EBU **TECHNICAL**

Technical challenges of legal Peer-to-Peer delivery

An update on where we are (going)

Franc Kozamernik

European Broadcasting Union

EBU·UER

Kerbango Internet Radio

2000

Plays thousands of Internet Radio stations

A conventional “retro” radio look & feel, not a computer

Easy to use: set-up, listening and tuning

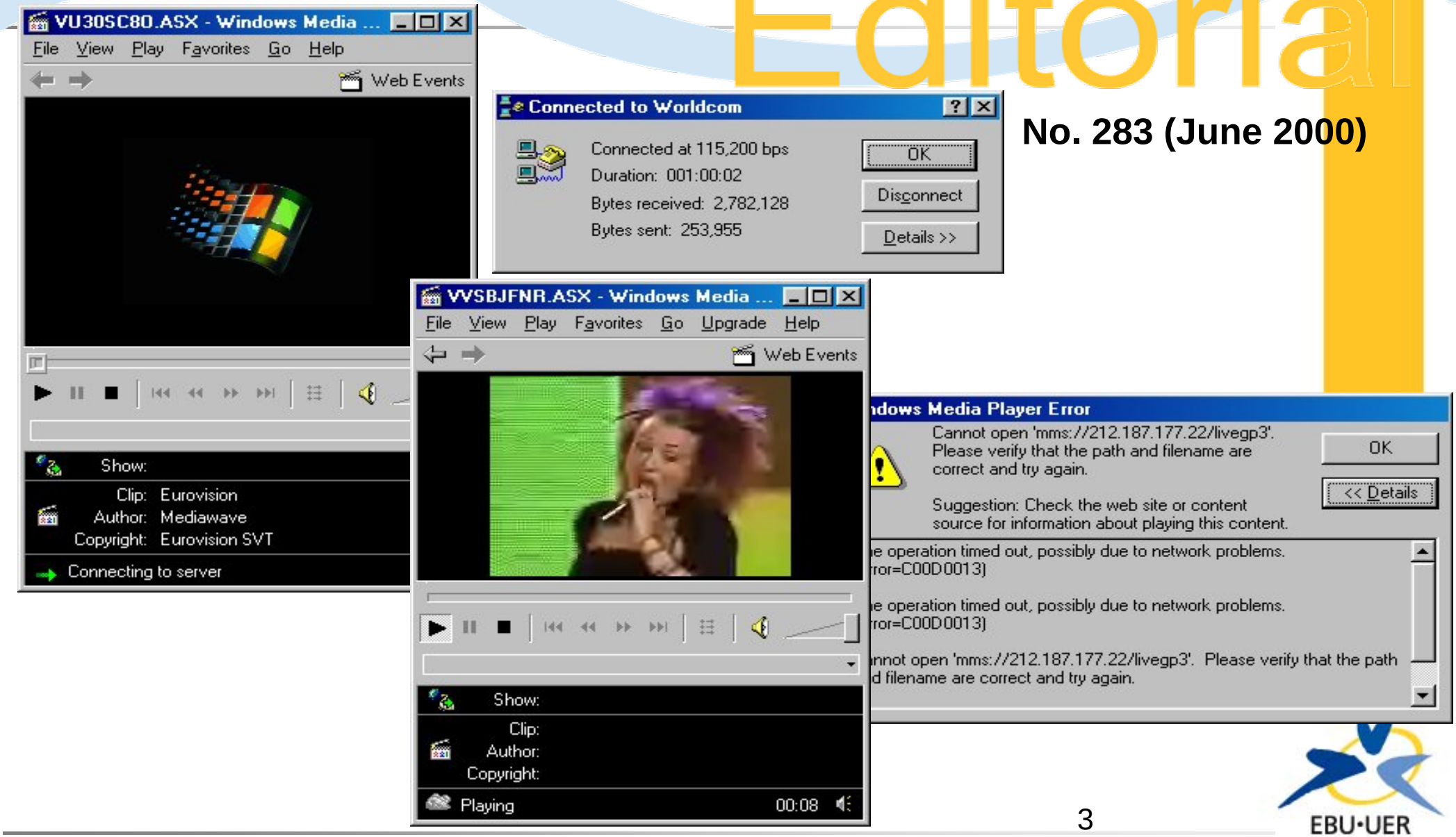
Costs about as much as a high-end radio

No PC required

EBU Technical Review

Editorial

No. 283 (June 2000)



Eurovision Song Contest 2002

The current infrastructure of the Internet is not suited to simultaneous transmission of live events to millions of people (i.e. broadcasting). The problem is that a dedicated stream of data must be sent to every single user. With millions of potential users, the network easily becomes congested by the millions of simultaneous streams of data. For several years, we have been told that the answer to this problem is "multicasting", whereby the data stream is distributed to many local servers which then "re-broadcast" the content to local users. However, most IP routers cannot support multicasting – and there seems to be no financial incentive for operators to introduce multicasting.

Eurovision Song Contest 2006

- Technical trial using Octoshape P2P system
- Maximum 15.000 concurrent streams
- More than 70’000 unique users
- Windows media player
- 3 levels of quality: Q2CIF: 200, QCIF: 450, CIF: 700 kbit/s
- No rights management (DRM)
- No geolocation (geographical restrictions)
- No major technical problems with P2P
- No congestion while downloading Octoshape plug-in
- Network dependent quality - asymmetricity

No distribution cost was involved

Octoshape was successfully used for ESC in May 2007. The audience figures were twice as big.

Eurovision Song Contest 2008

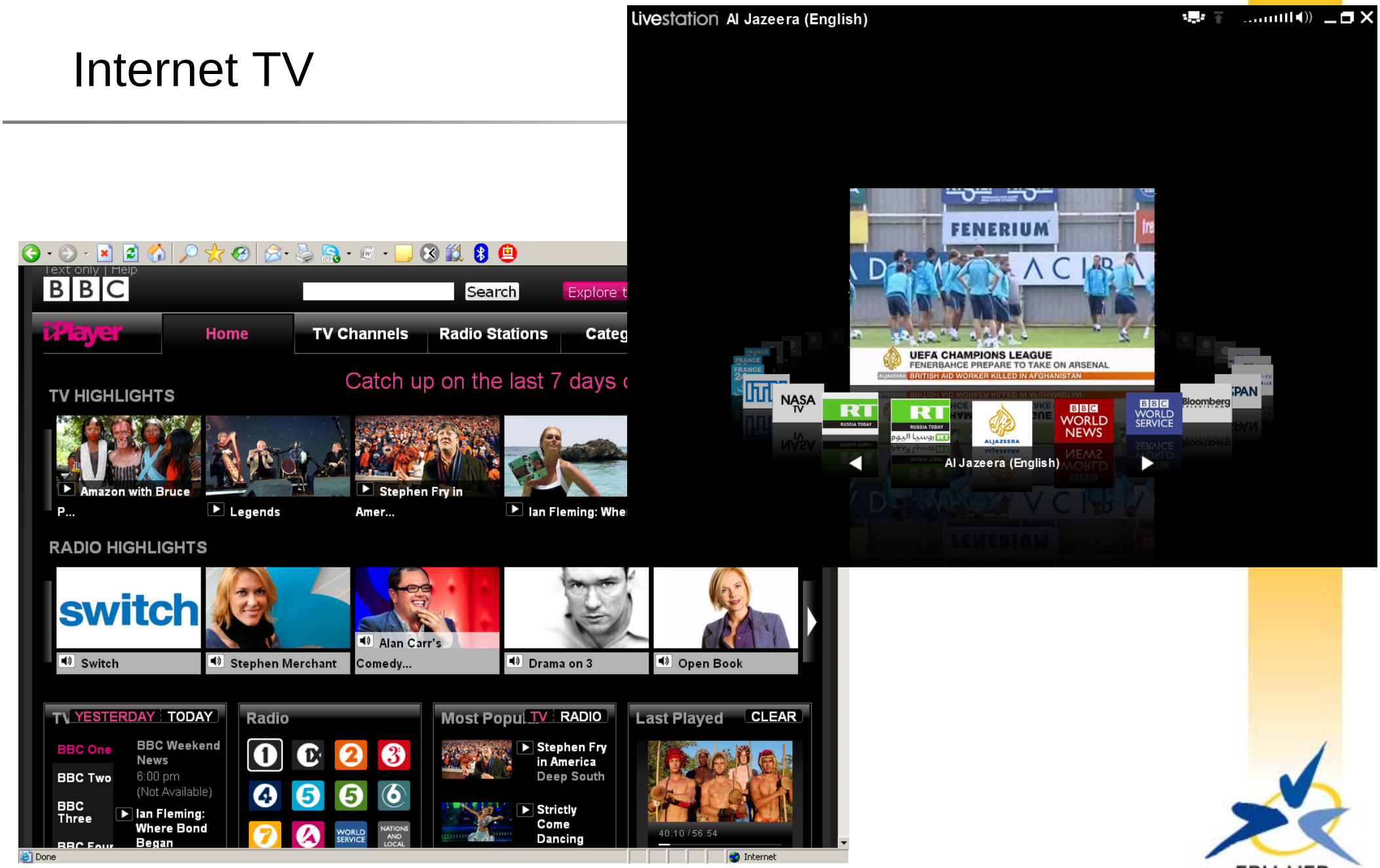
More than 155’000 unique visitors

45’000 concurrent streams

338’000 sessions

Total 171’000 viewing hours

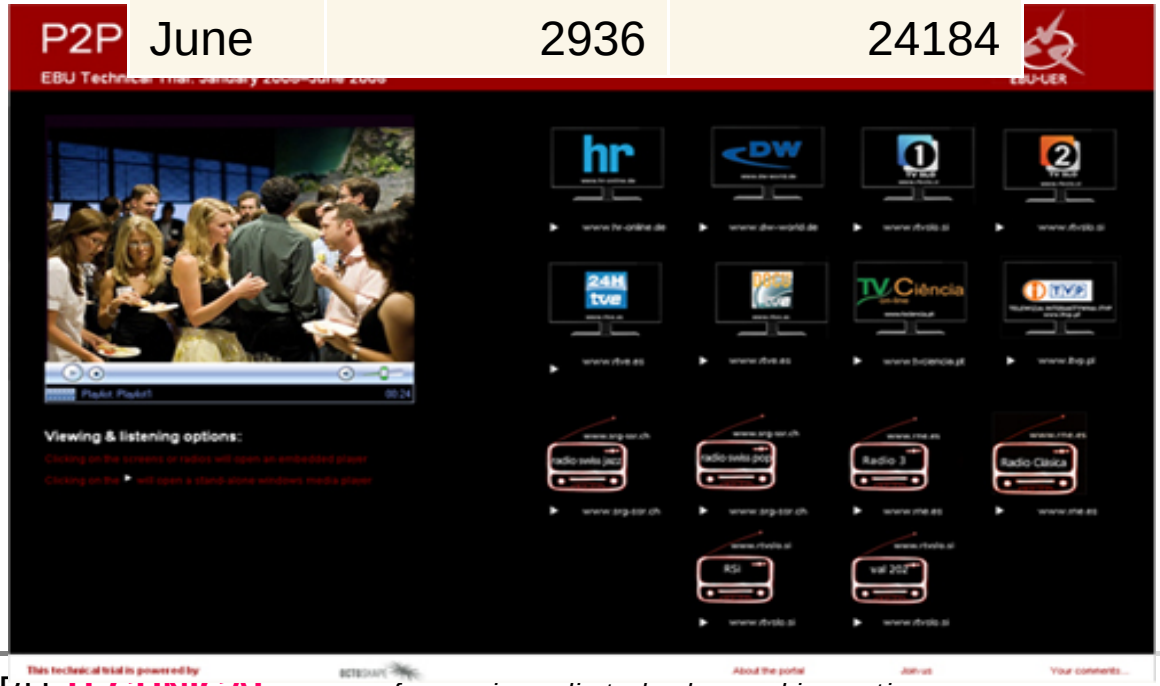
Internet TV


livestation Al Jazeera (English)
FENERIUM
UEFA CHAMPIONS LEAGUE
FENERBAHCE PREPARE TO TAKE ON ARSENAL
BRITISH AID WORKER KILLED IN AFGHANISTAN
NASA TV
RT
RUSSIA TODAY
ALJAZEERA
BBC WORLD NEWS
BBC WORLD SERVICE
Bloomberg
Al Jazeera (English)
Text only | Help
BBC
Search
iPlayer
Home
TV Channels
Radio Stations
Catch up on the last 7 days
TV HIGHLIGHTS
Amazon with Bruce
Legends
Stephen Fry in
Ian Fleming: Whe
RADIO HIGHLIGHTS
switch
Switch
Stephen Merchant
Alan Carr's
Comedy...
Drama on 3
Open Book
TV YESTERDAY TODAY
BBC One
BBC Weekend News
6:00 pm
(Not Available)
BBC Two
BBC Three
Ian Fleming: Where Bond Began
Radio
Most Popul TV RADIO
Stephen Fry in America
Deep South
Strictly Come Dancing
Last Played
CLEAR
40.10 / 56.54
Done
Internet

EBU P2P Media Portal

www.ebu.ch/members/EBU_Media_portal_Trial_1.php

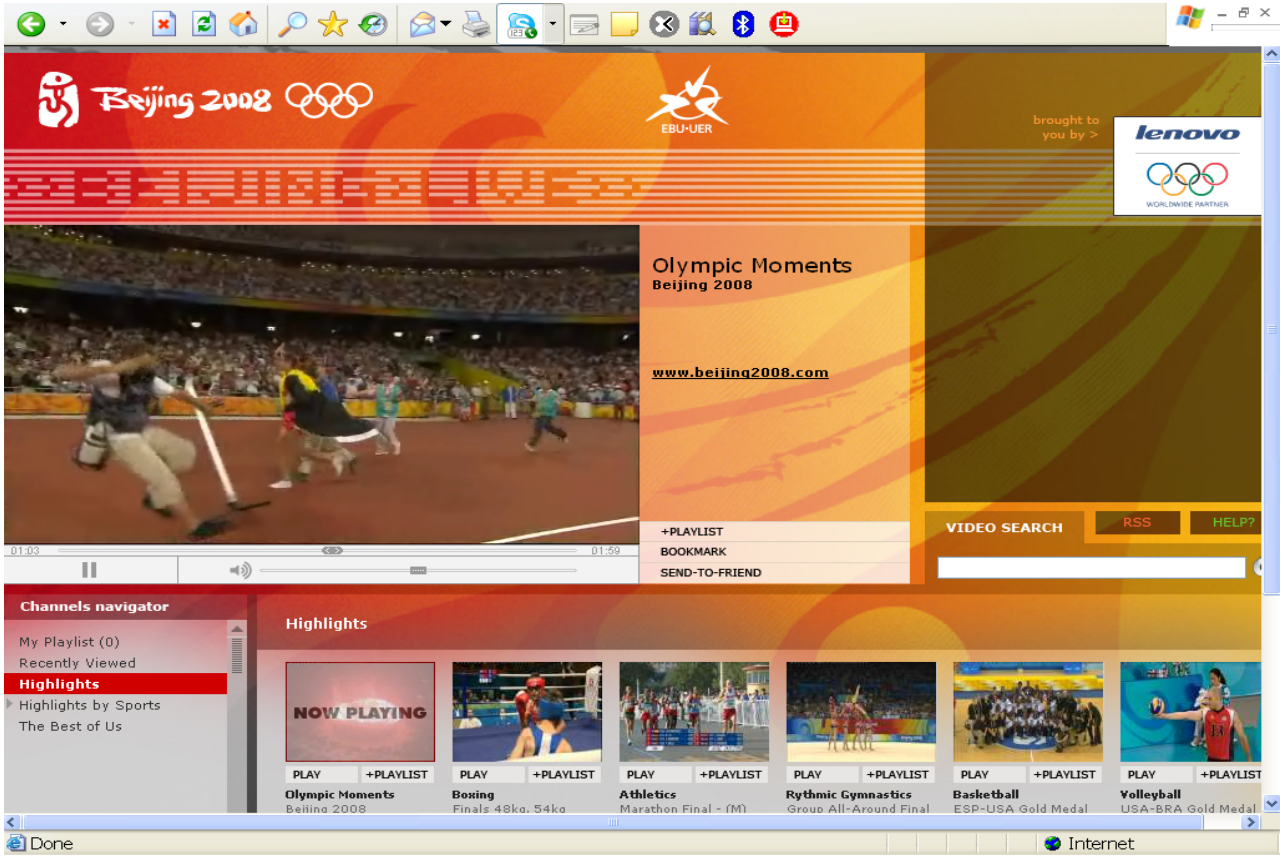
	Users	Hours
Jan	9072	32375
Feb	8157	39777
March	8652	44898
April	7031	41519
May	3808	26247
June	2936	24184



- Trial from Jan 08 to June 08
- Powered by Octoshape
- 8 TV stations - live
- 7 radio stations – live
- Video: 700 and 200 kbit/s
- Audio: 64 to 192 kbit/s (MP3 and WMA)
- Two video players: WM and embedded
- Geolocation “IP2location”
- Pre-roll advertising (HR)
- Audience stats –on the fly
- No DRM

Coverage of Olympic Games - CDN

Beijing 2008



www.nbcolympics.com

- NBC reached 214 m viewers
- 53 m unique users
- 75.5 m video streams
- 10 m hours of video viewed

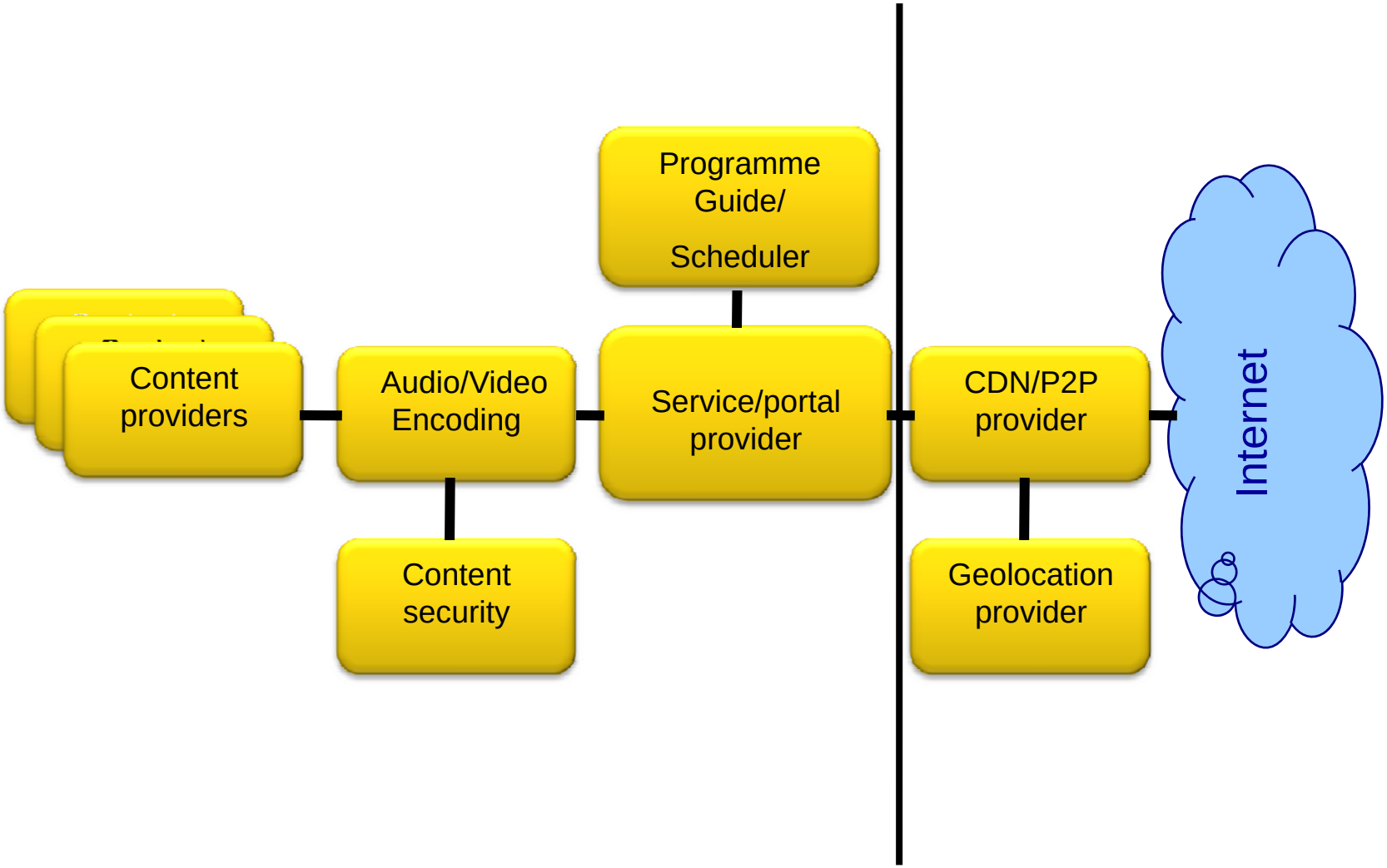
www.cctv.com

- 153 m people watched live
- 237 m people watched
- 20 m page views on mobile
- phone

www.eurovisionsports.tv/olympics

- 51 m unique users
- 180 m video streams
- 22 m hours of video viewed

Internet Distribution chain (CDN/P2P)



Broadcast requirements
for Internet distribution

Low cost compared to conventional broadcast

Reliable delivery

- no glitches, no interruptions, reasonable delay

Quality levels - high and standard quality

- HDTV and multichannel audio as well as SDTV and FM-quality
- extensive metadata

Large channel capacity

- there are no frequency spectrum constraints

Large number of concurrent users

- typically serveral millions of users at the same time

Secure delivery

Not only PCs – but also standardised CE devices

Broadband: Managed versus Unmanaged

Public broadcasters are starting to deliver TV and multimedia content in IP format to exploit ON DEMAND features:

- **IPTV over Telco** managed "closed" networks, for TV sets and STBs.

  Pros: quasi-broadcast quality.

  Cons: broadcasters are only "content providers", service offer and user profile controlled by Telco

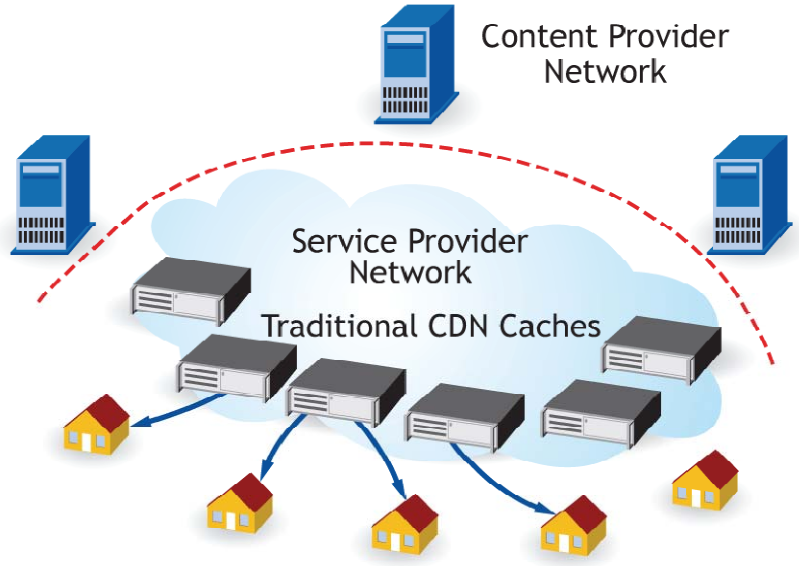
- **Internet TV** over open Internet connections, for PC user terminals.

  Pros: broadcasters fully control their brand/offer.

  Cons: limited picture quality and poor service continuity

- EBU are testing advanced techniques (CDN, P2P) to deliver high quality TV and HDTV on the OPEN INTERNET
- Possible convergence of broadcast / broadband services

Content Distribution Networks (CDN)

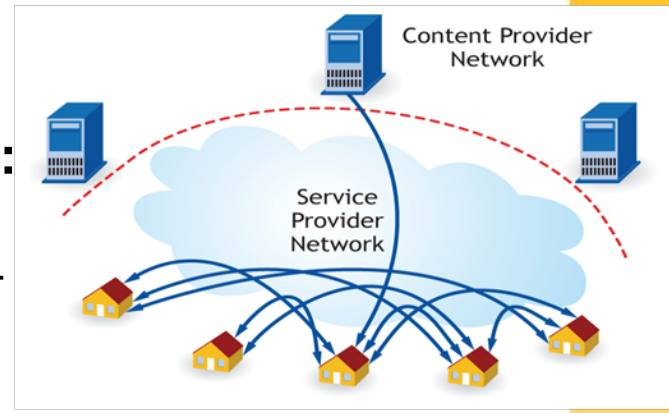


Peer-to-Peer

P2P is a distribution network consisting of users' computers or CE devices

Each user receivers *and transmits* segments to other users

However, users must allow to use their machines' storage and processing power, even after they have actively participated in sharing streams or files



No dedicated transmitting network is required:

- Little investment in the network infrastructure
- Almost zero distribution cost for service provider
- No single point of failure
- Highly scalable

P2P can covert two-way communication (one-to-one) networks into efficient one-way broadcast (one-to-many) network

Motivation for P2P

P2P is increasingly an attractive solution for carrying media across the internet and seems to be an attractive long term solution for the following reasons:

- P2P is an overlay to the existing broadband network and does not change the existing network infrastructure
- Relatively low service cost (per GB delivered) compared to Content Delivery Networks (CDN)
- Low investment and maintenance cost,
- Excellent scalability
- High service reliability
- No single point of failure

- Lower network load (compared to unicast).

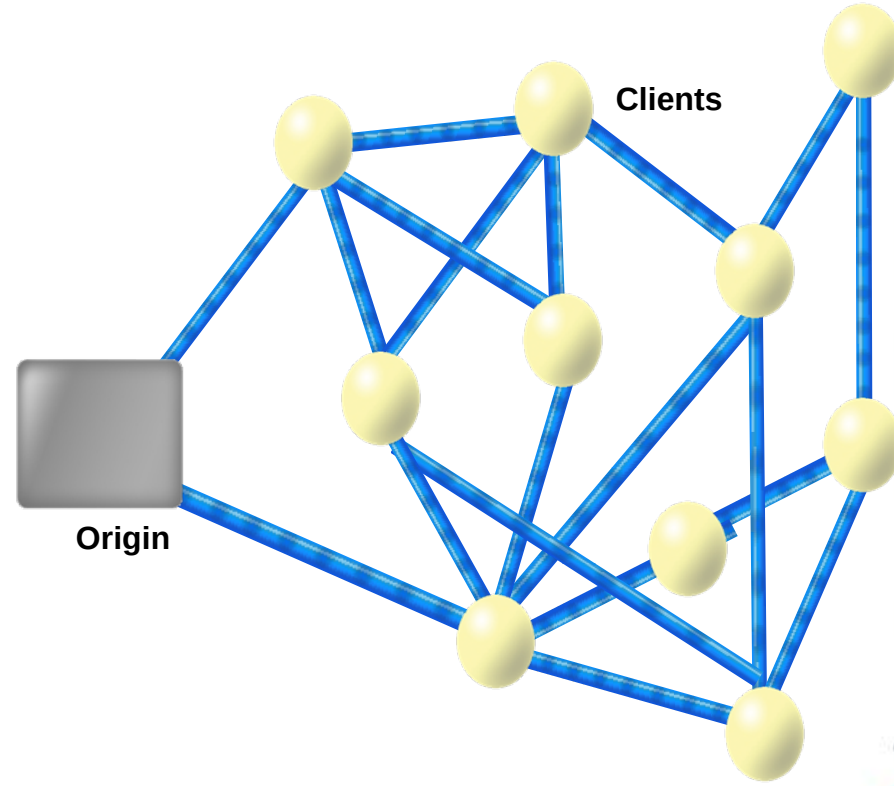
Network cost

- Up until recently Internet was uneconomic
- Some Broadcasters built their own Internet server factory
- Investments in the Internet streaming infrastructure was very high
  - Only powerful and rich broadcasters can afford large investments

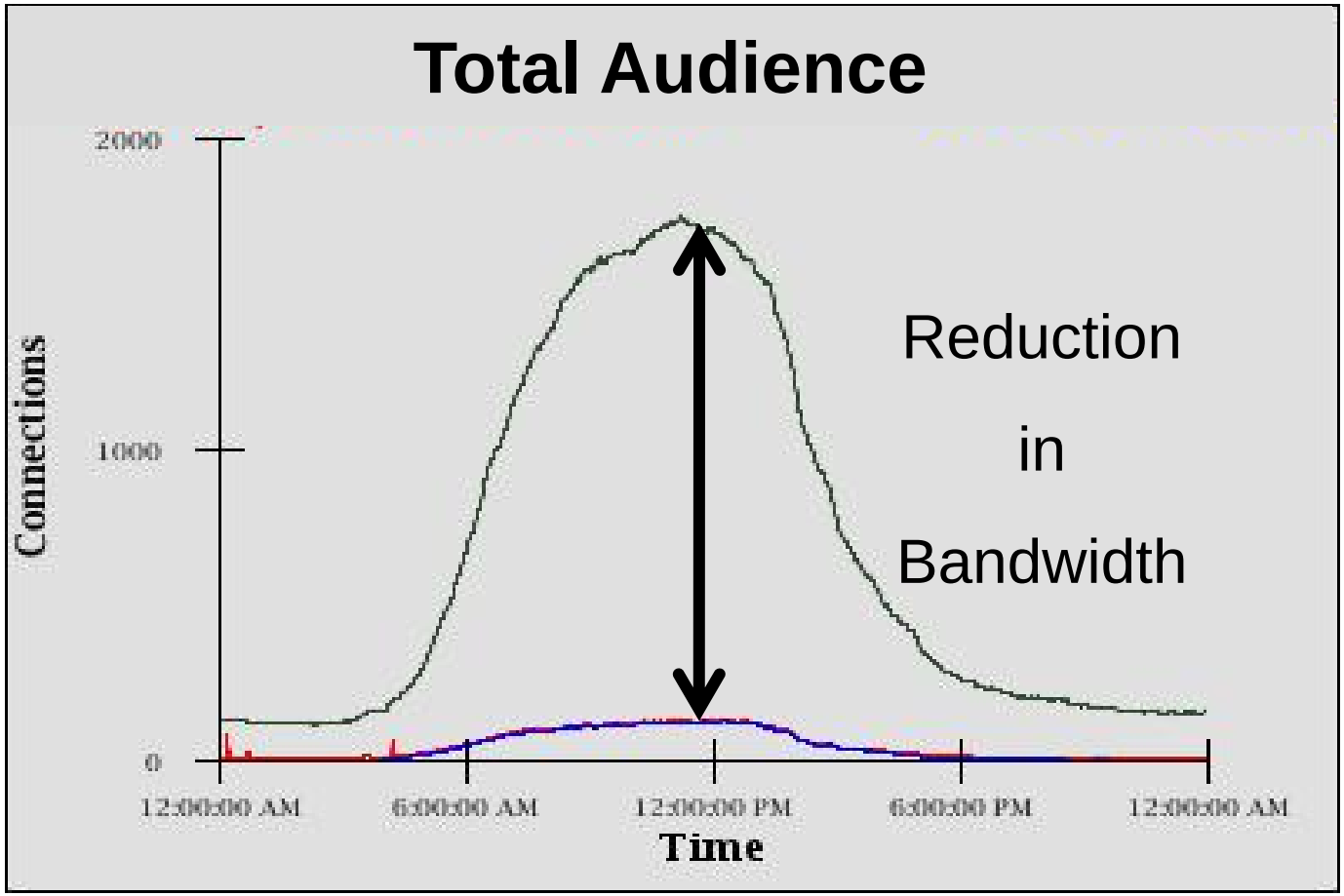
- Some other broadcasters became dependent on Internet Service Providers (ISPs)
- Business relationship with Internet Service Providers
  - Expensive bandwidth – we pay per stream
    - 1 GB costs 1€
    - 1 stream of 256 kbit/s per 1 hour costs 0.115 €
    - ESC: 100’000 users, 3 hours, 512 kbit/s should cost 70’000€

Using conventional unicast streaming over the Internet, cost *per user* is between 100 and 1000 times more expensive than for terrestrial networks (such as DAB or DVB-T)

P2P architecture: TREE versus GRID



Example Streaming Network Efficiency



1882 Total Audience

X 64Kbps

= 117.6Mbps

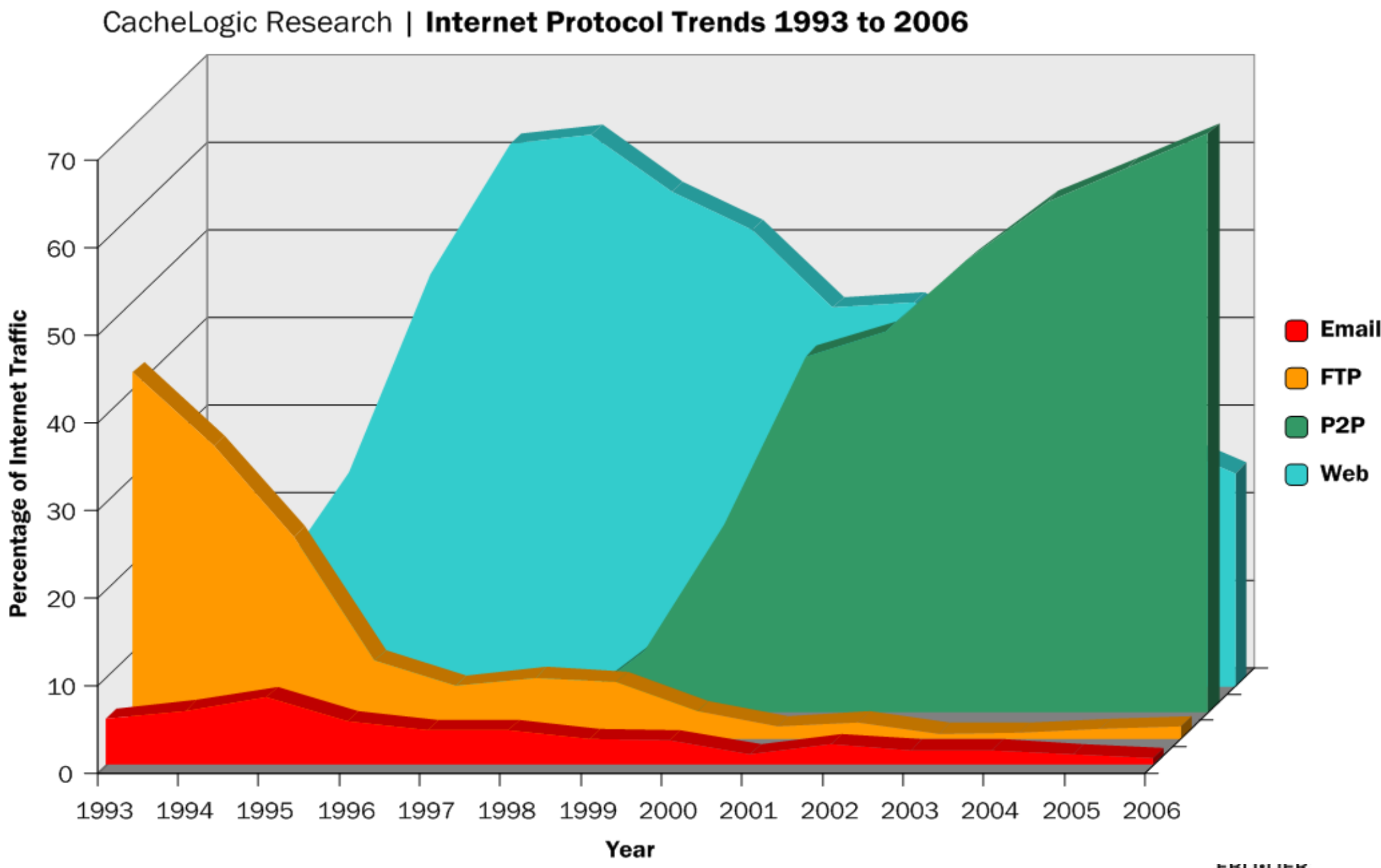
102 Direct Connected

X 64Kbps

= 6.4Mbps

Bandwidth saved

= 111.2Mb/s



courtesy Cachelogic

Commercial P2P – state-of-the-art

Today more than 50 broadcasters deploy P2P portals for

- downloading
- VoD
- streaming

P2P streaming

- BitTorrent, Abacast , Octoshape , PPLive, TVKoo, Rawflow, TVants

P2P download

- BitTorrent, Azureus & Aelitis, Kontiki

CCTV (China PSB) was using P2P PPLive for the Olympic Games 2008 from Beijing

PPLive reported more than 10 million (!) concurrent streams

Hybrid P2P-CDN

P2P services are increasingly being used in conjunction with other delivery mechanisms such as CDNs, as opposed to stand-alone P2P systems

Examples:

- Octoshape going with CDNetworks
- Joost moving to CDN
- Rawflow using Velocix

Dedicated super peers

Temporarily assigned peers (hyper peers)

Edge caching servers

Complementary CDNs

Inter-domain issues

P2P is most efficient system for *local*, contained area services

It seems to be less suitable for *inter-domain* services involving two or more different ISPs, especially if the broadband network is star based (example: the Netherlands, the UK, etc). In this case traffic goes via a backbone linking two domains which makes P2P less efficient than unicast.

Novel algorithms proposed by DCIA's P4P and several EC funded projects provide solutions to this problem.

Intelligent P2P

Several P2P approaches have been recently refined (or are in the process of becoming more “intelligent”)

They understand the broadband network topology, so that media flows can be optimised. Examples: Octoshape, Tribler (NextShare).

- smallest number of hops
- shortest latency
- lowest transport cost

Such “intelligent” P2P systems are able to potentially ease substantially the network load and improve service quality, compared to traditional P2P systems (such as BitTorrent, Kazaa, etc).

ISPs should adjust themselves to adopt P2P

Intelligent P2P should ideally enable all players in the value chain to improve their services (win-win situation)

Nevertheless, all players will need to adjust themselves to the new P2P paradigm (if P2P is to be commercially successful).

For example, in the light of commercial pressure and vigorous competition, ISPs may wish to make their networks

- more symmetrical
- offer higher download and upload capacities,
- introduce flat rates and
- remove service caps (ceilings).

All business models

The future P2P standard should be able to accommodate any business model in order to satisfy commercial requirements of any constituency in any country.

Examples:

- flat rate
- various solidarity approaches
- bandwidth as currency

Ideally, the *same* P2P standard should be able to perform streaming, downloading, VoD, catch-up TV, etc.

DRM and geolocation

P2P services should be restricted to the use of the rights-cleared, copyrighted content

All content related copyrights should be cleared out in advance to P2P broadcasts.

Suitable rights system should be used

Suitable geolocation system should be used in order to restrict access territorially, if required for copyright.

Building Communities

P2P is a “natural” environment for building different group of users interested in the same programme and willing to chat, share, communicate, invite friends (and friends of friends) and help each other.

Incentives for the users

Incentive mechanisms in P2P environment are very important – people should be encouraged to share content and contribute to the aggregate upstream capacity.

- One incentive mechanism could be “progressive service/QoE degradation” in the event that the consumer does not contribute upstream bandwidth
- Use of a “battery level indicator” with markers for HD, SD, CIF, QCIF to incentivise the correct usage pattern
- Convergence towards parity upload/download should be an ideal target

Large-scale VoD HD-quality long tail could be provided

Some challenges

Users have to install a P2P plug-in software

- Some corporations do not allow to download .exe or Java files
- Octoshape has proposed a Java-free plug-in
- P2P-Next is developing a session-based plug-in, which is downloaded together with the content

Users should contribute to upstream bandwidth

- It would be important to identify mechanisms which encourage users not to switch off their devices when they do not watch TV programmes.
- Overall energy consumption of potentially millions of such stand-by devices should be taken into account.
- Might be a problem if the total bandwidth is capped

High Quality (HDTV or 3D) TV streaming

- Due to xDSL asymmetricity (downstream/upstream bandwidth ratio)

Security

- User and source authentication required

P2P standardisation

In order to accommodate P2P-enabled CE devices in the market, there is a strong requirement to standardise a P2P algorithm

Before it is standardised, P2P algorithm must be

- fully specified, so that it can be reproduced by any interested partner,
- checked whether or not it fulfils all commercial requirements,
- fully tested by independent laboratories
- IPR issues must be resolved

Other layers of the stack (e.g. video coding, middleware, metadata, signalling, interactivity, authentication, etc) should also be standardised

PC vs. CE device

- Intel Core 2 CPU~30,000 MIPS
- >= 1 GByte RAM
- S/W Decode Audio/Video
- Lean forward UI
- Current YouTube Quality OK?
- PC Powerful, User Extendible Device

- Embedded CPU Core~300MIPS
- 16 -128 MByte RAM
- Decode “On Chip” H/W Audio/Video
- 10 feet UI
- Current YouTube Quality OK?
- Appliance, designed for purpose

EBU Project Group D/P2P

Was set up in 2006, Chair: Frank Hoffsümmer (SVT), more than 50 members from all constituencies

3 tasks:

- studies the commercial P2P propositions and related business models
- prepares a background paper on P2P and EBU requirements for a viable P2P system
- contributes towards developing an open source P2P system (perhaps based on TUD Delft “Tribler”)

Cooperation with DVB, EU funded P2P-Next Project, American DCIA (Digital Computing Industry Association) and the network operators and ISPs

Works with the EBU Legal Dept on net neutrality

Plans to co-organise a World P2P Summit with all interested parties

P2P-Next

EC funded project – FP7

Started in January 2008, 20 million €, 4 years

Will develop an intelligent algorithm based on Tribler

The Project includes all constituencies including broadcasters, operators, manufacturers

- EBU and three EBU Members (IRT, BBC, RTVSLO) are active members of P2P-Next

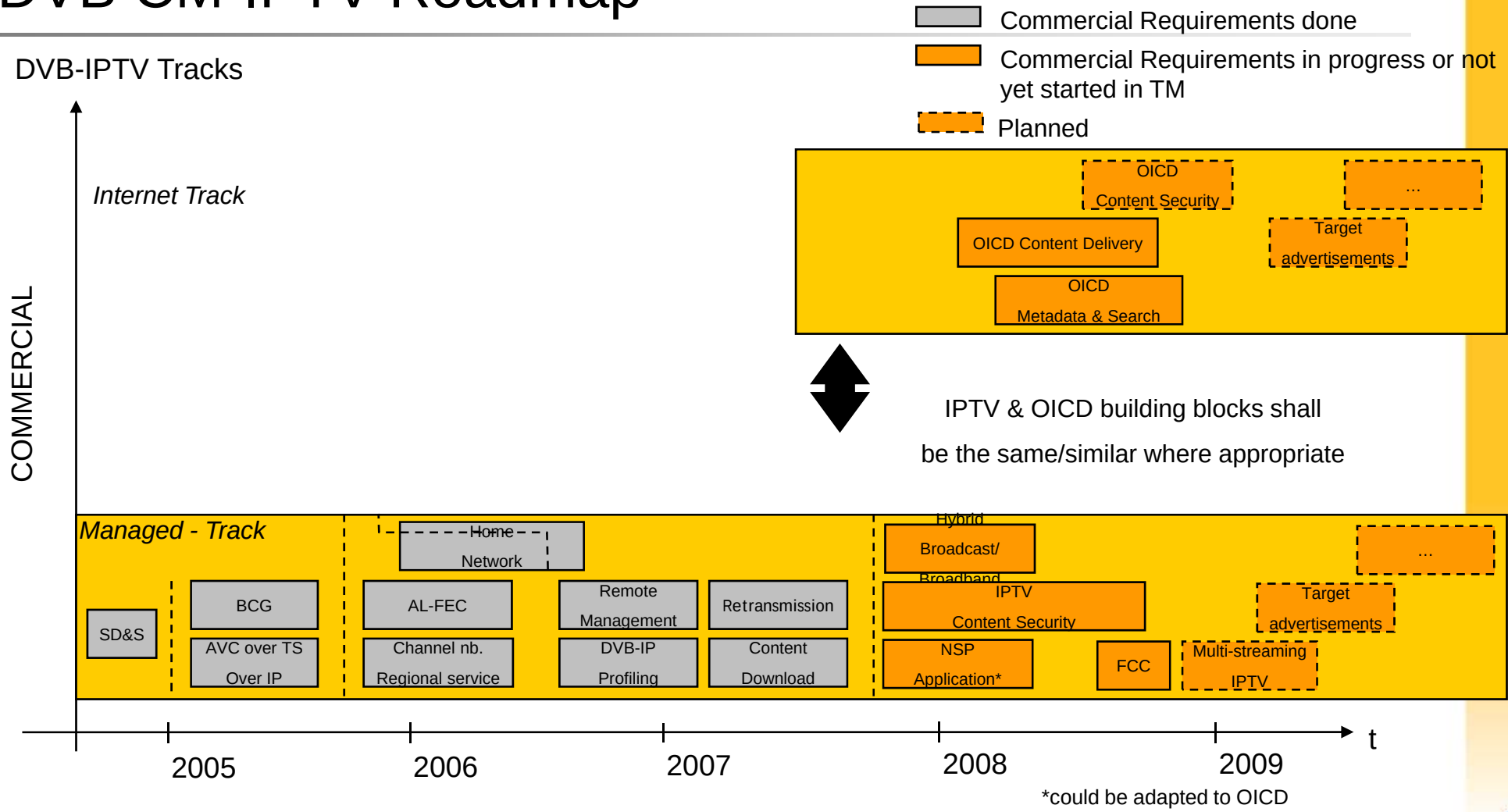
Will provide an open, legal, trusted, license free P2P stack system

Will be available to all content providers for no cost

Will develop a living laboratory with some 20’000 set-top boxes

An initial P2P-enabled STB demonstrator has been developed by Pioneer and shown at the IBC 2008.

DVB CM-IPTV Roadmap



And finally ...

In the past P2P protocol has been tainted by its association with copyright piracy.

Many detractors still associate P2P with illegal file sharing.

It is now high time to remove its bad name and consider P2P a legal mechanism for transport/distribution of legal TV/video content.

If all barriers are overcome, P2P may become a dominant media delivery mechanism on the internet in the forthcoming years