Improving multimedia content delivery in CARNet community

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TwoOfUs (tm)

- **Zvonimir Zelenika**
- B.Sc.EE Telecommunications/FER, Zagreb
- CARNet 1996-2002, some networks, mostly multimedia
- TrioMedia 1998-1999, multimedia CDs, multimedia webs
- As of 2000 – Multimedia services in CARNet – CARNet MoD, iTV

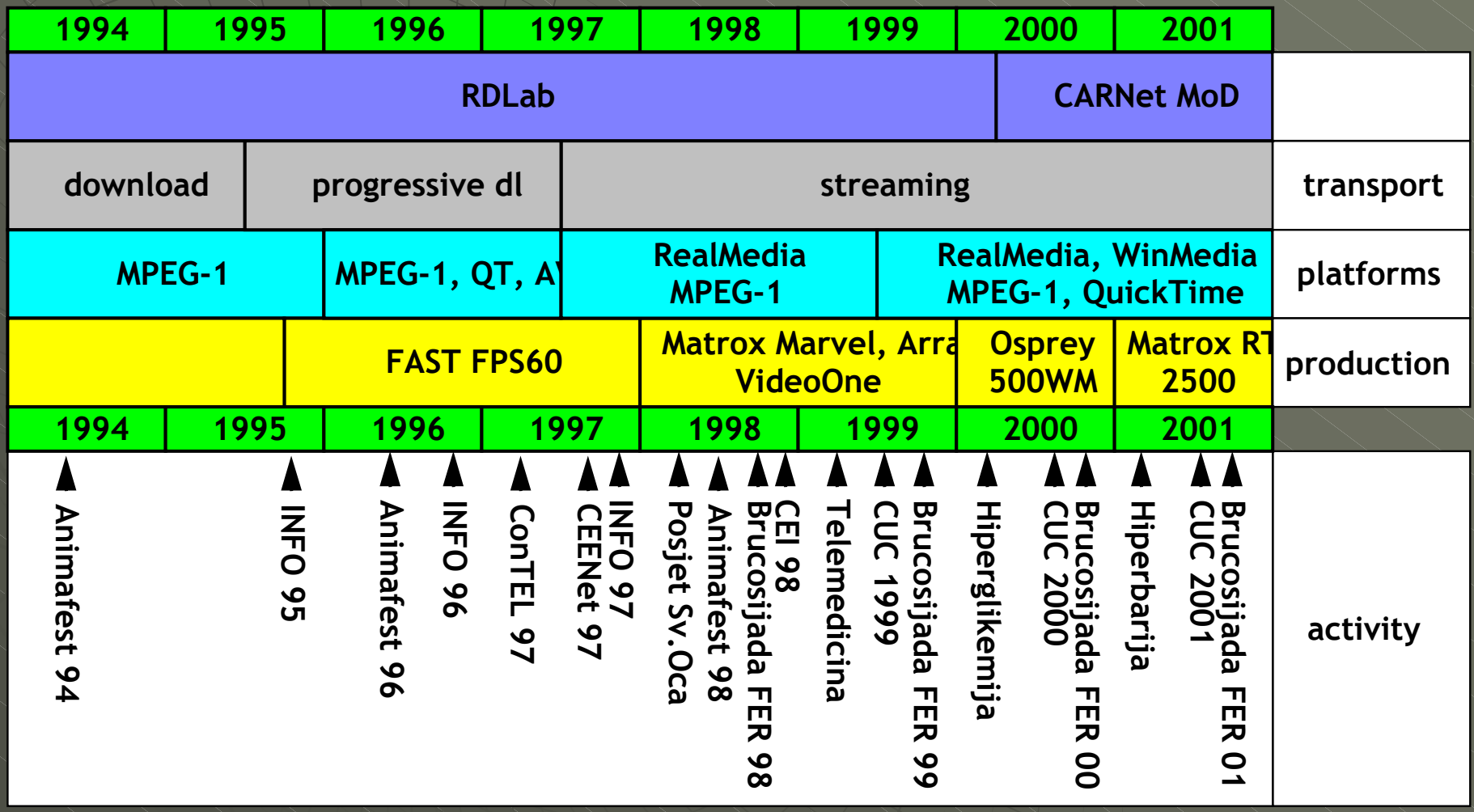
TwoOfUs (tm)

- **Robert Maček**
- Allmost B.Sc.EE (final year)
- Radiocommunications/FER, Zagreb
- As of 2001 – CARNet Multimedia services
- Testing and Implementing of media services and technologies

Our work in CARNet

- Development and implementation of multimedia applications and technologies
- CARNet Research and Development Laboratory – small competence and development centre for multimedia
- Implementing multimedia applications since 1994

History...


1994
1995
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RDLab
CARNet MoD
download
progressive dl
streaming
transport
MPEG-1
MPEG-1, QT, A
RealMedia
MPEG-1
RealMedia, WinMedia
MPEG-1, QuickTime
platforms
FAST FPS60
Matrox Marvel, Arra
VideoOne
Osprey
500WM
Matrox RT
2500
production
1994
1995
1996
1997
1998
1999
2000
2001
Animafest 94
INFO 95
Animafest 96
INFO 96
ConTEL 97
INFO 97
CEENet 97
Posjet Sv.Oca
Animafest 98
CEI 98
Brucosijada FER 98
Telemedicina
CUC 1999
Brucosijada FER 99
Hiperglikemija
CUC 2000
Brucosijada FER 00
Hiperbarija
CUC 2001
Brucosijada FER 01
activity

We'll talk about transport

- In the beginning universe was created
- Transport of multimedia over the Internet is tricky business
- Internet was made to survive The Bomb, not to transport multimedia
- QuickTime 1.0 in 1991 brought multimedia to personal computers
- Also, along came the Internet

First idea...

- We'll put multimedia files on web server and let people download them
- You needed to download complete file as some headers were at the end of the file (sounds bit oxymoronic)
- Also web browsers would do the download (HTTP/TCP) and then launch media players by the extension

Second idea

- We'll move all headers to beginning and teach media players to do the download themselves and be able to show the file before they download it completely
- If network speed > media bitrate, we'd get uninterrupted stream
- This was called progressive download
- Again, works over HTTP/TCP

Progressive download

Great idea came around

- With progressive download we would transfer lots of useless content
- So, we'll synchronize server and player and deliver the content at the speed of its bitrate
- Turned out that we would need specialized servers – media servers which would know how to talk to the player

Great idea continued

- TCP sucks for this purpose – we can survive loosing some packages
- We'll use UDP, and implement "session" on a level above with some thin protocol
- In the beginning we'd use PNM and XDM, but IETF standardized RTP, RTSP, RTCP both for transport and for control
- It is called streaming

Streaming

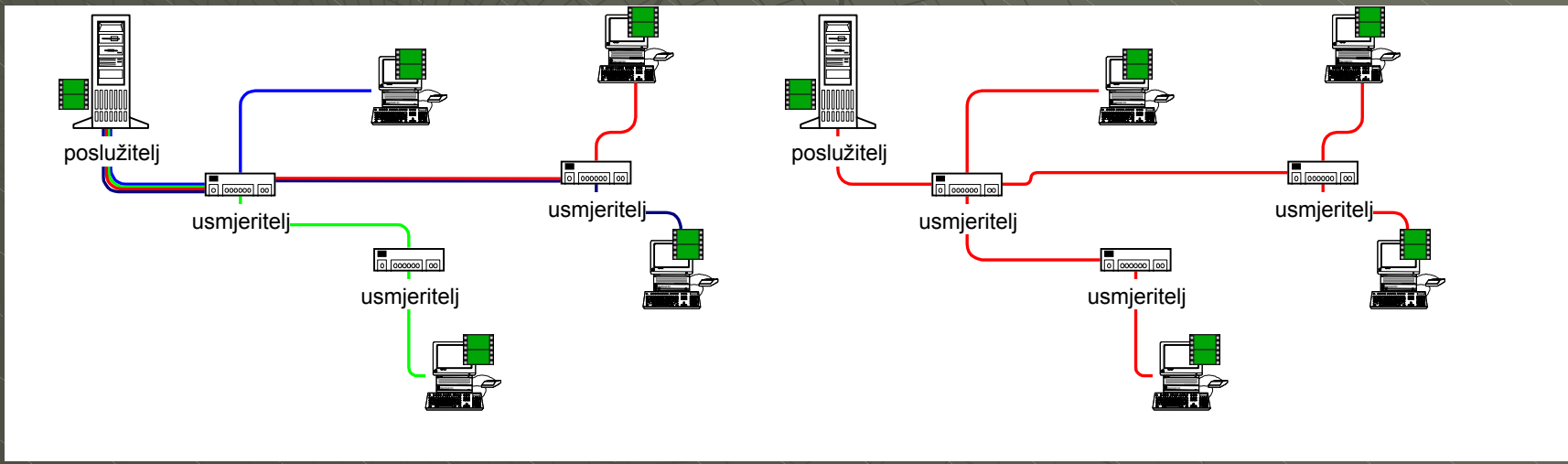
cuc2000.mov
File Edit Movie QTV Window Help
cuc2000.mov
Streaming Trac
Bit Rate
Data rate (kbits/sec):
Current:
Average: 837.83
Maximum: 2986.37
Packet loss (percent):
Current:
Average: 3.28
Maximum: 87.15
Buffer size:
<stopped>

But (there's always but)

- Every client would connect to a server and pull a separate stream
- Servers need "big pipes" to be able to serve large audience on high bandwidths
- Our record: 25Mbps from the server
- So, the idea of multicast came to be to reduce the load on the servers and the backbone

unicast vs multicast

- Unicast – every client receives its own stream, clients receive separate streams
- Multicast – network multiplies the streams, clients join/leave groups receiving the stream



multicast vs unicast

- Clients join/leave from multicast groups transmitting media streams
- Network multiplies the streams to every client in the group
- We need:
  - multicast network
  - multicast enabled clients
  - multicast enabled servers

multicast network

- We don't have it now, just a testbed
- It's due to our implementation of the backbone with IP running over ATM AAL5
- Also due to design of the backbone routers running as LANE, not PVC/SVC
- There were pros and cons of these solutions, but to gain some things multicast was bit sacrificed

multicast network

- But new Network is coming – our little pig
- GiCa – Gigabit CARNet
- And we're damn sure we'll implement multicast in it (together with many other nice TLAs and FLAs)
- We'll handle the address space, make applications and solutions

CARNet MoD/TV is ready

- We have a small testbed multicast network in our lab
- Our media servers are already talking multicast with unicast rollover for non-multicast clients
- Windows Media Services 9
- Apple Darwin Streaming Server
- still lots to do, but we're getting better

Windows Media Services 9

- Full Paper with this presentation is obsolete, we moved to next-generation Windows Media Services 9 as primary content-delivery mechanism
- Supports multicast in Enterprise Edition, we're currently running it on Windows .NET Server 2003 Beta (soon RC1)

Publishing Point

- More-or-less equivalent to the "program"
- On Demand or broadcast
- Only broadcast can be multicasted
- Description files (almost SDPs) are created to define parameters of the multicast group we transport to
- Just with mcast we can't properly monitor number of clients connected

Problems

- Actually people mostly (both around here and in Microsoft/Cisco)
- Multimedia applications and Network technology are too often observed as two very separate things, though its crucial to cover both of these "layers"
- Need to use multidisciplinary approach from Layer 1 to Layer 7

Where to go?

- Our Cisco routers are starting to talk multicast
- We hope to spread to FERs network (new GBEthernet-based backbone)
- With new CARNet backbone we'll spread the scope of multicast network until we cover entire network
- Implement Video Conferencing, Streaming, IP Telephony

Vision

- CARNet Video Network
- Enable everyone in CARNet community to use multimedia in their work/life for education and entertainment
- Provide "multimedia infrastructure" capable of supporting all the wildest dreams – on network, applications and services level

Q & A