POZNAŃ SUPERCOMPUTING AND NETWORKING CENTER
Long-distance Human-Robot Interaction with 3D UHDTV 60p video supported by VISIONAIR
Enhanced Media Content Generation, Transmission and Consumption I

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Poznan Supercomputing and Networking Center

- Center for Development of e-Infrastructure
- Center for Research & Development
- New Generation Networks
- Grids
- Digital Libraries and Portals
- Cyber Security
- New media technologies (UHD, 4K/8K/16K, 3D)

- Network
  - Research Metropolitan Area Network – POZMAN
  - PIONIER - National Research and Education Network

- HPC Center
  - Clusters, Multiprocessor computational servers (SMP), Graphical servers, Service providing systems, Data storage infrastructure.
New Media Research in PSNC

- **4K 3D node** (since 2008)
- High bandwidth streaming over optical networks
- Professional Educational TV *platonTV*
- Advanced visualization (clusters)
- Real time rendering and interfaces human-computer
- Videoconferencing and augmented reality
- Electronics development (mini 4K cam)
Keynotes of demonstration

**Long-distance**

**Human-Robot Interaction with**

**3D UHDTV 60p video**

**VISIONAIR**

**Assumptions:**
- TERENA Networking Conference (2013, Maastricht)
- Collaboration with SURFNet, Univ. Of Twente, Ciena
- 40Gb/s connection between Poznań and Maastricht
  - And fill the pipe…
- 4K 3D HFR
- Holographic illusion display in 4K
- Robot interaction with force feed back
Issues and problems – 1

• Distance between Poznań and Maastricht
  – 900 km road distance
  – 2000 km network optical path
  – Can we send it?
Issues and problems – 2

- Logistics and funding
  - Transportation
    - UHD devices to Maastricht:
      2x 4K projectors, several monitors
    - Ciena network devices and robot arm to Poznań
Issues and problems – 3

- Building cinema room

- 5 meter wide screen
Issues and problems – 4

• Technology integration
  – Different video interfaces:
    • single SDI / dual SDI / 3D / DVI / HDMI / DP
  – 4K vs UHD resolutions
  – No support for all video modes, resolutions, frame rates
Maastricht
Poznań
Haptic technology and game

- Remote gameplay using robot arm
  - Leaning tower of Pisa
- Force feedback controller
- Natural experience over long distance
- Low latency
- Haptic Master from University of Twente
Network for video transport

- 2.000 km lightpath
- 40Gb/s link between Poznan and Maastricht
  - Direct PIONIER (PL) and SURFNet (NL) network (via Hamburg)
  - No regeneration!
  - 10 ms network latency (OWD)
- Ciena Ultra Long Haul system
  - Error-free transmission of the 40G ULH alien wavelength using Ciena dual carrier BPSK coherent optical technology
  - Video MOTR cards
    - 12x SDI 3G in-out
4K / UHD

- Resolution: 3840x2160
- 3D stereoscopic image
- High Frame Rate – 60 fps progressive
- Low latency:
  - 50ms for video + 10 for network (~4 frames!)

2x JVC GY-HMQ10

2x SONY SRX T-105
And of course it was a bit more complicated...
Holographic illusion display in 4K

Half-mirror foil

Real objects view

Virtual objects view

4K LCD
Uncompressed and compressed video

• Demonstration „Comparison of JPEG2000 and uncompressed video”
  – Network bandwidth
  – Latency
  – Visual quality

• Results:
  – 24 times less bandwidth
    12Gb vs 500Mbit
  – No visible degradation of signal
  – Latency increased up to 120-160 ms (additional 4-6 fr.)
Why not HEVC?

• **HEVC** is a fresh standard
  – No devices capable to encode/decode real-time UHD

• **JPEG2000** is a Digital Cinema standard for encoding
  – Use of intoPIX Pristine4 encoding/decoding cards
  – Mature 4K 3D streaming system: collaboration of intoPIX and PSNC
  – SURFNet and PSNC has been using the system for last 4 years
Plans for future

• Go for 8K / UHD-2
  – No camera
  – No display to be transported
• Use of multiple own 4K cams
• Use 100G network
• Try to compare HEVC vs. JPEG2000
The demonstration was possible thanks to VISIONAIR project

The VISIONAIR project

- Allows scientists and researchers access to Visualization Infrastructure in Europe
  - VR, Synthetic Environment, UHD-NET
  - 25 partners (visual installations in Europe)
  - Free access, reimbursement
  - Trans national access

More in VISIONAIR booth on NEM Summit
http://www.infra-visionair.eu/
Thank you...