

NM -TF

NETWORKED MEDIA
LONG TERM RESEARCH
TASK FORCE



Information Society
Technologies



CONTENT
excellence in
Content Distribution Network Research



A NETWORK OF EXCELLENCE



VISNET II networked audiovisual media technologies

The Challenge of the Distributed Control

Workshop of the Future Media Internet

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CONTENT NoE
University Carlos III Madrid

Brussels, 22nd January 2008



Outline

- ◆ **CONTENT NoE**
- ◆ **The Challenge of Distributed Control Infrastructure and Future Media Internet**
- ◆ **Conclusions**



CONTENT NoE

CONTENT NETWORKS AND SERVICES FOR HOME USERS

NoE IST-2006-38423

Networked Audiovisual Systems

Start date: 1/07/2006 End date: 30/06/2009

Project duration: 36 months

Total budget: 2,648,000 €

11 partners from 10 countries

www.ist-content.eu

IAB Board: Philips Research, Eindhoven, NL - Agilent Laboratories, UK - Danet GmgH, DE - Thales Broadcast & Multimedia, FR - Ericsson Research, IR - Telefónica, Publicidad e Informacion, ES - TECHMATH – Blue – Order, UK - Alcatel-Lucent, BE - Nokia Research, FI - Telefonica Research Lab Barcelona, ES - Google Switzerland GmbH, CH - TANDBERG ASA, NO



LANCASTER
UNIVERSITY



ΕΘΝΙΚΟΝ & ΚΑΠΟΔΙΣΤΡΙΑΚΟΝ
ΠΑΝΕΠΙΣΤΗΜΙΟΝ ΑΘΗΝΩΝ
NATIONAL & KAPODISTRIAN
UNIVERSITY OF ATHENS

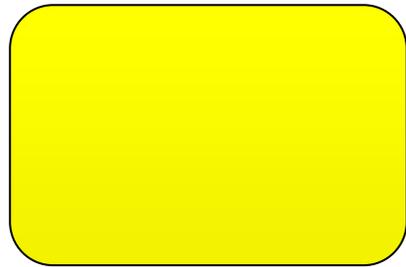


UNIVERSITETET
I OSLO



Why CDNs?

◆ Technical development:



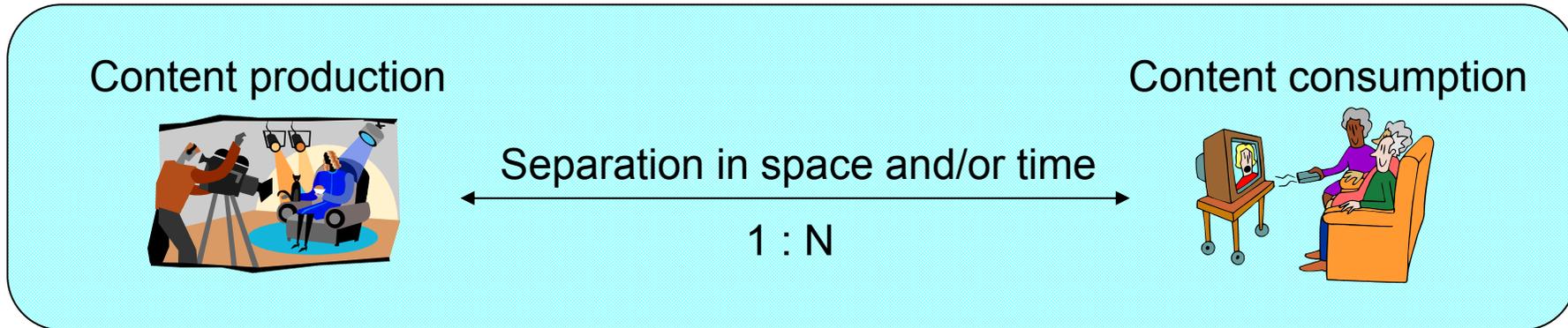
➔ Digital representation is dominant

◆ Affordable devices allow direct production

- ❖ MPEG or DV based
- ❖ For broadcasting, movie theatres, domestic use, etc.
- ❖ Not just by professionals.

➔ There is an explosion of digital multimedia content

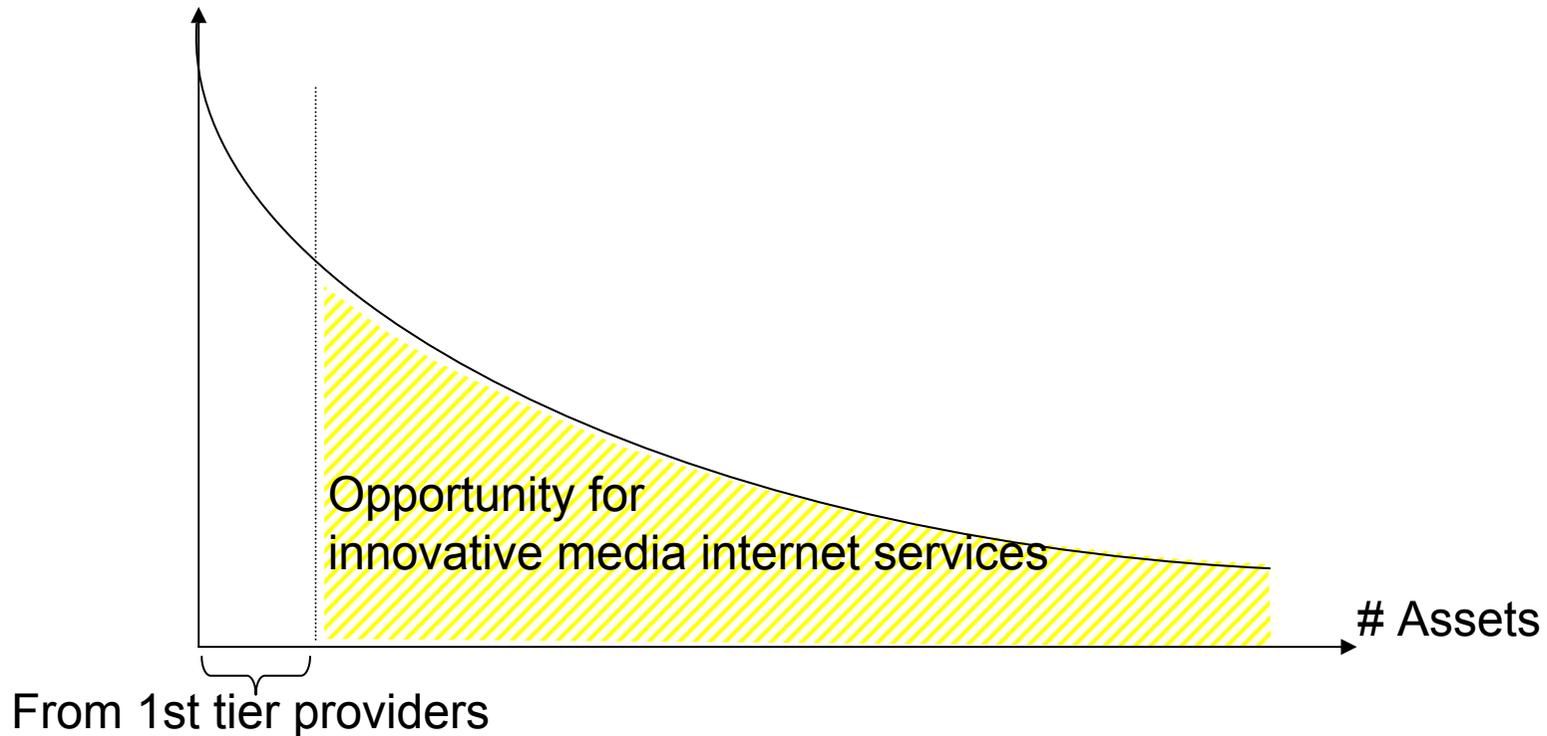
Why CDNs? (cont.)



- ◆ **Content Distribution Network (CDN)** is an infrastructure designed to efficiently deliver content to the users
 - ❖ E.g. broadcast networks for television
- ◆ **Role of IP networks as a basic communication platform for content distribution is becoming more important**
 - ❖ More digital multimedia content
 - ❖ Better access technology (xDSL, cable, etc)

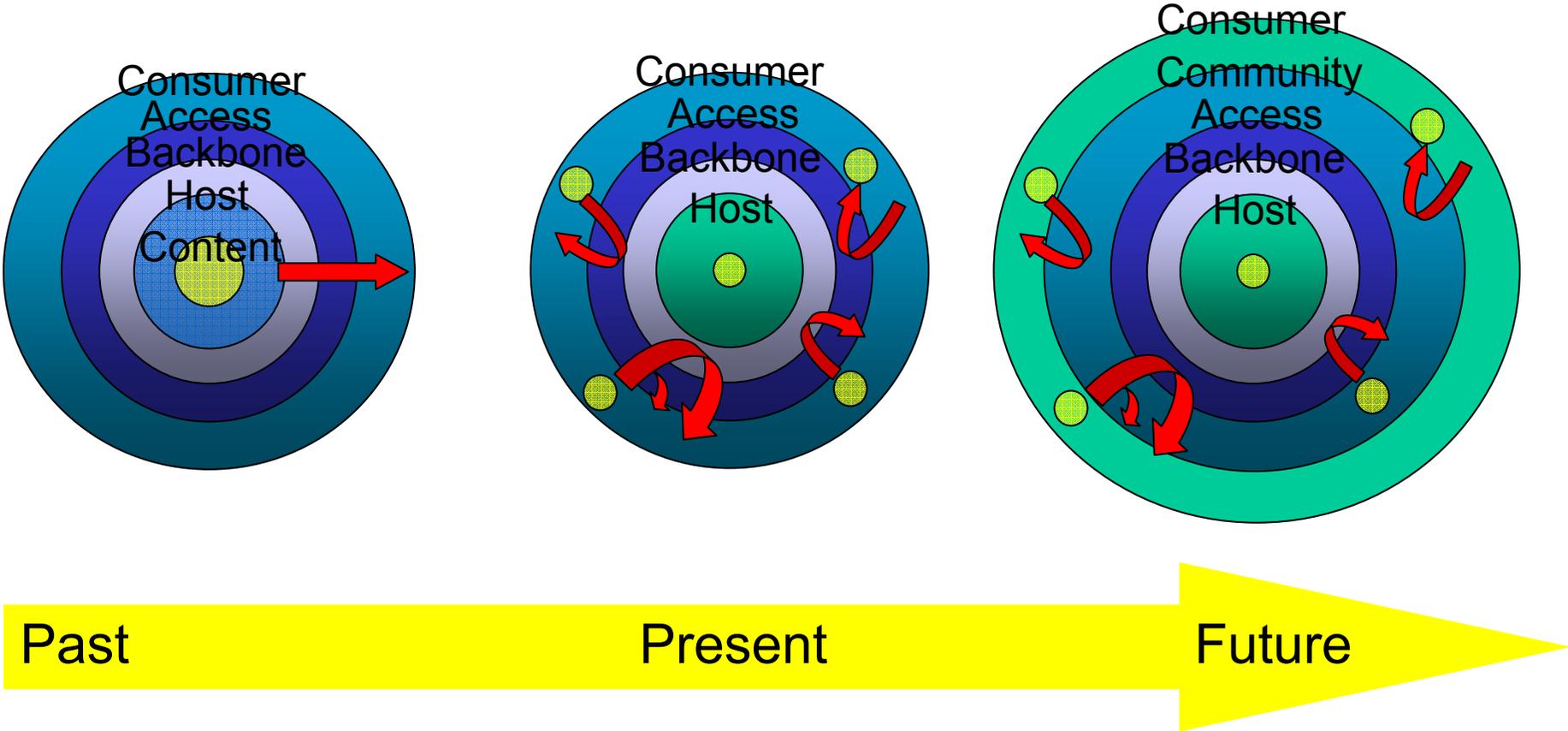
Media Internet for Communities

Users

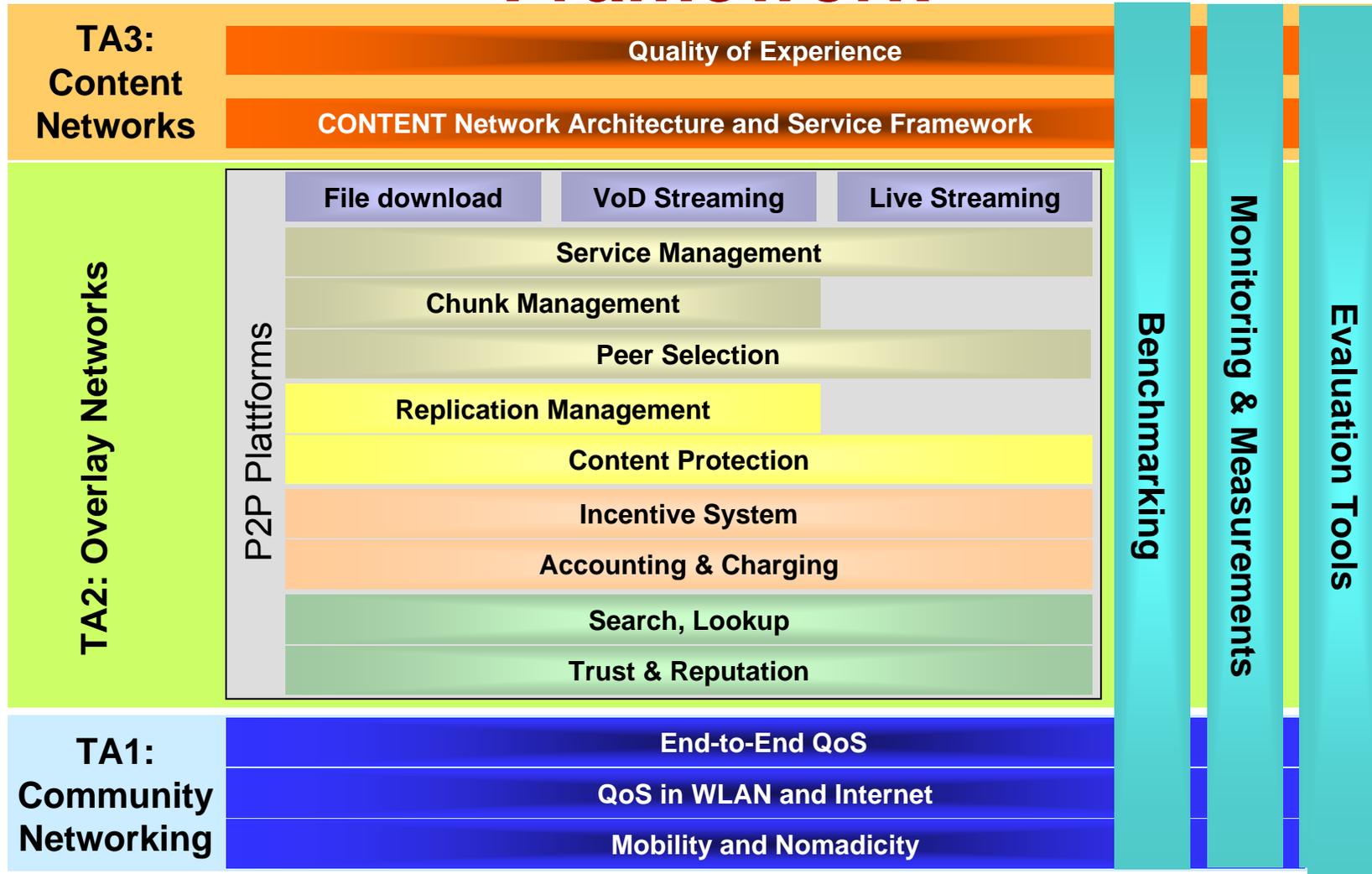


- ◆ We seek to integrate our research expertise on the different levels of **(overlay) networks** and **services** for **AV content** and put special emphasis on the new challenges that arise from **community networks**.

Content Networks for Communities



CONTENT Research Framework



Outline

- ◆ **CONTENT NoE**
- ◆ **The Challenge of Distributed Control Infrastructure and Future Media Internet**
- ◆ **Conclusions**

Expected Networked Media of the Future

◆ Built upon three axes:

- ❖ True broadband
- ❖ Personalized media
- ❖ **Distributed control**

◆ Developments on these axes will lead:

- ❖ New models of rich media interactions
- ❖ Enhanced AV content distribution at community level
- ❖ Pervasive personalized media

The Challenge of the Distributed Control Infrastructure

◆ Research question :

- ❖ *what is the challenge of distributed control. (CONTENT NoE question)*
- ❖ The infrastructures and services which are based on the composition and interaction of many subsystems and entities, relying in self-organization and self-interaction technologies

◆ Key research directions

- ❖ Infrastructure
 - ✓ Networked media infrastructure
 - ✓ Content service infrastructure
- ❖ Content
 - ✓ Interactive, scalable, multi-model content search
 - ✓ Content summarization
 - ✓ Content adaptation, aggregation and digestion
 - ✓ New paradigms of interactions with abstract entities
 - ✓ Metadata and indexing



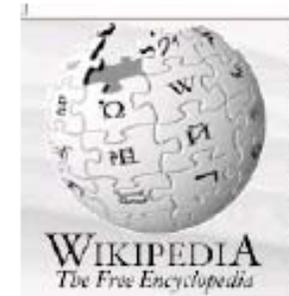
Today Media Internet

social networks

friendster



knowledge sharing



personalized browsers, search engines

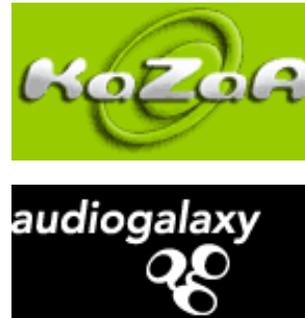


content sharing

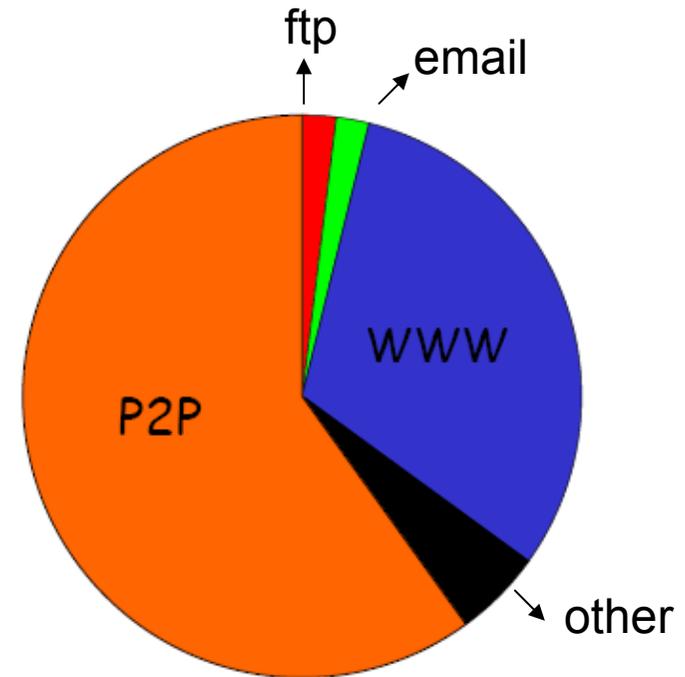
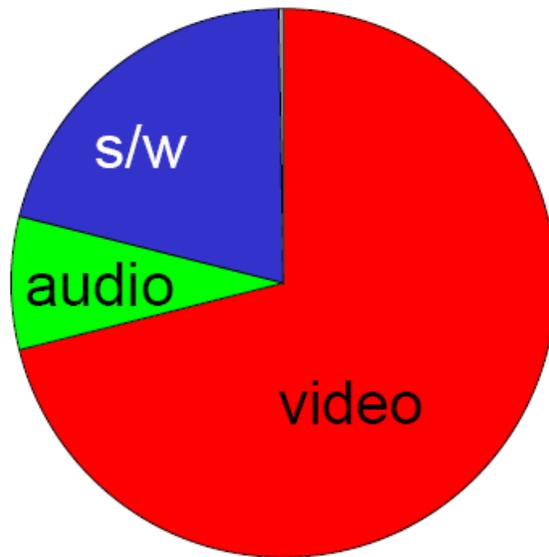


Today Media Internet (ii)

◆ And much more almost every day...

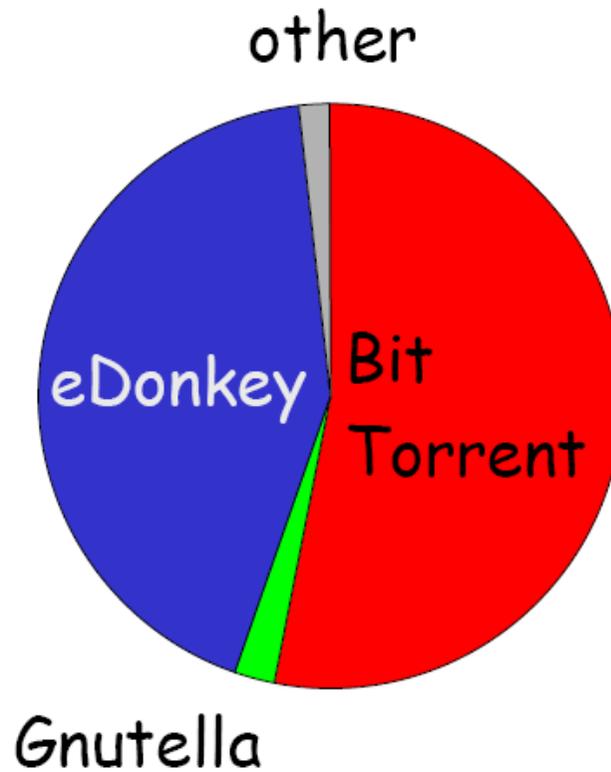


Evolution of Internet Traffic



- ◆ 1993 – academic traffic
- ◆ 1995 – web in scene
- ◆ 2000 – ~ 75% web traffic and data content
- ◆ 2004 – 70% P2P traffic and media content

Inside P2P



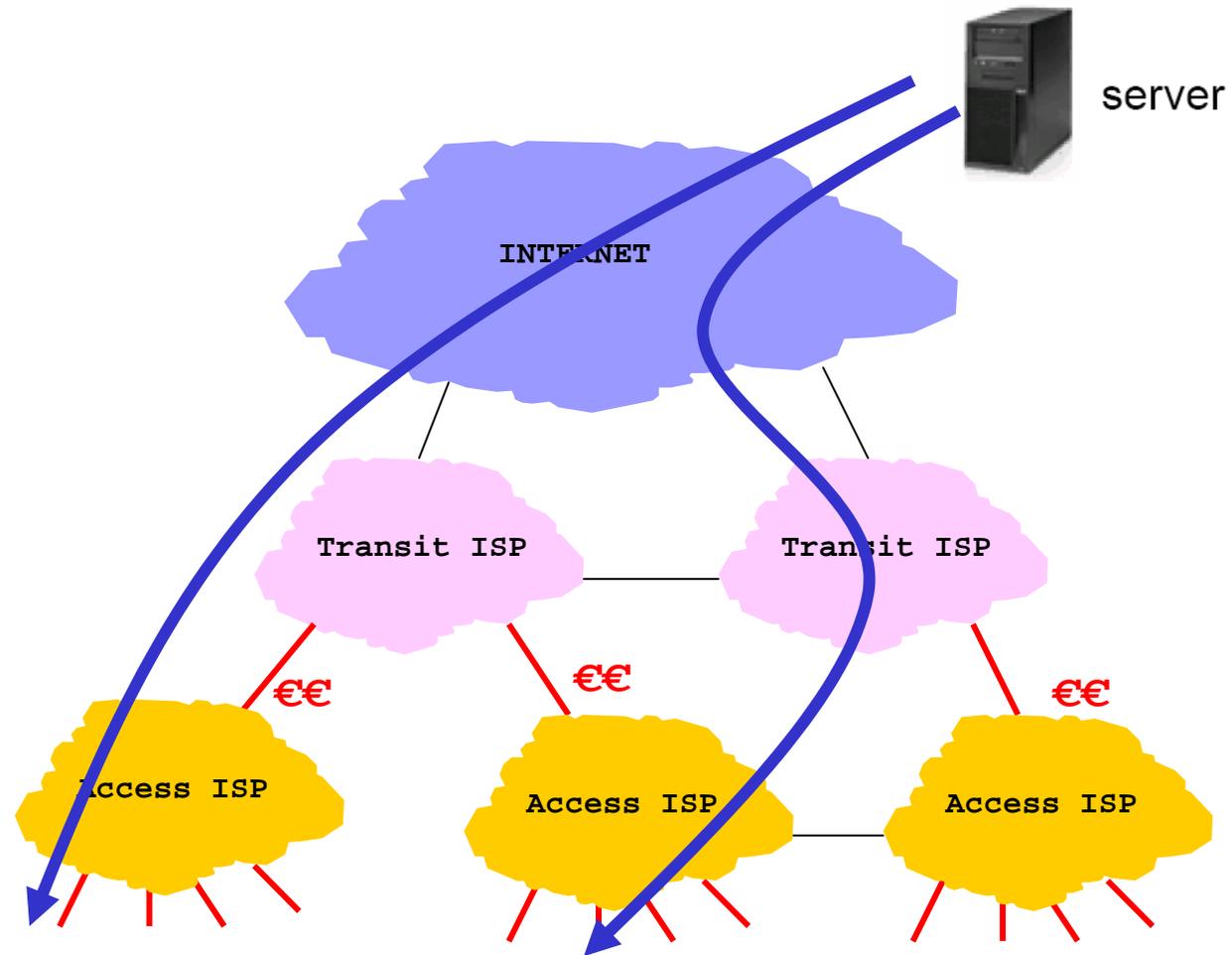
- ◆ Internet Study 2007 in Germany (similar in rest of the world)
- ◆ www.ipoque.com

Internet Traffic Today (ii)

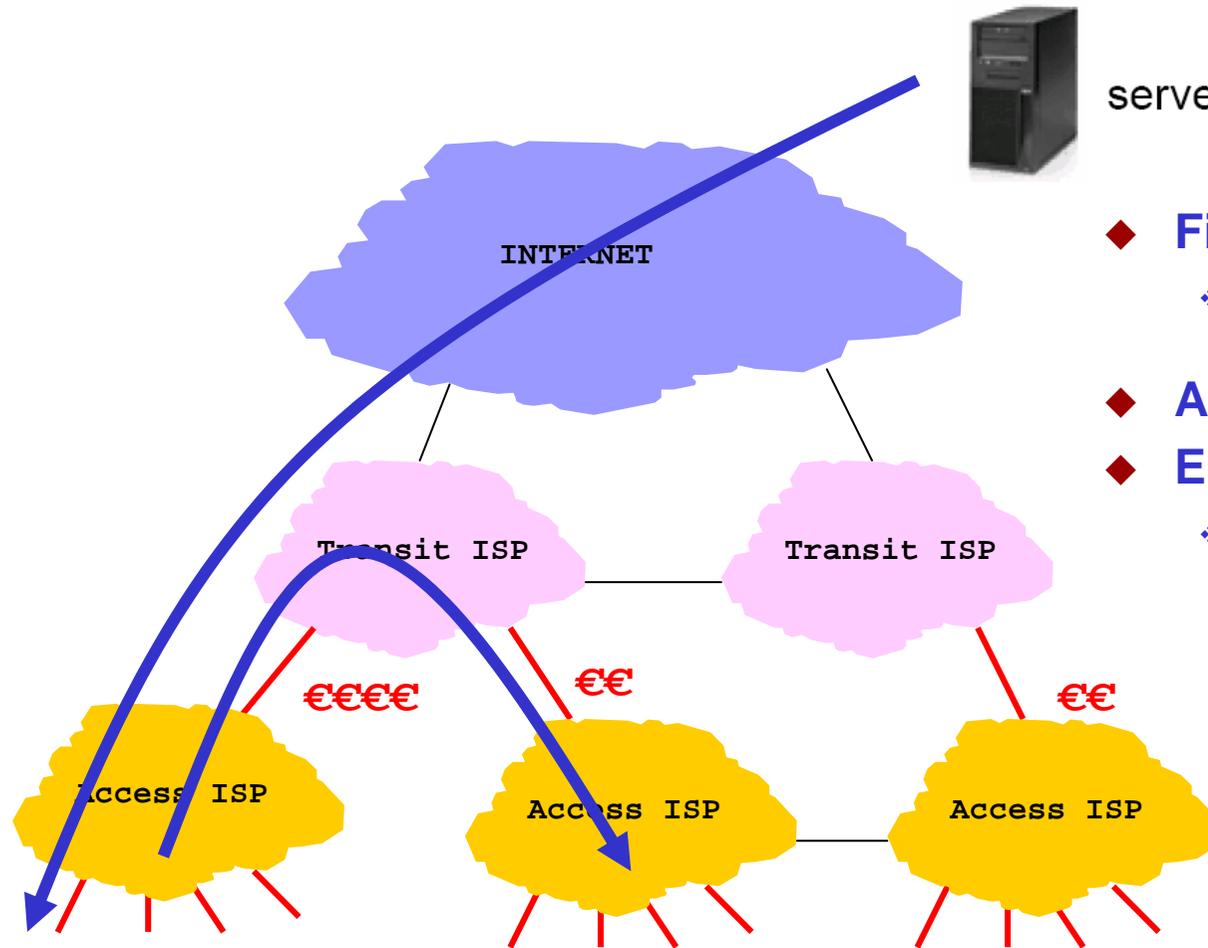
- ◆ **30%-70% traffic P2P**
- ◆ **~ half Bittorrent**
- ◆ **~ 70% media content**
- ◆ **Implications:**
 - ❖ **Economics of ISPs**
 - ❖ **Impact on traffic engineering and routing**
 - ❖ **Interaction between applications and network**
 - ❖ **Next generation of CDNs**



Client-Server Economics



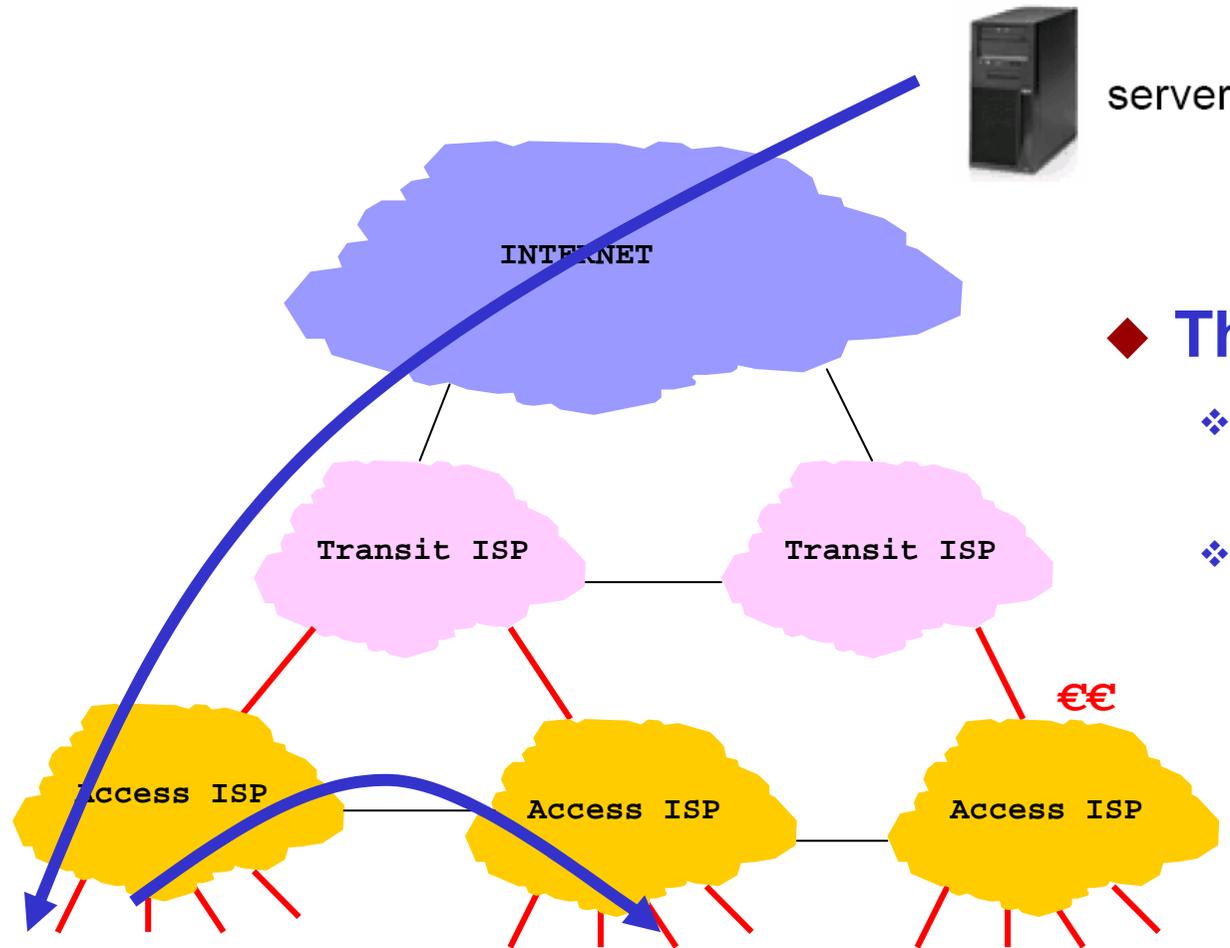
P2P Economics



server

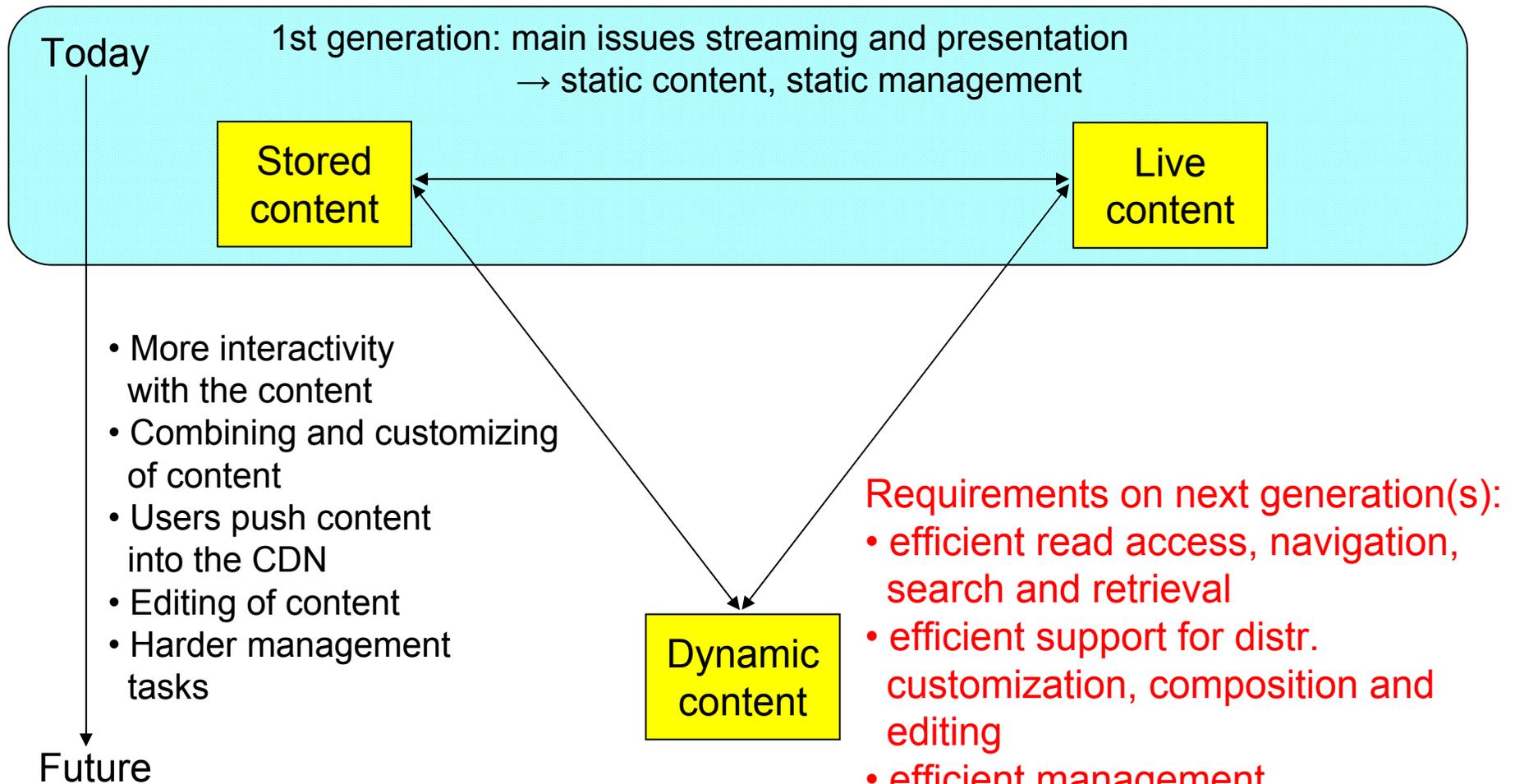
- ◆ Filtering out P2P traffic
 - ❖ But P2P increases access demands (€€)
- ◆ Add caches
- ◆ Enrich connectivity
 - ❖ Peering between access ISPs

P2P Economics



- ◆ **That means:**
 - ❖ **Flattening Internet**
 - ❖ **Impact on the design of Internet**

Evolution to Future Media Internet

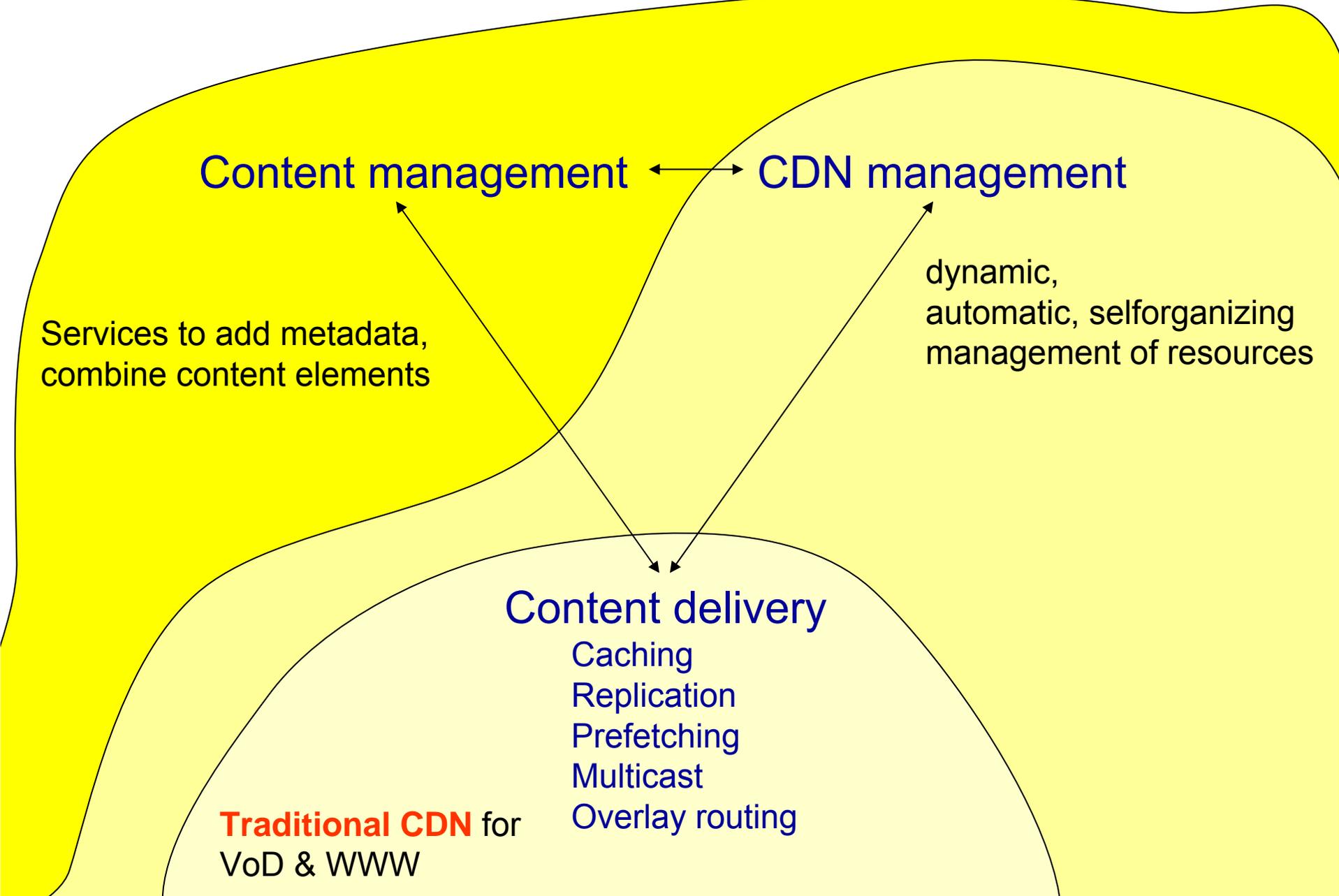


The Need for Flexibility

◆ Future Media Internet:

- ❖ No more static specialized infrastructures, but ...
- ❖ Flexible, dynamic, multi-service content-centered infrastructures, supporting:
 - ✓ The concept of dynamic user communities
 - ✓ The entire life cycle of each piece of content, and of combinations of them
 - ✓ Mobility of users
 - ✓ A variety of networking technologies
- ❖ Emerging paradigms well fitting these needs:
 - ✓ P2P and Overlays
 - ✓ Self-describing, composable services
 - ✓ Self-describing, composable pieces of content (metadata)

From CDNs to Future Internet Media



Challenges of Future Media Internet

◆ Internet infrastructure

- ❖ **Flattened Structure**
- ❖ **Big increase in traffic volume and number of terminals**
- ❖ **Explosion of heterogeneous hand-held and wearable devices**
- ❖ **Wireless Access: Future Wireless Internet**
- ❖ **End-to-end paradigm: consider limited-capabilities of hand-held terminals**
- ❖ **Mobility (not just nomadicity) is a must**
- ❖ **Dominance of P2P and overlay over client-server**
- ❖ **QoS and multicast issues to deal with**
- ❖ **...**

Challenges of the Future Media Internet

◆ Internet is sociologically flat

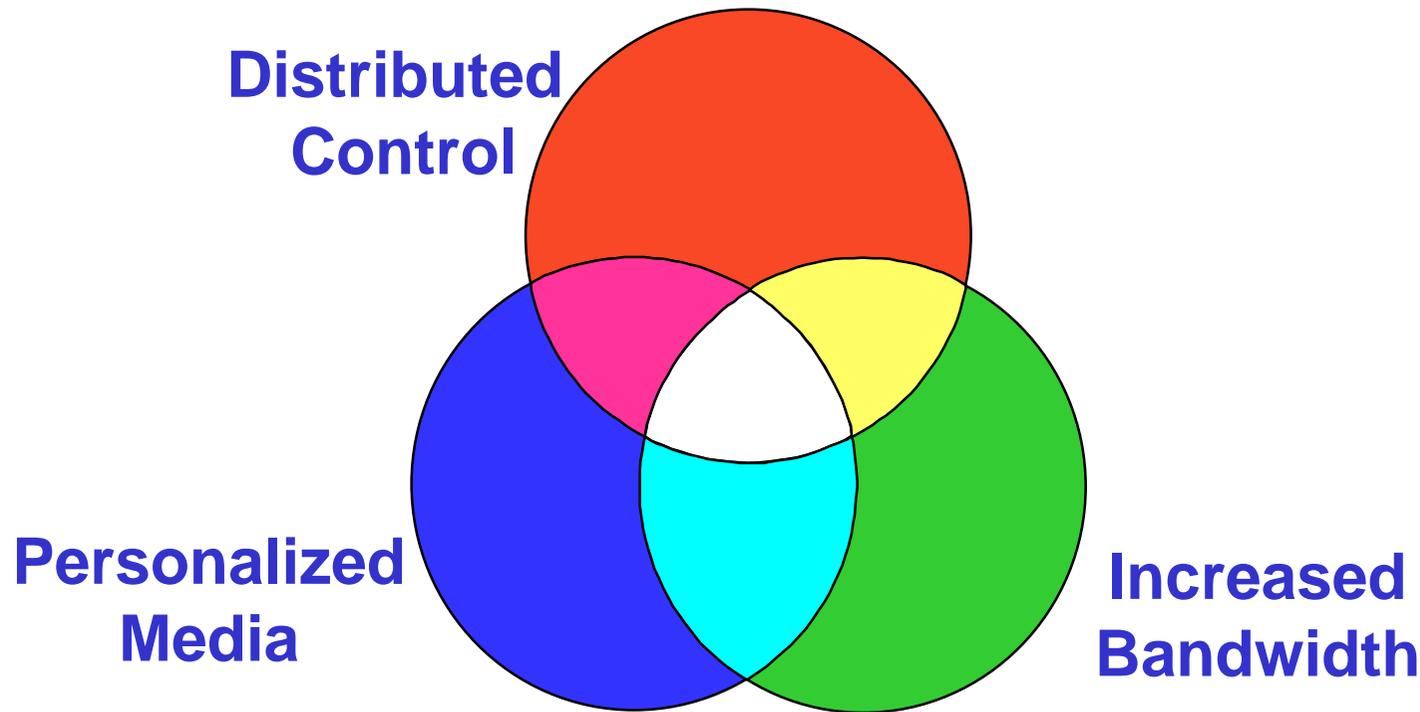
- ✓ Empowering people
- ✓ Equalizing experimental opportunities

◆ Technologically flat

- ✓ **Hierarchical** structure
 - **Flat** structure
- ✓ **Network** resource management
 - **End-host/application** resource management
- ✓ **Complexity**
 - **Simplicity**

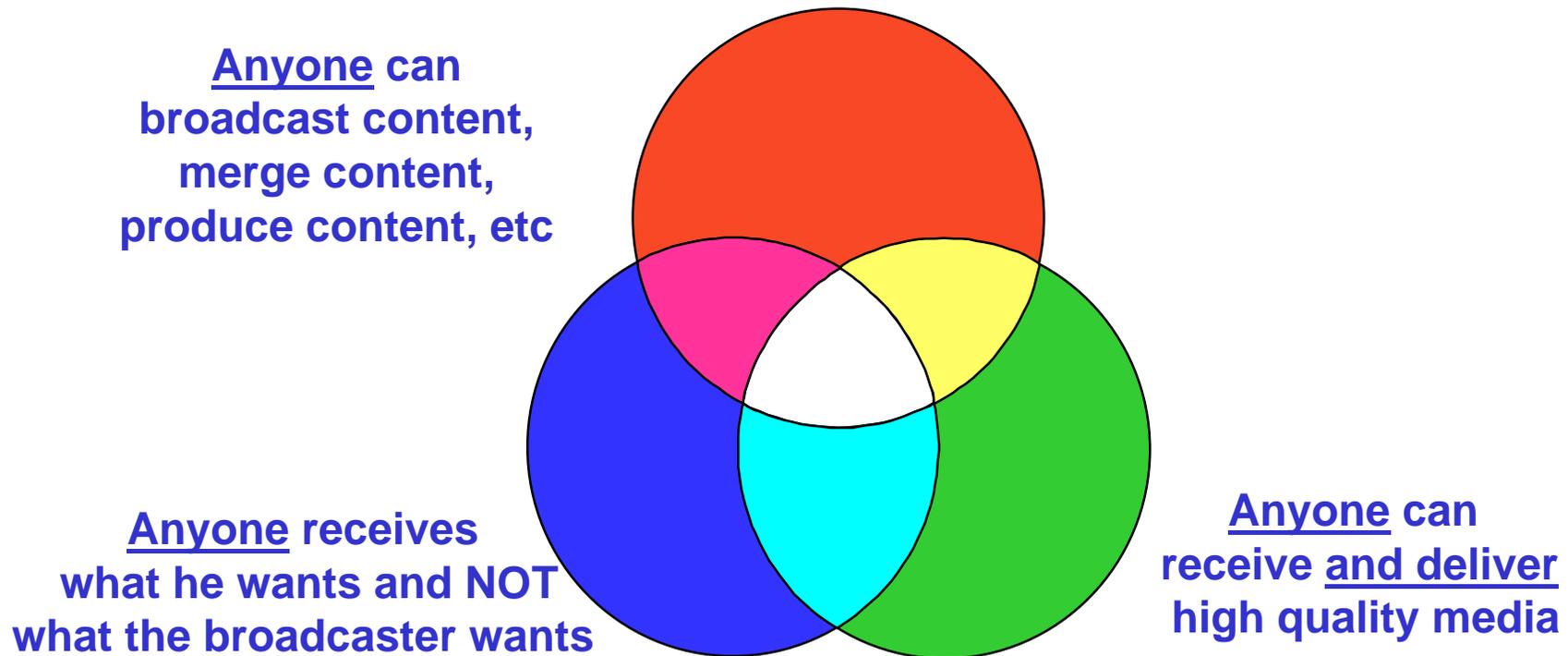
Challenges of Future Media Internet

- ◆ The three challenges are not independent, and rather reinforce each other



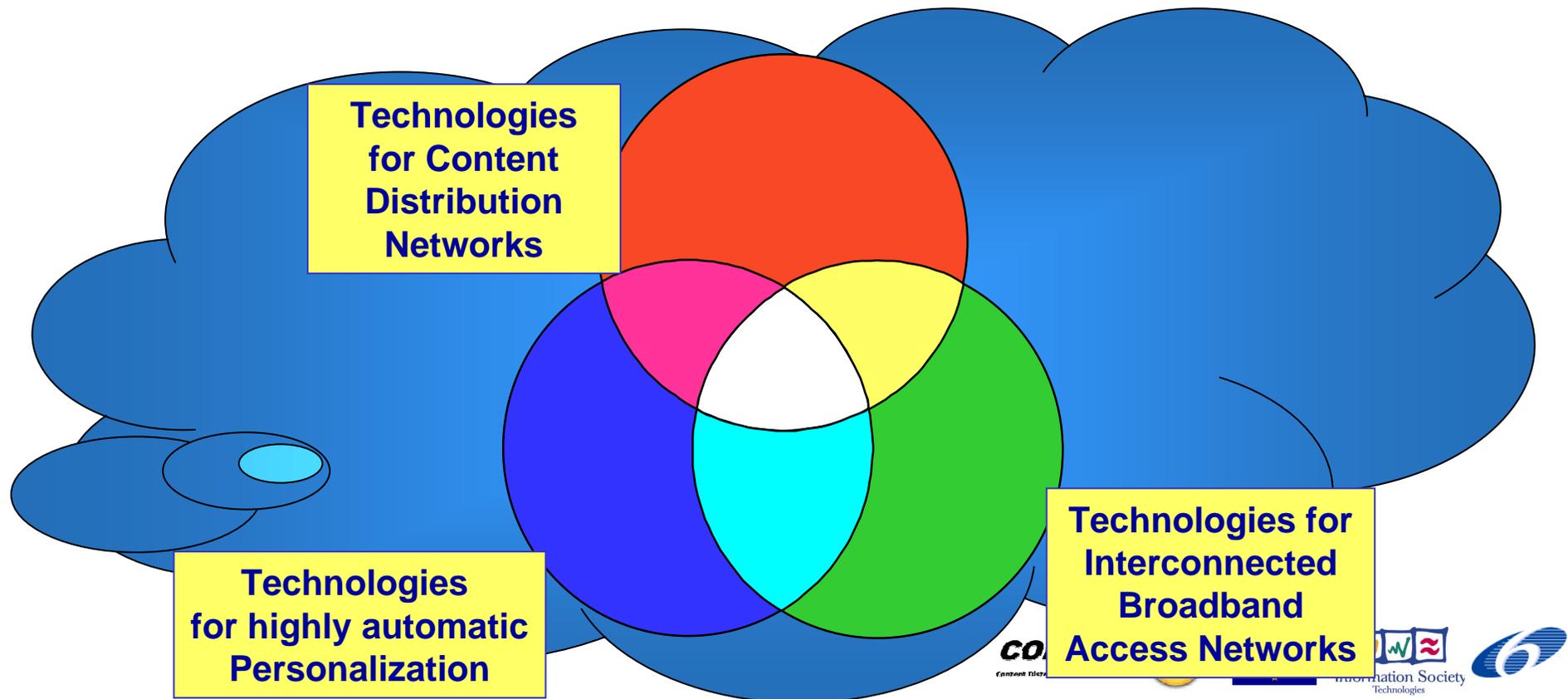
Challenges of Future Media Internet

- ◆ The three challenges imply very fundamental techno-socio-economic alterations



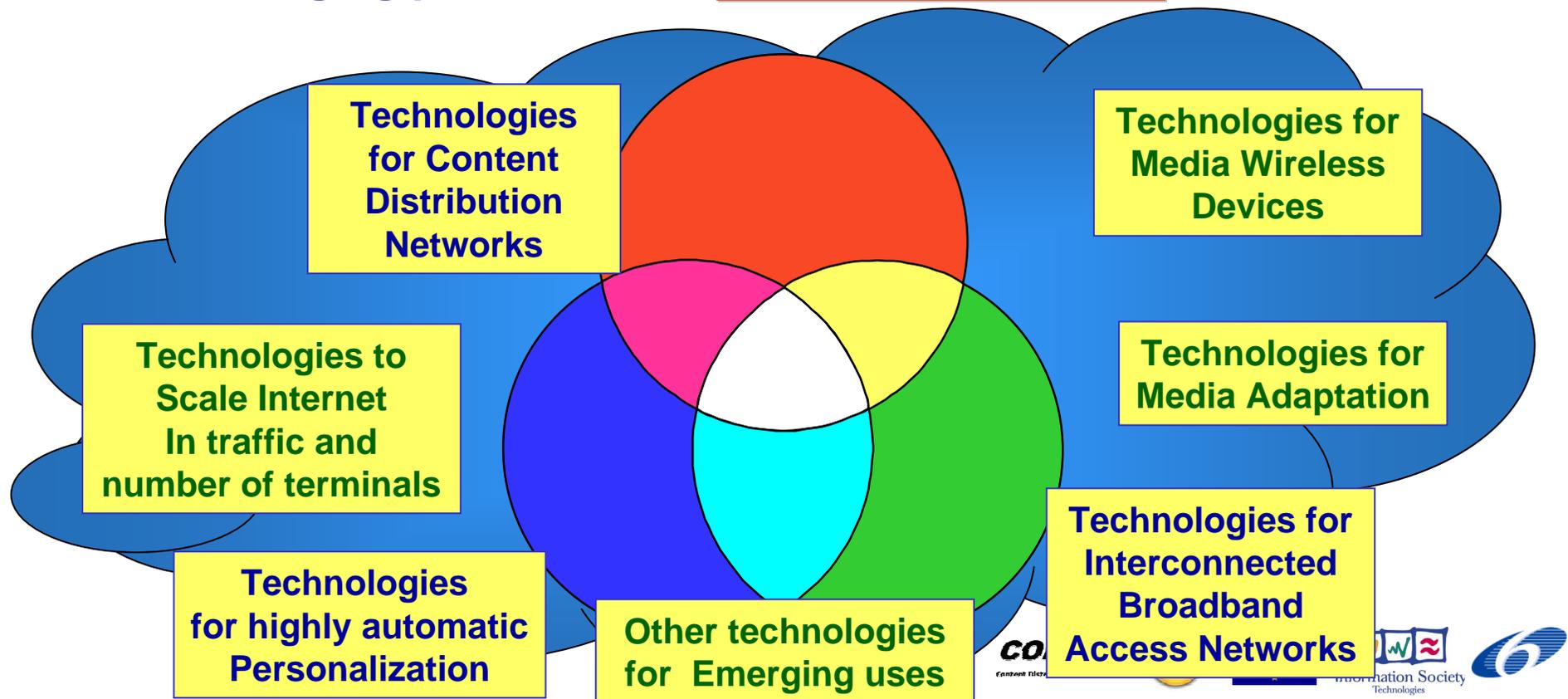
Challenges of Future Media Internet

- ◆ Overall Conclusions are that in 5 to 10 years we should see:
 - ❖ Fundamental reshaping of the mass media business structure
 - ❖ Fundamental reshaping of the Internet
- ◆ Emerging phenomenon: Future Media Internet



Challenges of Future Media Internet

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