UltraGrid 1.1
and Future Plans

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UltraGrid Platform

- Technology
  - affordable platform for high-quality interactive image transmissions
  - use of commodity hardware
    - Linux PC and Mac platforms
    - commodity video capture cards
    - commodity GPU cards
    - 10GE is a plus but not necessary
  - as low latency as possible on commodity hardware
  - open-source software

- Applications
  - medicine
  - cinematography
  - education
UltraGrid Platform

Mac Pro

10GbE

Kona 3

dual-link HD-SDI

BaseLight Four

Mac Pro

dual-link HD-SDI

SONY SXRD 4K

CESNET
UltraGrid Platform

- Available inputs
  - HD-SDI, SDI
  - HDMI
  - component/composite HD and SD
  - screen capture

- Available outputs
  - HD-SDI, SDI
  - HDMI (including stereoscopic HDMI 1.4a)
  - component/composite HD and SD
  - computer screen (VGA, DVI, HDMI via OpenGL/SDL)
  - SAGE
  - specialized display filters
UltraGrid Platform

Line-interlaced stereoscopic video
UltraGrid Platform

SAGE display with various compressions
Features as of UltraGrid 1.1

- Video support
  - HD/2K video support (4:2:2, 4:4:4)
  - tiled SuperHD video support (with Linsys Quad/i and DeckLink Quad)
  - native SuperHD/4K (with Kona 3G)
  - stereoscopic video support

- Audio support
  - full audio support: ALSA, CoreAudio, PortAudio, Jack, audio embedded in HD-SDI
  - multi-channel audio
  - support for mono-audio (e.g., echo-canceling mics)

- Full-duplex operation (both sender & receiver)
- Embedded UDP/RTP packet reflector
Features as of UltraGrid 1.1

- Available compressions
  - DXT₁: CPU-based
  - DXT₁, DXT₅: OpenGL Shader Language (GLSL) based
  - JPEG: NVidia CUDA based

- Forward error correction (FEC)
  - shifted multiplication
  - Low Density Generation Matrix (LDGM)

- GUI
  - with persistent parameter storage
  - works both on Linux and Mac
Audio features
- channel mixer/spitter
- volume adjuster
- software acoustic echo canceller (mono)

Improved IPv6 and multicast support
- support for IPv6 zone ID (RFC 4007)
- multicast interface selection

LDGM – profiles
- `uv ... -f LDGM:<max_loss>% ...`
Post-1.1 Features

- File I/O
  - storing of received streams
  - playback from files
- High-performance screen capture for dummy X server
  - 32 fps for SuperHD/4K desktop
  - can be used even for local playback over 4× HD-SDI/3G-SDI/HDMI
  - with or without cursor
- DXT compression in CUDA
- Interlacing processor (50p → 50i)
- Performance optimizations
- Improved structure of wiki-based docs
Post-1.1 Features

8K video support (GLIF 8.–11.10.2012)

Full HD
GPU-Based Compressions
Making High-Quality Affordable!

- Updated compression performance numbers (including transfer from GPU)
  - DXT1 GLSL: 798 Mpix/s (NVidia 580GTX), 593 Mpix/s (ATI 6990)
  - DXT5 GLSL: 349 Mpix/s (NVidia 580GTX), 305 Mpix/s (ATI 6990)
  - JPEG CUDA: up to 1.580 Mpix/s = 4.740 MB/s (NVidia 580GTX, 4:4:4)
GPU-Based Compressions
Making High-Quality Affordable!

uncompressed

(full size vs. the crop)
GPU-Based Compressions  
Making High-Quality Affordable!

uncompressed

(enlarged crop)
GPU-Based Compressions
Making High-Quality Affordable!

DXT1 CPU (FastDXT)

(enlarged crop)
GPU-Based Compressions
Making High-Quality Affordable!

DXT1 GPU

(enlarged crop)
GPU-Based Compressions
Making High-Quality Affordable!

DXT5 YCoCg GPU

(enlarged crop)
GPU-Based Compressions
Making High-Quality Affordable!

uncompressed (again)

(enlarged crop)
GPU-Based Compressions
Making High-Quality Affordable!

JPEG Q=90 GPU

(enlarged crop)
GPU-Based Compressions
Making High-Quality Affordable!

uncompressed (again)

(enlarged crop)
Latency Measurements

- Uncompressed
  - 2.5 frames (83 ms, DeckLink HD → DeltaCast 3G)
- Impact of compressions
  - 2.5 frames (+<16.7 ms) for JPEG
  - 3.5 frames (+33.3 ms) for DXT1/5
ABX tests

- Summary of ABX test results:
  - JPEG Q=90: undistinguishable for all the persons in test
  - JPEG Q=70: undistinguishable for some of the persons in test
  - DXT5: undistinguishable for most of the persons in test
  - DXT1: distinguishable for most of the persons in test
Medical Applications

XX. Anniversary Congress of Czech Cardiology Society
Plans Until End of 2012

- Multi-receiver
  - aka iHDTV tiled mode, but more flexible (scalable tiled screen, more full-size windows)
  - with reflectors/without multicast
- Joint release with CoUniverse
  - support for automatic setup of multi-point distribution trees
  - automatic allocation of on-demand networks (e.g., Internet2 ION or NSI-enabled nets)
- Port to Microsoft Windows platform (may slip to early 2013)
Further Plans

- GColl functionality
  - advanced multi-point setup for group-to-group collaboration
- Recompression in a distribution tree (on reflectors)
- AES encryption
- Video-mixing capabilities
- More complex FEC codes
- Other low-latency compression schemes
  - e.g., low-latency mode of H.264
- Pipeline to ffmpeg and/or GStreamer
- Let us know if you need something else
How to get it

- Source and binary distributions
- Linux & MacOS X
- BSD-licensed software
- UltraGrid is now also part of SAGE toolkit http://www.sagecommons.org/
Thank you for your attention!

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