

4k Transmission on CineGrid

ADVNET2007 in Hiroshima
--2007/01/15--

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Overview

- ☒ What is 4k?
- ☐ 4k transmission system
- ☐ What is CineGrid?
- ☐ 4k related events
- ☐ Lessons learned from events

What is 4k?

☐ SD

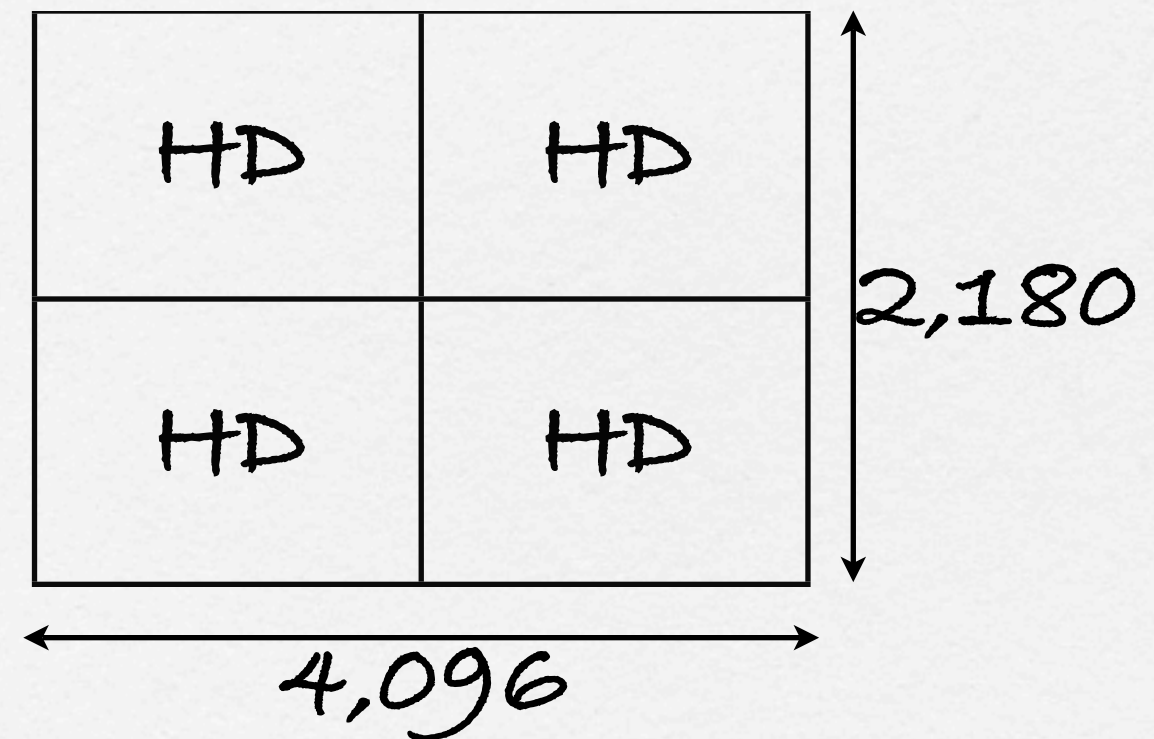
- ☐ Standard Definition
- ☐ $720 \times 483 = 0.3\text{M}$ pixels
- ☐ 200Mbps uncompressed

☐ HD

- ☐ High Definition
- ☐ $1920 \times 1080 = 2\text{M}$ pixels
- ☐ 1.5Gbps uncompressed

☐ 4k = SHD

- ☐ Super High Definition
- ☐ $4096 \times 2180 = 8\text{M}$ pixels
- ☐ 6Gbps uncompressed



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4k Input/Output (1)

❑ 4k Camera

❑ Olympus Octavision

❑ YCbCr (4:2:2)

❑ HDSDI embedded audio



❑ 4k Projector

❑ SONY SXRD

❑ RGB/YCbCr
(4:4:4/4:2:2)



4k Input/Output (2)

❑ 4k Recorder

- ❑ Keisoku Giken, UDR



❑ 4k Switcher

- ❑ Imagenics, 16 x 16 HDSDI Switcher
- ❑ for 4k, 2 x 2



4k Transmission System (non-IP)

- HD Transmitter x 8
 - using SM ~50km
- Audio Transmitter
 - MADI: 64ch bidirectional
 - usin MM ~2km



4k Transmission System (IP)

❑ Compressed

❑ Video: JPEG 2000 CODEC

- ❑ Maximum Resolution: 4096 x 2160
- ❑ Color Space: RGB(4:4:4), YCbCr(4:2:2)
- ❑ Color Depth: 12bit
- ❑ Frame Rate: 24p, 30p

❑ Audio: ADAT(8ch) x 3 = 24ch

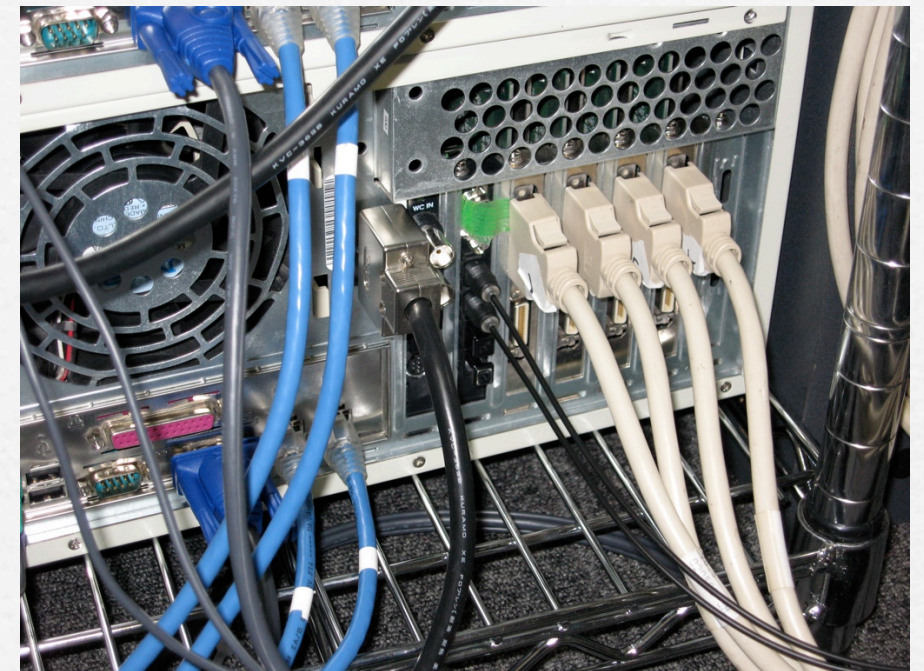
❑ OS: SuSE 9.1, Linux kernel: 2.6.9smp

❑ Uncompressed

❑ Video: HD Uncompressed x 4 stream

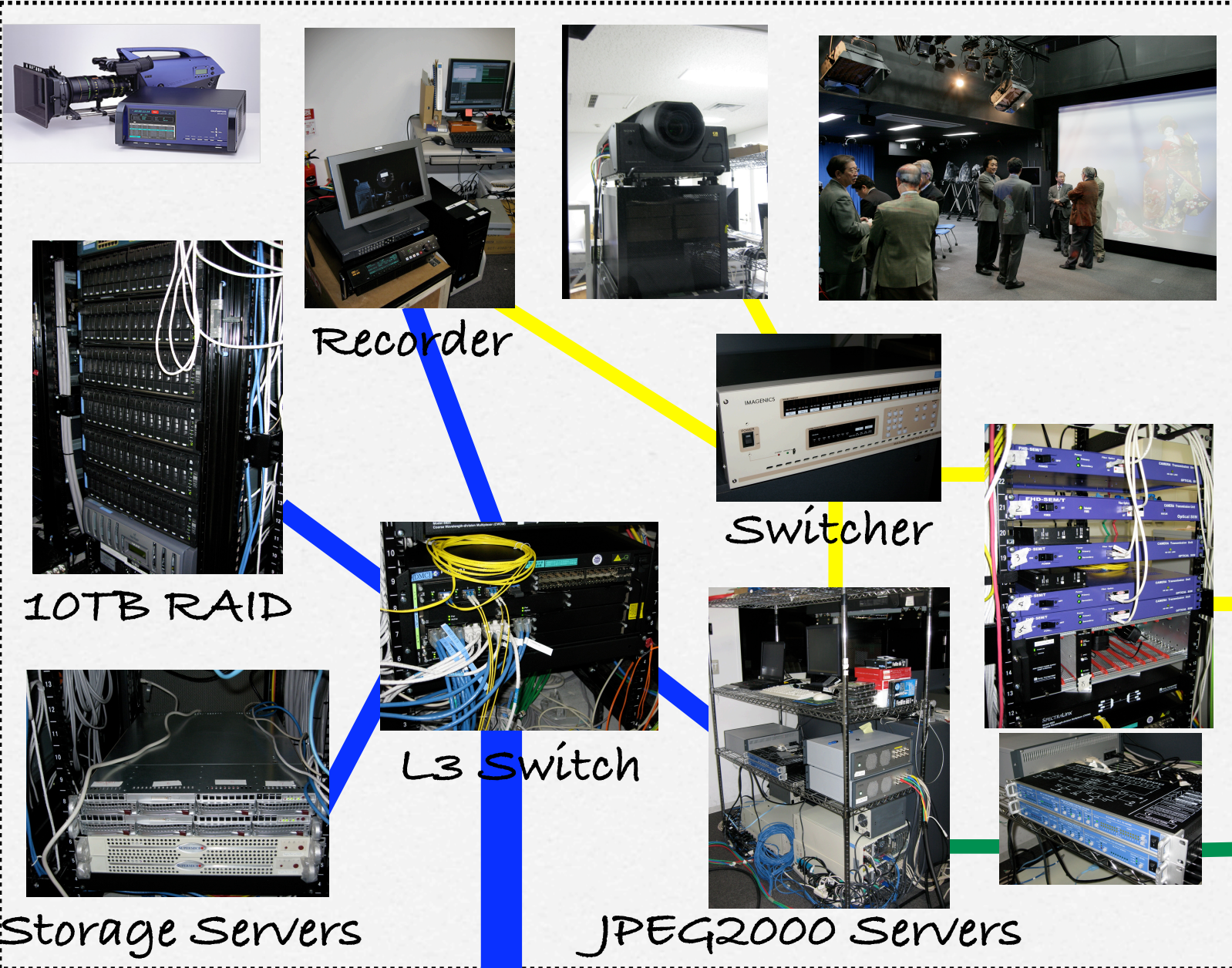
❑ Audio: HDSDI embedded

❑ e.g., iVisto(NTT)



4k System at DMC

West Annex



East Building



- Screen
 - 300 inch
- Projector
 - SONY SXR D
- Sound
 - 5.1ch
- HDSDI Receiver
- MADI Receiver

T-Lex

kaneko@dmc.keio.ac.jp, DMC, Keio University

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What is CineGrid?

☐ CineGrid

- ☐ A community that is focused on the research, development, demonstration and exchange of visualization and collaboration tools and technologies for the transfer of very-high-quality digital media over photonic networks.

☐ Main members

- ☐ Keio DMC, UCSD/CalIT2, NTT, Pacific-Interface

☐ Kick-off

- ☐ CineGrid Event on AES2006 (2006/10)
- ☐ 1st workshop @ UCSD (2006/12)
 - ☐ 2 days workshop incl. 4k demonstration
 - ☐ Attendee: 120

CineGrid Network (2006/08)

- Japan

- Keio

- U.S.

- UCSD



- Network

- DMC-KEIO-WIDE=T-LEX=IEEEAF=P-Wave=CENIC-UCSD



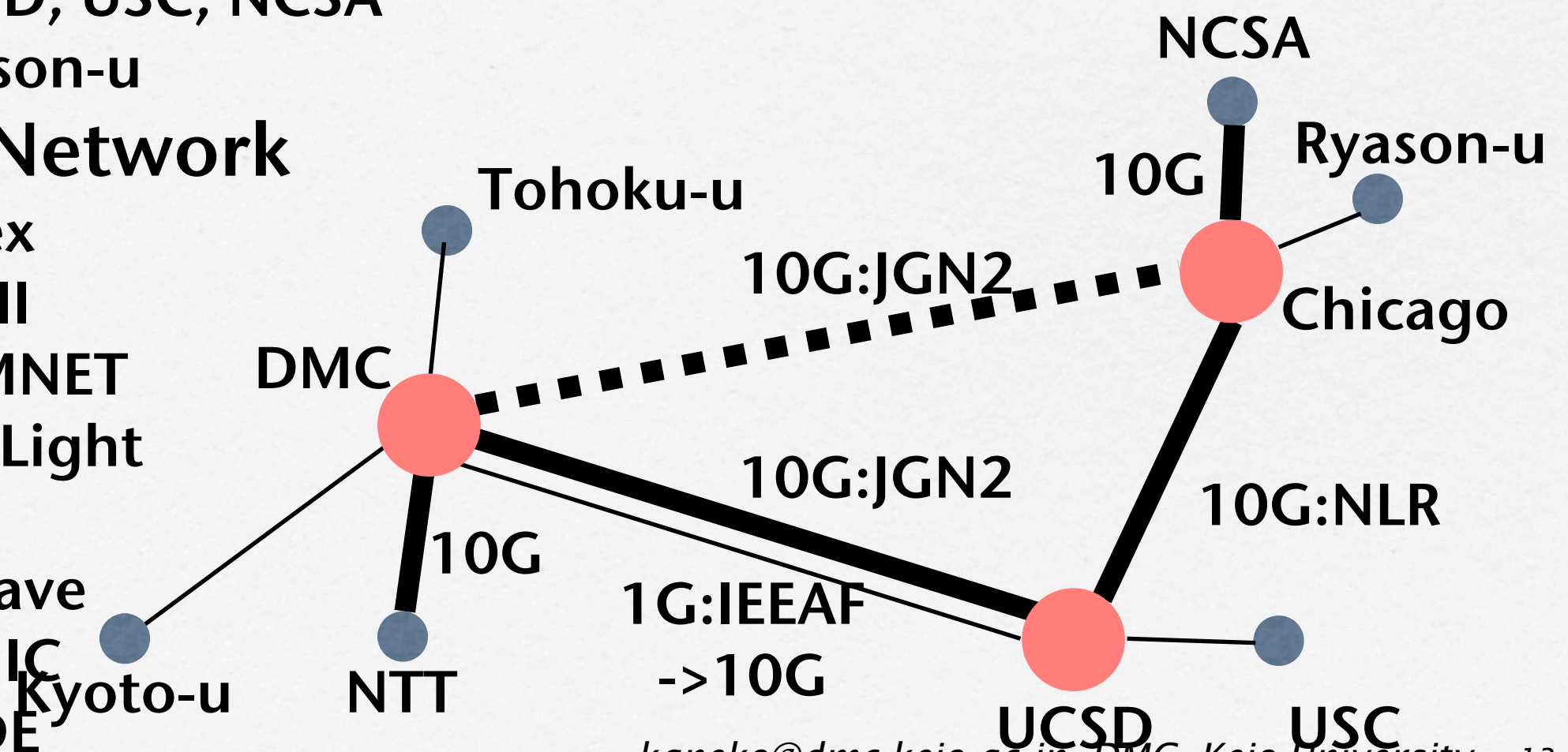
CineGrid Network (Now)

- Japan
 - Keio, Kyoto-u, Tohoku-u, NTT

- U.S. & Canada
 - UCSD, USC, NCSA
 - Ryason-u

- Base Network

- T-Lex
- JGNII
- GEMNET
- StarLight
- NLR
- P-wave
- CENIC
- WIDE



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4k Related Events

- ❑ Calit2 Mid-term Review (2006/10/3)
 - ❑ 4k live from DMC to Calit2
- ❑ AES2006 (2006/10/7-9)
 - ❑ 4k live, 4k streaming, multi-channel audio transfer
- ❑ Digital T!FF@Tokyo International Film Festival (2006/10/23)
 - ❑ 4k live, 4k streaming, HDx4 transfer
- ❑ 1st CineGrid Workshop (2006/12/14-15)
 - ❑ 4k streaming from DMC, NTT, USC, and NCSA to Calit2
- ❑ JGNII Symposium (2007/1/17-18)
 - ❑ 4k uncompressed live, 4k streaming

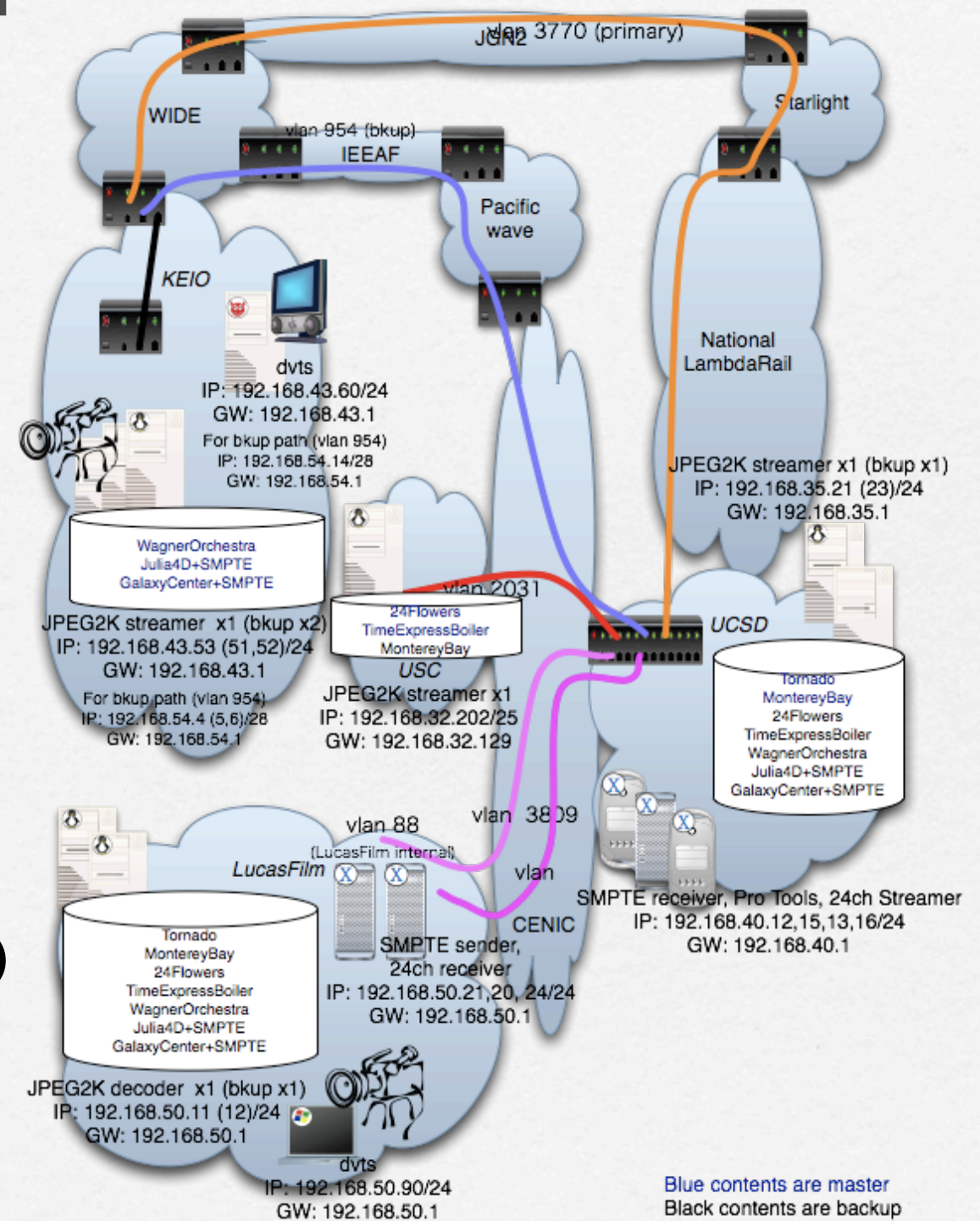
AES2006

- ❑ AES: Audio Engineering Society
- ❑ Venue
 - ❑ Lucasfilm/Letterman Art Center@ SanFrancisco

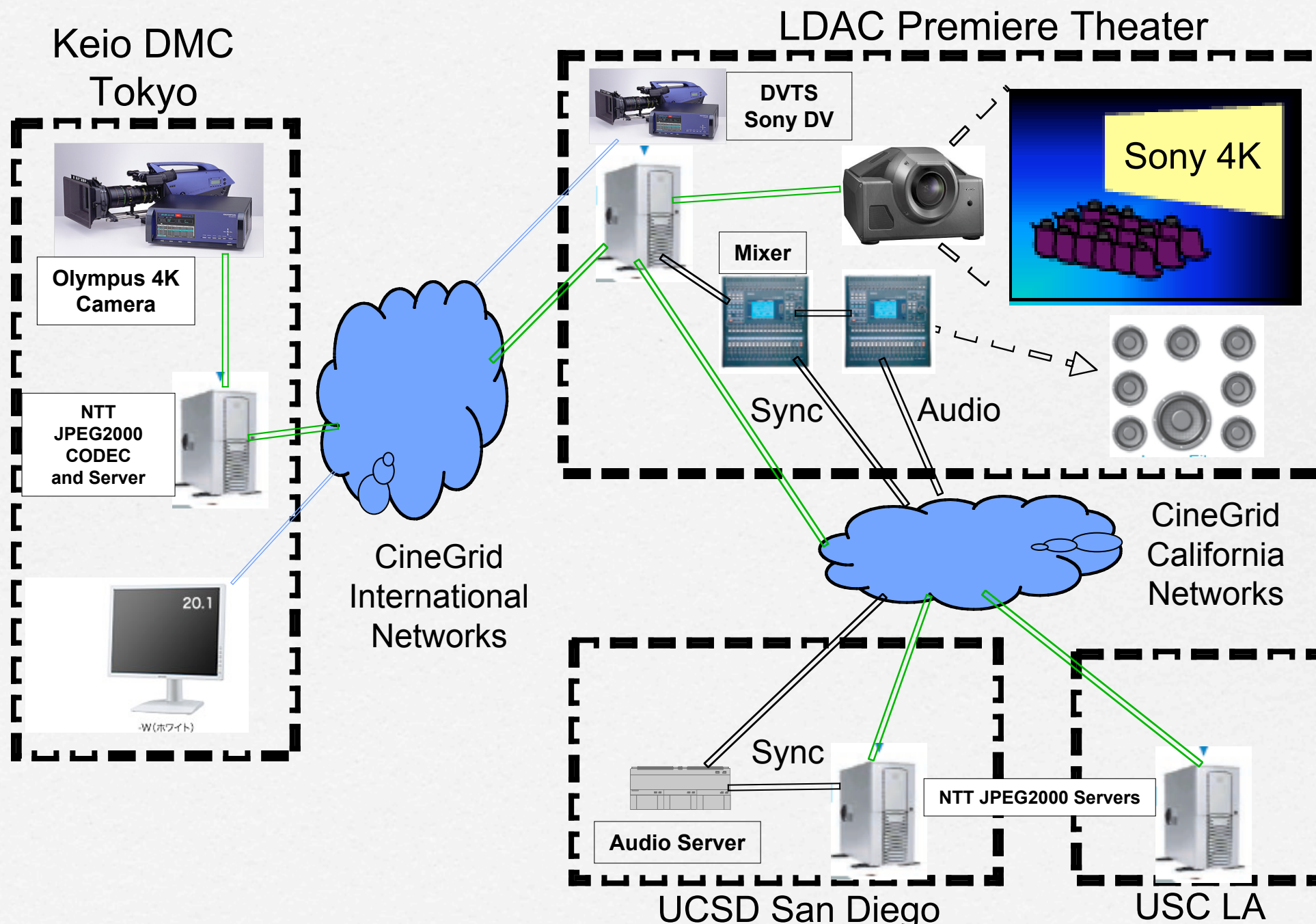


AES2006 Program

- ❑ 4k live streaming
 - ❑ DMC -> Lucas (4k)
 - ❑ Lucas -> DMC (DVTS)
- ❑ 4k contents streaming
 - ❑ DMC -> Lucas
 - ❑ USC -> Lucas
- ❑ Audio live performance with 4k streaming
 - ❑ DMC -> Lucas (8ch audio)
 - ❑ UCSD -> Lucas (24ch audio)



AES2006 System Diagram



UCSD San Diego

USC LA



Digital T!FF

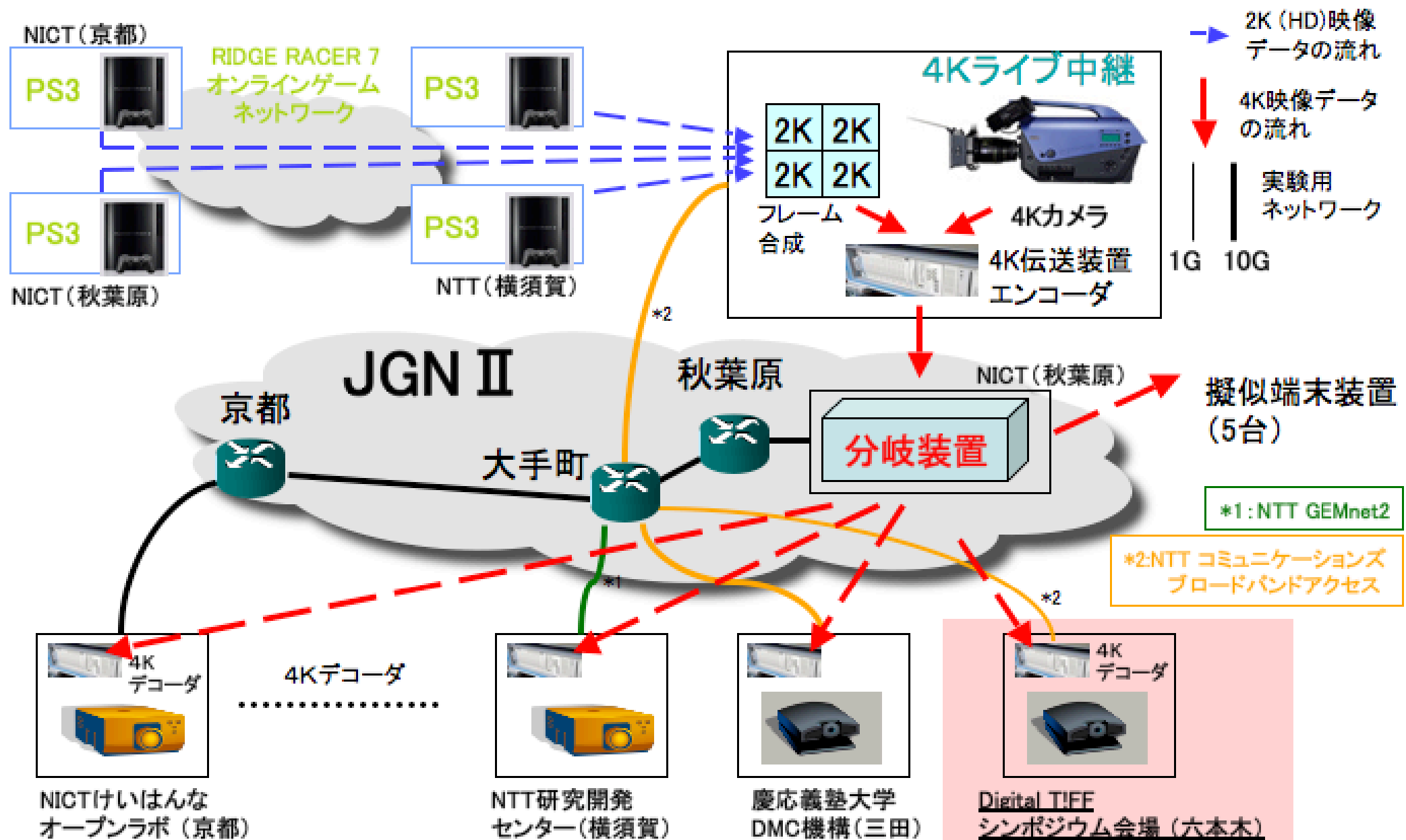
- ❑ Venue

- ❑ Roppongi, TOHO Cinemas

- ❑ Program

- ❑ 4k live streaming from DMC
 - ❑ 4k/HD contents streaming
 - ❑ PS3(HD) x 4 MPEG2 streaming to DMC and 4k (=HDx4) streaming from DMC
- ❑ All of the streaming replicated to over 10 locations

Digital T!FF System Diagram





JGNII Symposium 2007

- **Venue**

- Here!! (Hiroshima)

- **Program**

- 4k uncompressed live from DMC to Yokosuka
 - 4k compressed streaming from Yokosuka to Hiroshima
 - ...

JGN II シンポジウム2007 in 広島での実験構成

1 映像編集・制作支援技術 (1)

4K非圧縮映像ストリーム(6Gbps)の無輻輳切替

慶応義塾大学(DMC)

4Kカメラ



4K非圧縮
映像サーバ

6Gbps



6Gbps

4K-HDDレコーダ



4K非圧縮映像サーバ

1 映像編集・制作支援技術 (2)

映像品質管理・評価用コンテンツ

JGN II



多地点の受信装置へ

2 映像コンテンツ流通支援技術 (1)

4K圧縮映像ストリーム(500Mbps)の認証多地点配信

2 映像コンテンツ流通支援技術 (2)

4K圧縮映像暗号化ストリームの実時間復号処理

NTT横須賀

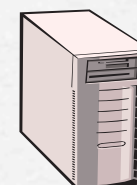


4K非圧縮映像
受信クライアント

JPEG2Kエンコーダ



暗号化ストリーム
サーバ



配信

認証要求

認証機能付き
分岐装置

広島会場

実時間AES暗号化
ストリーム復号装置



4K液晶
ディスプレイ

JPEG2Kデコーダ



4K液晶
ディスプレイ

配信

認証要求

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We have problems...

- ❑ **Every time!!**

- ❑ Why?

- ❑ **Just before the events!!**

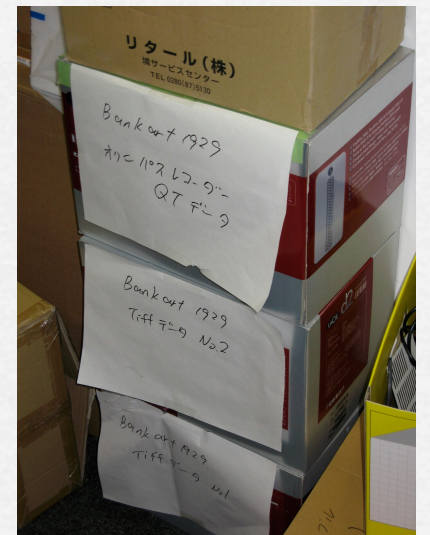
- ❑ No time to trouble shoot...

- ❑ **there is time difference!!**

- ❑ Sleepy days before the events...

Technical difficulties of 4k

- ❑ 4k is きれいさ、きつさ、恐怖、桁ちがい
- ❑ File Size: 50MB for 1 frame (1/30 sec)
- ❑ TIFF file output: 2 sec. for 1 frame
- ❑ Encoding: 1 day for 8 min.
- ❑ JPEG2000 streaming: 800Mbps
- ❑ 4k uncompressed streaming: 6Gbps



Technical Issues

- ❑ **Pure networking issues**
 - ❑ **Delay vs. Jitter**
 - ❑ Tremendous number of switches
 - ❑ **Redundancy**
 - ❑ Different paths go through the same switch.
 - ❑ **Announce**
 - ❑ No announce after repair..... what was the problem????
- ❑ **Special, special, and special...**
 - ❑ **High-bandwidth tools need “special” things.**
 - ❑ hardware, OS, middle-ware, applications, and operator
 - ❑ **Difficult to find out where the problems lay on.**
 - ❑ **Difficult to import useful tools to our system.**

Wrap up

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- ❑ Thank you
 - ❑ for your kindly supports for our events
 - ❑ for everything!!