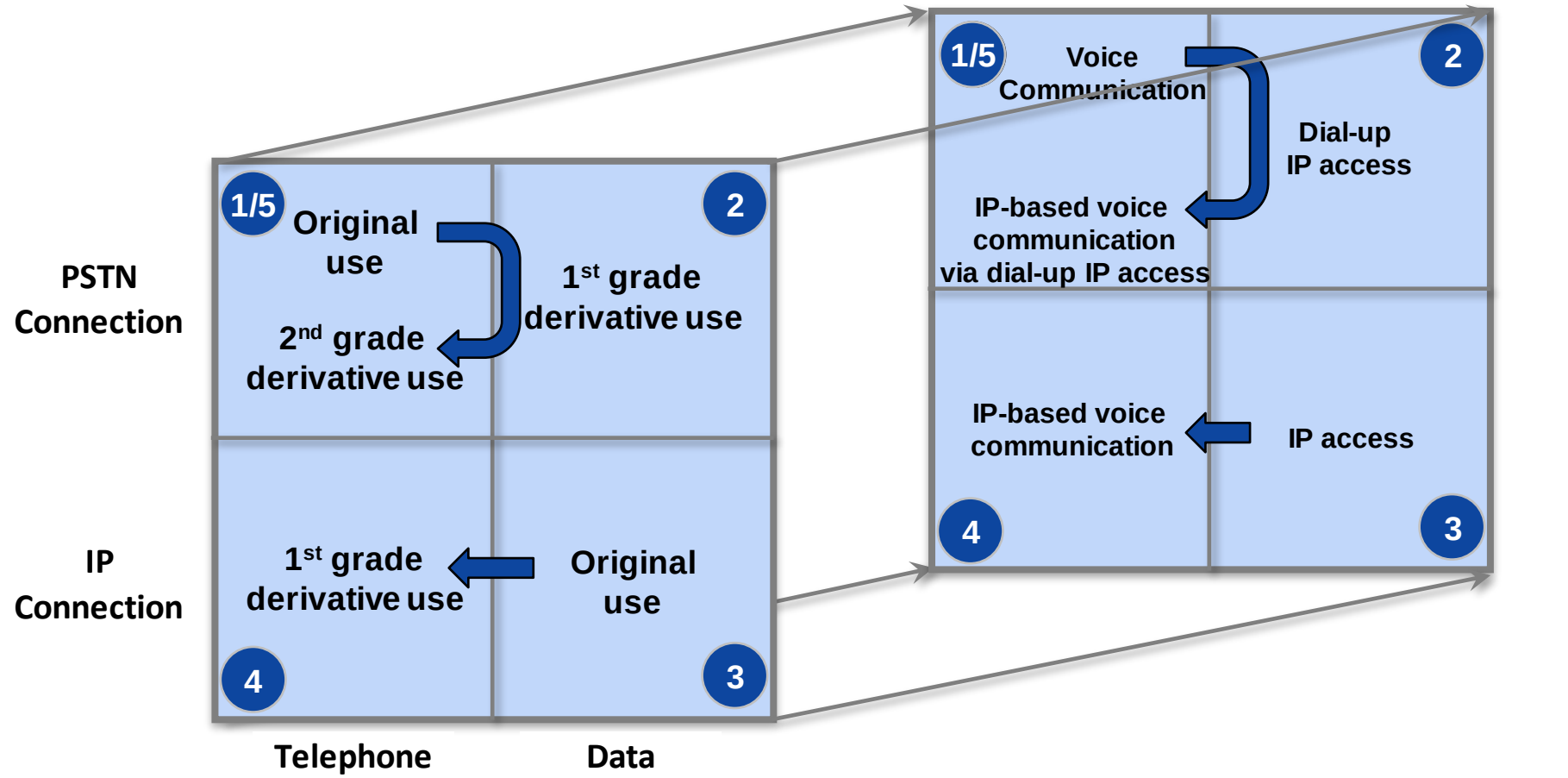


Complexity increase of the infrastructure(s)

Source: Grove (2005)

Today, communications is dominated by IP, detaching infrastructure from service.

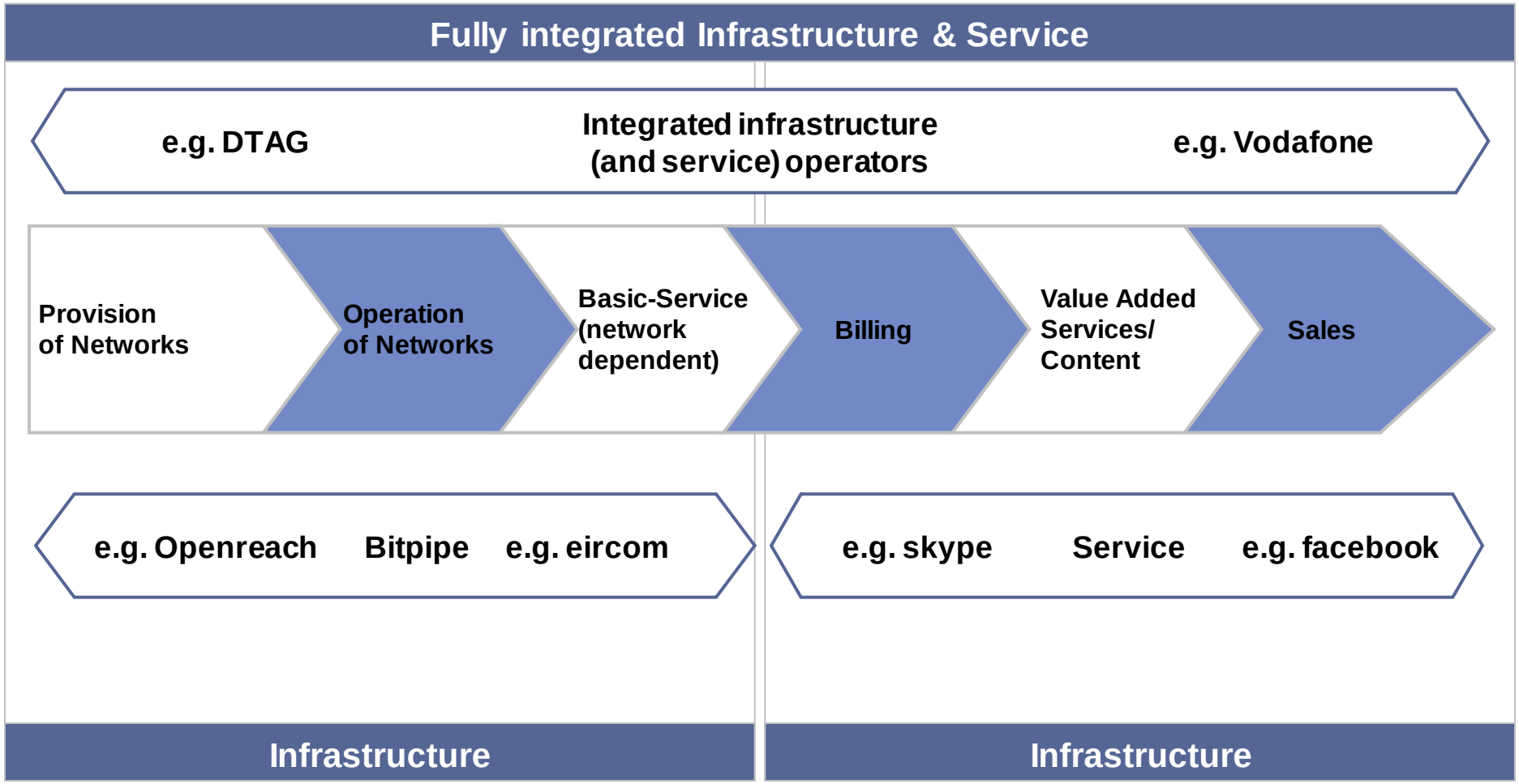
Complexity in Telecommunications III/IV



Source: Grove (2005)

New entering competitors are using existing infrastructures of fully integrated operators in order to offer own services to end consumers.

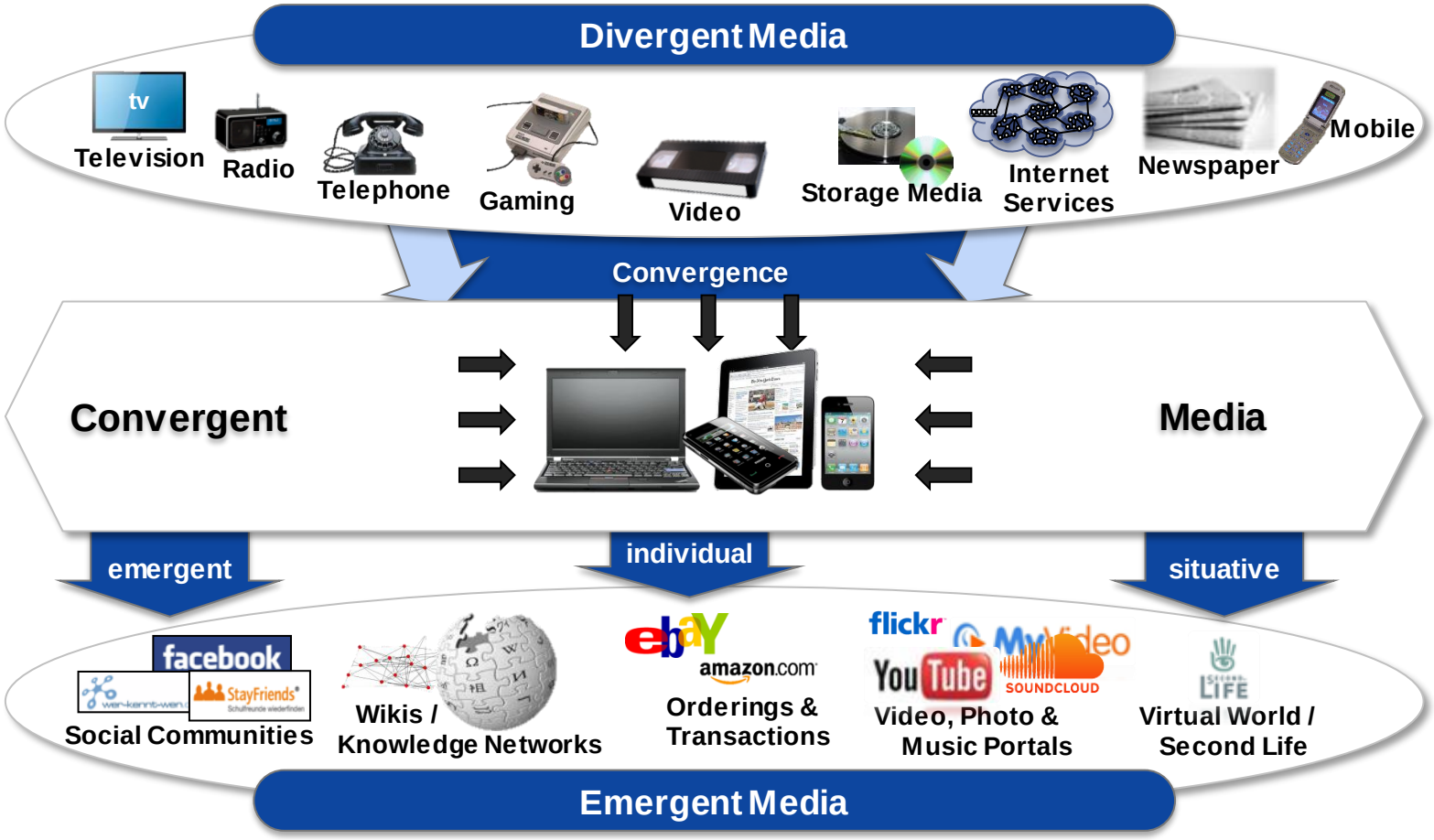
Complexity in Telecommunications IV/IV



Source: Picot/Wernick/Grove (2008);

Services and applications developed along the provision of the Internet.

Media Convergence

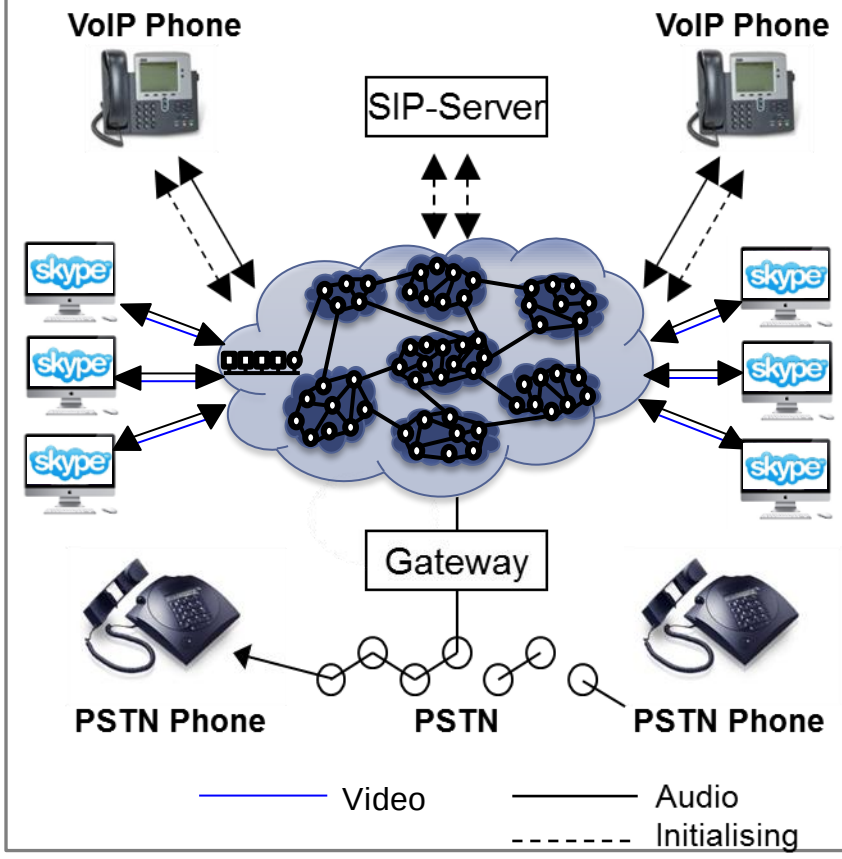


- Reciprocal development of media industry in parallel to technical development of the Internet

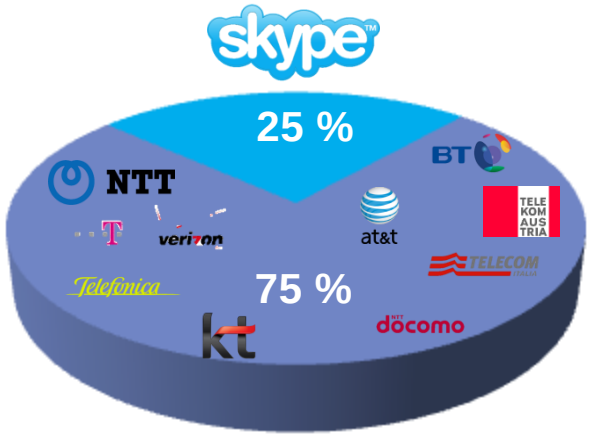
Source: Based on JustIS (2011)

Case Example: VoIP

Transmission forms VoIP and PSTN



25 Percent of all international telephone traffic is handled via Skype

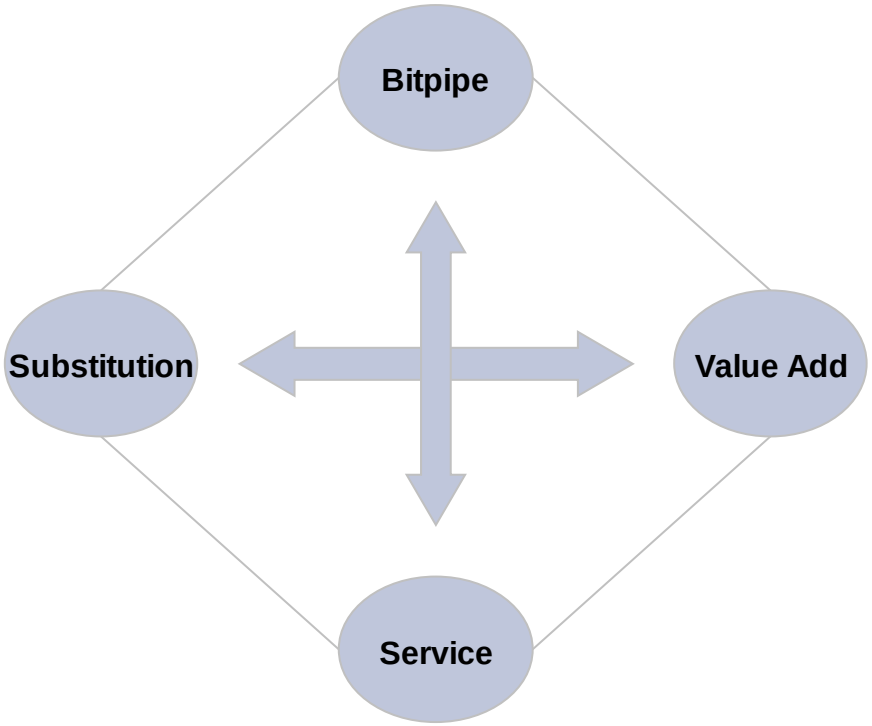


Skype-to-Skype calls comprised nearly 25% of 2011's total 583 billion international calling minutes (total is comprised of international PSTN call traffic and Skype-to-Skype call traffic).

Source: Data based on TeleGeography, Skype (2012)

Operators use now traffic management as an alternative to traditional strategies.

Supply Side: Reactions, Levers & Tools for Optimization



I Capacity Investment ?

II Provider based Revenue Services ?

III Traffic Management via Pricing Policy ?

IV Traffic Management via Service Discrimination → Provider Goal

Flatrates were intended to increase cross selling service offerings by fully integrated operators.

Case Studies I: Flatrate

Flatrate

Picture Flatrate Offerings

Incumbent	Service	Bitpipe
▪ Usage independent data tariffs	▪ „Over the Top“ service offerings (e.g. VoIP/video)	▪ Pricing via capacity (e.g. Mbit/s)
▪ Development of own services (e.g. portals)	▪ Development of own services (e.g. portals)	▪ Concentration on infrastructure provisioning
▪ Oversizing of service infrastructure	▪ Demand oriented dimensioning	▪ No own developed services
▪ Cross sub-sidization of infrastructure	▪ Demand oriented pricing models	▪ Cost related pricing on infrastructure

Result:
- **Incumbent increases traffic consumption**
- **Incumbent develops beyond market demand**
- **Service operators offer better and cheaper services**

Source: Company information; pictures © DTAG, Vodafone

By integrated additional network equipment, fully integrated operators are trying to protect their infrastructure assets against pure service operators.

Case Studies II: QoS Offerings

QoS Offerings

Picture QoS Offerings

Incumbent	Service	Bitpipe
▪ Cross sub-sidization of infrastructure	▪ Infrastructure as enabler for services	▪ Pricing via capacity (e.g. Mbit/s)
▪ Blocking of third party services	▪ Innovative and user oriented development	▪ Concentration on infrastructure provisioning
▪ Priorization of own service offerings	▪ Dependent on equal treatment by IS operator	▪ No own developed services
▪ Specific invest-ments in „QoS“ infrastructure	▪ QoS as barrier for services	▪ Cost related pricing on infrastructure

Result:
- **Incumbent applies changes to infrastructure at high costs**
- **Service operators develop counter strategies**
- **Generation of market inefficiencies**

Source: Company information;

Fully integrated infrastructure operators are only trying desperately to increase service quality with additional network components.

Case Studies III: IPTV

IPTV

Picture IPTV Provider

Incumbent	Service	Bitpipe
▪ Cross sub-sidization of infrastructure	▪ Infrastructure as enabler for services	▪ Cable/TV, terrestrial offerings
▪ Cannibalization of existing cable offerings	▪ Innovative and user oriented development	▪ Concentration on infrastructure provisioning
▪ Generation of additional revenues (VoD)	▪ Revenues via distribution and advertising	▪ No own developed services
▪ Investments in additional IPTV infrastructure	▪ No intervention in infrastructure required	▪ Cost efficient, hybrid approaches (single/multicast)

Results:

- **Incumbent changes infrastructure at high costs**
- **Service operator offers IP based video without interventions in infrastructure**

Source: Company information; pictures © © KDG AG, DTAG, Hansenet, youtube, ZDF, myvideo, hulu

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Internet users and operators have conflicting interests regarding data transport.

Network Neutrality

User

- Fast data transmission
- Steady data flow
- Freedom of speech

Conflicting interests in treating data traffic (content)

Operator (ISP)

- Rising costs due to increasing internet traffic
- Differentiate between different kind of data packets to enable network management (QoS)

Content

- Traditional textual content
- Audiovisual content
- Search engines (e.g. Yahoo, Google, Bing)
- Applications and Services
  - VoIP (e.g. Skype, Viber)
  - P2P (e.g. BitTorrent)

Three main cases of network discrimination can be distinguished.

Cases of Network Discrimination

1. Data traffic (applications and services) being blocked

- **Primarily due to economic reasons**
  → Network operators are willing to exclude certain services and applications of competing market players to maximize profits

2. Data traffic is being slowed down

- **Quality degradation of data transmission or prioritisation of specific services and applications according to provider´s preferences**

3. Unwanted content is discriminated or blocked

- **Manipulation and blocking of content**
  → Some internet access providers having blocked specific websites for providing controversial and critical content of itself

Source:Holznagel et al., (2010). p. 4.

ISPs claim data differentiation to be required for traffic management reasons in order to deal with increasing internet traffic.

Consumer Discrimination

Reasons for Consumer Discrimination

- Massive increase in internet usage
- Providers claim increasing internet traffic results in "ballooning" costs for network provisioning
- To manage the growing amounts of data transmitted over their networks and to preserve sound network traffic, ISPs regard data differentiation as an appropriate measure
- Some end-users might accept price differentiation in order to enjoy a better quality of specific services ->

Mechanisms for Traffic Management

- Deep Packet Inspection (DPI)
- Quality of Service (QoS)
- Packet Shaping

→ Prioritising between different data flows

→ Charging different prices for different types of information carried over their networks

→ Differentiating between applications (two-lane model)

→ Blocking (or discriminating against) certain applications and content from their networks

Source:Marcus, et al., (2011) and Mueller, (2011)

Restricting Network Neutrality limits economic growth, social development and political and cultural diversity.

Network Neutrality

Restricted Network Neutrality

(limiting the users' ability to use the network connection according to their personal preferences)

- **Reduces value of the Internet**
- **Reduces incentives to innovate**
- **Decreases Internet´s contribution to economic growth**
- **Curbs the Internet´s social, political and cultural potential**

Continuous flow of emerging innovation in applications and services

Great need to ensure faster and more precise data transmission

Source:van Schewick, (2007). p. 331-332.

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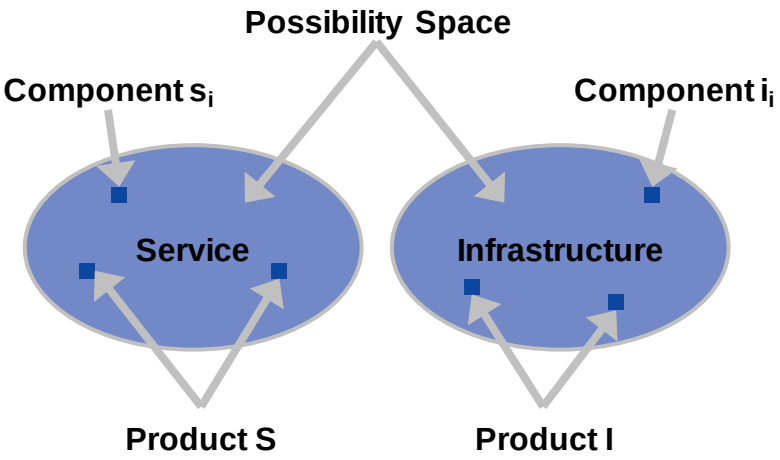
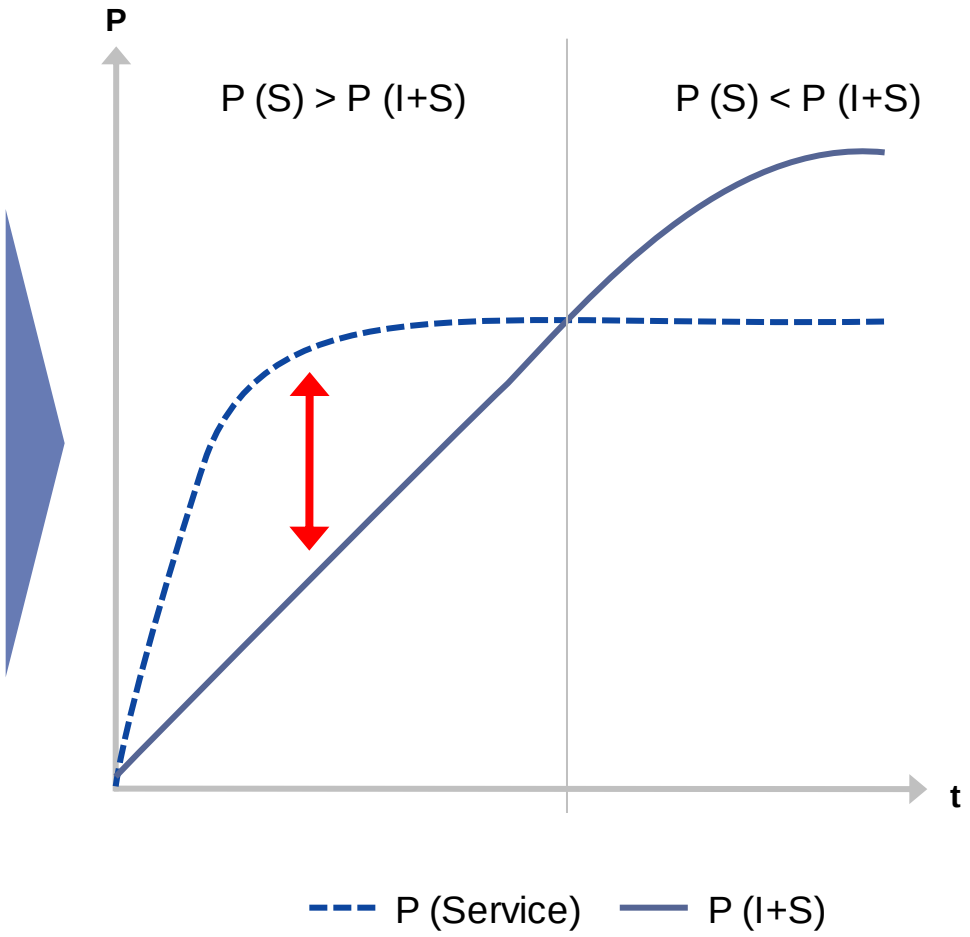
Pure service operators gain a higher performance than fully integrated infrastructure operators in a short- and mid-term base.

Structural Separation? Mulit-Agent Analysis

Simulation





Source: Simulation model, Grove/Baumann (2012)

Fundamental systemic changes to the market framework in place would be required to overcome current incentive pattern of market participants.

Discussion

„Patentlösungen“

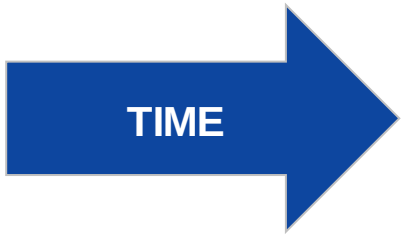
1. Nationwide Network internalizing costs
2. Universal Service
3. Structural Separation
4. Incentive Schemes for Operators/Clients
5. …

?

From Whichcraft to Commodities…

Energy Production and Use

Picture Whichchraft



Picture Commodity

Thank You!

nico@grove.ch