


# UbiMed4K

## Transmission optimization and performance evaluation of a real-time ultrahigh definition medical collaboration

medVC

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FEC3

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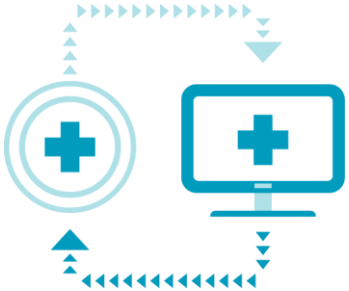
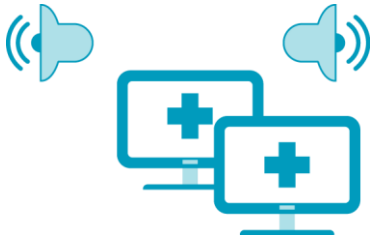
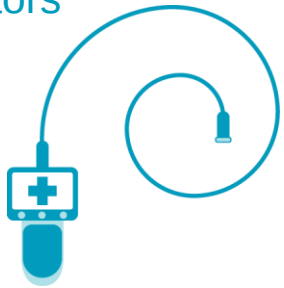
# medVC





Real-time audio-video collaboration for doctors

Remote consultations and medical education



Video from medical devices 2D and 3D

Pausing, drawing, remote control, snapshots, recording, live streaming

# medVC in action

- What is medVC
  https://youtu.be/g-D6LxXVkyQ
- 3rd ELS broadcast 2017
  https://goo.gl/zAXfDJ
- E3 live surgery event, 2D & 3D video (endoscope and da Vinci robot) (France-Finland)
  https://youtu.be/EhpKsiEhmUE

# Compatibility

Medical cameras, microscopes, endoscopes, C-arms, surgical robots and other medical video devices, both in 2D and 3D

Storz, Olympus, Medrobotics, Zeiss,
Trumpf Medical, ConMed, Intuitive Surgical and others

# Competition

cisco

VSee

Polycom

Less functionality

More expensive


No integrated collaboration services: pausing, drawing, remote control, snapshots, recording, live streaming

No separately encoded video streams for highest medical quality

Limited support of 3D medical devices

medVC

# Clients


LUMC
Universitäts-klinikum Essen
Krankenhaus MärkischOderland
PTU
CHL
UKGM
UNIVERSITÄTSKLINIKUM GIESSEN UND MARBURG
HPM
UNIVERSITÉ DE LORRAINE
IST
UAB
Universitat Autònoma de Barcelona
HOSPITAL DE LA SANTA CREU I SANT PAU

# Basic configuration

medVC terminal

- Main unit (2 video inputs)
- Touch-screen monitor
- Audio device
- Wireless headset microphone
- Loudspeaker

# OR rack or cart configuration

OR rack or cart with wheels

- medVC terminal
- video router
- scalers and converters
- convenient connector panel
- monitor arm
- cable and equipment drawers

Configuration can be adjusted according to hospital's needs


Example configuration video: https://youtu.be/ecS6NKXW330

# UbiMed4K experiment

## Goals

- Assess medVC's readiness to support 4K video
- Assess medVC's readiness to support live intercontinental collaboration

# UbiMed4K experiment

## Reasons for coming to F4F+

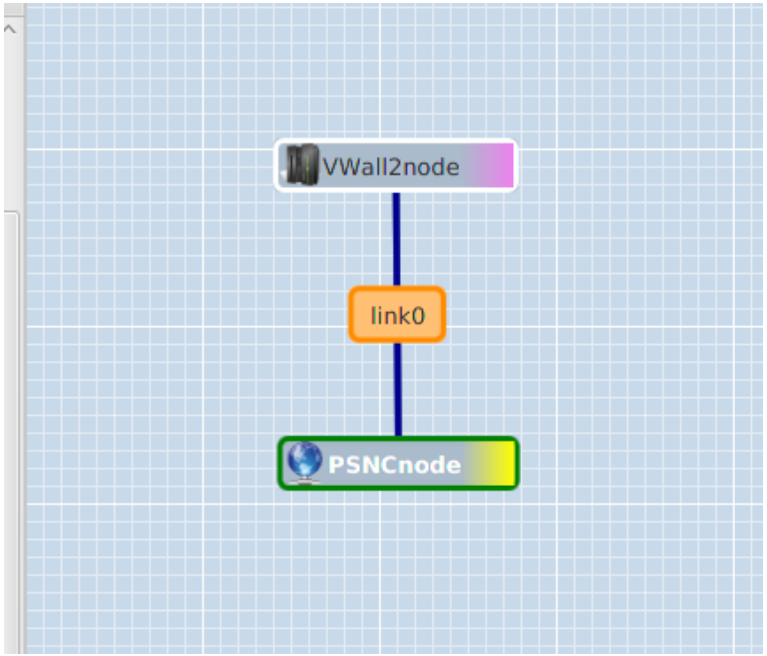
- Access to 4K-enabled video sources, content and reference display devices
- Access to 4K-related expertise
- Access to infrastructure outside of Europe

# UbiMed4K experiment

## Setup – PL-LAB


# UbiMed4K experiment

## Setup – Virtual Wall



# UbiMed4K experiment

## Experiment scenario

- 2 identical medVC terminals
- Each sending out 1 stream
- 2 resolutions – 1920x1080 (FullHD) and 3840x2160 (4K)
- 5 different bitrates – 2, 4, 8, 16, 32 Mb/s
- Each parameter combination ran 3 times

# UbiMed4K experiment

Parameters measured

- Average actual video throughput
- Packet loss
- Sequential errors
- Maximum delta
- Mean and max jitter
- Max skew
- Average packetization and framing overhead
- Encoding node resources usage
- One way end-to-end delay
- Quality of experience

# UbiMed4K experiment

## Results

| Resolution | Bit rate [Mbps] | CPU usage [% of core] | Correlation CPU–bit rate | Encoding fps | RAM usage [%] | Correlation RAM–bit rate |
|---|---|---|---|---|---|---|
| 1920x1080 | 2 | 133 | 0,89 | 25 | 8,3 | -0,21 |
| | 4 | 138 | | 25 | 8,3 | |
| | 8 | 142 | | 25 | 8,3 | |
| | 16 | 146 | | 25 | 8,3 | |
| 3840x2160 | 4 | 457 | 0,97 | 16,8 | 31,2 | -0,58 |
| | 8 | 466 | | 16,8 | 27,0 | |
| | 16 | 471 | | 16,5 | 25,5 | |
| | 32 | 502 | | 16,3 | 26,2 | |

# UbiMed4K experiment

## Results

| Resolution | Bit rate [Mbps] | Median of one way end-to-end delay [ms] | Correlation delay–bit rate | Median of objective QoE metrics value | median of expert subjective video quality estimation |
|---|---|---|---|---|---|
| 1920x1080 | 2 | 202 | 0,65 | 0,283 | Poor |
| | 4 | 202 | | 0,094 | Good |
| | 8 | 219 | | 0,055 | Excellent |
| | 16 | 240 | | 0,030 | Excellent |
| 3840x2160 | 4 | 407 | 0,54 | 0,419 | Bad |
| | 8 | 405 | | 0,245 | Poor |
| | 16 | 421 | | 0,211 | Fair |
| | 32 | 430 | | 0,105 | Good |

# UbiMed4K experiment

## Results

medVC terminal is technically compatible with 4K, but:

- Framerate drops by 30%
- Encoding of fewer streams in parallel
- End-to-end delay rises

Intercontinental collaboration possible, end-to-end delay rises but acceptable

# UbiMed4K experiment

## Conclusions

- medVC compatible with 4K
- New hardware components for media processing are being researched in order to improve efficiency
- This will allow to be ready for 4K medical devices entering the market
- More detailed view of the operating field for remote doctors, also on other continents

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