EXPO 2005 Aichi, Japan Message Event,
Closing Forum,
"Towards the Creation of a Sustainable Society"

Event: Sept 21st, 2005

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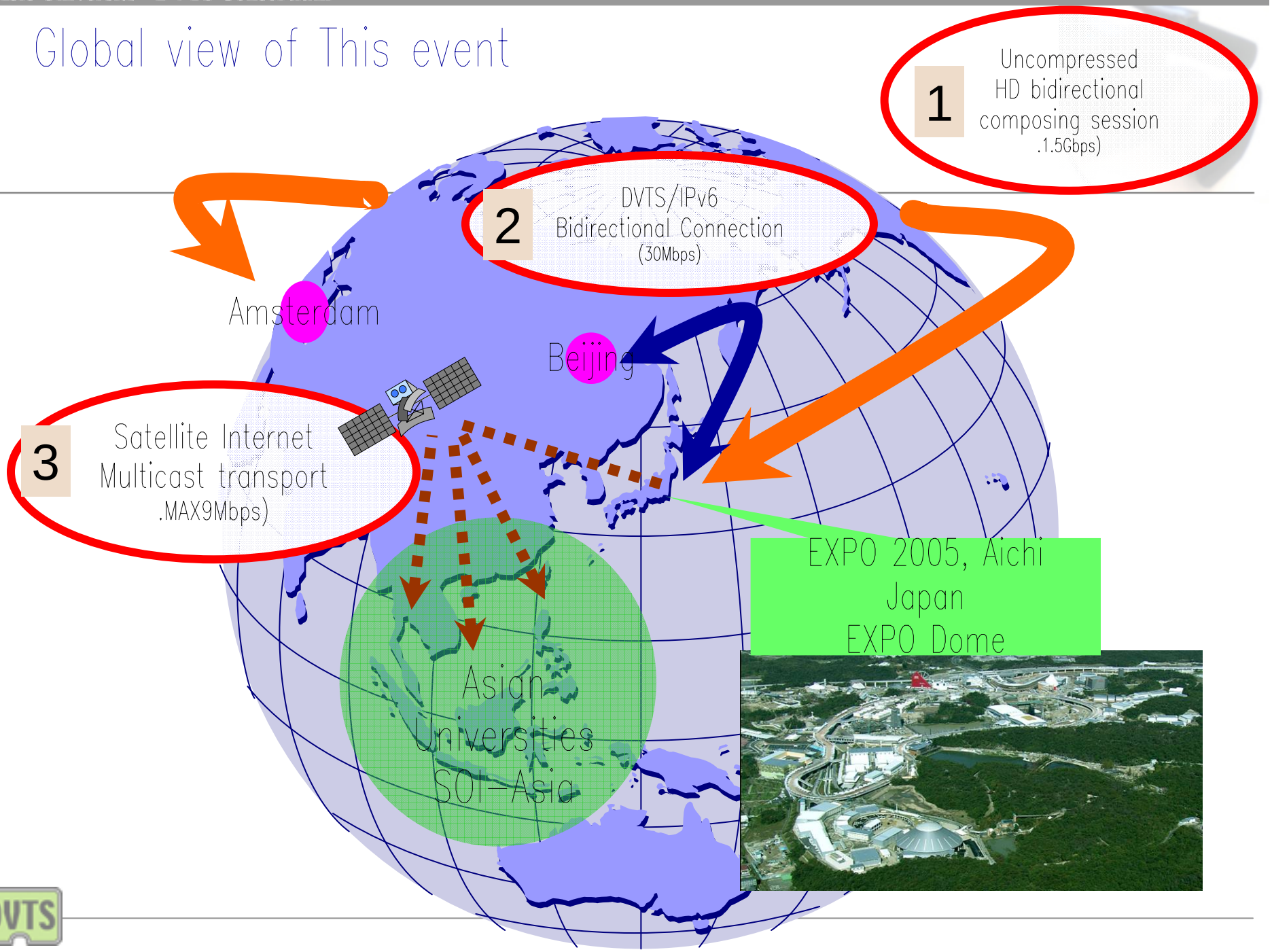
Egon Verharen, SURFnet

Key of this event

- Interactive connection between the event site at EXPO 2005 and Amsterdam, incorporating i-Visto, uncompressed HDTV transmission technologies developed by the NTT Research Lab.
- The demonstration will use this platform as a test bed for musical collaboration using Internet Metronome to overcome time delays in transmission.
- The demonstration will also feature a live video cross talk panel session with students participating from all over the world via a link made possible with IPv6 from Amsterdam, Beijing, and EXPO 2005.
- All of the demonstrations will be widely broadcast over Asia.

Global view of This event



DVTS

Uncompressed HD Bidirectional Communication

- HDTV over IP
  - i-Visto Gateway
    - Developed by NTT Communications

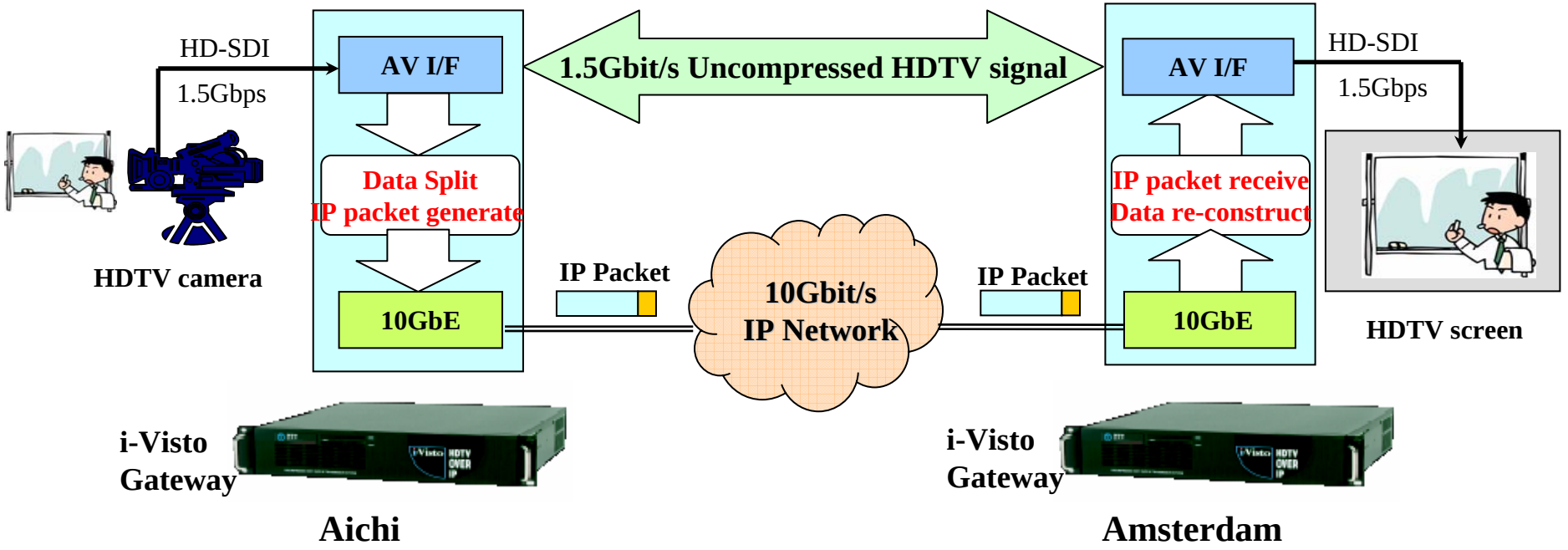
HDTV over IP . i-Visto Gateway

  - Realizing a collaborative Jam session between Japan and Netherlands

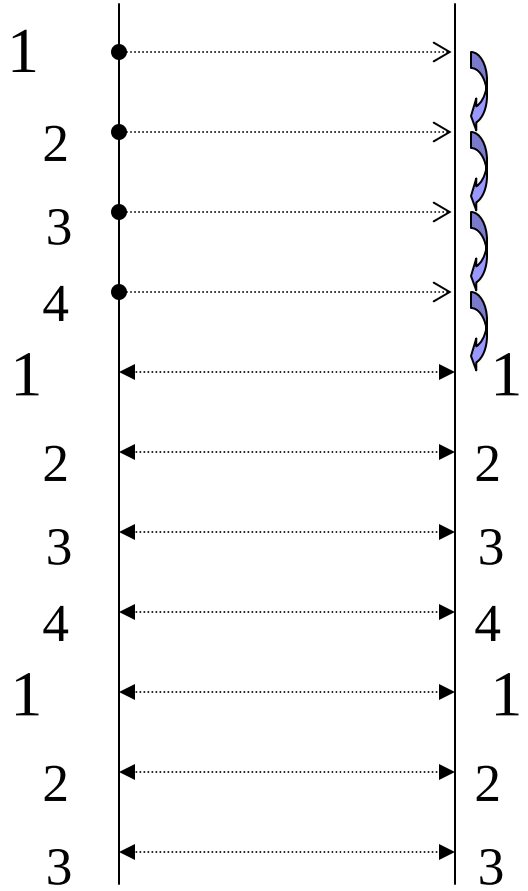
Real-time HD over IP with "**i-Visto**"

i-Visto['aibist] : Internet video studio system for HDTV production

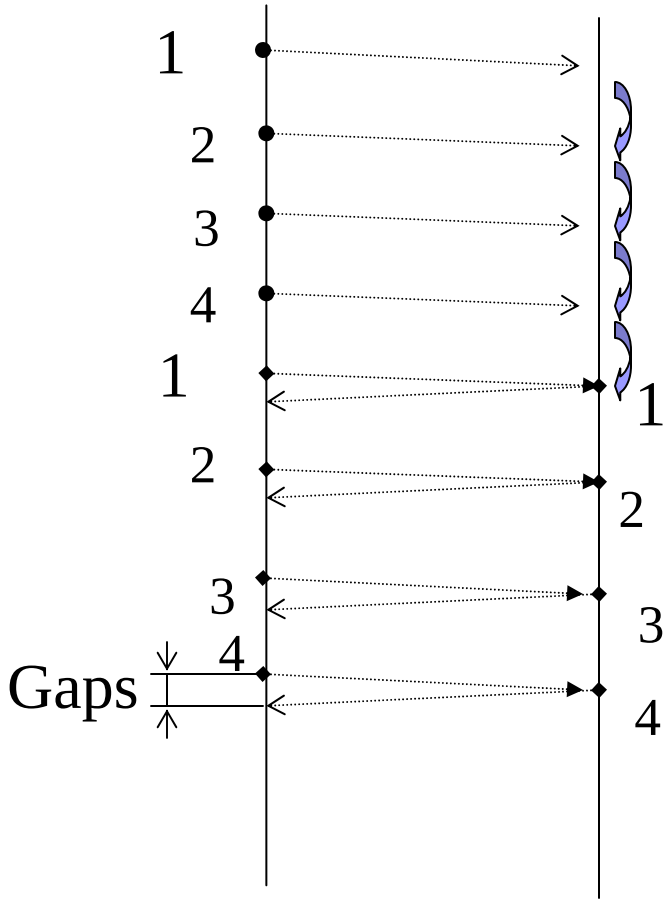
Real-time transport system for high quality video signal over IP network such as uncompressed HDTV (1.5Gbps), SDTV (270Mbps) between multiple points which is provided by NTT Communications



Music Collaboration and Delay

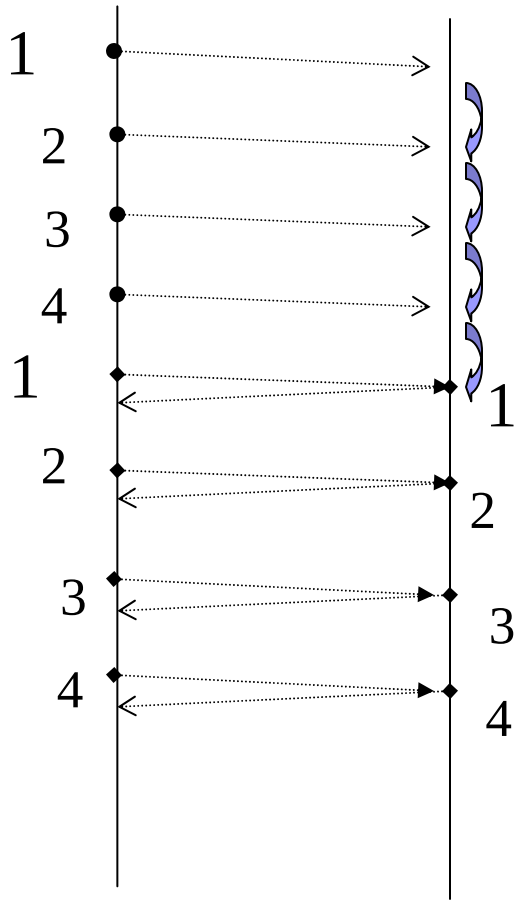


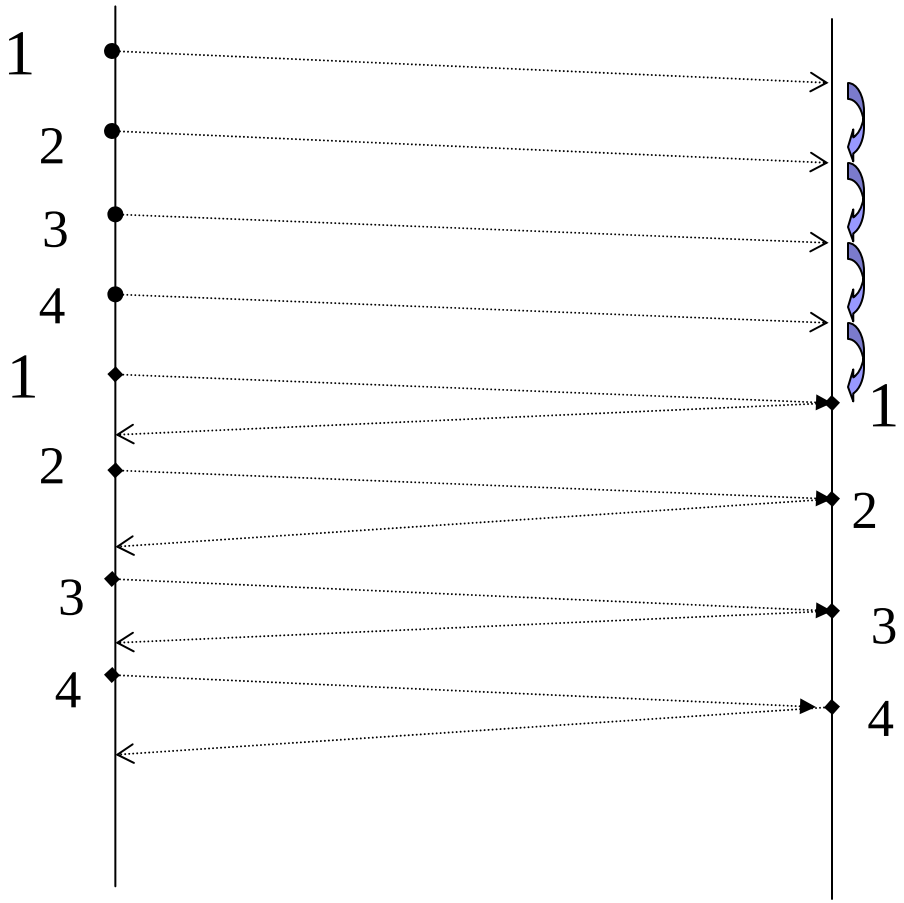
Without Delay



With Delay

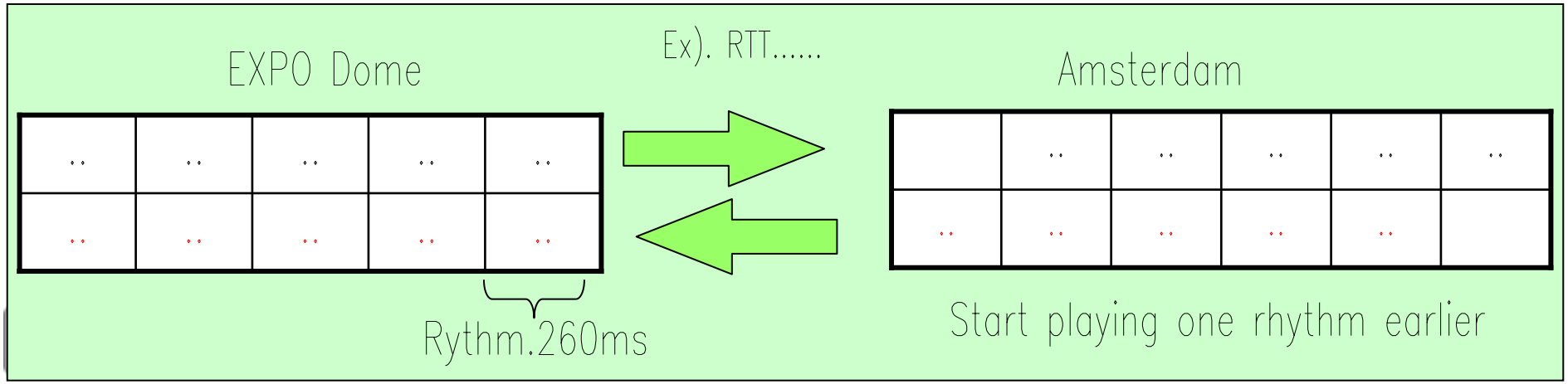
Longer Delay, Longer Gaps
Distance = Delay





Delay absorbed Music Live session

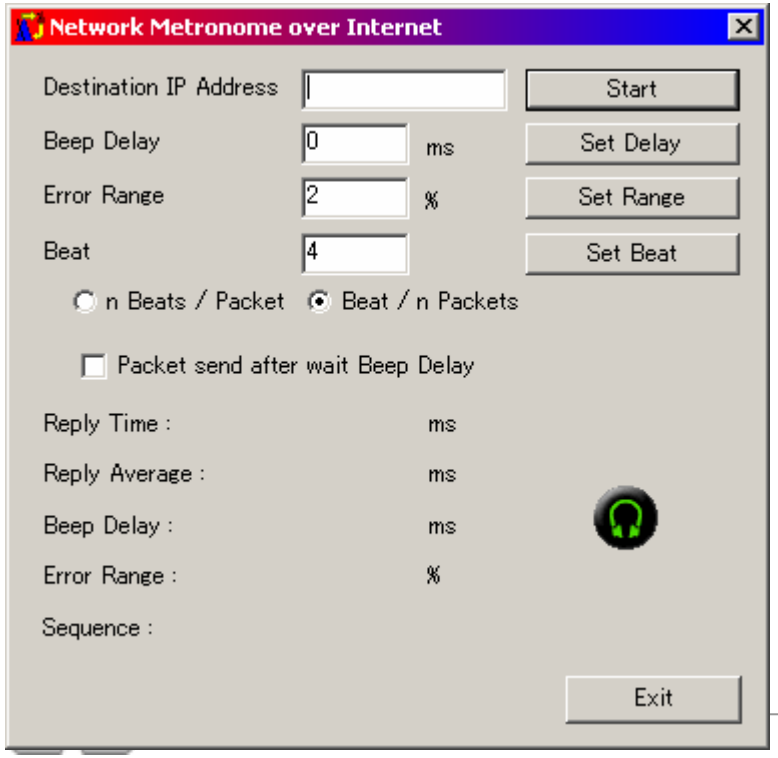
- Delay: EXPO Japan and Amsterdam
  - 260mS
    - Does not really affect real time communications
    - Playing music in such a delay is impossible
- Internet Metronome
  - A ping metronome to establish rhythms between locations.

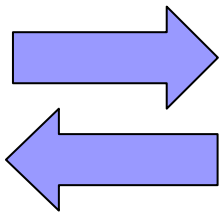


Internet Metronome

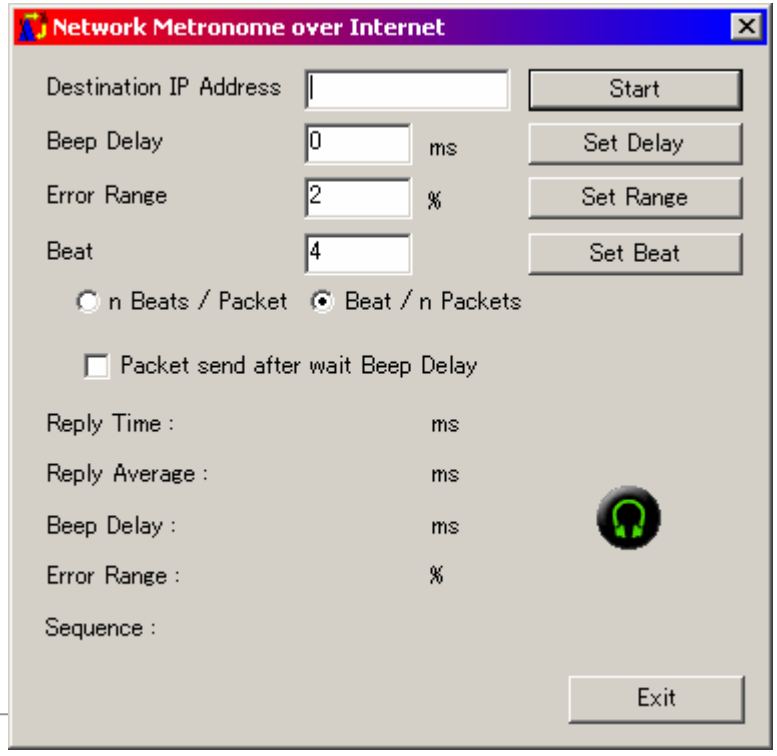
- Similar to “Ping” application
  - Based on RTT average

Tick! Master





Tack! Slave



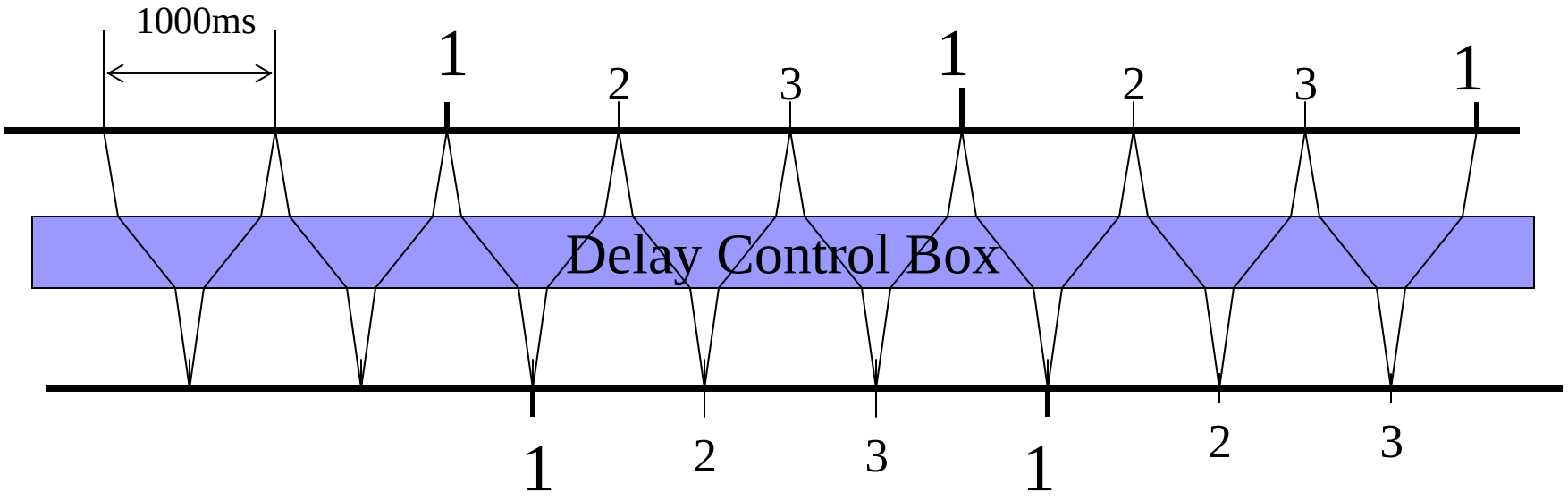
How should we control the Rhythm?

- By adjusting beat sound by
  - n beats / Packet
  - beats / n Packets
- Encoding delay, decoding delay
  - Of D/A and A/D of audio can be adjusted in addition to packet arrival
- Packet losses of Rhythm packet
  - Average RTT is used (5 average windows)
    - x % range (adjustable) RTT is used for calculation

Adding a Delay box

- FreeBSD 5.4 Delay box created with
  - Dummynet
  - Custom kernel with large kernel and network buffer space
- 2 versions
  - 10G dummynet version
    - AMD Opteron PC with 2 10G Ethernet (Intel)
  - 1G dummynet version
    - Intel Xeon PC with 2 1G Ethernet (Intel)

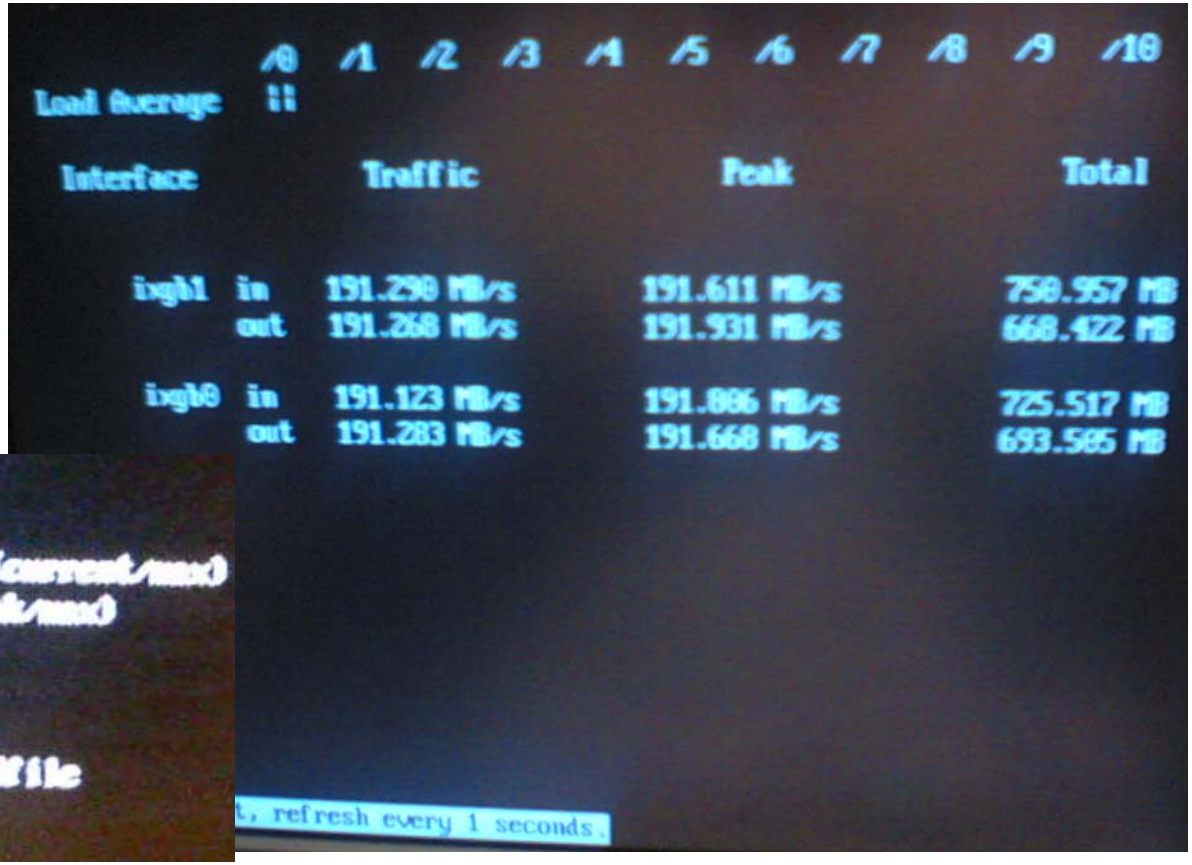
Delay 500ms(RTT 1000ms):

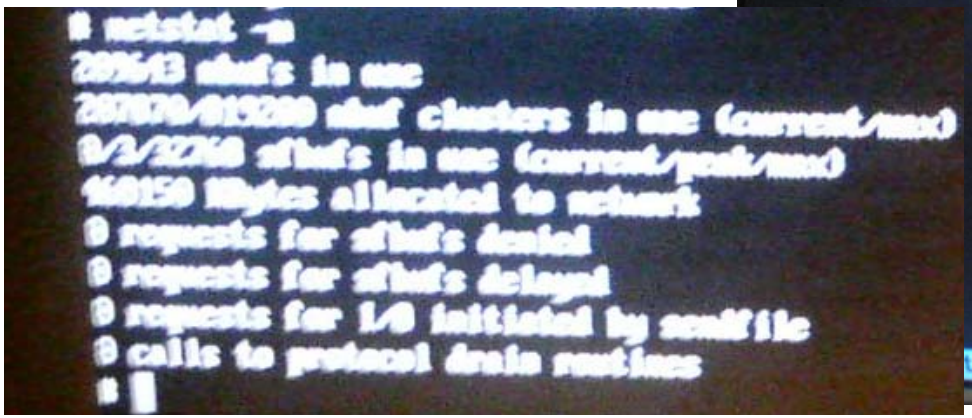


Using a delay control box to change the timing of RTT resulting a speed of rhythm

10G Delay box with HD bidirectional transmission

- Maximum delay
  - 800ms delay (1600ms RTT)
- Maximum Bandwidth
  - 3Gbps (Full Duplex)





Unfortunately…

- We are using i-Visto with 2 Gigabit Ethernet as a transport
  - We needed to construct a 10G backbone with a set of VLANs' to establish 2 subnets for HD transport
  - 10G version Delay box was not stable with VLANs
    - When constructing a delay network, Spanning tree loops may occur during initialization, causing switches to shutdown the interface to avoid packet loops. (under inspection)
  - We used 2 PCs to construct 2 dummynet subnets
    - Packet forwarding with delayed network using dummynet may be a problem when too much delay is configured
      - Reconfiguration of scheduler of Unix (10ms)
      - Hertz configuration (Hz=1000)

Adding a delay

- Adding a additional delay to the network using delay PC.
  - 270ms (+10ms)
  - 600ms (+170ms)
  - 1600ms (+670ms)
- Perform a music with different rhythm constructed with additional delay to the network

DVTS IPv6 Connection to Beijing

- Using DVTS IPv6 for live discussion between EXPO Aichi and Japan

Satellite Connection to Asian Countries

- Internet Multicast streaming to SOI Asian Satellite connected countries.

Connected sites:

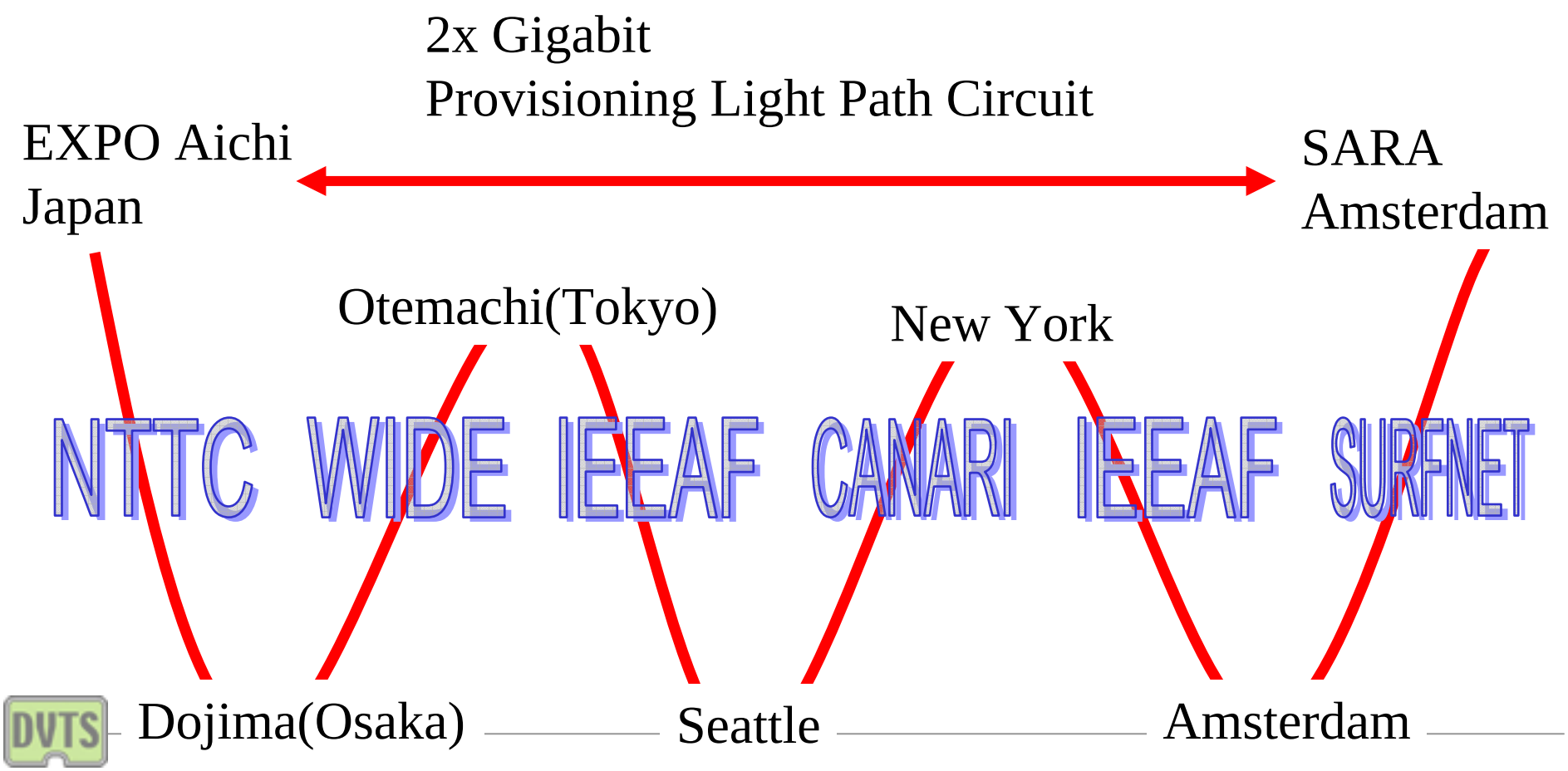
Chulalongkorn University, Asian Institute of Technology, Chulachomklao Royal Military Academy, Prince of Songkla University (Thailand), National University of Laos, Laos (Laos), University of Computer Studies, Yangon (Myanmar), Brawijaya University, Sam Ratulangi University, Institut Teknologi Bandung, Universitas Syiah Kuala (Indonesia), Hasanuddin University (South Sulawesi), Asian Youth Fellowship (Malaysia), Institute Of Information Technology (Vietnam), Advanced Science and Technology Institute, University San Carlos (Philippines), Tribhuvan University (Nepal), Institute of Technology of Cambodia (Cambodia), Bangladesh University of Engineering and Technology (Bangladesh), Mongolian University of Science and Technology (Mongolia)

Social Impact of this Event

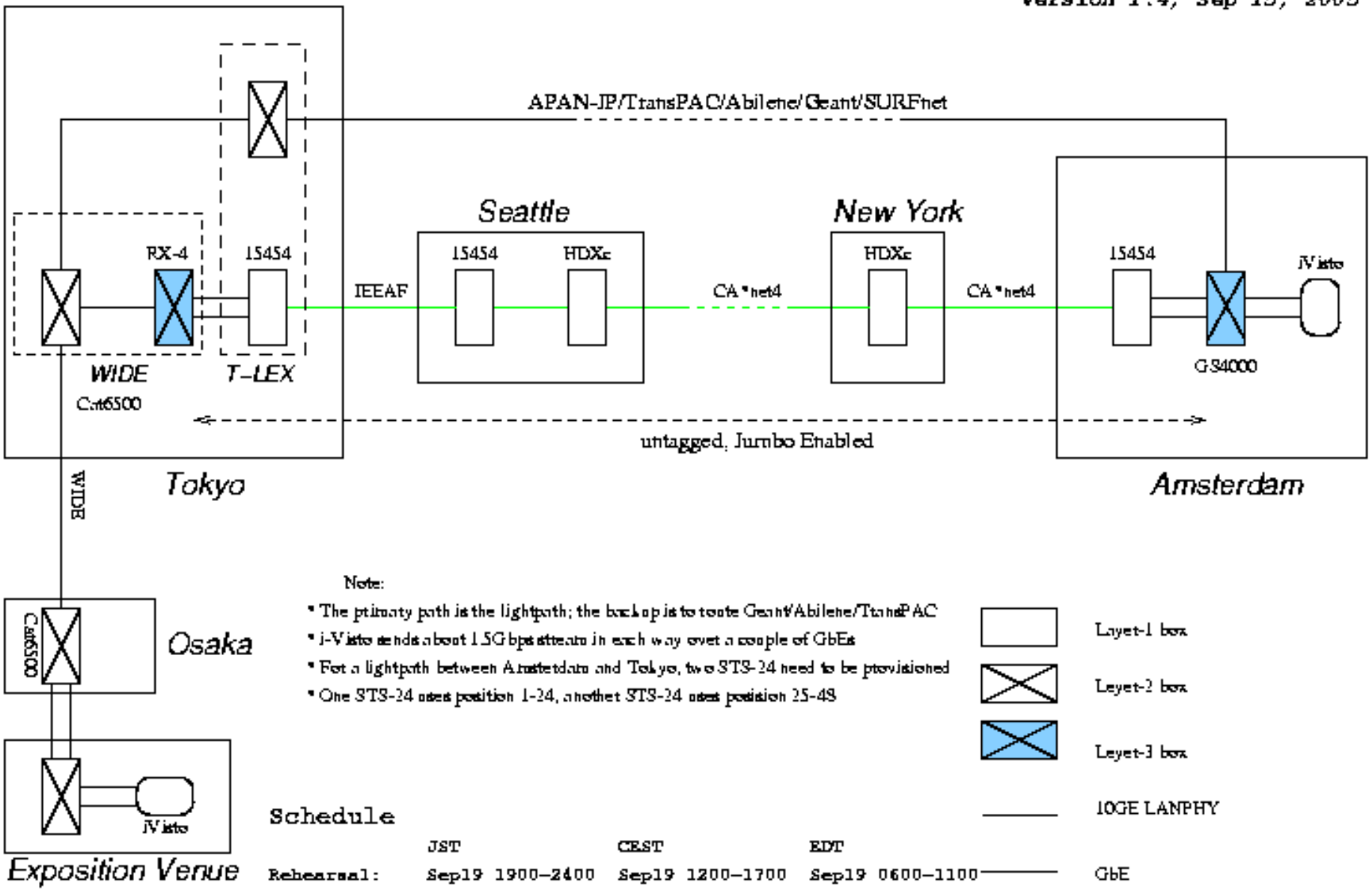
- To emphasize the concept (Theme) of EXPO 2005 event “Communication with Earth”
- To show practical readiness for the Internet technology shown in this event

Event Infrastructure

International Light Path



Version 1.4, Sep 15, 2005



Note:

- The primary path is the lightpath; the backup is to route Geant/Abilene/TransPAC
- i-Visto sends about 1.5Gbps stream in each way over a couple of GbEs
- For a lightpath between Amsterdam and Tokyo, two STS-24 need to be provisioned
- One STS-24 uses position 1-24, another STS-24 uses position 25-48

Layer-1 box

Layer-2 box

Layer-3 box

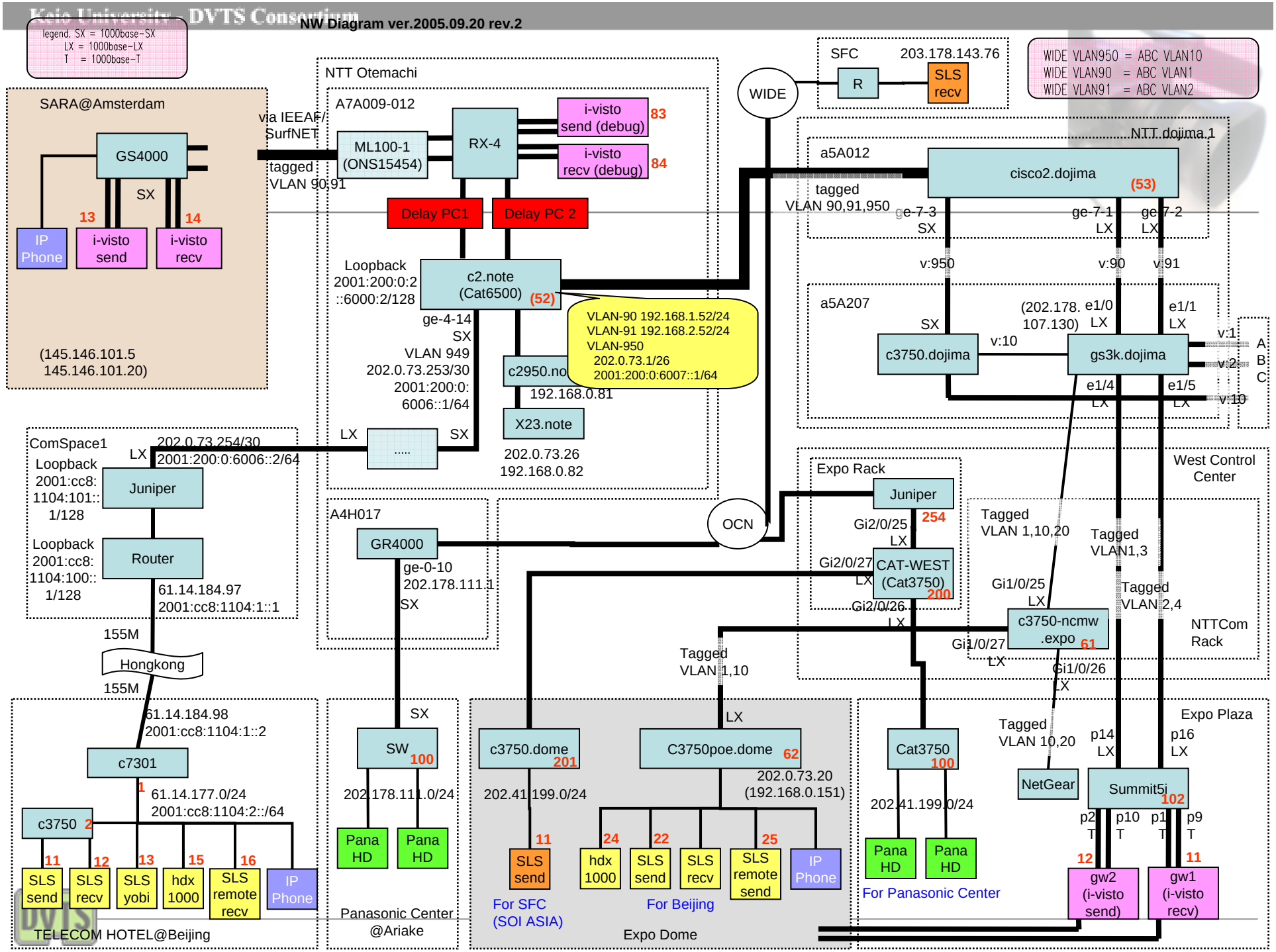
10GE LANPHY

GbE

STS-24*2 provisioned out of OC-192

Schedule

	JST	CEST	EDT
Rehearsal:	Sep19 1900-2400	Sep19 1200-1700	Sep19 0600-1100
Rehearsal:	Sep20 1900-2400	Sep20 1200-1700	Sep20 0600-1100
Performance:	Sep21 0900-1530	Sep21 0200-0830	Sep20 2000-Sep21 0230


Keio University DVTS Consortium
NW Diagram ver.2005.09.20 rev.2
legend. SX = 1000base-SX
LX = 1000base-LX
T = 1000base-T
WIDE VLAN950 = ABC VLAN10
WIDE VLAN90 = ABC VLAN1
WIDE VLAN91 = ABC VLAN2
SARA@Amsterdam
GS4000
SX
13
14
IP Phone
i-visto send
i-visto recv
(145.146.101.5
145.146.101.20)
via IEEAF/SurfNET
tagged
VLAN 90,91
NTT Otemachi
A7A009-012
ML100-1 (ONS15454)
RX-4
i-visto send (debug)
83
i-visto recv (debug)
84
Delay PC1
Delay PC 2
Loopback
2001:200:0:2
::6000:2/128
c2.note
(Cat6500)
(52)
ge-4-14
SX
VLAN 949
202.0.73.253/30
2001:200:0:
6006::1/64
c2950.no
192.168.0.81
X23.note
202.0.73.26
192.168.0.82
LX
.....
SX
VLAN-90 192.168.1.52/24
VLAN-91 192.168.2.52/24
VLAN-950
202.0.73.1/26
2001:200:0:6007::1/64
WIDE
SFC
203.178.143.76
R
SLS recv
NTT dojima.1
a5A012
cisco2.dojima
(53)
tagged
VLAN 90,91,950
ge-7-3
SX
ge-7-1
LX
ge-7-2
LX
v:950
v:90
v:91
a5A207
(202.178.
107.130)
e1/0
LX
e1/1
LX
SX
c3750.dojima
v:10
gs3k.dojima
v:1
v:2
v:10
A
B
C
e1/4
LX
e1/5
LX
ComSpace1
202.0.73.254/30
LX
2001:200:0:6006::2/64
Loopback
2001:cc8:
1104:101::
1/128
Juniper
Loopback
2001:cc8:
1104:100::
1/128
Router
61.14.184.97
2001:cc8:1104:1::1
155M
Hongkong
155M
61.14.184.98
2001:cc8:1104:1::2
c7301
1
61.14.177.0/24
2001:cc8:1104:2::/64
c3750
2
11
12
13
15
16
SLS send
SLS recv
SLS yobi
hdx 1000
SLS remote recv
IP Phone
TELECOM HOTEL@Beijing
A4H017
GR4000
ge-0-10
202.178.111.1
SX
SW
100
SX
202.178.111.0/24
Pana HD
Pana HD
Panasonic Center
@Ariake
OCN
Expo Rack
Juniper
Gi2/0/25
LX
254
Gi2/0/27
LX
CAT-WEST
(Cat3750)
200
Gi2/0/26
LX
Tagged
VLAN 1,10
LX
c3750.dome
201
202.41.199.0/24
11
SLS send
For SFC
(SOI ASIA)
C3750poe.dome
62
202.0.73.20
(192.168.0.151)
24
22
25
hdx 1000
SLS send
SLS recv
SLS remote send
IP Phone
For Beijing
Expo Dome
Tagged
VLAN 1,10,20
Tagged
VLAN1,3
Gi1/0/25
LX
Tagged
VLAN 2,4
c3750-ncmw
.expo
61
Gi1/0/27
LX
Gi1/0/26
LX
West Control
Center
NTTCom
Rack
Cat3750
100
202.41.199.0/24
Pana HD
Pana HD
For Panasonic Center
Expo Plaza
Tagged
VLAN 10,20
p14
LX
p16
LX
NetGear
Summit5i
102
p2
T
p10
T
p1
T
p9
T
12
11
gw2
(i-visto
send)
gw1
(i-visto
recv)

IP Address Summary

VLAN-90(expo - AMS)
192.168.1.0/24

ivisto-recv.expo	192.168.1.11
ivisto-send.expo	192.168.1.12
ivisto-send.ams	192.168.1.13
ivisto-recv.ams	192.168.1.14
ve-90-gs4k.ams	192.168.1.51
ve-90-c2.note	192.168.1.52
ve-90-cisco2.dojima	192.168.1.53
ve-90-gs3k.dojima	192.168.1.54
ve-90-summit5i.expo	192.168.1.102

VLAN-91(expo - AMS)
192.168.2.0/24

ivisto-recv.expo	192.168.2.11
ivisto-send.expo	192.168.2.12
ivisto-send.ams	192.168.2.13
ivisto-recv.ams	192.168.2.14
ve-91-gs4k.ams	192.168.2.51
ve-91-c2.note	192.168.2.52
ve-91-cisco2.dojima	192.168.2.53
ve-91-gs3k.dojima	192.168.2.54
ve-91-summit5i.expo	192.168.2.102

VLAN-950(expo – beijing & mgmt)
202.0.73.0/26
192.168.0.0/24(ABC)
2001:200:0:6007::/64

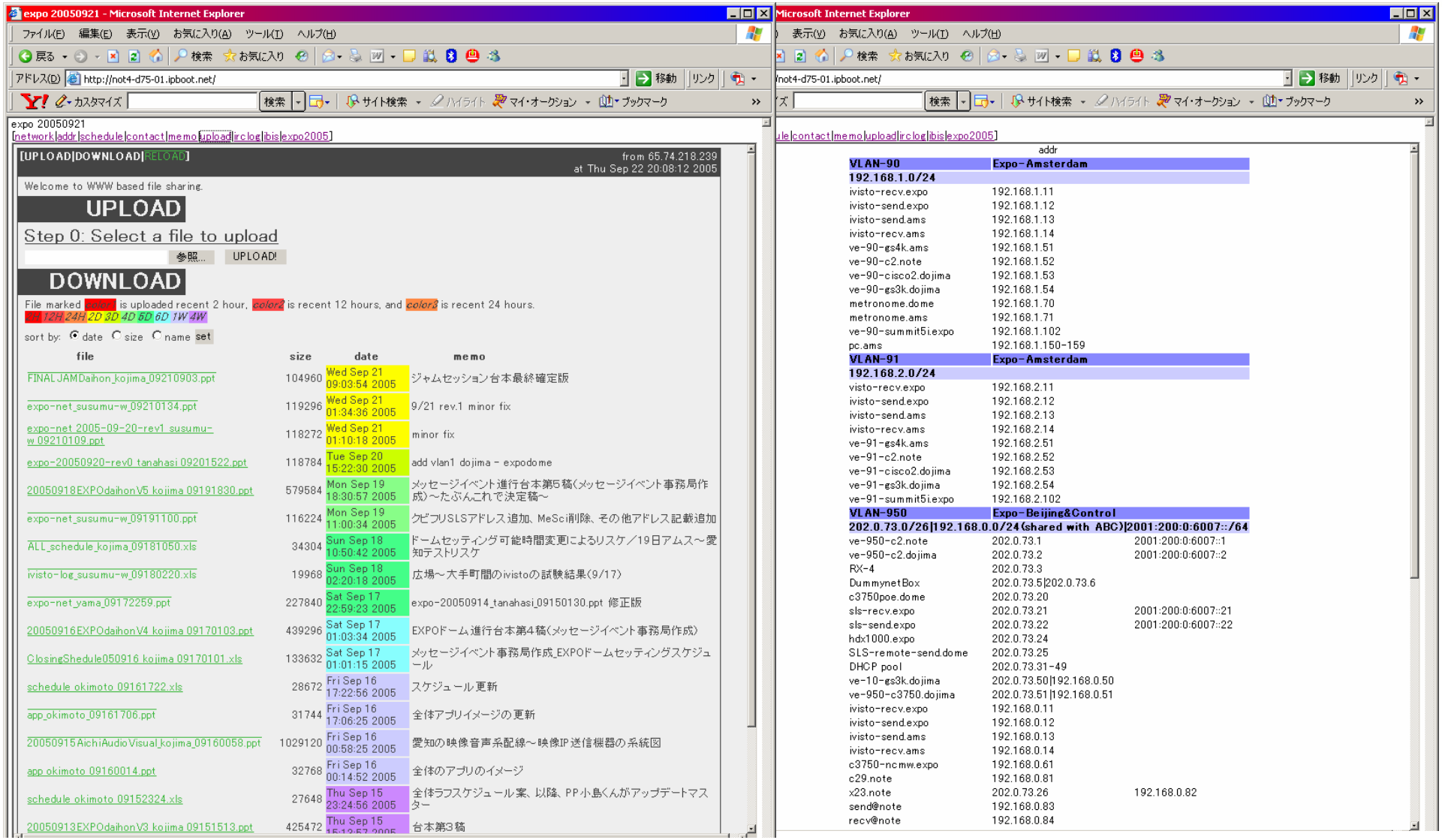
ve-950-c2.note	202.0.73.1 2001:200:0:6007::1
ve-950-c2.dojima	202.0.73.2 2001:200:0:6007::2
RX-4	202.0.73.3
Dummynet box (“delay” PC)	202.0.73.5 202.0.73.6
sls-recv.expo	202.0.73.21 2001:200:0:6007::21
sls-send.expo	202.0.73.22 2001:200:0:6007::22
hdx1000.expo	202.0.73.24
ve-10-gs3k.dojima	202.0.73.50 192.168.0.50
ve-950-c3750.dojima	202.0.73.51 192.168.0.51
ivisto-recv.expo	192.168.0.11
ivisto-send.expo	192.168.0.12
ivisto-send.ams	192.168.0.13
ivisto-recv.ams	192.168.0.14
ve-10-summit5i.expo	192.168.0.102

Beijing venue
61.14.177.0/24
2001:cc8:1104:2::/64

c7301	61.14.177.1
c3750	61.14.177.2
c3750poe	61.14.177.3
sls-send.pekin	61.14.177.11 2001:cc8:1104:2::11
sls-recv.pekin	61.14.177.12 2001:cc8:1104:2::12
sls-yobi.pekin	61.14.177.14 2001:cc8:1104:2::14
hdx1000.pekin	61.14.177.15

And many more addresses

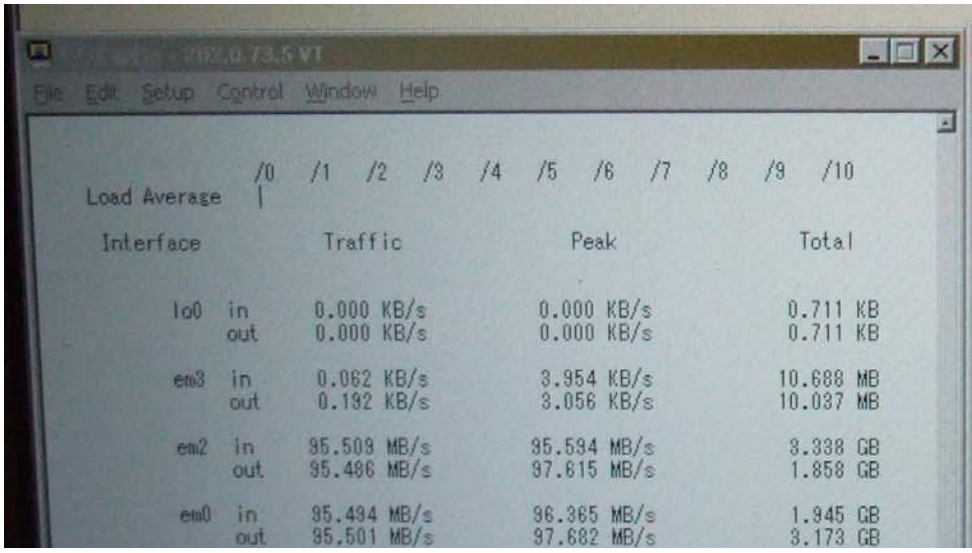
Web Pages: for staffs

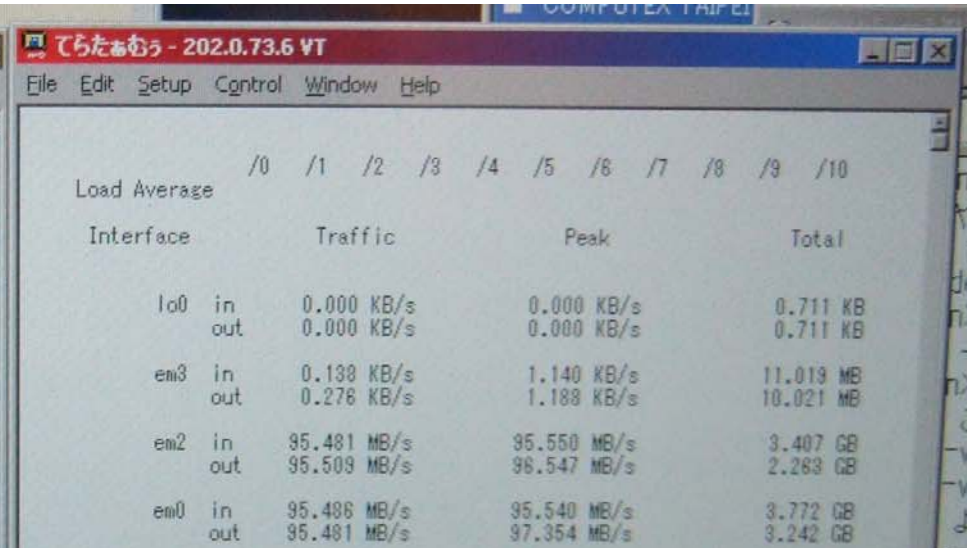


Some Pictures

Mostly from Amsterdam

AMSTERDAM INTERNET INFRASTRUCTURE WITH i-Visto






愛・地球 会議

Many Blessings!

- Meet Egon's new family: son, David
  - Born 17:11, Sept 20th
  - 3 born babies during this event ☺

Many Thanks!

- Japan Association for the 2005 World Exposition
- NTT Communications
- Asia Netcom Japan
- Global Access Ltd.
- Marubeni Corporation (Beijing)
- Matsushita Electric Industrial Co., Ltd.
- Asahi Broadcasting Corporation Cisco Systems Inc.
- Powerplay Inc.
- Japan Science and Technology Agency
- Keio University
- WIDE Project
- APAN
- TransPAC
- Abilene
- Geant
- SARA
- SURFNet