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CESNET Multimedia

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SIG-MM 22.2.2022

CESNET Meetings

- Videoconferencing and webconferencing services
  - **Pexip** - on premise platform, primarily for online meetings
  - **Adobe Connect** - on premise platforma, remote lectures
  - **Zoom** - cloud based, remote lectures, conferences
  - **eduMeet** - mostly for testing, some special usage
- Resources reservation portal - https://meetings.cesnet.cz/
- Working with users
  - User support, integration of our users video and webconferencing resources and LMS systems
- Stabilizing services, procurement

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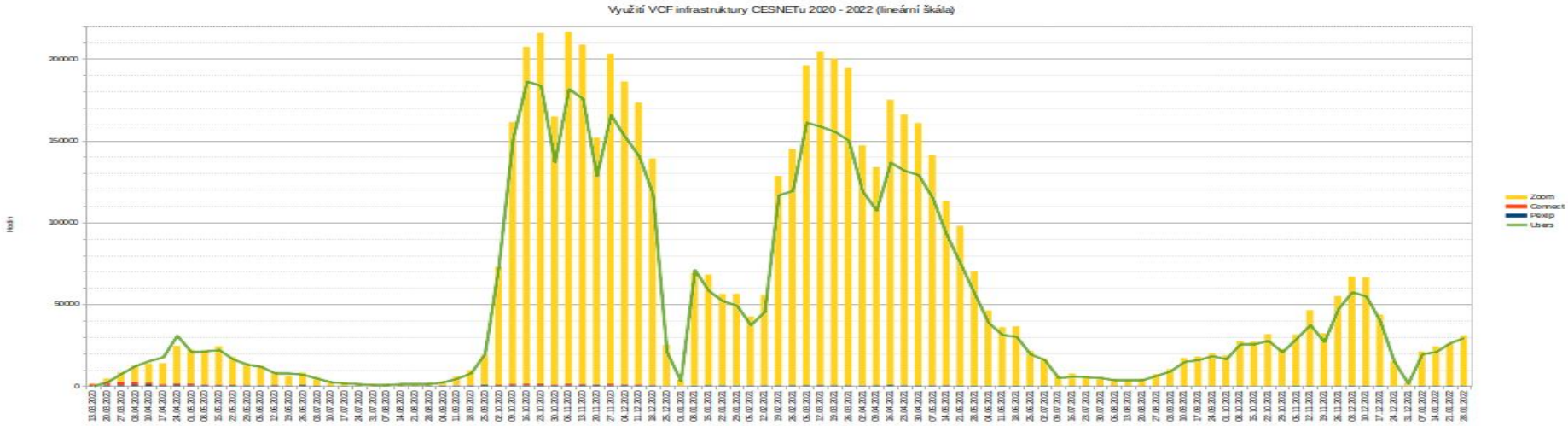
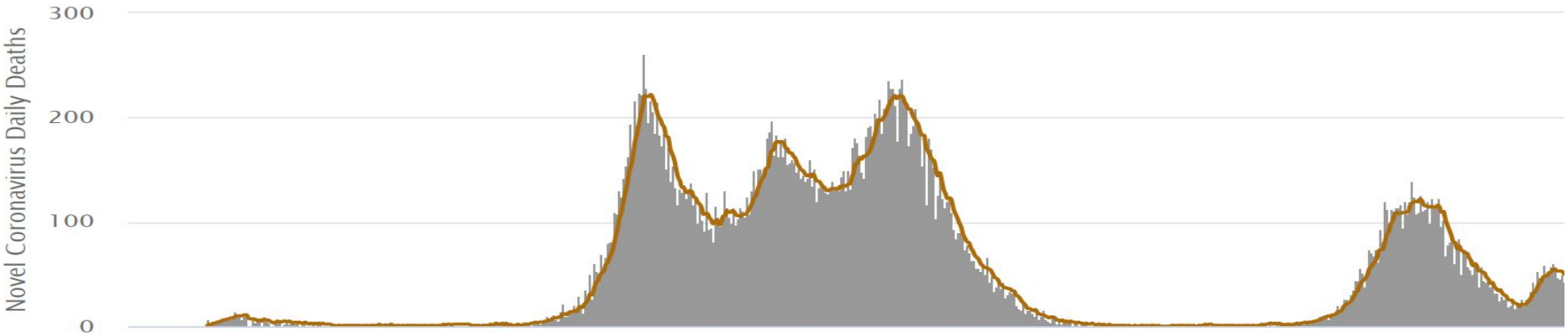
COVID-19





Streaming

- Video processing and streaming infrastructure
  - Wowza streaming platform, on prem infrastructure
- Video on demand
- Transcoding service
- On prem “CDN”
  - Actually a system of Nginx caches plus simple load balancer

- So we basically have all the infrastructure and technology but no real service
- Kaltura deployment in discussion

Beyond Videoconferencing

- Spatial technologies - Gather.town
  - Nice toy combining traditional videoconferencing with gamification and MMORPG
  - Great for e.g. virtual conferences with multiple tracks and break time activities like poster sessions, virtual coffee etc.
  - We have a group of users experimenting with these principles, having a virtual floorplan with offices kitchenette etc. and minigames

Beyond Videoconferencing

- VR videoconferencing - Facebook Workrooms
  - Strikingly good user experience
    - Closed group
      everyone knows each other
    - Avatars resembling real people
    - Spatial audio

  - Possibility to combine VR and WebRTC based conferencing
    - Fine for those in VR as they have pretty much standard conferencing room experience
    - Awkward for those using WebRTC and talking to avatars
  - Not completely convincing interaction with physical world
    - Virtual laptop/PC keyboard not quite matching physical
    - Can not really use notepad and pen

- an affordable platform for very high-quality interactive video (up to 8K) and audio transmissions

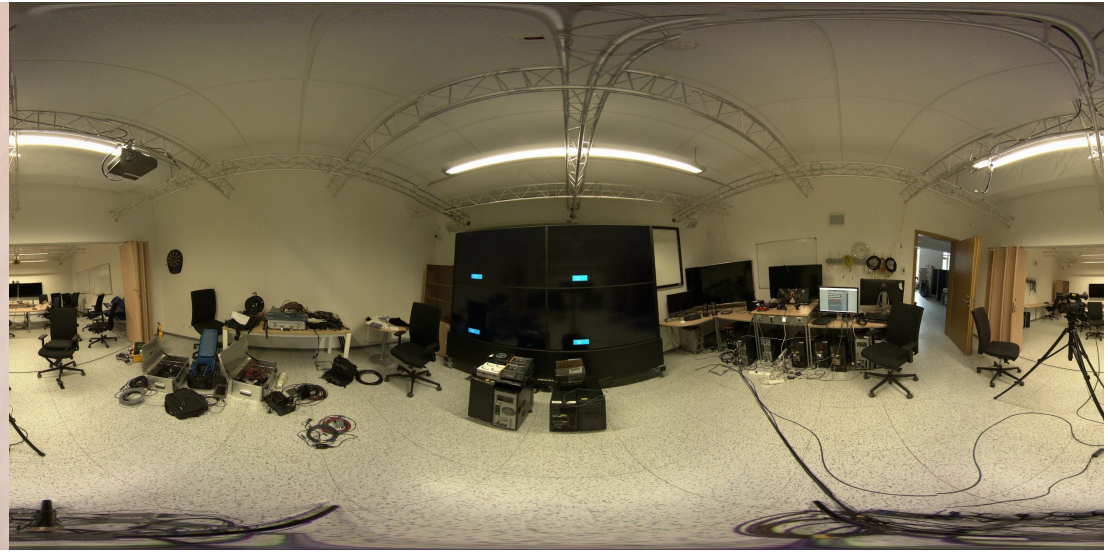
- Medical applications, film production and postproduction, broadcasting, networked performing arts

- UltraGrid 1.7
  - NAT traversal support (PCP, PMP)
  - Server mode
  - 360 video support including own GPU accelerated stitcher and VR headsets support
  - NDI 5 support
  - Improved ARM architecture support including Apple M1

  - 822 files changed, 28252 insertions(+), 117268 deletions(-)

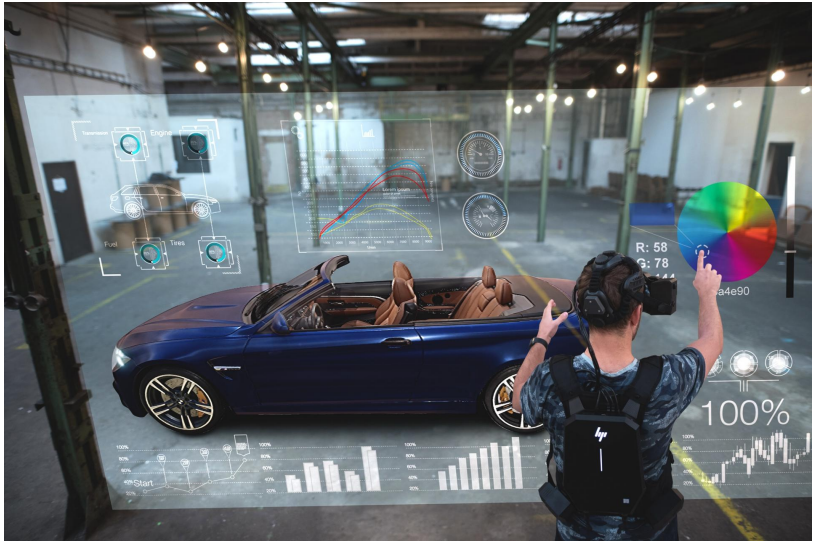
Low-latency 360° Video Transmissions

- 4x4K 60fps video, ~120ms end-to-end latency (OpenGl pano display)
- Low-latency stitching/blending as a grand challenge for research/development
- Initially based on NVidia VRworks 360 Video
- Own CUDA based stitcher (Panotools/Hugin) and blending (Pyramid blending) implementation, SW displaying and HMD support



Low-latency VR/AR Transmissions

- A project with IT4Innovations and VRGineers
- VRGineers XTAL - 5K or 8K 120fps HMD incl. e.g., eye tracking
- Vysoké nároky na rendering modelů a scén
- IT4I Blender - HPC rendering, optical networks based transmissions



COVID19, UltraGrid and Networked Arts

- Requests for distributed rehearsals started to pop out
- Individual musicians/small bands
  - Totally limited equipment/possibilities
- Home setups
- UltraGrid + JackTrip (+ tpf-tools and packet reflector in UltraGrid)
- We had some success with deployment even in home environments
  - Still requires someone technically savvy to deploy this
- Limitations
  - Network (18ms latency w/ 23ms jitter on my home DSL connection), bandwidth
    - A reasonable UG deployment requires at least 20Mbps
  - NAT, Firewalls
  - Home routers

What is Brewing?

- UltraGrid “server”
  - UltraGrid basically operates on a peer-to-peer principle (multipoint with packet reflector is still based on that principle)
  - Users are more accommodated to client - server model
- Virtual room mode in the packet reflector
  - Basically a MCU mixer (mixes incoming video streams into predefined layout)
  - “UltraGrid rooms”
- NAT support

Thank you for your attention!

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