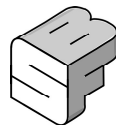Keynote Speech
Net Neutrality
and Future Internet Models

Alessandro Bogliolo

DiSBeF – University of Urbino

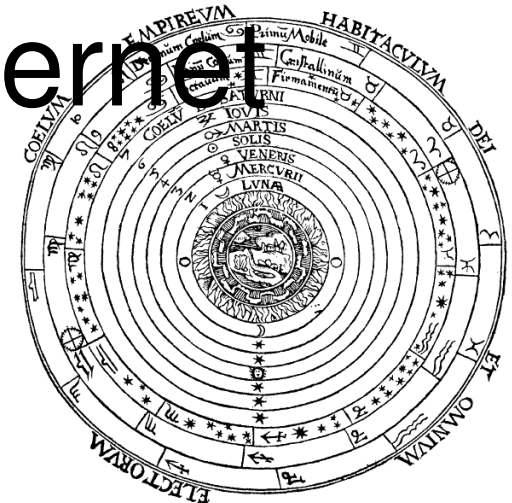NeuNet Cultural Association

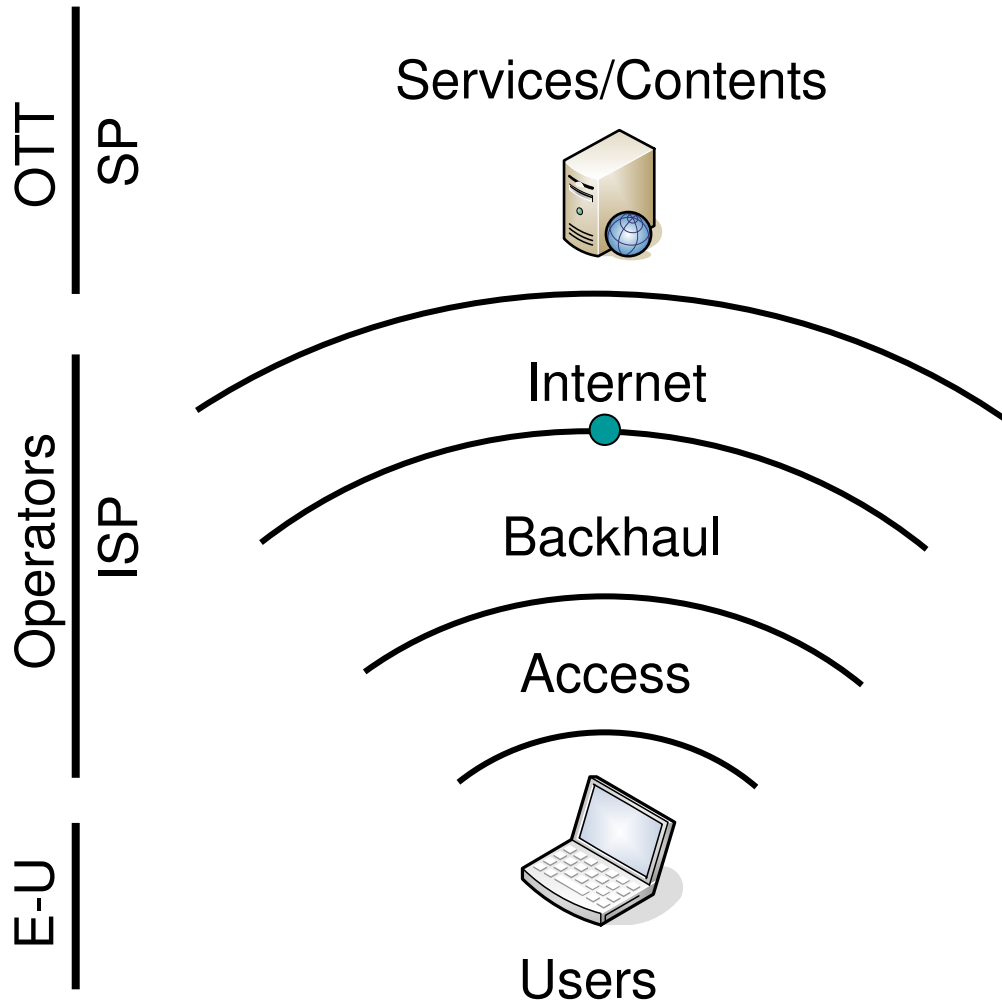alessandro.bogliolo@uniurb.it

Outline

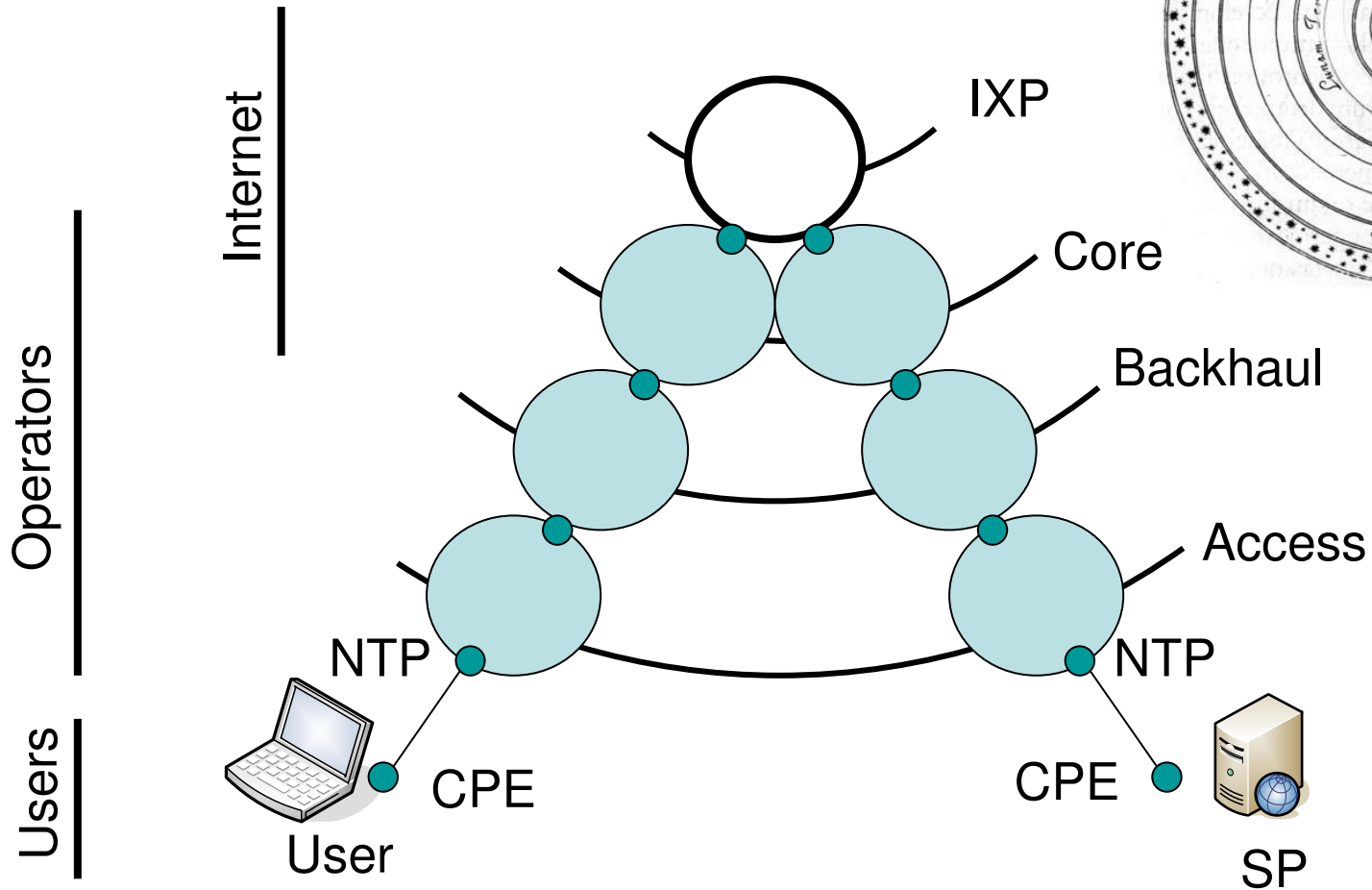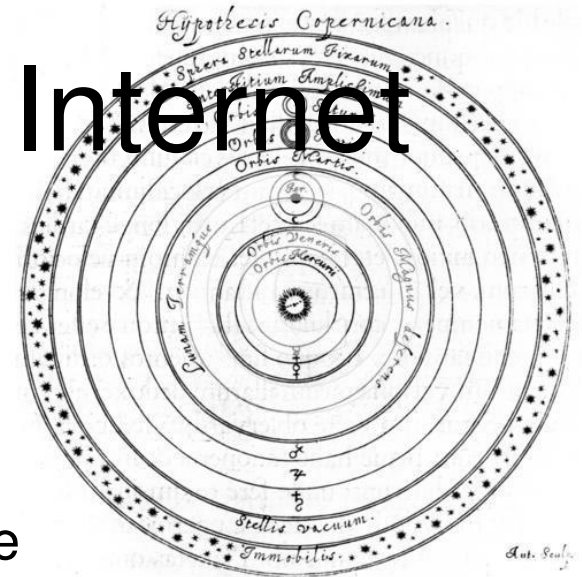1. **The Network**

2. The Net Neutrality Principle

3. The Net Neutrality Debate

4. The Internet Value Chain

5. Policy making

6. Viable Future Internet Models

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Ptolemaic view of the Internet

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Copernican view of the Internet

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Protocol stack

Protocol stack at work

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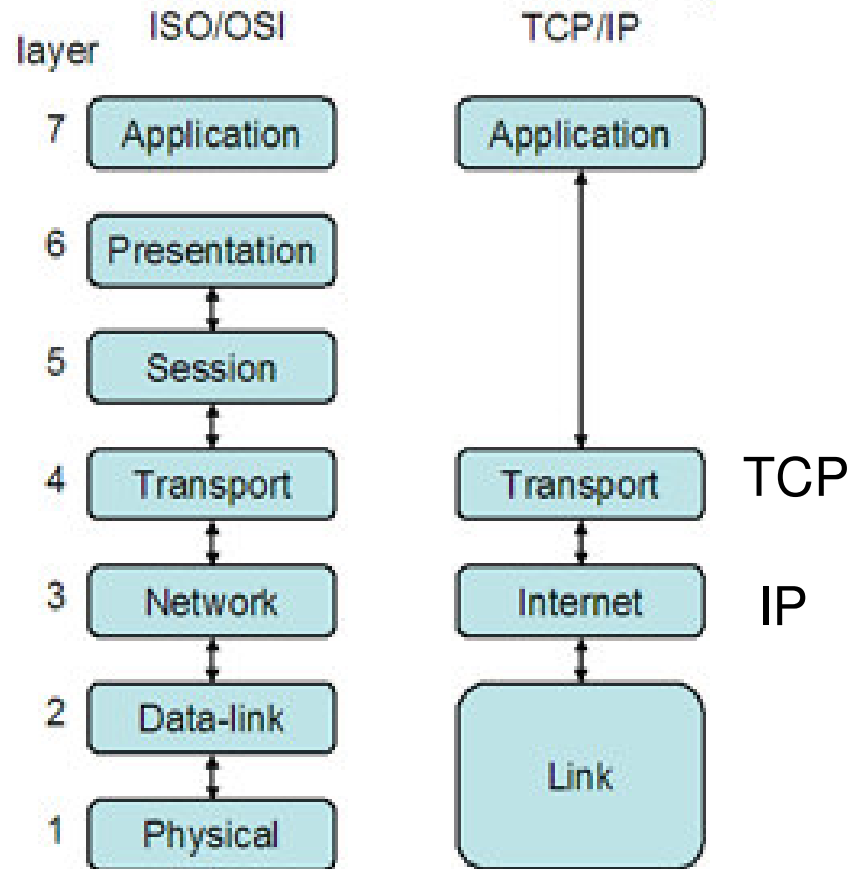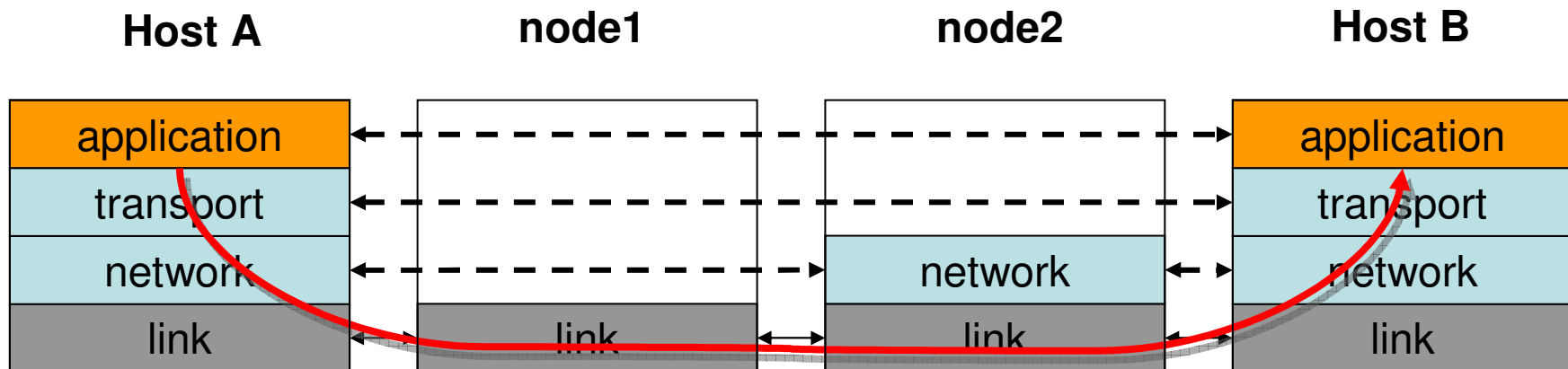
Design principles

- ## Separation of concerns
  - The IP suite separates concerns into well-defined layers which allow designers to focus on one layer at the time

- ## Best effort
  - The network makes its best effort to deliver packets, but it does not guarantee QoS

- ## End-to-end
  - Services can be developed at the termination end points without involving intermediate nodes

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Quality of Services/Experience

- Performance can be measured in terms of
  - Bandwidth
  - Latency
  - Jitter
  - Packet loss

- QoS affects QoE
  - QoE requirements translate into QoS requirements
  - Best-effort networks do not guarantee QoS, unless they are over-provisioned
  - Networks are usually under-provisioned

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Outline

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2. **The Net Neutrality Principle**
3. The Net Neutrality Debate
4. The Internet Value Chain
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Definitions of Net Neutrality

- "Network neutrality is best defined as a network design principle. The idea is that a maximally useful public information network aspires to treat all content, sites, and platforms equally"

  [Tim Wu, 2003]

- "If I pay to connect to the Net with a given quality of service, and you pay to connect to the net with the same or higher quality of service, then you and I can communicate across the net, with that quality and quantity of service."

  [Tim Berners Lee, 2006]

- "the fundamental concern is that the provider of broadband service not be able to take advantage of that to act in an anticompetitive fashion against others that are trying to provide competitive applications using the same broadband facilities."

  [Vinton Cerf, 2009]

- What constitutes network neutrality? Several definitions are in current use:
  – The ability of all Internet users to access the content or applications of their choice.
  – Assurance that all traffic on the Internet is treated equally, whatever its source, content or destination.
  – Absence of *unreasonable discrimination* on the part of network operators in transmitting Internet traffic.

  [EC, 2011. IP/A/IMCO/ST/2011-02 PE457.369]

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Forms of Neutrality

- Network (Access, Transport)
  - Non-discrimination
- Economic
  - Competition, Innovation
- Social (Digital inclusion)
  - Infrastructural
  - Cultural
  - Socio-economic
- Technological
  - Access technologies, Devices
- Applications/services
  - Online communities, Search engines, Aggregators, …
- Address
  - IPv4 (7 per square Km) vs IPv6 (655×10^{21} per square Km)

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The origins of the debate (1)

- Scarcity as a matter of fact
  - Under-provisioning as a design principle
  - Exponential growth of traffic
  - Lack of sufficient resources

- Traffic management as a counter measure
  - Prioritization
  - Traffic shaping
  - Throttling
  - …

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The origins of the debate (2)

- OTT preassure
    - Bandwidth hungry contents/applications
    - Bandwidth unaware usage practices
    - Lack of price signals for operators
    - OTT services competing with legacy TLC services

- Traffic management as a counter measure
    - Blocking
    - Degradation
    - …

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The origins of the debate (3)

- Convergence over IP
  - Economy of scope
  - Instant messaging, Voice, Video
  - QoE requirements
  - QoS constraints

- Traffic management as a counter measure
  - Prioritization
  - Bandwidth reservation
  - …

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The origins of the debate (4)

- Connected devices
  - Bandwidth hungry "smart" devices
    Smart phones, smart TV, …
  - Ubiquitous computing
    Residential, nomadic, mobile
  - Demand for mobile data traffic
- Data tariffs as a counter measure
  - Lack of transparency
  - Information asymmetry

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Evidences of violations (e.g.)

- At least 20% of mobile users in Europe experience some form of restriction on their ability to access VOIP services

  [BEREC, 2012]

- The South Korea Communications Commission said that it will let mobile operators charge users extra fees for VOIP applications or block their use entirely

  [Yweon Kang, July 2, 2012]

- KT throttles 'data-hungry' Samsung smart TVs, although Korea has the best broadband network

  [February 10, 2012]

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Public consultations

- "… FCC to give interested persons an opportunity to participate in the rule making through submission of …"

  [United States Code, Title 5, §553 (c)]

- "… EC to carry out borad consultations with parties concerned in order to ensure that the Union's actions are coherent and transparent."

  [Treaty of Lisbon, Art 8(B)(3)]

- In 2009 the FCC launches a "Notice of proposed rulemaking" for "Preserving the Open Internet Broadband Industry Practice"

  [FCC 09-93]

- In 2010 EC launches a "Consultation on Net Neutrality".

  "I am committed to keeping the Internet open and neutral. Consumers should be able to access the content they want. Content providers and operators should have the right incentives to keep innovating. But traffic management and net neutrality are highly complex issues. I do not assume that one approach or another should prevail. We need input from all sides so we can examine all the issues carefully, in a very objective way, strike the right balance between all the interests involved and work out what new measures, if any, may be needed."

  [Neelie Kroes, June 2010]

- Between 2010 and 2011 public consultations on Net Neutrality are launched by the national authorities in many member states

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Interests involved

- ## Net Neutrality

  Liberty, Fundamental rights (free speech, freedom of expression, information, self-determination, …), Innovation, Consumer protection (transparency, choice), Competition, …

- ## Potentially conflicting interests

  Convergence over IP, Optimization, Profit, Revenue sharing, Return of investments, Digital inclusion, Security, Privacy, Legality, …

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Stakeholders

- ## Internet supply chain players

  Operators/ISPs, Suppliers of net equipment, Manufacturers of handsets (smart phones), Governments/Authorities, Media organization, Application/Content providers

- ## Others

  NGOs, Industry/Social/Consumer organizations, Academics, Individuals, Political parties, Other companies

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Positions

- FCC has adopted three basic open Internet rules:
    - Transparency.
    - No blocking.
    - No unreasonable discrimination.

- EC (report on public consultation), 2011.
    - Traffic management cannot be avoided
    - New business models should be explored
    - No significant risks/evidences of violations
    - Choice, transparency, and switching to be guaranteed
    - Monitoring and self regulation

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Universal service

- A service guaranteed by the government to all end users, regardless of their geographical location, at reasonable quality and reliability, and at affordable prices that does not depend on the location.

- Internet access as a Universal service
    - US Telecommunication Act of 1996 (baseline level of service)
    - Directive 2002/22/EC as amended by 2009/136/EC
- Internet access and human rights
    - "The Internet in not a human right"

        [Vinton Cerf, 2012]
    - "The promotion, protection and enjoyment of human rights on the Internet"

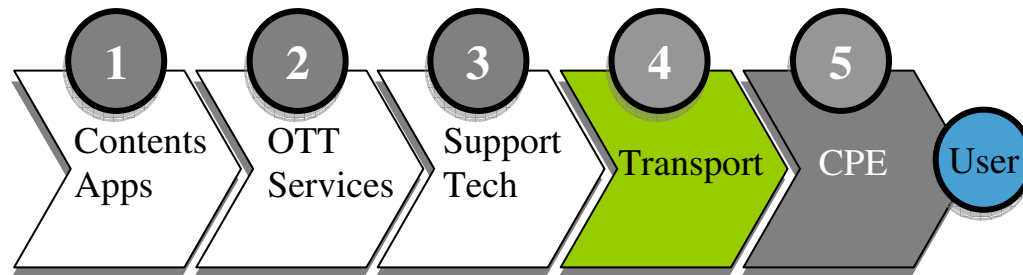   [UN Human Rights Council, 29 June 2012]

Open issues

- Definition of baseline level of service
- Exact meaning of fuzzy terms:
  - "reasonable", "affordable", "baseline"
- Information asymmetry
- Metrics
  - e.g. Contribution to congestion [Bob Briscoe, 2011]
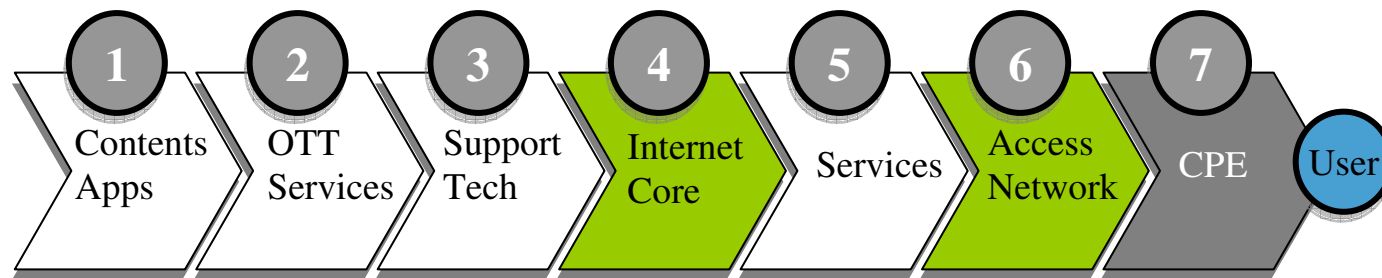- Monitoring tools

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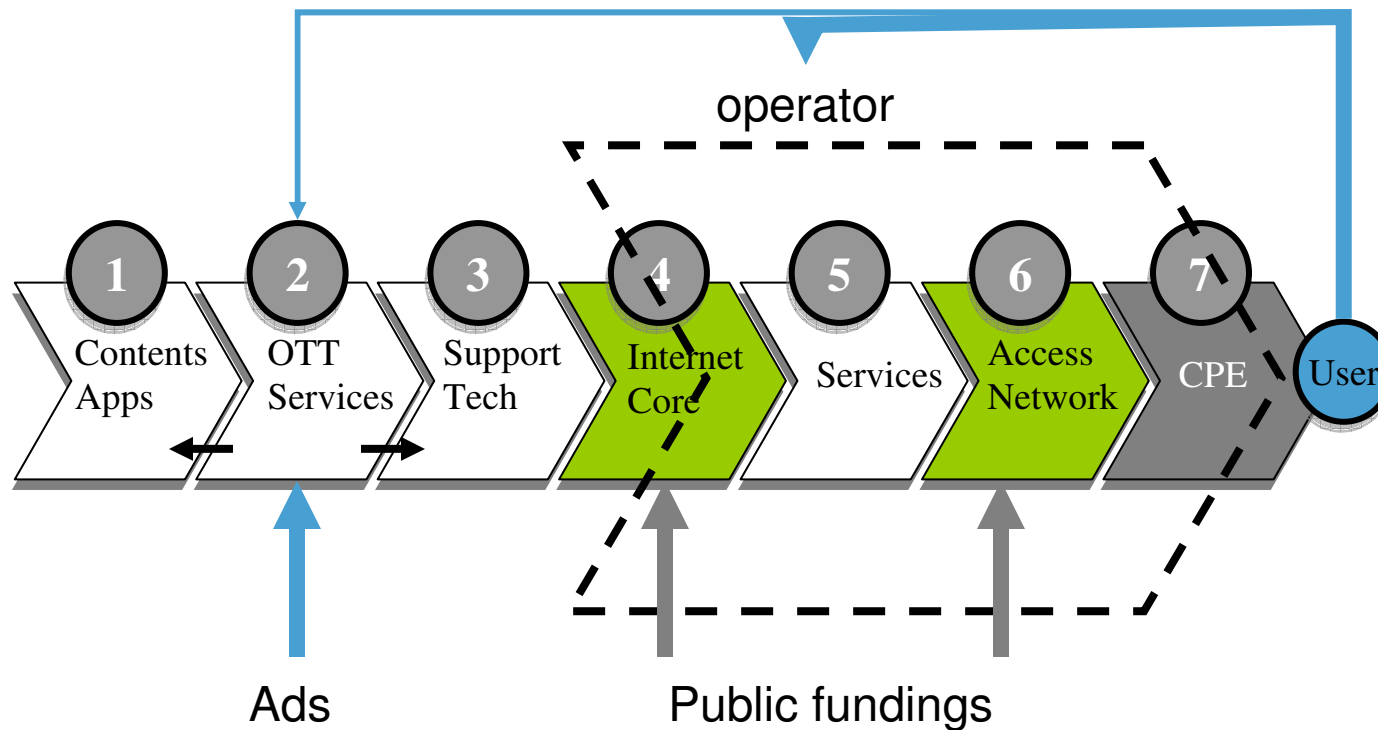
6. Viable Future Internet Models

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5-Stage Internet Value Chain

1 Contents Apps — **2** OTT Services — **3** Support Tech — **4** Transport — **5** CPE — User

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7-Stage Internet Value Chain

Money flows: who pays for traffic

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Imbalance of capitalization (2004-2010)

Operators against OTTs
operator

Content right owners
against Google

Lack of cost signals

1	2	3	4	5	6	7
Contents Apps	OTT Services	Support Tech	Internet Core	Managed Services	Access Network	CPE

User

4x   **2x**   **2x**   **5x**

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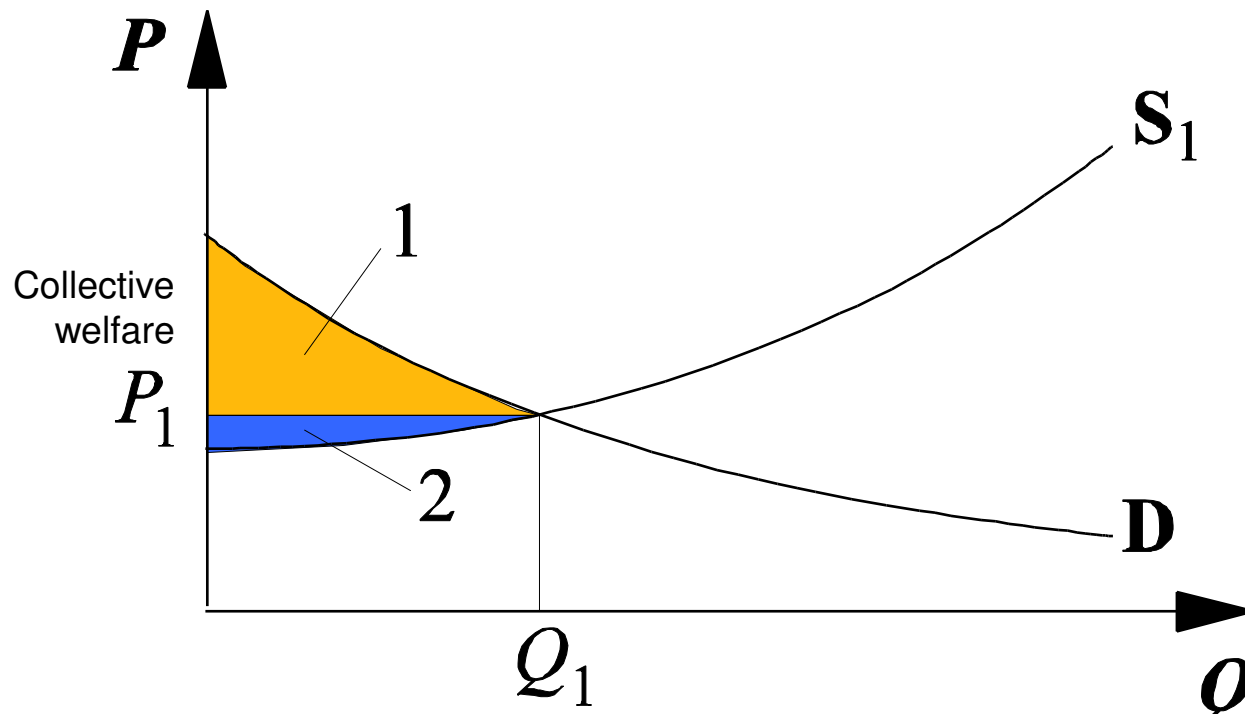www.neunet.it
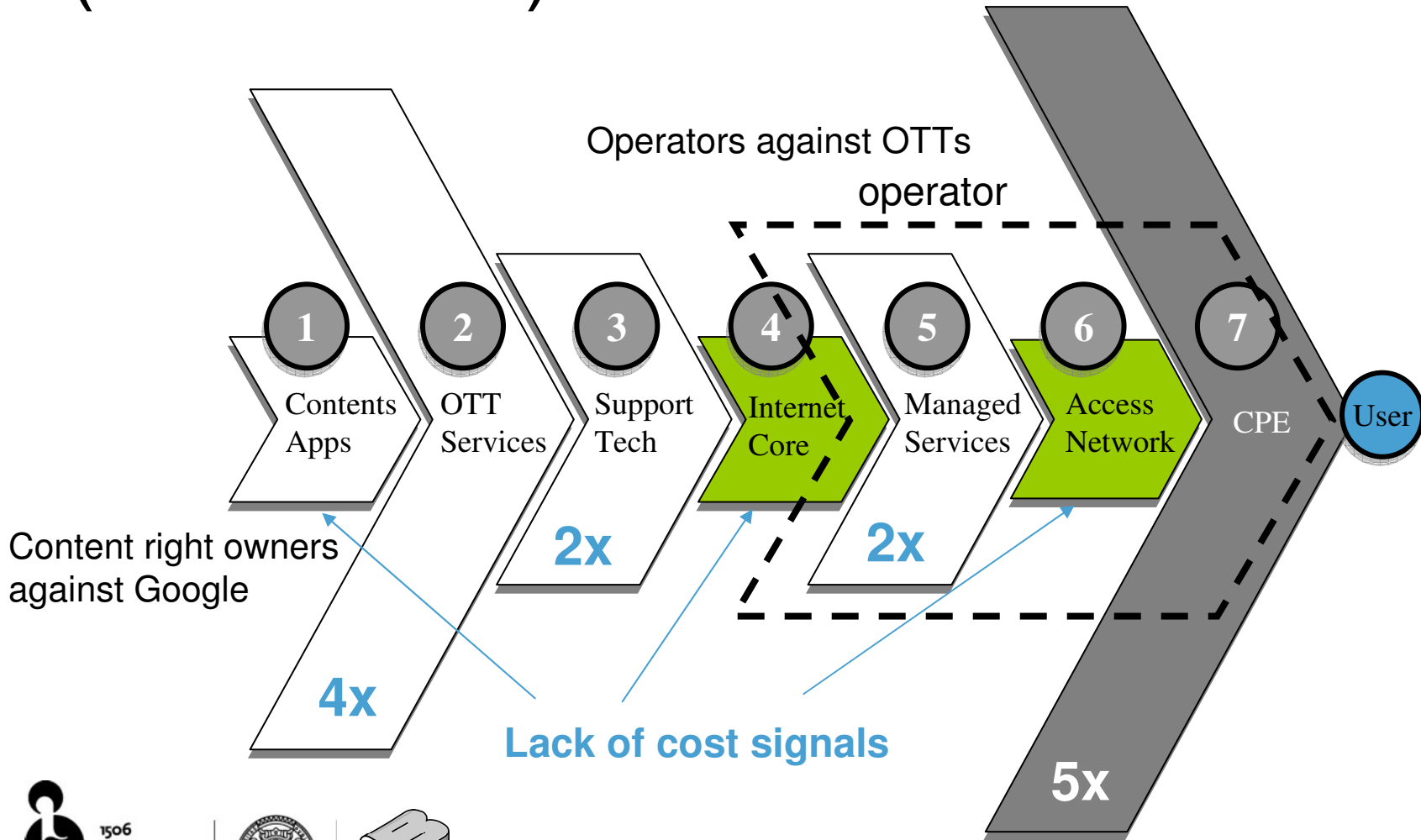
Two-sided market model
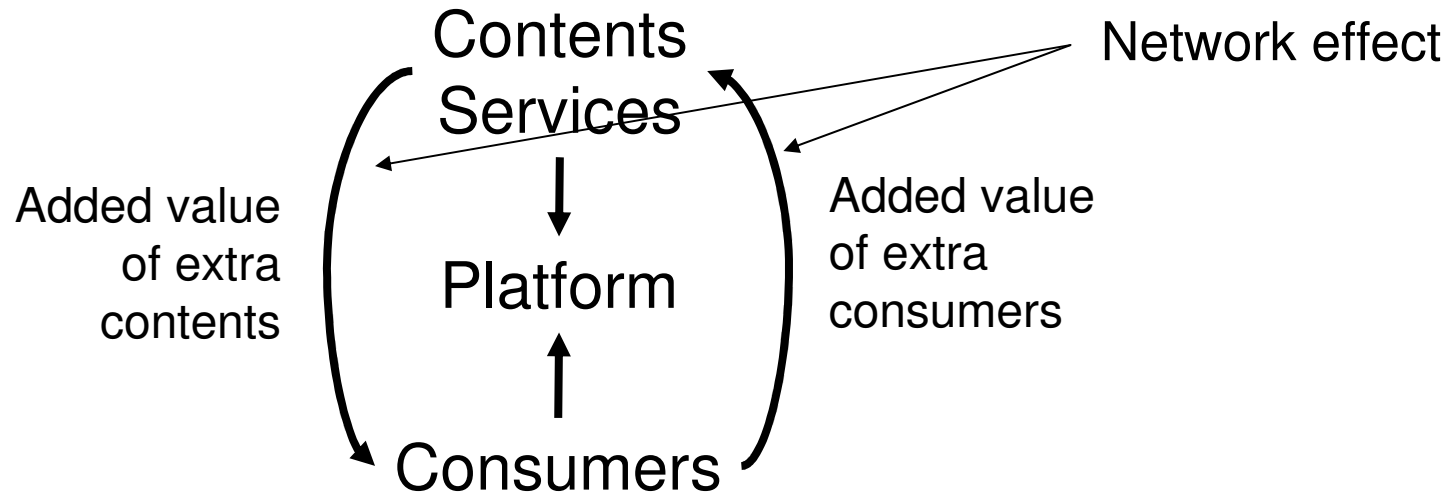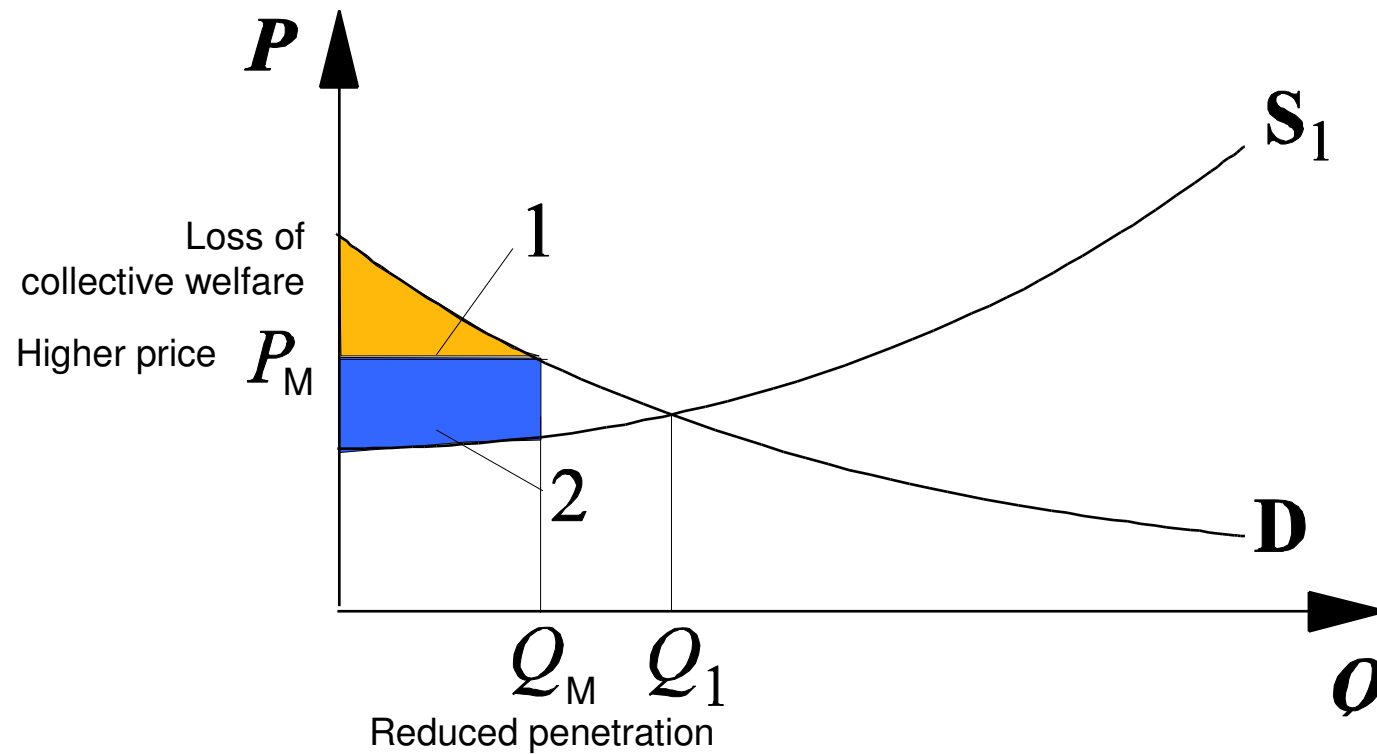

- Rationale for net neutrality regulations in specific parameter ranges
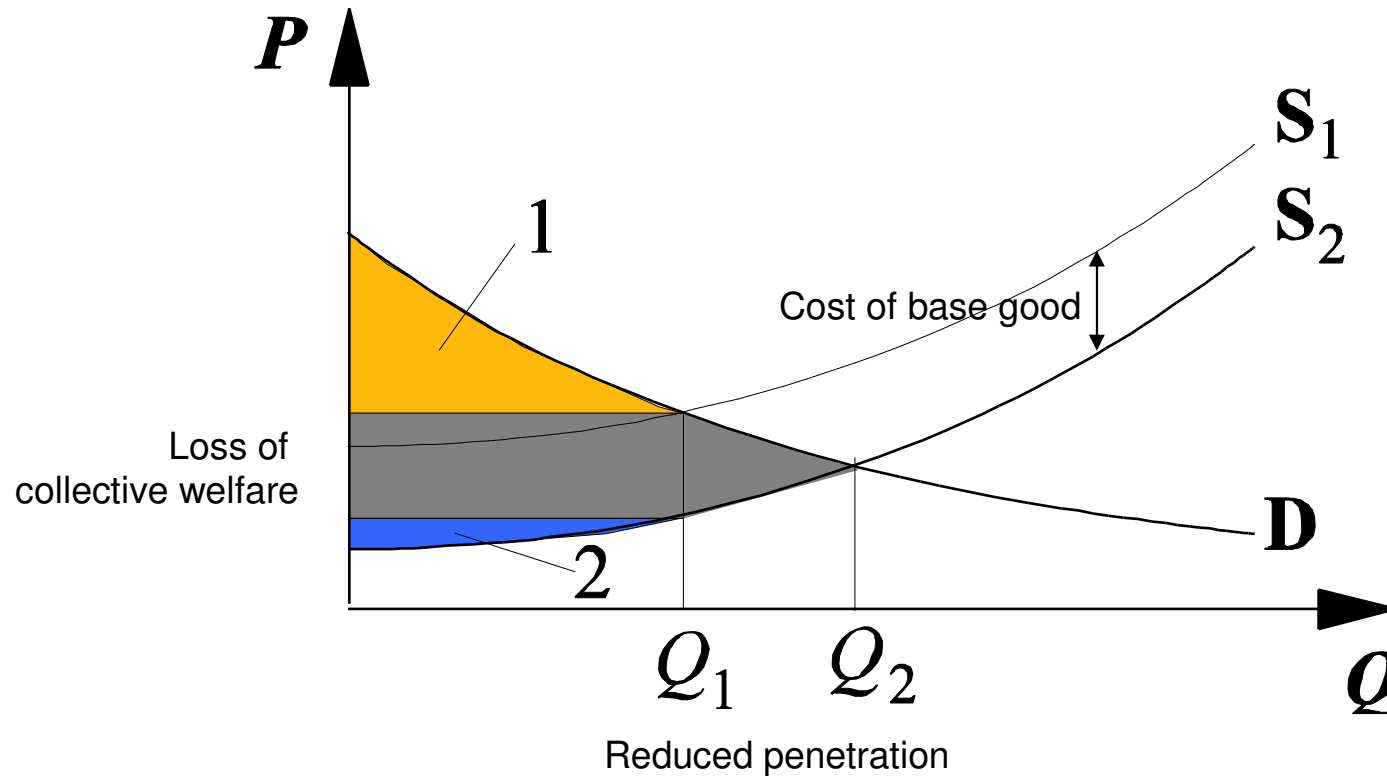- Two-sided price/cost can increase total surplus

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Price-Quantity Equilibrium
(in a competitive market)
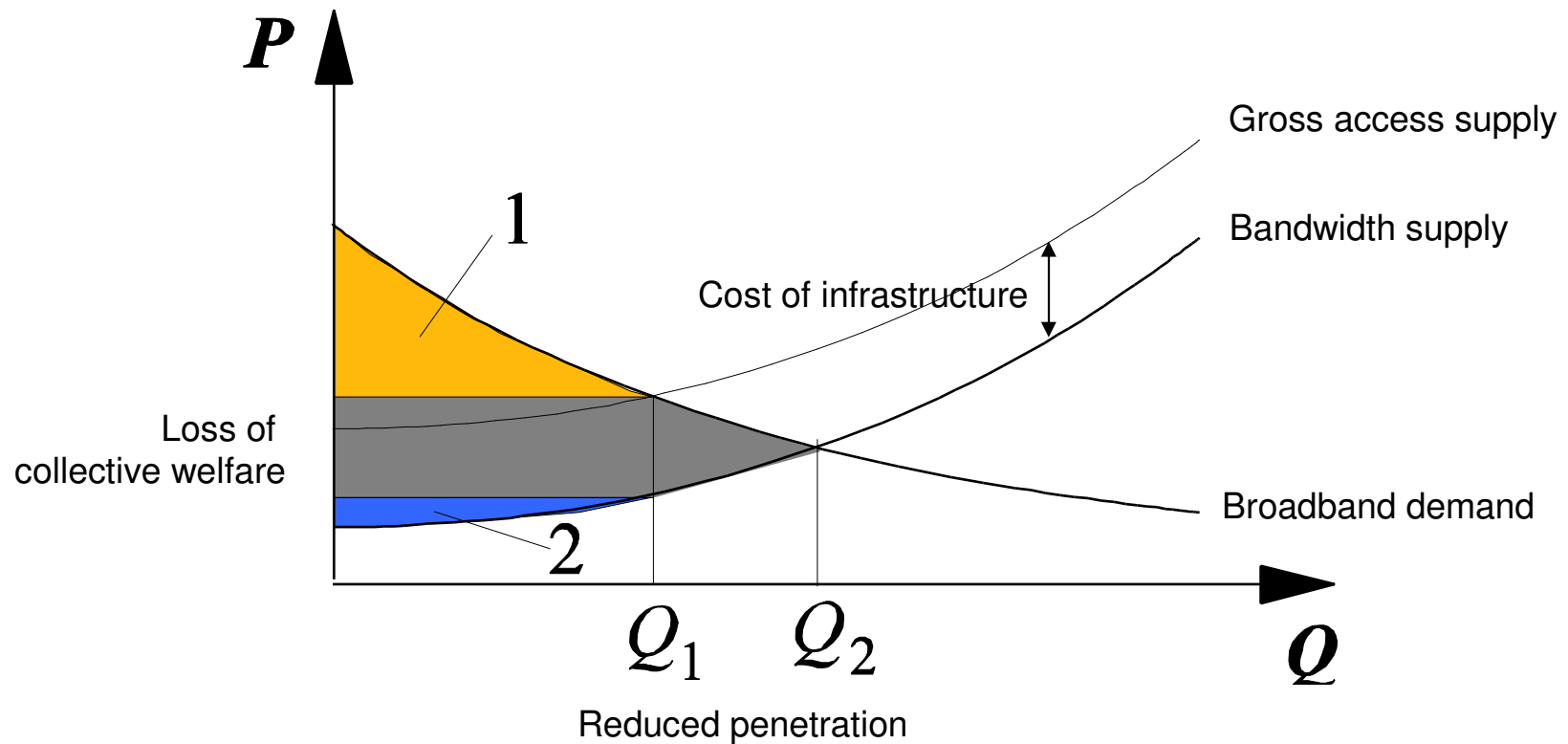
Effect of Monopoly

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Effect of a *Hidden Base Good*

Broadband market

Dominant business models

- Vertical integration
- Bundled services
- Flat-fee offers
- One-sided price model (0-price to OTT)
- Consequences:
  – Misalignment between cost and price models
  – Lack of price/cost signals
  – Lack of investments
  – Lack of traffic awareness (e.g. cloud computing)

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How to provide price signals

- Increase flat fee rates
  - Higher access barrier
  - Unfair policy
- Pay per use
  - Information asymmetry
  - Deterrent to use online services
- Charge OTTs
  - Neutrality issues
  - Barrier to entry

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Emerging business models

- ## Kindle 3G

  - Always connected device devoted to a vertical application

- ## Verizon "Toll-free data"

  - Called-party-pays model

- ## In-app purchase + virtual currency

  - Contents and apps as merchandising platforms to sell something else

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EC position

- Adequacy of existing directives
  - Choice [Art. 8 of Framework Directive]
  - Transparency [Artt. 20-21 of USD]
  - QoS [Art. 22(3) of USD]
  - Switching [Art. 30 of USD]
  - E-privacy [Art. 5 of ePrivacy Directive]
- Why to take actions now
  - Evidence from BEREC of NN violations
  - Risk of fragmentation
  - Need of investors for regulatory certainty

[Vesa Terava, June 2012]

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Policy maker interventions

- Specific EC directives

- Necessary and proportionate actions taken by local authorities
  - Decisions to be taken case-by-case
    - Significant market power
    - Vertical integration

[Paolo Alagia, 2012]

- When to take actions
  - Transparency → ex-ante
  - Anti-competitive behavior → ex-post
  - Pricing → wait and see
  - Degradation → wait and see
  - Liability → ex-ante
  - Blocking cyber crimes → ex-post (without waiting for lawsuite)
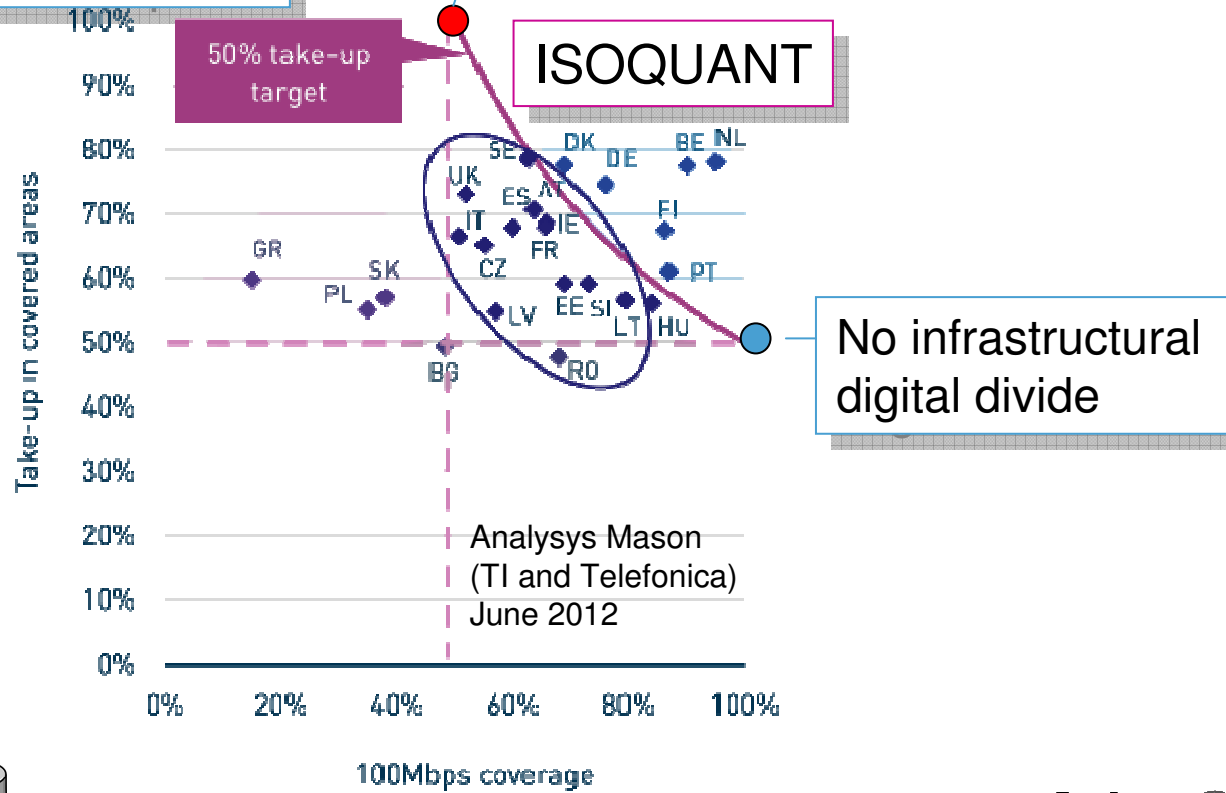
[Pietro Crocioni, 2011]

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Early actions… and reactions

- **June 2011**, Dutch provision on net neutrality
  - ISPs do not hinder or slow down traffic unless it is necessary …
  - ISPs notify endusers to òet them terminate infractions before disconnecting them
  - ISPs do not make price dependent on services
  - Minimum quality of service
- **July 2011**, higher data tariffs announced by KPN in the Netherlands
- **October 2011**, Dutch Net Neutrality rules criticized by Neelie Kroes:
  - "acting quickly and without reflection can be counterproductive"
  - "requiring operators to provide only 'full internet' could kill innovative new offers".
- **June 2012**, EC to take actions on Net Neutrality

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Digital Agenda 2020 objectives

Digital Agenda 2020 targets
-100% 30Mbps coverage
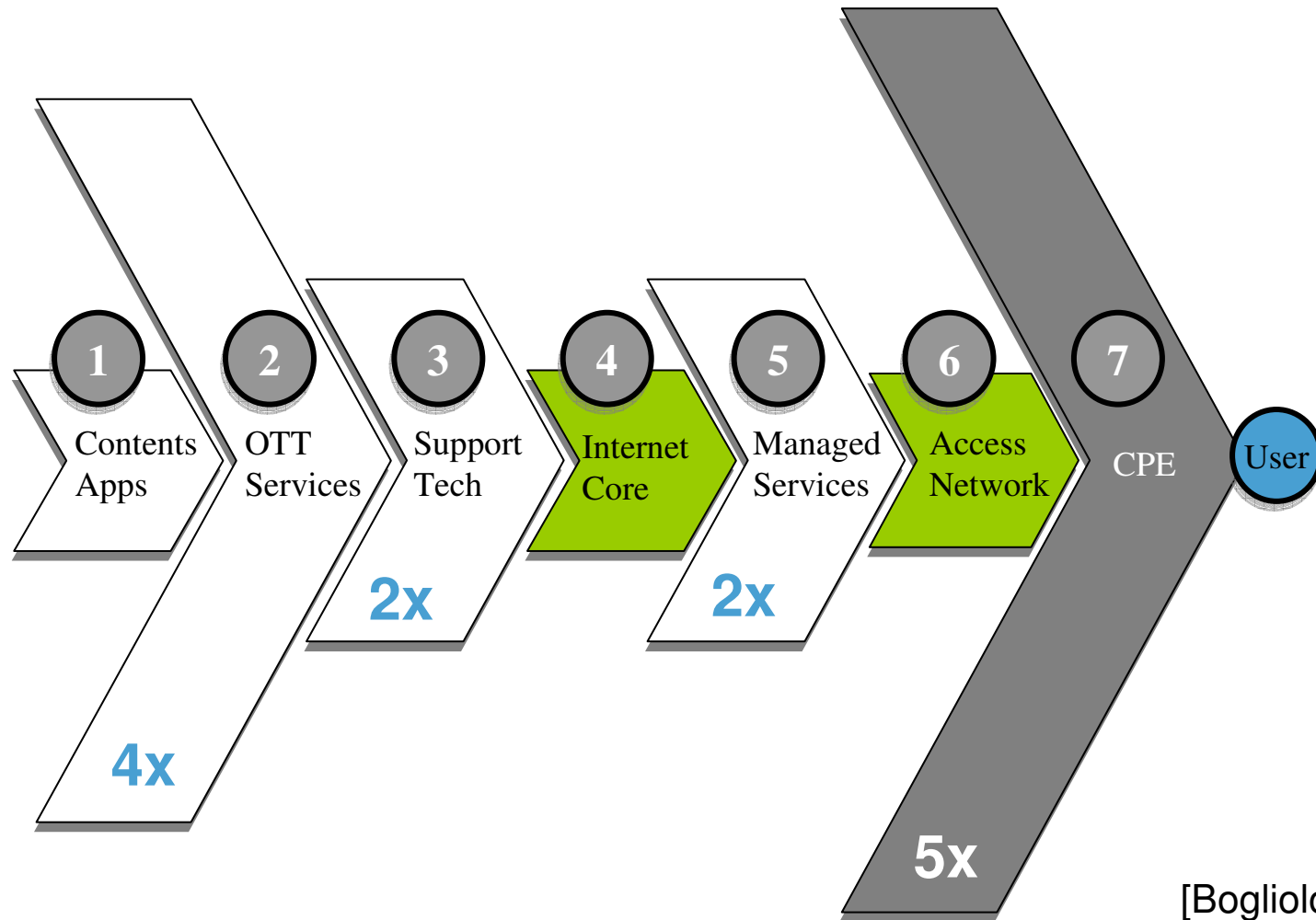-50% 100Mbps take-up

Hard-to-bridge
infrastructural digital divide

ISOQUANT

50% take-up
target

No infrastructural
digital divide

Analysys Mason
(TI and Telefonica)
June 2012

Take-up in covered areas

100Mbps coverage

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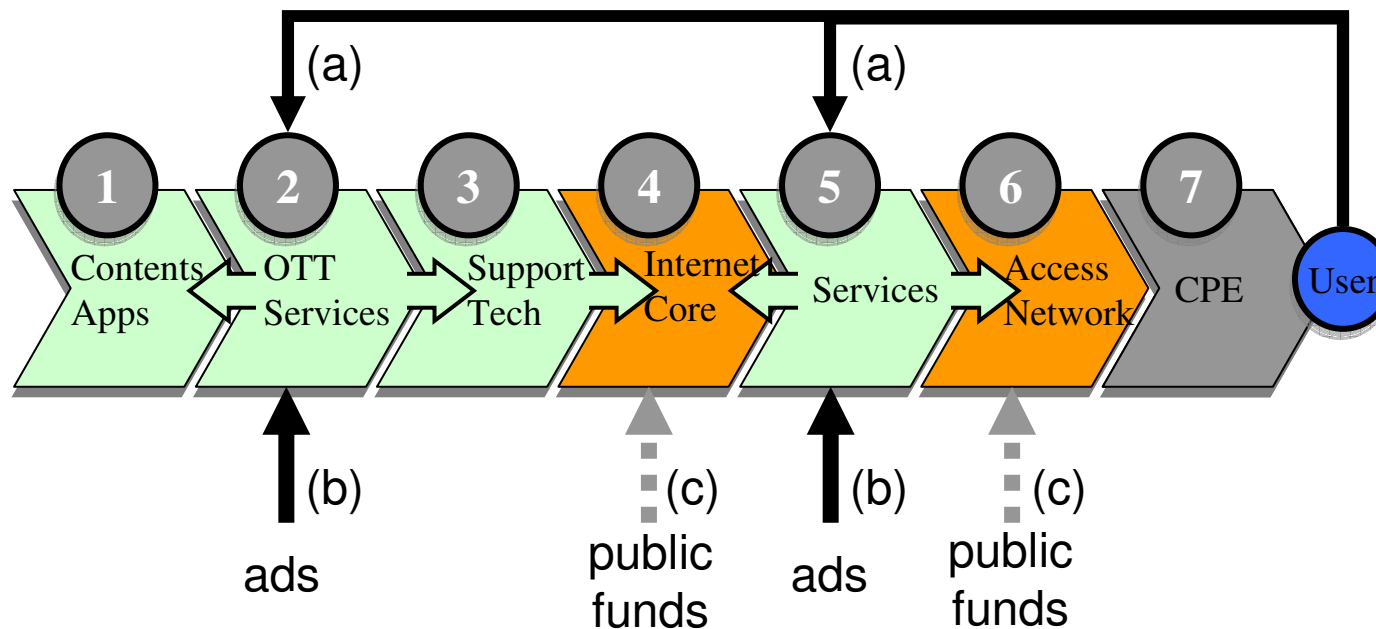DI URBINO
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Fairness for growth

1 Contents Apps

2 OTT Services

3 Support Tech

4 Internet Core

5 Managed Services

6 Access Network

7 CPE

User

2x

2x

4x

5x

[Bogliolo, 2012]

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Service-based model

User-centricity

Consumer

1	2	3	4	5	6	
Contents Apps	OTT Services	Support Tech	Internet Core	Services	Access Network	CPE	User

Prosumer

1	2	3	4	5	6	7
Contents Apps	OTT Services	Support Tech	Internet Core	Services	Access Network	UCN	E-U
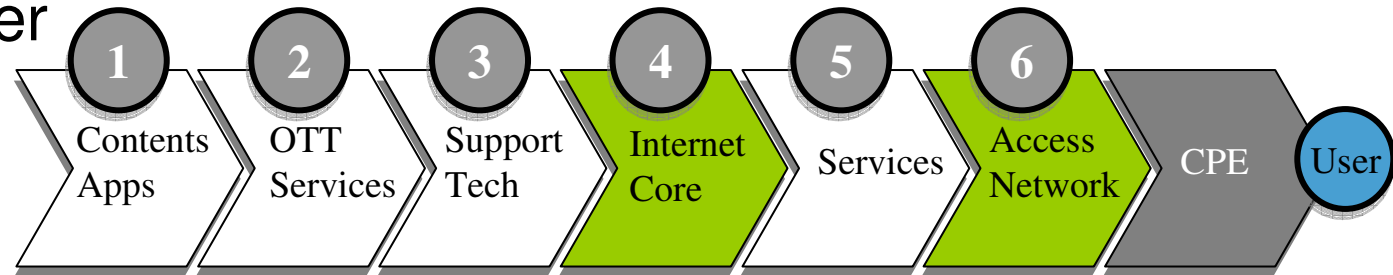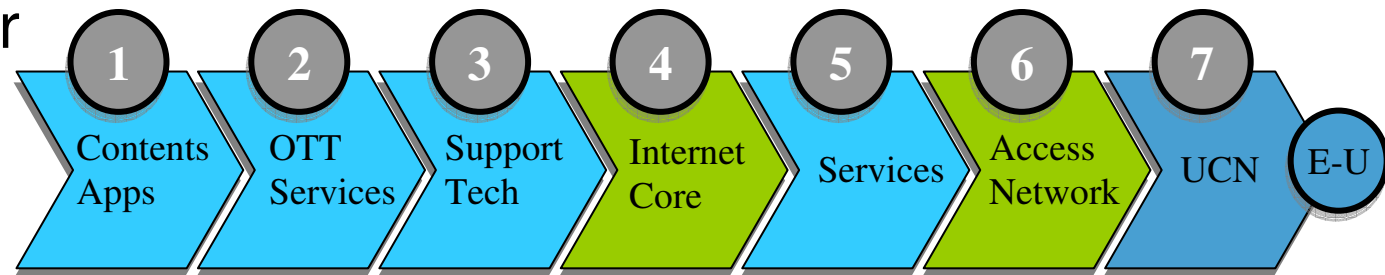
[ULOOP consortium, 2012]

Value

2	1	3	4	5	6	
Ads	OTT Services	Contents Apps	Support Tech	Internet Core	Services	Access Network	Time Attention	User

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4-lane model