S-38.3041 Operator Business

Course introduction

S-38.3041 – Contacts

- Personnel
  - Lectures Heikki Hämmäinen and team (tel. 4516144)
  - Course assistant Turo Brunou (tel. 4512462)
- Communications
  - Course web site http://www.netlab.hut.fi/opetus/s383041
  - News group opinnot.sahko.s-38.tietoverkkotekniikka
  - Email: see course web site

S-38.3041 - Completion

- Examination
  - An acceptable performance required in the examination
  - Exam includes 5 questions a 6 points
- Excercise
  - A one day session of mobile operator business game
  - Obligatory, grading of team and individual performance
  - Organized in April
  - Information about registration announced on web site

Lecture schedule

14.03	Course introduction. Big picture (HH)
19.03	Consumer customers (HH)
21.03	No lecture (Easter)
26.03	No lecture (Easter)
28.03	Enterprise customers (HH)
02.04	Operators (AK)
04.04	Pricing 1 (AK)
09.04	Competition and MOB game (HH/TB)
11.04	Pricing 2 (HV)
16.04	Investments (TS)
18.04	Interconnect and roaming (HH)
23.04	Charging and billing (HV)
25.04	Regulation (TS)
30.04	Spectrum, course wrap-up (TS)

April
Game sessions
15.4, 17.4, 19.4

07.05
Examination

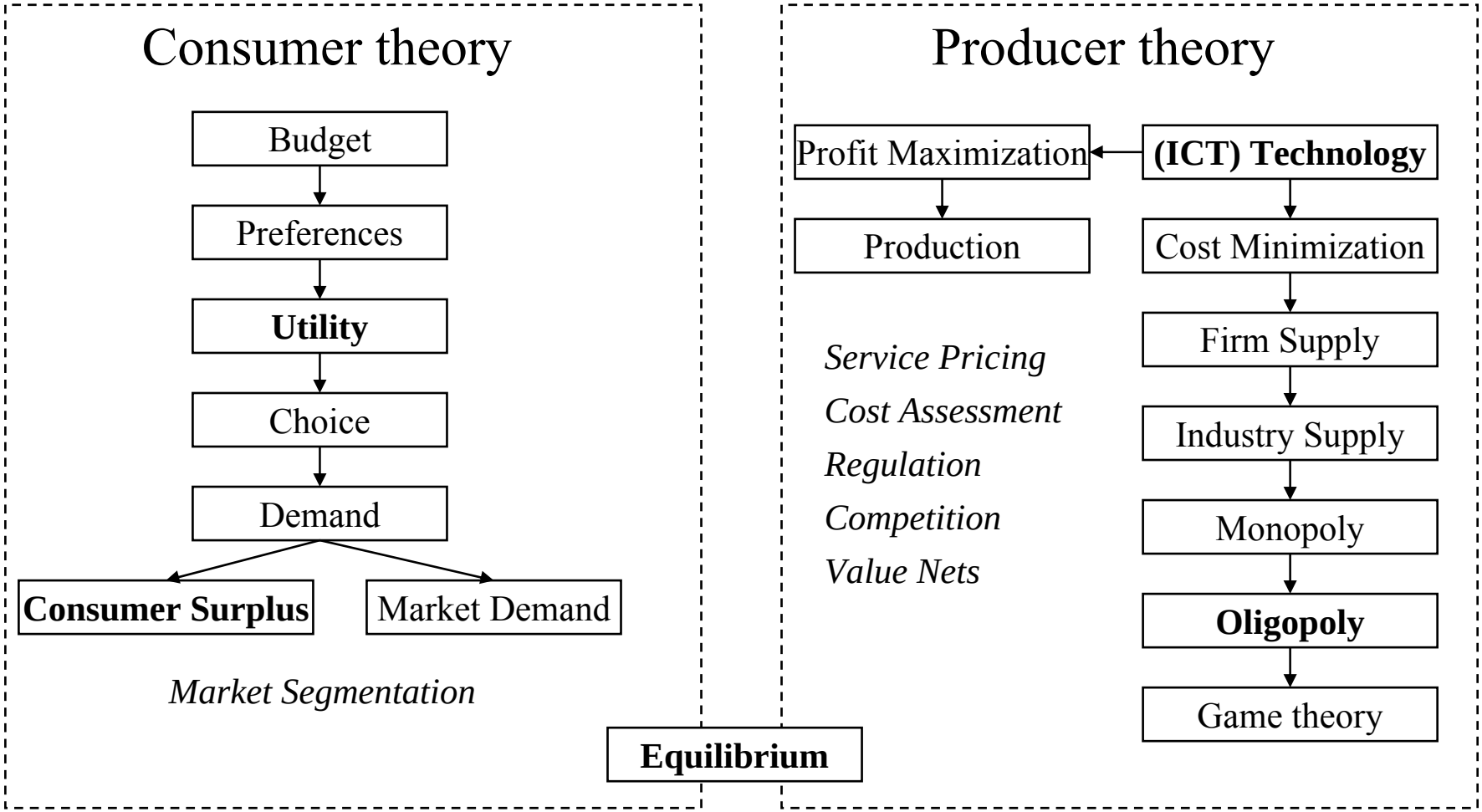
Course materials

- Exam material
  - *Pricing Communication Networks*, C Courcoubetis, R Weber, Wiley, 2003 (commercial, see Wiley, Amazon)
  - Lecture slides (to be available on web before/after each lecture)

- Other recommended readings
  - *ICT Regulation Toolkit (free, on-line):* www.ictregulationtoolkit.org
  - *Intermediate Microeconomics, H.Varian, 2002*
  - *Network Services Investment Guide*, Gaynor M, 2003
  - *The Telecom Managers Survival Guide*, Medcroft S, 2003

What is operator business?

Application of microeconomic theory to networking services markets



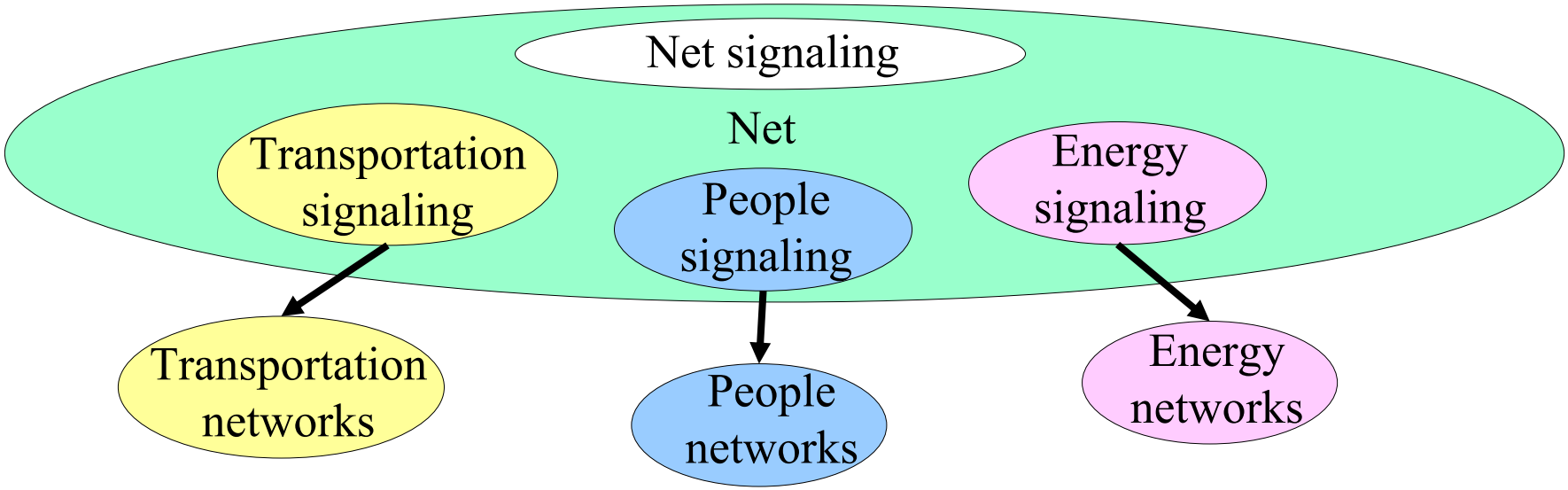
Introduction – Big Picture

Common aspects of networked industries

Problem	Description	Examples
Bottleneck	Traffic stacks because capacity is limited or temporarily blocked	Airport, telephone switch, damaged railroad bridge
Access	Physical availability, economical affordability	Electricity, water, Internet
Small vs large customers	Unit cost depends on the volume of contract	Prices of electricity, water, communications, etc
Short vs long haul	Unit cost depends on distance. International miles cheaper than local miles.	Prices of postal mail, telephone, etc

About ”signaling”

Core of information society



- Signaling controls the resources of a network
- Net enables signaling for physical non-ICT networks (e.g. energy)
- Signaling of non-ICT networks depends on signaling of Net

Visions of media convergence

Big Pipe
- Single channel
- Unified value nets
- E.g. Internet

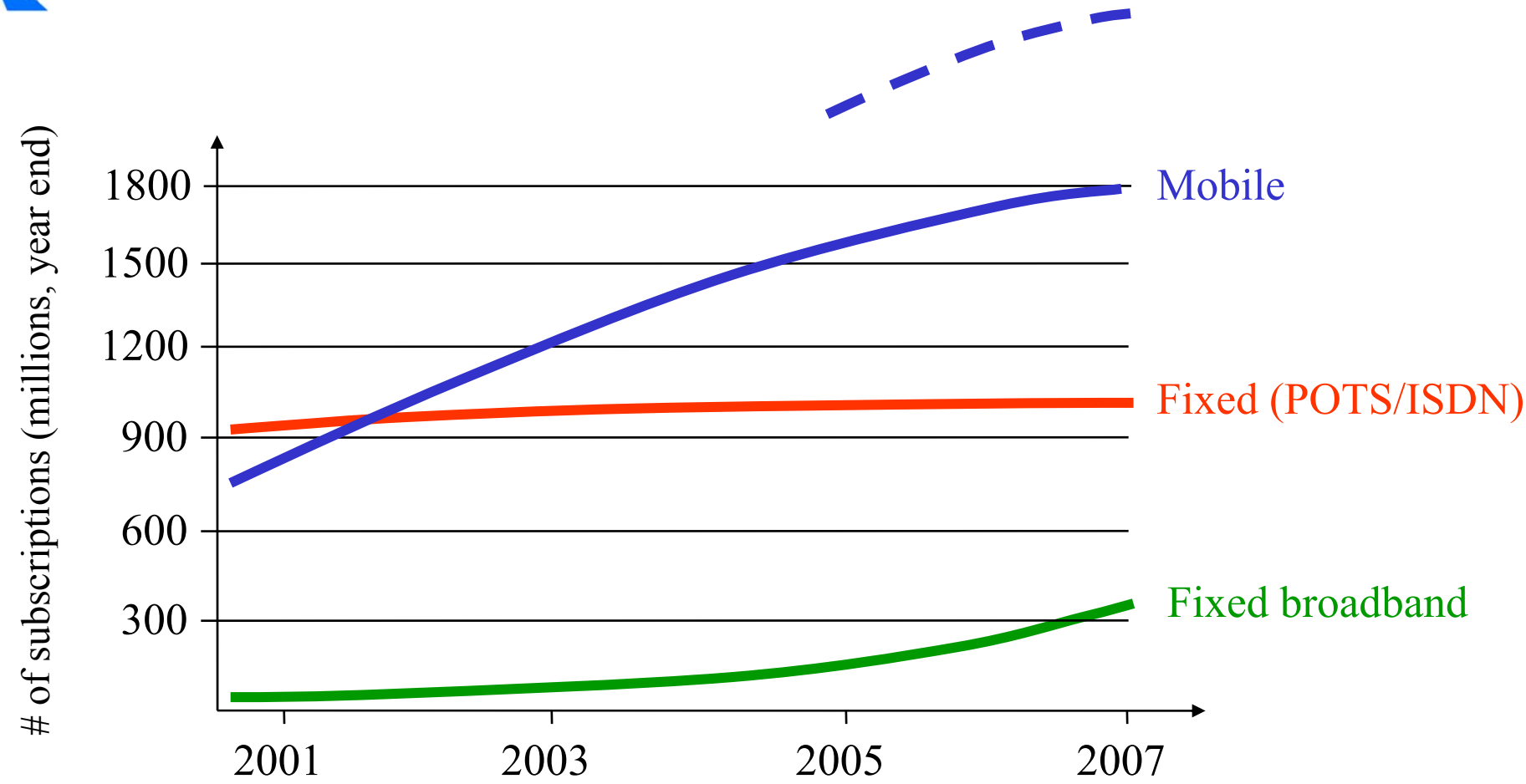
Big Box
- Single terminal
- Several channels
- Smart or dumb
- E.g. Linux/Java

Big Company
- Global company
- Single ecosystem
- E.g. Vodafone, MS

- Big Pipe may happen as Internet evolution
- Big Box may result from the operating system battle
- Big Company may get control of Big Pipe and/or Big Box
  - Business ecosystems grow and die slowly (e.g. Microsoft ecosystem)
  - Governments may interfere

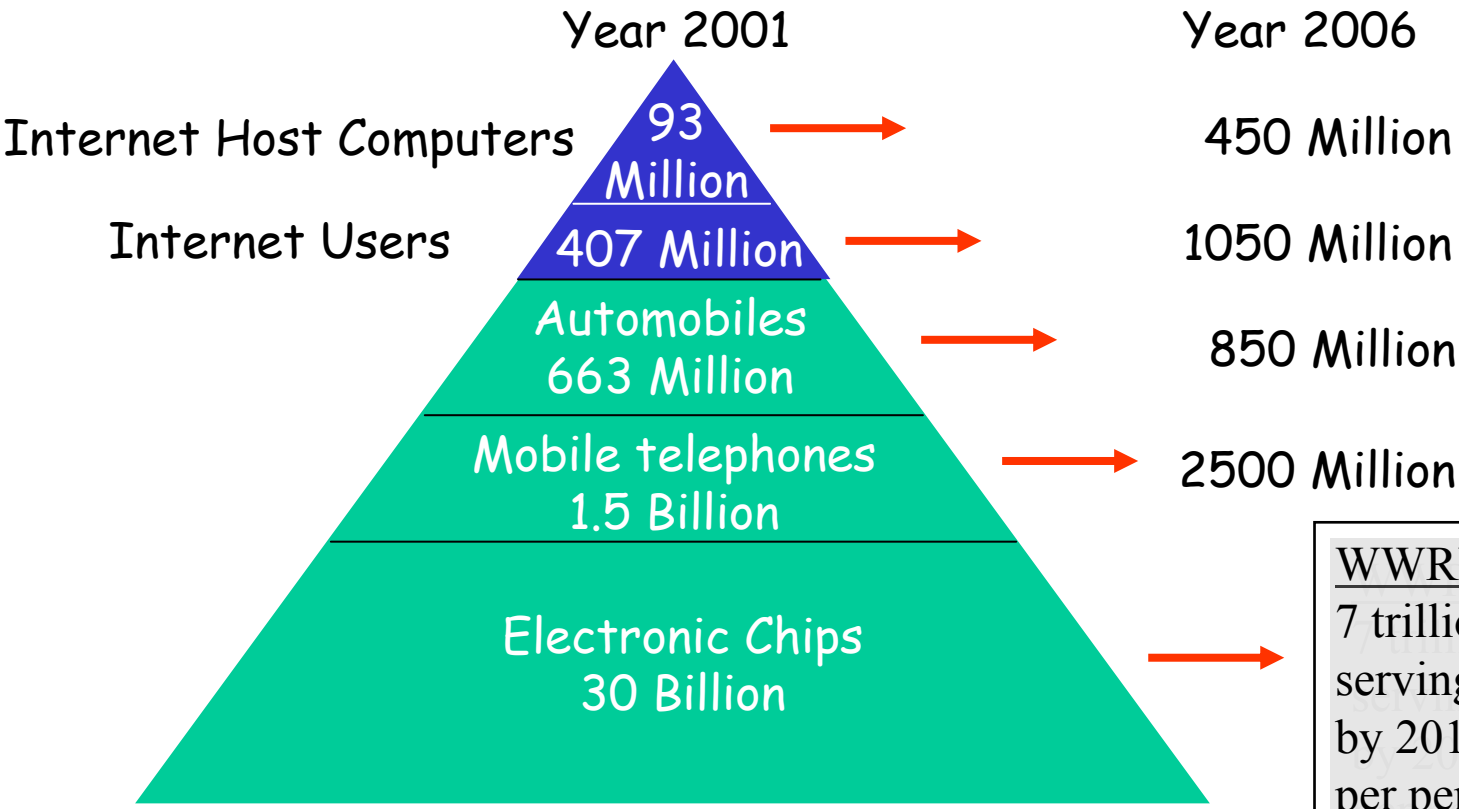
Source: P Longstaff, 2003

Worldwide subscriptions forecast



Source: Ericsson, 2003

Fast Increase of Users and Devices



WWRF predicts:
7 trillion wireless devices serving 7 billion people by 2017 (c. 1000 devices per person)

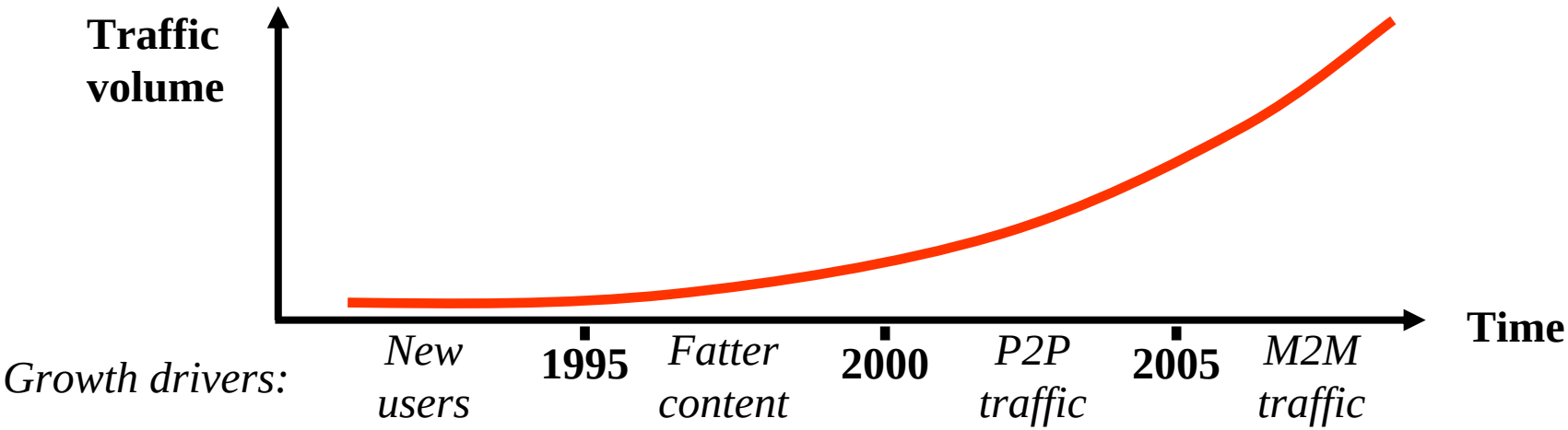
Can Internet technology stretch to the need of

- larger address space ?
- higher transport capacity ?
- lower costs ?

Source: Internet World Stats, 2006

Internet traffic

Upper limit?



- Internet traffic continues doubling per year
- Growth is currently limited by user-to-network bandwidth
- Machine readability increasing rapidly
- No obvious upper limit for non-human traffic (P2P and M2M)

Evolution of network value

Positive Network Effect

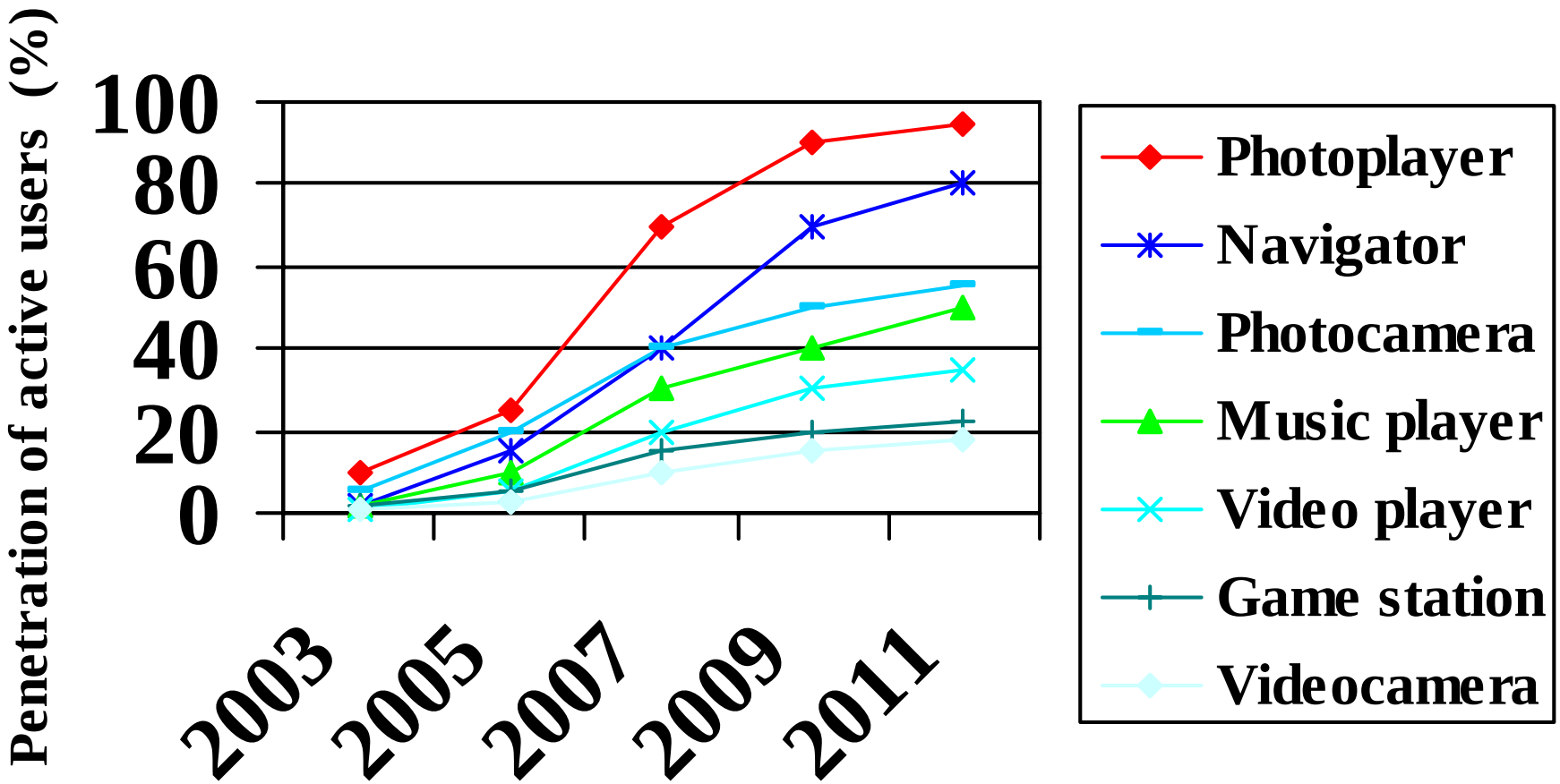
1. Sarnoff's Law
   - Value ≈ N (viewers in TV/radio broadcast networks)
2. Metcalfe's Law
   - Value ≈ N^2 (two-way connections in phone and data networks)
3. Reed's Law
   - Value ≈ 2^N (social groups in group-forming networks)

Value of Internet evolves favorably also because

- N grows (PCs, cars, mobiles, automatic devices)
- usage time per N grows (always-on)
- new service types
  - new delivery techniques (datacasting, audio&video, multicast)
  - new interaction techniques (MMS, chat, conferencing)
- more applications and content (commercial and user-created)

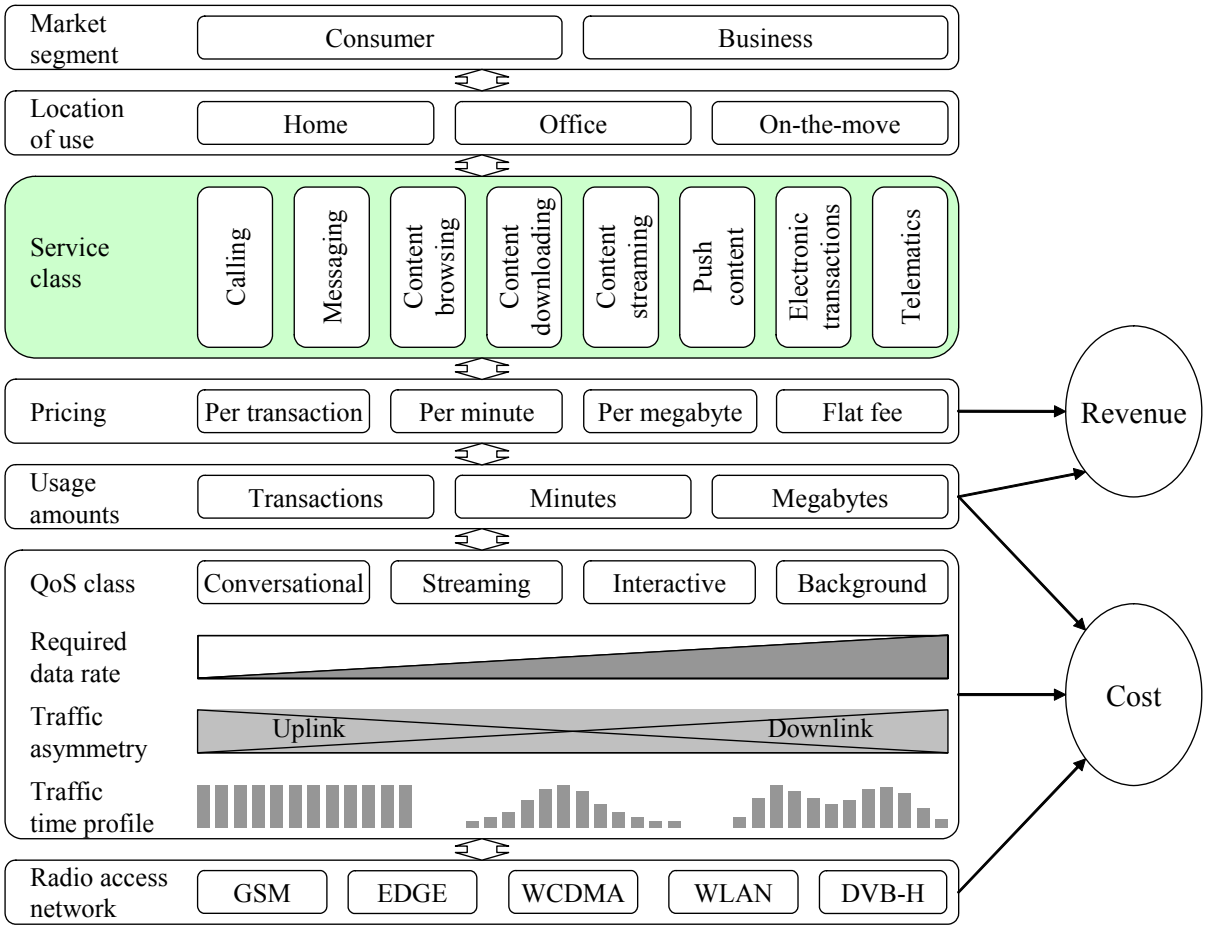
Adoption of New Handset Functions

Case Finland



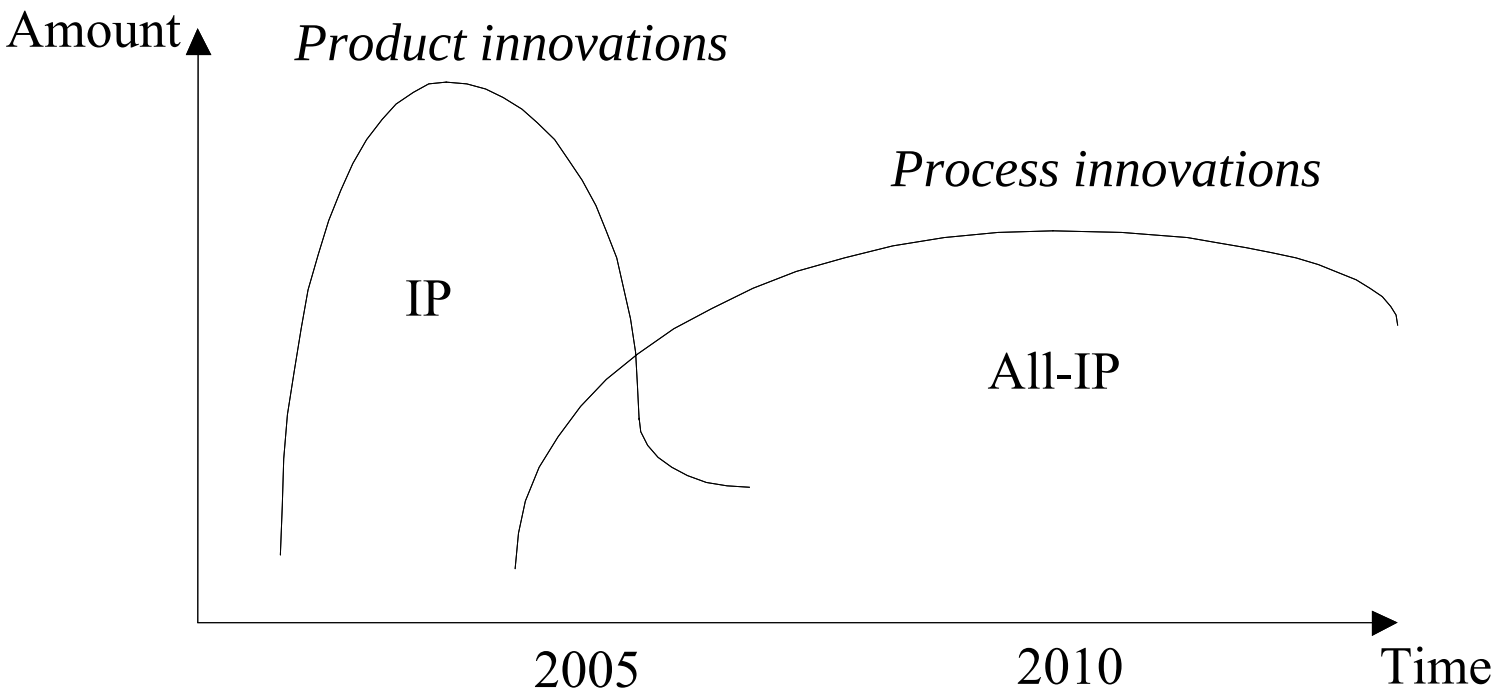
Source: LEAD project, 2004

Service Classification



Source: ECOSYS, T.Smura, 2005

Innovation model for Internet technologies



- Compare with the invention of electricity
- Processes and business models change slowly

Technology vision

Wireless systems

2005

- 28kb+ packet IP in all new handsets (GSM & WCDMA)
- Multiradio handsets spreading (GPRS & WLAN & Bluetooth)
- Bluetooth common in lightweight apps, and WLAN in heavy apps
- GPRS handset positioning common (GSM, GPS)

2010

- 100kb+ subscriber speed common in cellular (WCDMA)
- Energy conservation efficiency only tripled (fuel cells, solar cells)
- Seamless support for multiradio common (WCDMA & GSM & WLAN & PAN)
- Spectral efficiency of antennas clearly improved (adaptive antennas, MIMO)
- UWB (Ultra Wide Band) competing with BlueTooth and WLAN
- 4G spec maturing if WRC2006 has allocated bandwidth

Battery, heat, and radio are the bottlenecks

Source: TEKES NETS, 2003

Technology vision

Broadband packet networks

2005

- 512kb+ packet IP common in homes (ADSL, HFC)
- Access operators starting the prioritisation of traffic (diffserv, less than best effort)
- Optics increased in core and access networks (DWDM, MPLS)
- Ethernet changing the architecture of access networks

2010

- 10Mb+ IP common in homes (VDSL, HFC)
- Roaming common in fixed networks (WLAN/BlueTooth in homes)
- Increased capacity and operability in optical networks (all-optical, switching)

Network is the bottleneck, not terminal

Source: TEKES NETS, 2003

Technology vision

Services and applications

2005

- Mobile Internet services as common as those of wireline Internet
- Users can access their files from home, office, and on the move
- IP audio delivery common (plus broadcast radio in wireline Internet)
- Voice-over-IP emerging in wireline (WWW push-to-talk, chat, SIP)
- New services are based on open standards (IETF, 3GPP, W3C, OMA), but applications remain proprietary

2010

- Content adapts to environment (place, radio, device, user profile)
- IP audio/video has become efficient (multicast) and controlled (QoS)
- Voice-over-IP common in public networks (wireline and wireless)
- User controls (home) devices independently of place and time

Usability is the bottleneck

Source: TEKES NETS, 2003