

Experiences with uncompressed
high-definition internet TV for
advanced collaboration

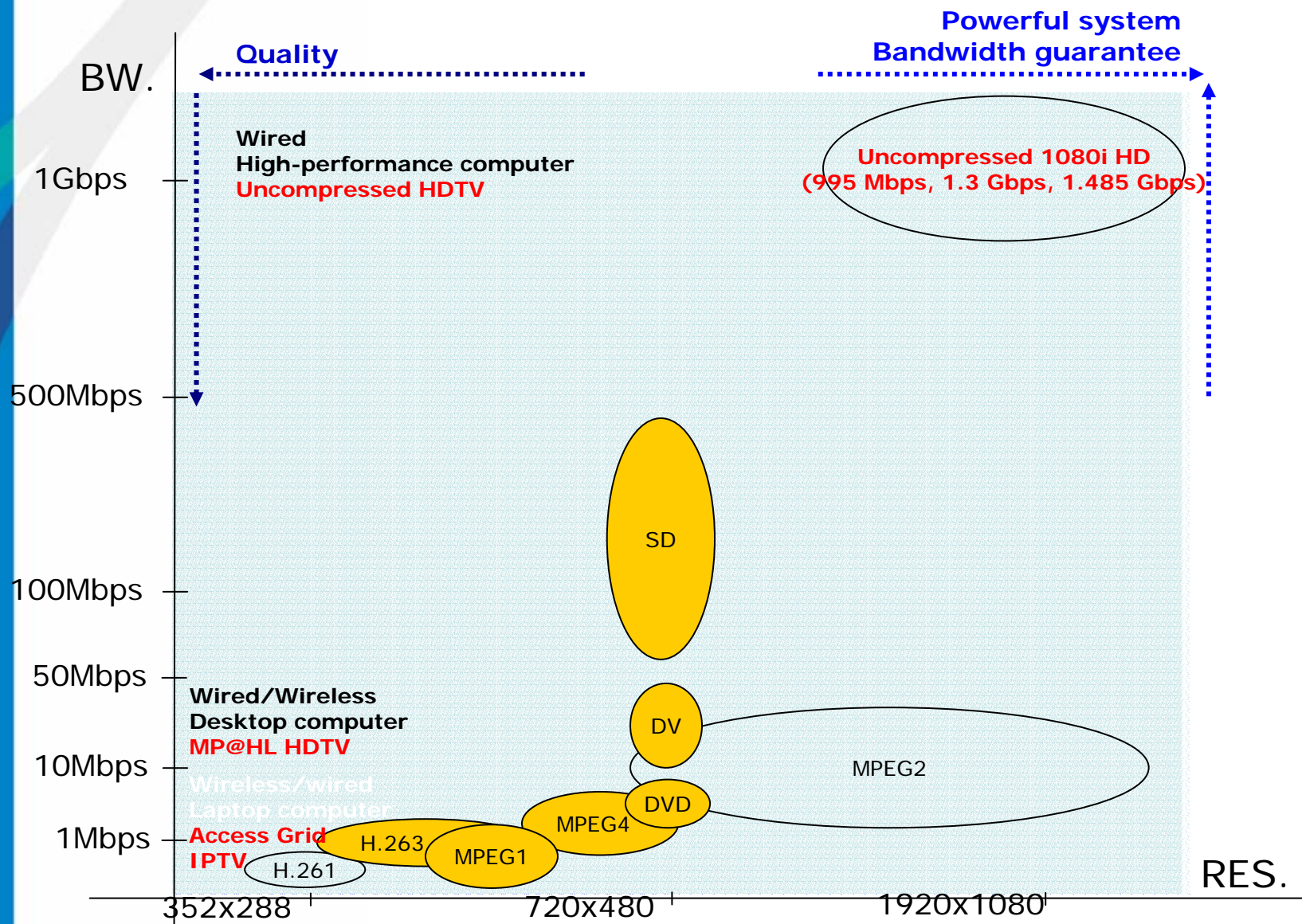
Jinyong Jo

jiny92@kisti.re.kr

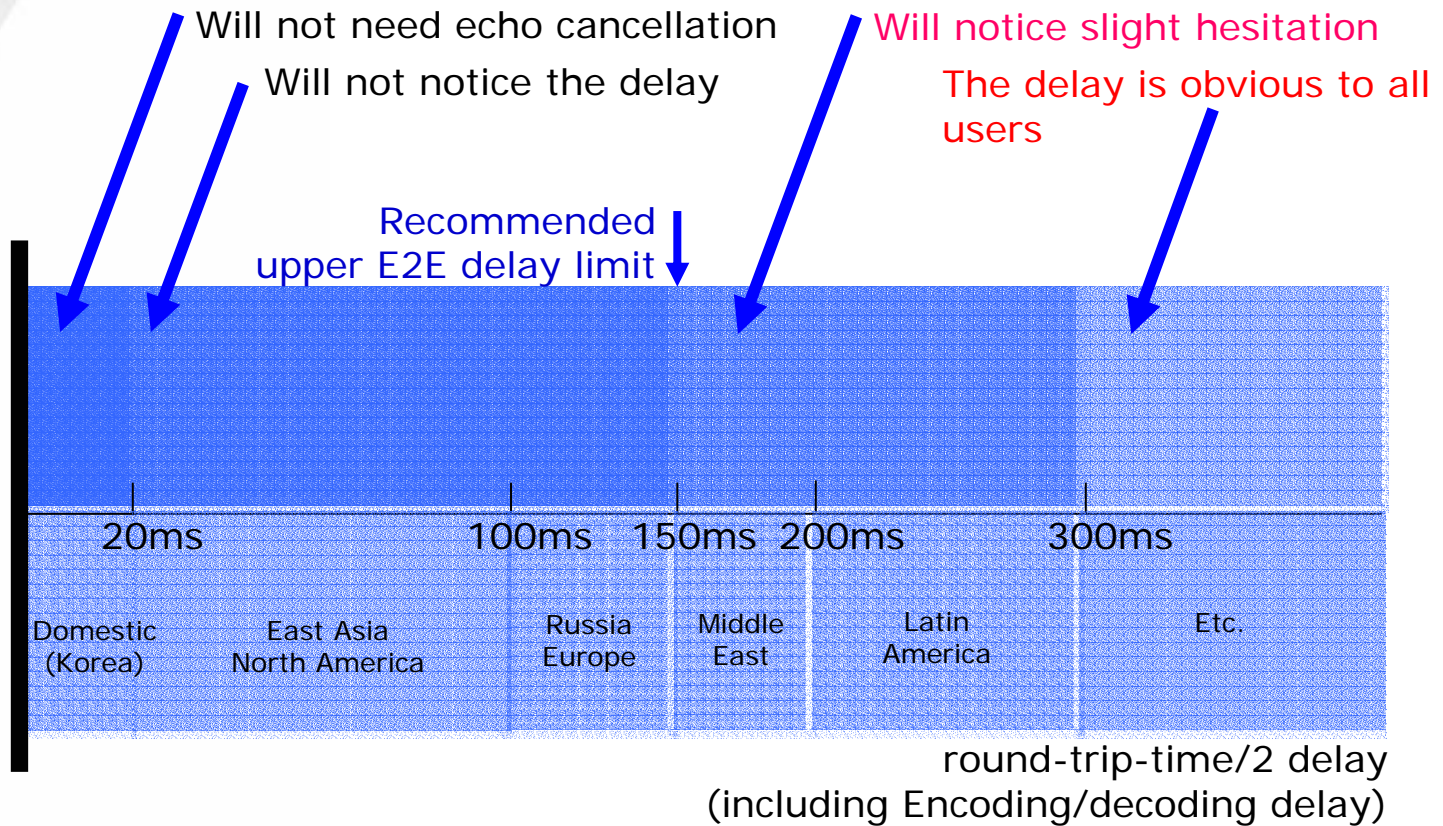
GLORIAD-KR HDTV Group

GLORIAD-KR

Multimedia over the Internet



One-way delay vs., user perception



May 2006. Based on PingER history.
ping from the east Asia to the world

Networked HDTV

		Compressed	Uncompressed
Res.		Up to 1920x1080	
Bandwidth		19.2Mbps	1.485Gbps
CODEC		MPEG2	-
Performance		Handle one stream with high performance server (Single CPU)	Handle one stream with high performance server (Dual CPUs)
Delay	En/Decoding	1~2 seconds	0
	Buffering	dependent on policy	Ideally, 0~5 frames (0ms~166ms)
Advantage		<ul style="list-style-type: none"> - Low cost - Low bandwidth consumption - high quality 	<ul style="list-style-type: none"> -Low delay - Ultra-high quality
Disadvantage		<ul style="list-style-type: none"> -High delay - sensitive to packet losses - not fit into interactive applications 	<ul style="list-style-type: none"> -High cost -Large bandwidth consumption
Killer apps.		IPTV	Broadcasting

Advantages of Streamed Uncompressed HDTV over Broadcast-style

1. Extremely **low processing delay** (No CODEC)
 - ideally, zero
2. **Ultra-high presentation quality** (No error propagation)
 - no temporal dependency
3. **Accessibility** to middleware technologies and network infra.
 - easy to apply it to numerous applications like education, entertainment, medical, and so forth.
4. Easy to **merge** and transport **other types of media**
5. **Interactivity**
 - support 1:1, 1:N, and limited N:N

Uncompressed HDTV in the World

	USC/ISI	Research Channel	NTT	GLORIAD-KR
Scanning	720p	1080i	?	1080i
In/Output	SMPTE292M	SMPTE292M	SMPTE292M	SMPTE292M
HD-SDI	DVS	DeckLink AJA	Own	AJA
SMPTE292M over IP	No, but Possible	Yes	Yes	No
Active samples over IP	Yes	No	No	Yes
Dual-channel	No	Yes	Yes	Yes
Hardware audio	No	Embedded	Embedded	Internal
Software video	xVideo, SDL	?	?	xVideo
Software audio	RAT	?	?	Yes (Linux ALSA)
Capture from disk	No	?	?	No
Software	UltraGrid 0.4.1	iHD1500	Own	UltraGrid 0.3.1 modify.
Etc.				

GLORIAD-KR version of UltraGrid

1. **Cost-effective** system integration and development
 - Adopt low-cost HD-SDI Interface ([AJA's OEM_HS](#))
 - Add [internal 24-bit 48KHz HW audio](#) to the system
 - : audio capture, separate audio RTP stream, audio playout
 - Support [dual-port streaming](#) with software packet-striping
 - [SW-based multi-channel audio playout](#) (PC sound card)
2. System Specification
 - Linux (Mandrake, Suse, Fedora Core 5)
 - EM64T dual Xeon (at least 2 PCI-X)
 - Dual-port 1 Gbps or 10 Gbps network interface

Partners

5 Sites are using GLORIAD-KR version of UltraGrid in the Globe



Cost-effectiveness

50% off over USC/ISI's UltraGrid

	DVS	OEM_HS	Software A/V playout	Dual-port support
HDV Cam.	\$4,500	\$4,500	\$4,500	\$4,500
1 HD-SDI converter	\$1,600	\$1,600	\$1,600	\$1,600
2 Servers	\$4,800	\$4,800	~ \$4,800	~ \$4,800
2 10 G NIC	\$2,600	\$2,600	\$2,600	\$0
2 Frame grabber	\$14,000	\$3,400	\$1,700	\$1,700
1 HDSDI converter	\$770	\$770	\$0	\$0
2 Audio A/D Converter	\$900	\$900	\$400	\$400
Display	\$2,400	\$2,400	\$2,400	\$2,400
Total	\$31,570	\$20,970	~ \$18,000	~ \$15,400

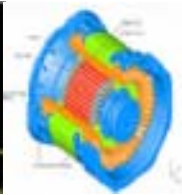
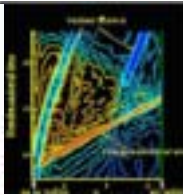
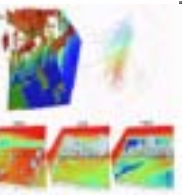
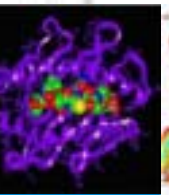
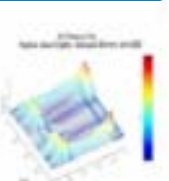
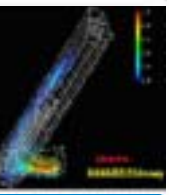
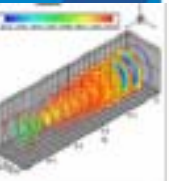
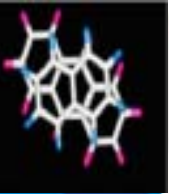
Sender & Receiver

Global Ring Network for Advanced applications Development (GLORIAD)

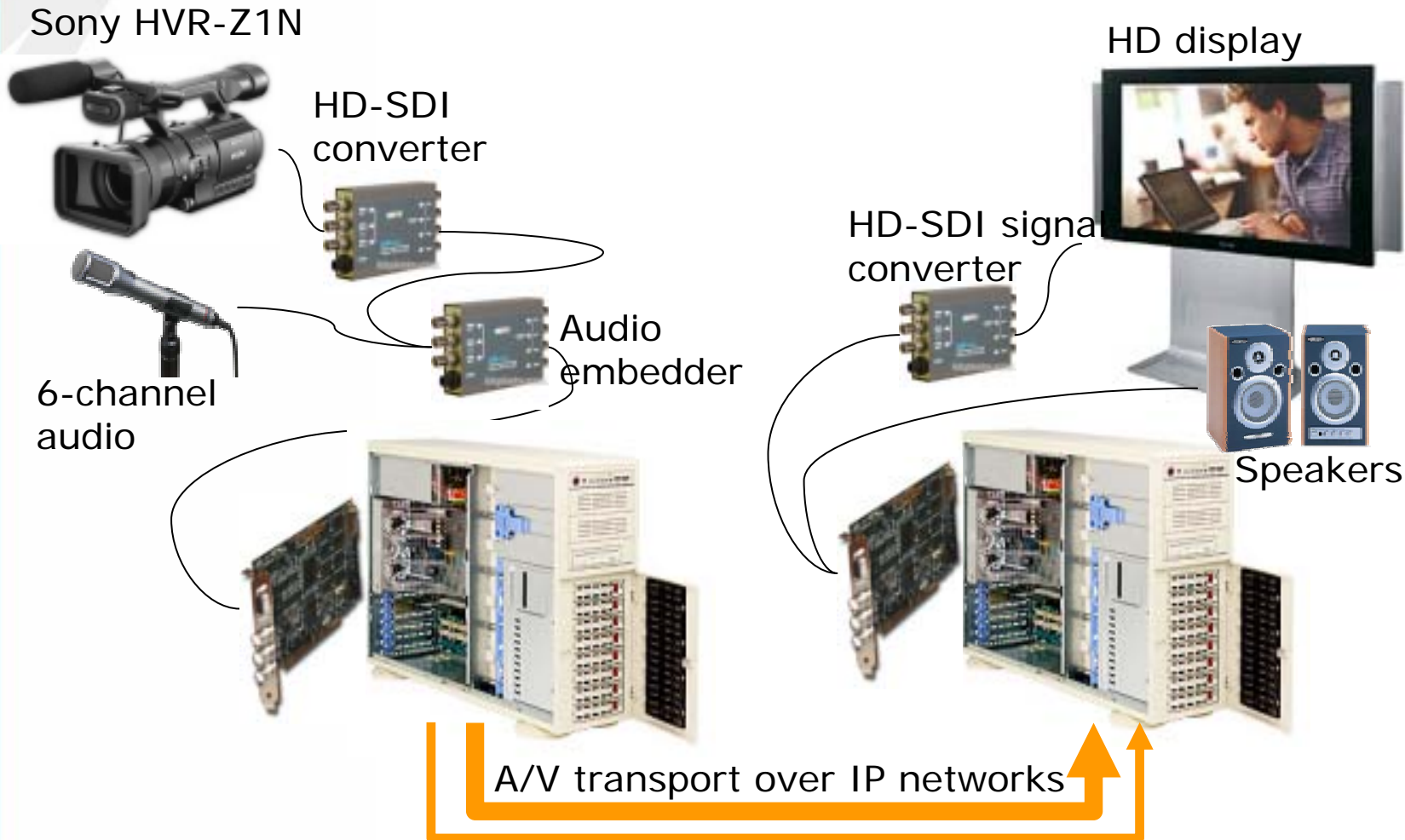
- The first round-the-world high-performance networks jointly established by Korea, China, United States, Russia, Canada and Netherlands
- Improve networked collaboration with e-Science and Grid applications like HEP, Astronomy, Fusion, Geosciences, Medical sciences, and so forth.



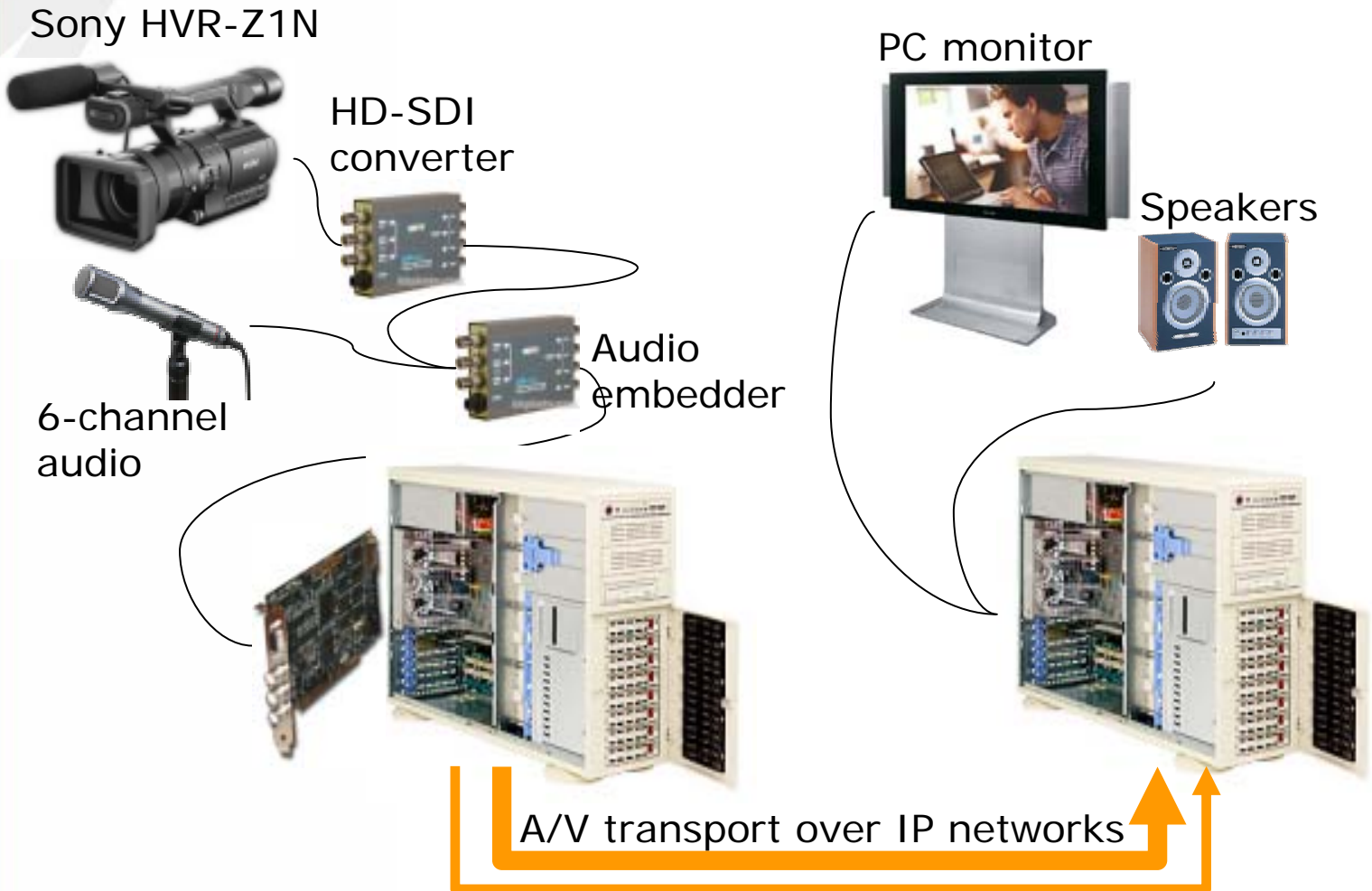
Grand Opening for Big GLORIAD('05.9.5)



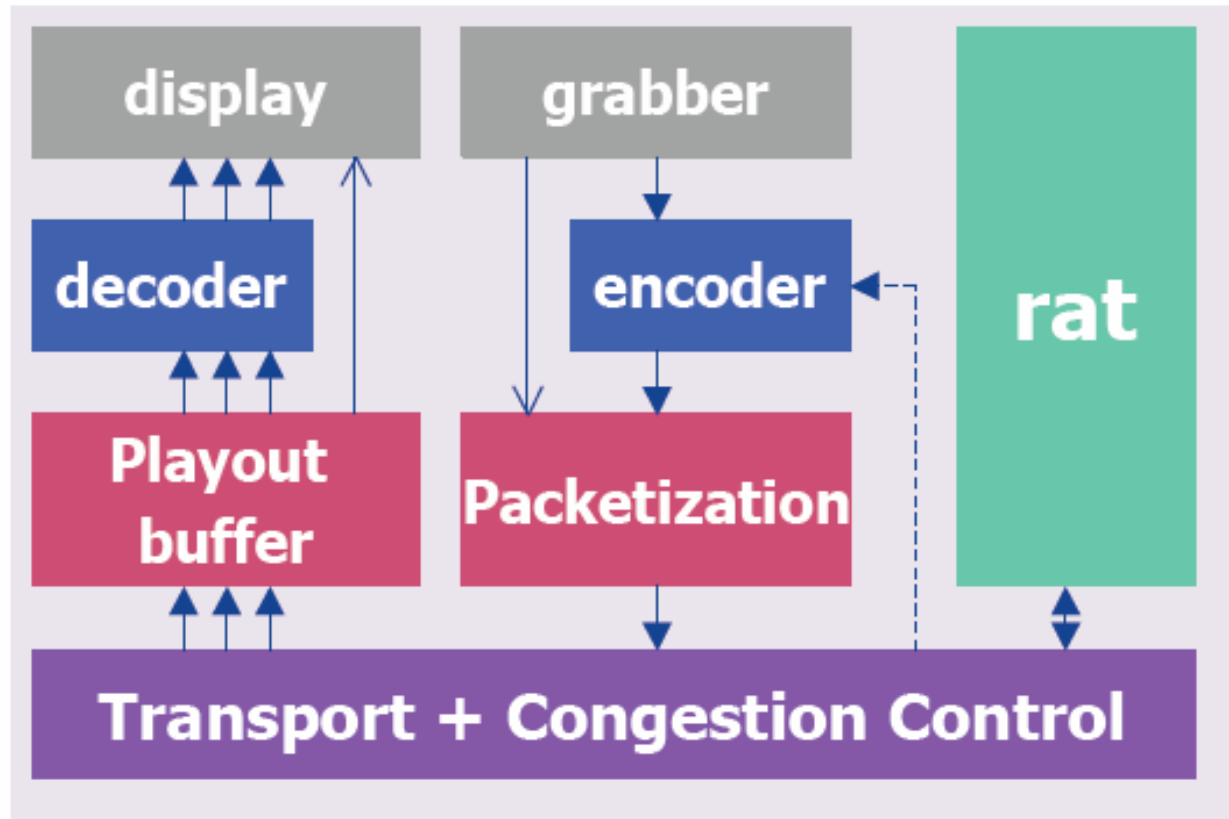
Uncompressed HDTV Transport System: GLORIAD-KR (HW-based HDTV-OUT)



Uncompressed HDTV Transport System: GLORIAD-KR (SW-based PC-OUT)

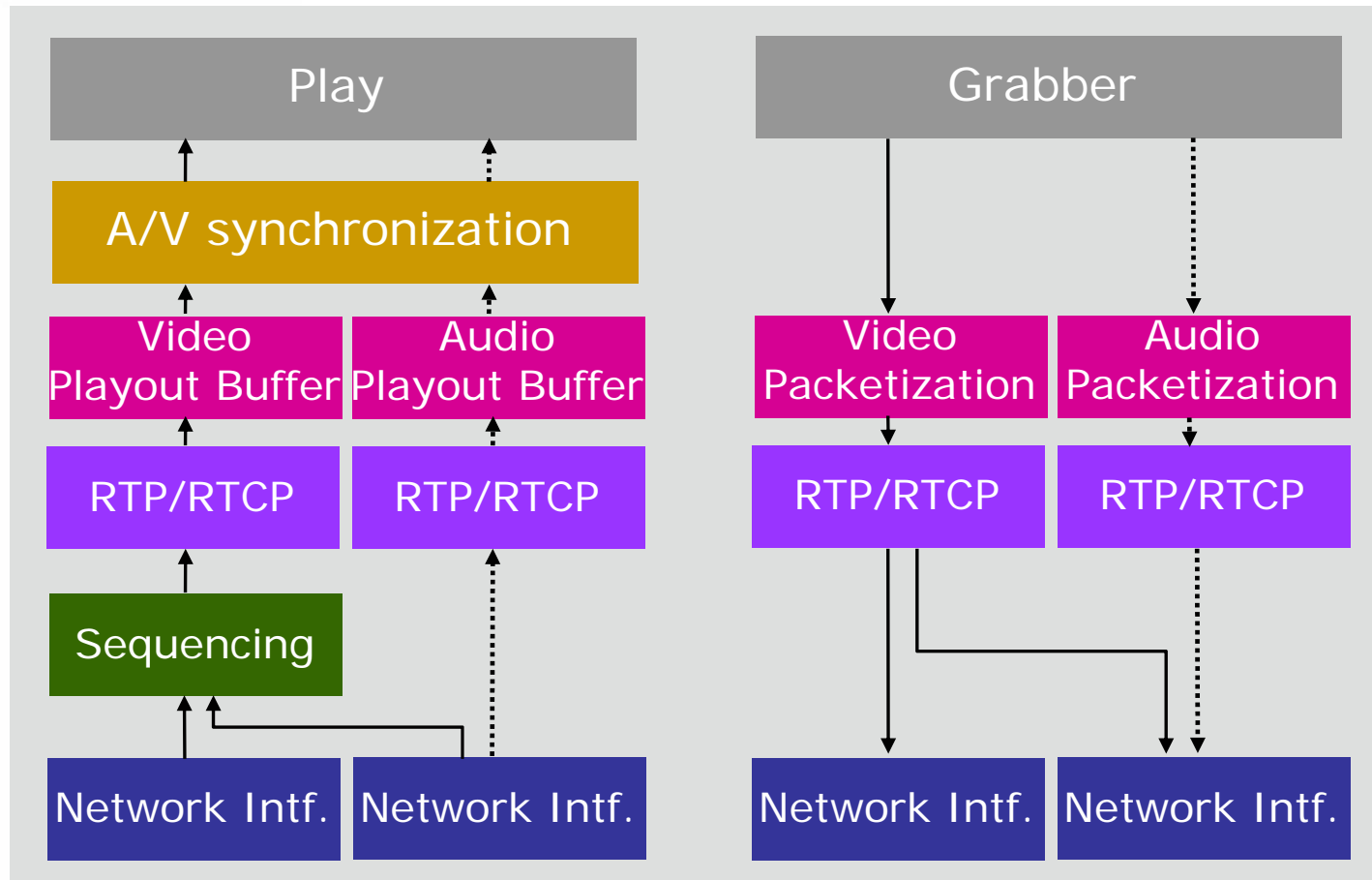


Uncompressed 720p HDTV : application technology in UltraGrid (UCS/ISI)



Ladan Gharai, "Putting the "Ultra" in UltraGrid: Full rate Uncompressed HDTV Video Conferencing",

Uncompressed 1080i HDTV : application technology in GLORIAD-KR



Demonstrations and Experiments with GLORIAD-KR Version

- **iGrid 2005**, Interactive 3D HD Video Transport and Collaborative Data Analysis for e-Science over UCLP.
KISTI, GIST
- **C-K Experiments**, First C-K Uncompressed HD experiment exploiting GLORIAD network.
KISTI, GIST, KAIST, TsingHua Univ, CNIC
- **DancingQ 2006**, The First Real-time Commercial Culture Event over R&E Network.
ANF, KISTI, CRC, i2Cat
- **ELSA 2006 Pre-congress**, Live Uncompressed HD broadcast of Laparoscopic Liver Surgery.
KISTI, Seoul National Univ. Bundang Hospital.
- **SC 2006**, Software-based A/V play with a low-cost uncompressed internet HDTV
KISTI, GIST

Demonstrations and Experiments

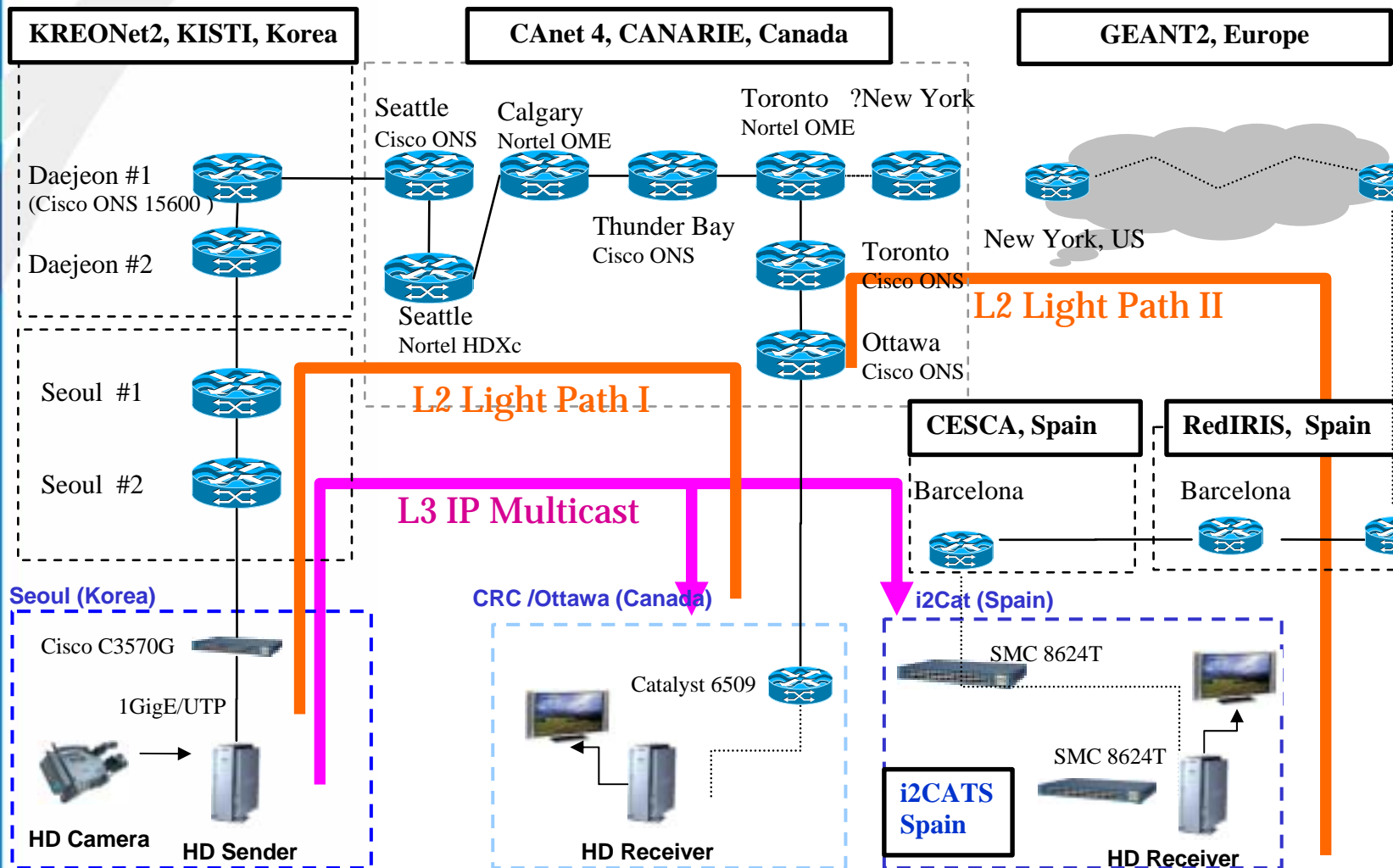


DancingQ 2006

- **DancingQ 2006 (L2+L3)**, The First Real-time Commercial Culture Event over R&E Network.
 - Bound two lightpaths with **port-based VLAN** (L2)
 - Add **L3 multicast** service
 - **Jumbo frame** support
 - 1 Gbps E2E network bandwidth
 - ANF, KISTI, i2Cat, CRC, KAIST, GIST



• DancingQ 2006 (L2+L3)

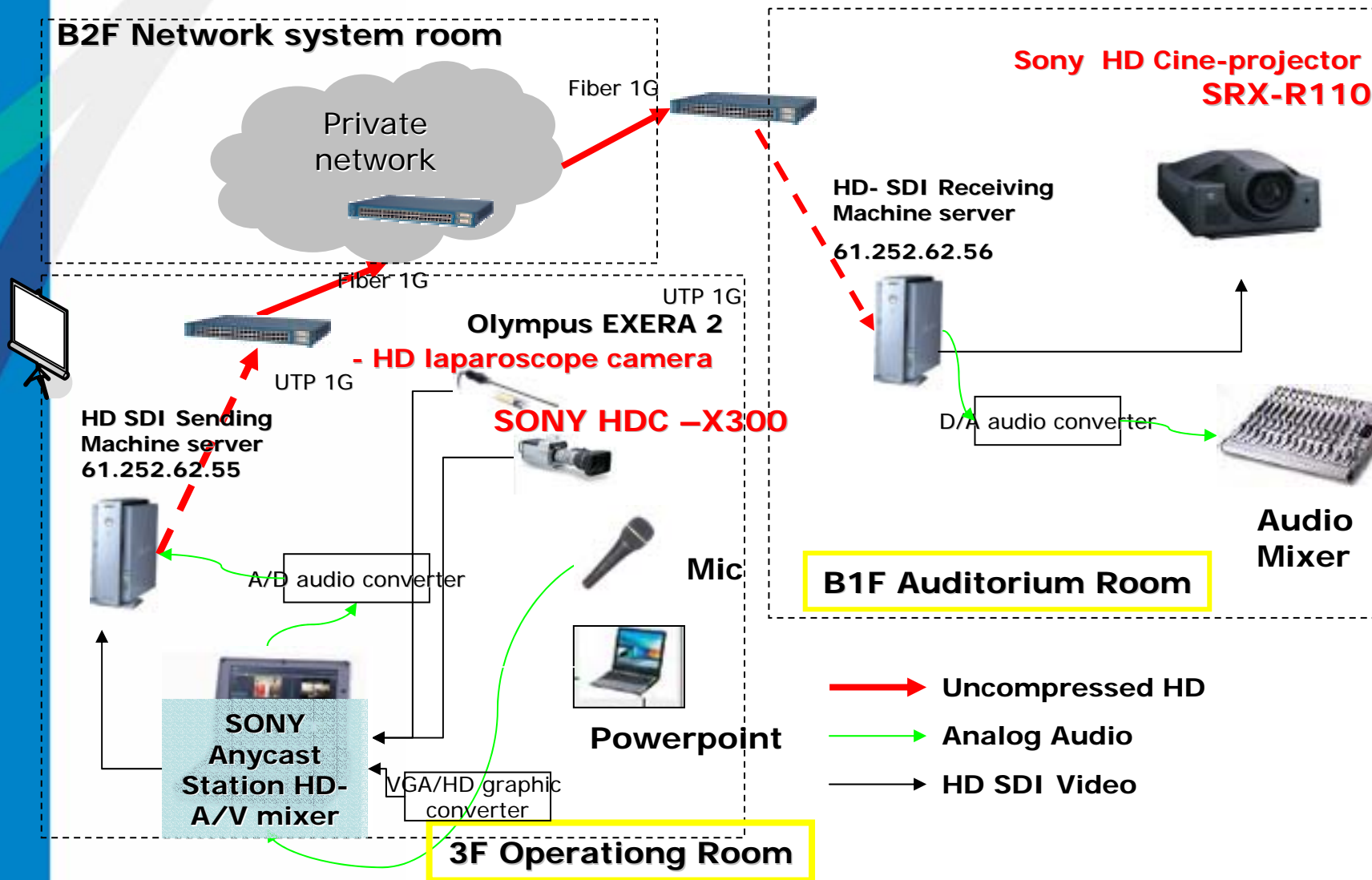


ELSA 2006 Pre-congress

- **ELSA 2006 (short-haul L3)**, Live Uncompressed HD broadcast of Laparoscopic Liver Surgery
 - Local network
 - No **jumbo frame** support
(Endpoint Fragmentation and Reassembly)
 - 1 Gbps E2E network bandwidth
 - KISTI, Sony, Olympus, SNU Bundang Hospital.

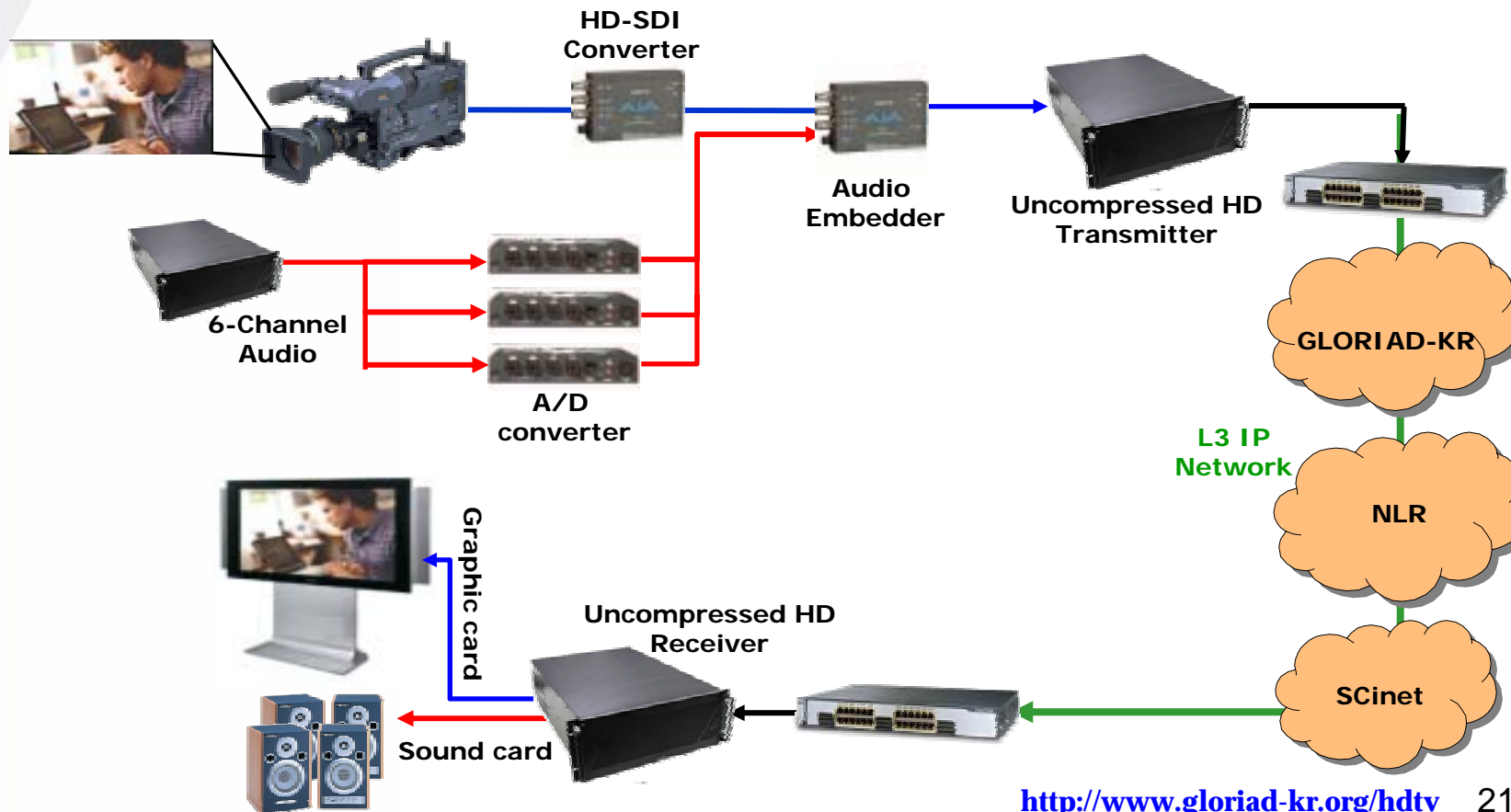


- ELSA 2006 (short-haul L3)



SC 2006 Demonstrations

- **SC 2006 (long-haul L3)**, 8-bit 1080i video & multi-channel 24-bit audio playout with low-cost graphic and sound card
 - No QoS guarantee
 - Jumbo frame support
 - KISTI, GIST



How to apply it to Access Grid

- Already have AG module
- Many-to-many?
 - One-to-one or One-to-many visual sharing
 - A one-to-many shared application
- Visual sharing with uncompressed HDTV
- Interactive conference with compressed HDV (VLC, DVTS) or AG

