Cees de Laat
CineGrid Amsterdam
System & Network Engineering

Many slides from partners & CineGrid.org
What is CineGrid?

- Formed 2004 – non-profit international membership organization
- Members – media arts schools, research universities, scientific labs, post-production facilities & hardware and software developers around the world
- Connected – via 1 G - 100 G Photonic - Ethernet networks
- For – research & education, experimentation, prototyping
CineGrid Mission

To build an interdisciplinary community that is focused on the research, development, and demonstration of networked collaborative tools to enable the production, use and exchange of very-high-quality digital media over photonic networks.

http://www.cinegrid.org/
Why is more resolution better?

1. More Resolution Allows Closer Viewing of Larger Image
2. Closer Viewing of Larger Image Increases Viewing Angle
3. Increased Viewing Angle Produces Stronger Emotional Response

- **UHDTV (8K)**: 7680 pixels
  - Viewable area: 4320 pixels
  - Viewing angle: 100º

- **HDTV (2K)**: 1920 pixels
  - Viewable area: 1080 pixels
  - Viewing angle: 30º

- **UHDTV (4K)**: 3840 pixels
  - Viewable area: 2160 pixels
  - Viewing angle: 60º

Visual acuity = 1.0 = 20/20

Standard viewing distance
Moving Big Data Objects Globally

- **Digital Motion Picture for Audio Post-Production**
  - 1 TV Episode Dubbing Reference ~ 1 GB
  - 1 Theatrical 5.1 Final Mix ~ 8 GB
  - 1 Theatrical Feature Dubbing reference ~ 30 GB

- **Digital Motion Picture Acquisition**
  - 4K RGB x 24 FPS x 10bit/color: ~ 48MB/Frame uncompressed (*ideal*)
  - 6:1 ~ 20:1 shooting ratios => 48TB ~ 160TB digital camera originals

- **Digital Dailies**
  - HD compressed MPEG-2 @ 25 ~ 50 Mb/s

- **Digital Post-production and Visual Effects**
  - Gigabytes - Terabytes to Select Sites Depending on Project

- **Digital Motion Picture Distribution**
  - Film Printing in Regions
    - Features ~ 8TB
    - Trailers ~ 200GB
  - Digital Cinema Package to Theatres
    - Features ~ 100 - 300GB per DCP
    - Trailers ~ 2 - 4GB per DCP
“Learning by Doing”
Early CineGrid Projects

CineGrid @ iGrid 2005

CineGrid @ AES 2006

CineGrid @ Holland Festival 2007

CineGrid @ GLIF 2007
CineGrid 2013 International Workshop
December 9 – 11, 2013
San Diego, CA

CineGrid logo
4K interactive digital cinema color grading
realtime 4K uncompressed streaming over IP
CinePOST@Prague  ←  Calit2@San Diego
Places + Perspectives
A Growing Documentary in HD

Keio University/KMD @ Hiyoshi
UCSD/Calit2 @ San Diego

- Explore network-supported collaboration process
- Combine traditional production tools with emerging tools for media sharing, review and critique such as Vroom, CineSAGE & PIX
- Use cloud server for media transfer and storage
- Use multi-channel 4K/HD video teleconferencing for face-to-face discussions, context sharing and project development
CineGrid Portal

Unified orchestration of distributed CineGrid resources
Real Time Rendering Workflow

Demo setup

- Three locations
  1) NFTA: greenscreen studio, Previzion, camera(+man), actress (+ dress)
  2) SARA: render node for keying, virtual scene rendering
  3) Calit2: keying controls, projection of final output, director
- Two lightpaths in between
- Video-conferencing for communication + low quality keying output back to NFTA

![Diagram of the workflow]
Directing Remote Live Shoot of Virtual Set Acting with Live Compositing in the Cloud

Live action camera, actors, green screen at NFTA (Amsterdam #1)
Virtual set compositing at SARA (Amsterdam #2)
Remote viewing and direction at UCSD/Calit2 Vroom (San Diego)
One Minutes: stunning quality
Direction

- Distributed Comp -> Grid -> Cloud -> Big Data
- Lego Block approach
- Application as a Service
- Elastic Cloud
- Determinism & Real Time?
- CineGrid ToolBox
- Storage
- Deep Storage
- Very Deep Storage
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www.cinegrid.nl