Super Hi-Vision at the London 2012 Olympics

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Super Hi-Vision

- Super Hi-Vision (SHV) system being developed by NHK
- 4360 lines with 7680 pixels / line (33 Mpxels)
- 60 frame/s progressive
  - 120 now being added to the standard
- 16:9 aspect ratio
- 22.2 multichannel sound
- NHK working towards first experimental in Japan by 2020
SHV viewing experience

Viewing distance: 0.75 x Picture height
Viewing angle: 100 degrees

- 100-200 inch
  Viewing distance: 1-2m

- 65 inch
  Viewing distance: 65cm

- A3 wide
  Viewing distance: 25cm
SHV listening experience
BBC’s interest in SHV

- Big screen public viewing events across the UK:
- Transmit to specially fitted out theatres
- Up to 600 in projection screen size possible
- Just like being there (Tele-presence)
London 2012 Olympics

Super Hi-Vision Showcase
Super Hi-Vision Showcase

- Partners: NHK, BBC, OBS
  - Associates: NTT, BT, Janet, Geant2, Internet2, Sinet4

- 3 Public View sites in UK
- 3 Public View sites in Japan
- 1 Private View site in USA
- 1 private site in the Olympic IBC
Capture at Olympic venues

Production & play out at BBC TVC

VIP and public presentation

© BBC MMXII
1. Glasgow (PQ)
2. Bradford (NMM)
3. London (IBC)
4. London (BH)
Bradford: National Media Museum
Glasgow: BBC Pacific Quay
London: BBC Broadcasting House
SHV equipment
SHV camera
Camera parameters

- 3rd generation camera
- 1.25in 4k x 2k sensors
- 4 sensors (2 x Green, 1 x Red, 1 x Blue)
- ½-pixel H and V offset between green sensors for 8k resolution
- 40 kg
- 5 x zoom lens
Outside Broadcast Video Truck
Microphones
Audio Truck
Olympic Park to TV Centre
SHV Operations Centre
Operations Centre plan
Video editing
Audio editing
Playout
Coding
Channel operations
PV Theatres
8k Projector
Projector adjustment
16 x HD-SDI cabling
22.2 multichannel audio
SHV IP Transmission System
Encoder implementation
Transmission parameters

- 280 Mbit/s Video coding bit rate
- 384 kBit/s per channel
- 350 Mbit/s IP bit rate
- FEC 20% overhead
IP output

- 2 x 175 Mbit/s UDP IP data streams (350 Mbit/s total)
SHV decoder rack
UK Network
The UK Network

- BBC Television Centre
- BBC (Atos)
- Janet
- Clydemet
- YHman
- BT link
- Glasgow
- Bradford
- London
Performance

• None of the links were error-free initially
• Errors came in bursts at various times of day & night
• Fixes involved collaboration across the networks
  – Only change one thing at a time
  – Wait several days between changes
• All three PV sites now have excellent performance
Experiences at PV sites: London

- On BBC R&D network
- Errors due to network reconfiguration or maintenance
- Solved by communication with the operators
Bradford

- National Media Museum link originally 100 Mbit/s
- Complicated upgrade to 1Gbit/s
- Significant packet loss on initial attempts
Bradford: National Media Museum
March 2012

Leeds University
YHMAN PoP

Bradford University
YHMAN PoP

National Media Museum

10 Gbps

100 Mbps

1 Gbps

10 Gbps
Glasgow: GRID Computing Traffic to ClydeNET

from Clydenet: 700.17 M b/s ave, 2.47 G b/s max, 599.92 M b/s last

to Clydenet: 1.62 G b/s ave, 4.35 G b/s max, 1.73 G b/s last
Glasgow

• Several network reconfigurations tried to separate GridPP traffic from SHV traffic
• Enabled Quality of Service on SHV data
• Detailed monitoring enabled to track down problems
• Analysis card was found to be overloaded
• Solution:
  – Turn off monitoring
Super Hi-Vision Transmission from London to Tokyo

• Joint project of SHV live streaming for future public viewing.
• Multi-hop shared R&E networks over EU/US/Japan.
Streaming Status
- from London to Japan.
- Burst Packet Loss
- Variation of Latency

![Graph showing packet loss and latency over time]

15:17:24
May Latency 326 mSec

14:40:14-14:40:15
Latency Change 264→270 mSec
FEC : Forward Error Correction for IP

- Recovering dropped IP packets from End—End. (NWs, SWs, Terms) – bursts of up to 16,000 packets corrected
- Larger packet size of processing blocks, More robust.
- UDP, Multicast

TX Data  1bit -> 1 IP-packet

Forward Error Correction by LDGM

Robustness vs Block-size (10% redundancy)

- LDGM (5000 blocks)
- Reed Solomon (256 blocks)
Fureai Hall, Tokyo
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