The CESNET supports telemedicine in Czech Republic

Talk focused on live-surgery and communication tools used for HD video

Jiri Navratil,
CESNET a.i.e. Zikova 4, Prague, 16000 Czech Republic

7th – Asia Telemedicine Symposium
December 13th – 14th 2013
Bangkok, Thailand

CESNET provides live-surgery as service

Live demo surgery or 3D video productions become the integral part of big medical symposia, annual conferences and specialized workshops

Such events are today only cases for which Czech MD are able to make a time. It is the an occasion where to exchange their experiences and to show their own mastering

Our service integrate communication between end sites (surgery room and venue) and the multimedia presentations in the venue. It is complex service requiring several types of specialists

We transmit (live video or video recordings in different format, size and quality) from different medical theatres to different rooms/halls/etc.

The size and the place of the conference defines the presentation mode and the tools used for such event.

Currently such service is not commercially available on the market.
Jiri Navratil, CESNET

We transfer different video signal from different surgery theatres

CESNET connects all University and academic institutions (including hospitals)

as S.Shimizu said
it is not enough for telemedicine, telemedicine need to be everywhere

It is also valid for the live-demos
Conference venues are in different places

- **Neurosurgery, CENS2012**
  - Prague - old town

- **Microsurgery**
  - Brno - Exhibition area

- **Urology**
  - Ostrava - new concert hall

- **Gynekology**
  - Poděbrady spa

Conference venues are in different places.
1) **H323 videoconference units**
(0.5 - 6 Mbps with compression)

- Codec – high compression
- Low quality of colours and grey scale,
- High latency (1-5 s)
- With MCU up to 40 clients for Point-to-Multipoint VC

2) **DVTS - Plus**
*based on DVTS (2001) DV stream on IEEE1394 encapsulated to IP* *(developed in CERNET/Tsinghua University)*

- 35 Mbps
- Free software,
- no compression,
- no internal latency
- Quality defined by the camera

Widely used in APAN medical community
Streaming service
Two levels of connection (V->S, S->Ib)

- Java driven (JRE)
- Bandwidth: 1 - 25 Mbps
- Client bandwidth required
  -- 2 Mbps for SD
  -- 6 Mbps for HD
- Different Internet browsers

Photos from
EYE CLINIC VETERANS MEMORIAL MEDICAL CENTER (Quezon City, Philippines)
More complicated situations need more complex solutions

- Transfer more HD signals in both directions
- 3D mode
- on-line transmission without latency
- large formats 4K appeared in medical devices (cardiology - Siemens Artic zee)
  etc.

We have two platforms for advance video transmissions

- 4K Gateway (HW box)
- ULTRAGRID (software on PC or MAC)

Both were developed in CESNET research teams during last 4 years, they have very similar characteristics and their own advantages)

MVTP-4K (Modular Video Transfer Platform)
Old name for 4K Gateway
http://www.4kgateway.com/

http://www.4kgateway.com/content/files/VisualUnity_4KGateway_techspec.pdf
Scheme of using 4K Gateway for 3D live-demo with own video production

Video from Operation room

Modular Video Transport Platform - codec MVTP-4k

10Gbps NETWORK

MVTP-4k

2 HD videosignals (Left a Right eye)
+ VC videos with sound

Multiple HD signals into venue ZOF2013 with satellite link from Italy

Satellite AM44

Camom Milano, Italy

Gemini Clinic Zlin, CZ

Distance ~5 km

Camera in surgery room

Laser

HD signal

Microphones/ headphones

Monitor (view from conference center)

Distance ~5 km

Conference center

Internet

H.264 streaming

3D projection (surgery)

2D projection (operating room)

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ZOF Satellite transmission Milano - Zlín

Projection to multiple screens

http://www.ultragrid.cz/en

Software for low latency and high-quality video network transmissions

Ultra-high definition video stream

End-to-end latency low as 100 ms

Transmissions using PC and Mac HW
Basic scheme of using ULTRAGRID

Network

Mac Pro

dual-link HD-SDI

BaseLight Four

Mac Pro

dual-link HD-SDI

SONY SXRD 4K

Recommended HW

LINUX SETUP

Mac Pro with at least 3 cores
OpenCL + compatible card
For enco-deco streams
10G/GE network interface card
For 50i or 59.94i capabilities, DVI

MAC SETUP

Intel-based Mac Pro with at least 3 cores
10G/GE network interface card for
1080p streams or better encoding or
reconverting
For sending capabilities QuickTime

Nvidia GeForce GTX 580

GPU Engine Specs

CUDA Cores 512
Graphics Clock (MHz) 772 MHz
Processor Clock (MHz) 1544 MHz
Feature Support
OpenCL
PCI 5.2.1

Supported Technologies
3D Vision Surround, SLI, DirectX 11, CUDA, 3D Vision, PhysX
SLI Options
3-way
Famous ULTRAGRID users

Electronic visualization laboratory
FCCN
California Institute for telecommunications and IT
University of Michigan Medical School
LSU national center for biomedical communications

ACM Open-Source of the Year Award
October 2012

We win Open-Source of the Year Award ACM Multimedia 2012 conference through the paper "ULTRAGRID: Consistently high-quality video transitions using commodity HW.”

GPU-Accelerated Compression

- Performance numbers (including transfer to/from GPU)
  - DXT1 GLSL: 798 Mpix/s (Nvidia 580GTX), 593 Mpix/s (ATI 6980)
  - DXT5 GLSL: 349 Mpix/s (Nvidia 580GTX), 305 Mpix/s (ATI 6980)
  - JPEG CUDA: up to 1,580 Mpix/s = 4,740 MB/s (Nvidia 580GTX, 4844, Q=60)
  - DXT5 CUDA: 21,580 Mpix/s (Nvidia 580GTX)

Now... what bandwidth do I need?

Bandwidth

1080@30

990 Mbps

245 Mbps

489 Mbps

From 20 Mbps

From 80 Mbps

No compression

DXT1

DXT5 YCoCg

H264

M-JPEG

Codec
3D laparoscopic surgery
Urogynecology and pelvic reconstructions
Zlin, October 2013
http://urogyn2013.bpp.cz

From the hospital to the venue transmitted via Ultragrid

“we provide live-surgery as service but ..”

On big events we need collaboration with multimedia companies

(Main problem, it needs extra money)
Strong projectors, 3D projectors with glasses, etc.
Flexible Managing
(Picture in picture, different images in different screens, etc.)
XXI conference of ČKS (Czech Cardio society) May 2013

ULTRAGRID transfer

Projection to multiple screens

3D video
(doubled lines, etc.)
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Thank you for attention