Network Performance and Possible Improvement For Medical Demonstration

APAN-JP/KDDI/NICT/TEIN2-JP
Jin Tanaka

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Who am I ?

- Jin Tanaka tanaka"at"kddnet.ad.jp

- KDDI Cooperation
    - Japanese Telecommunication Carrier
    - OTC/Otemachi Technical Center

- Network Operation Engineer
    - Worked as network engineer of Commercial ISP for 2 years
    - Currently working as network operator of R&E Backbone Networks
        - APAN-JP NOC : Chief Engineer
        - JGN2plus NOC
        - TEIN2-JP NOC
        - JP-NOC member
        - NICT/SPARC Guest Researcher
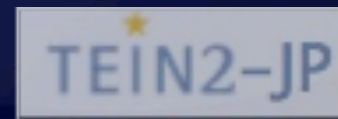
Agenda

- CanalAVIST demo support

- Network Performance Measurement

- New Network Technology

- Conclusion

Network Configuration in Japan for CanalAVIST medical forum
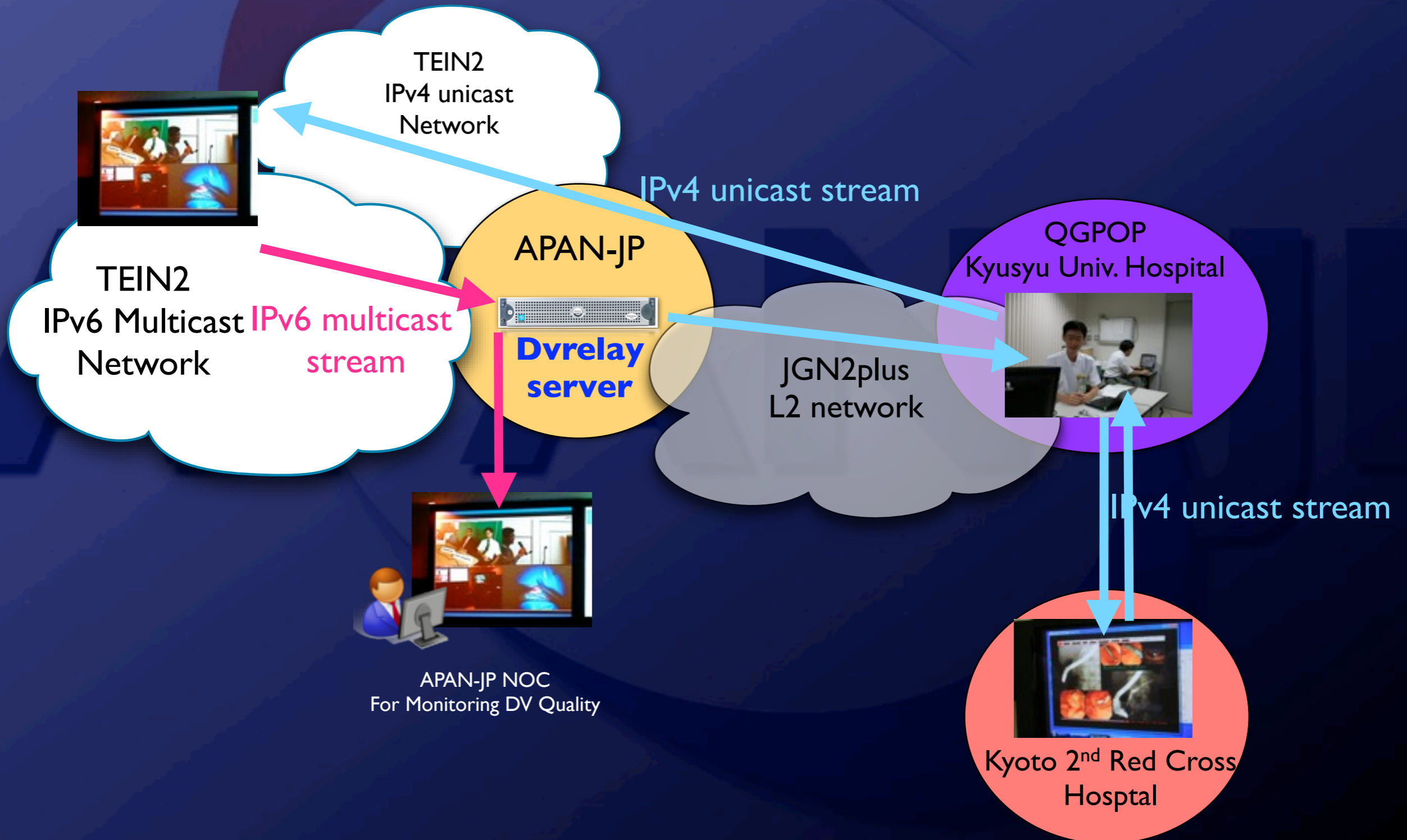
Lessons and Learned from CanalAVIST -1-

- Provisioning
  - Networking
    - Native multicast network is unpopular in Japan
    - Multicast connectivity is not well deployed to Japanese universities
    - Decided to use DVrelay convert Ipv4/Ipv6 muticast to unicast for CanalAVIST demo

  - DVrelay
    - Prepared and Installed Linux Machine for DVrelay in APAN-JP network
    - Installation of DVrelay was very easy:-)
    - Prepared an environment for quality monitoring of DVTS over IPv6 multicast

Lessons and Learned from CanalAVIST -2-

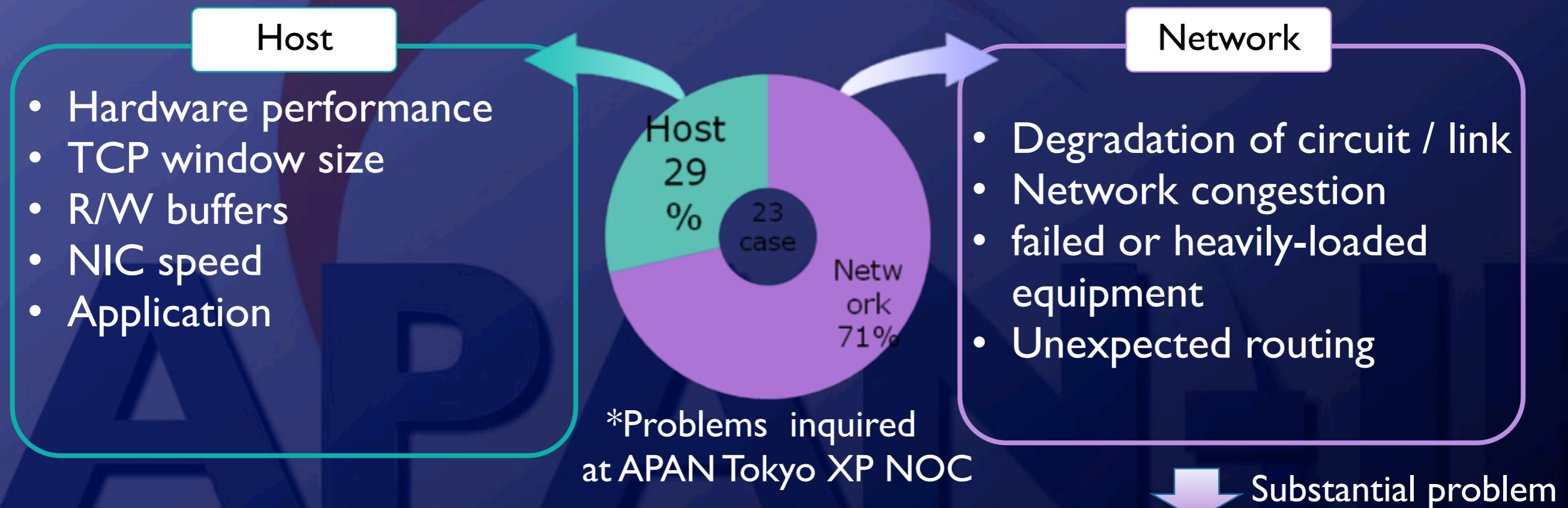- Operation -System-
    - Operation of DVrelay was very easy
    - It is so simple it is difficult to debugging
    - DVrelay machine was acting up, we needed to restart it
    - We didn't know which is problem on hardware or DVrelay software?
    - Do we need more high-end machine for DVrelay?
    - It is important that we also gain operation know-how of DVrelay for the solution of various problems
    - Installing a DVrelay on backbone network is not enough, we should prepare an environment monitoring for audio and video.

Lessons and Learned from CanalAVIST -3-

- **Operation -Networking-**
  - Unicast/multicast routing was good, excellent!
  - Network performance was not good...
  - IPv6 multicast traffic occasionally leaked into APAN Tokyo XP

    =>>   Deal with setting of MLD Snooping on internal switches
  - There was a packet loss between AIT and Chulalongkorn University Hospital, because IPv6 multicast between Tokyo and AIT has been connected with high quality.
  - It was very important to measure the network performance over End-to-End and Hop-by-Hop before start of DV stream.
  - Especially, it might be a good idea to measure the packet loss data constantly for observing a statistical network performance. In the result, packet loss point can be find out in early stage.
  - It may be better to deploy a native multicast network, it would be difficult for Japan to expand as long as killer application does not appear.

Cause of E2E performance problems

Host

- Hardware performance
- TCP window size
- R/W buffers
- NIC speed
- Application

Host 29%

23 case

Network 71%

*Problems inquired at APAN Tokyo XP NOC

Network

- Degradation of circuit / link
- Network congestion
- failed or heavily-loaded equipment
- Unexpected routing

Substantial problem

NOC's Action

- Identify the problem and resolve it.
- Show user that there isn't any problem on the network.

- Packet Loss
- Reorder
- Delay

Performance Measurement

- Iperf + BWCTL
  - Iperf – A network performance measurement tool
  - BWCTL - A command line client application and a scheduling and policy daemon that wraps Iperf.

Performance Measurement

Iperf +BWCTL

Portable Iperf + BWCTL

Client

Performance Problem

Server
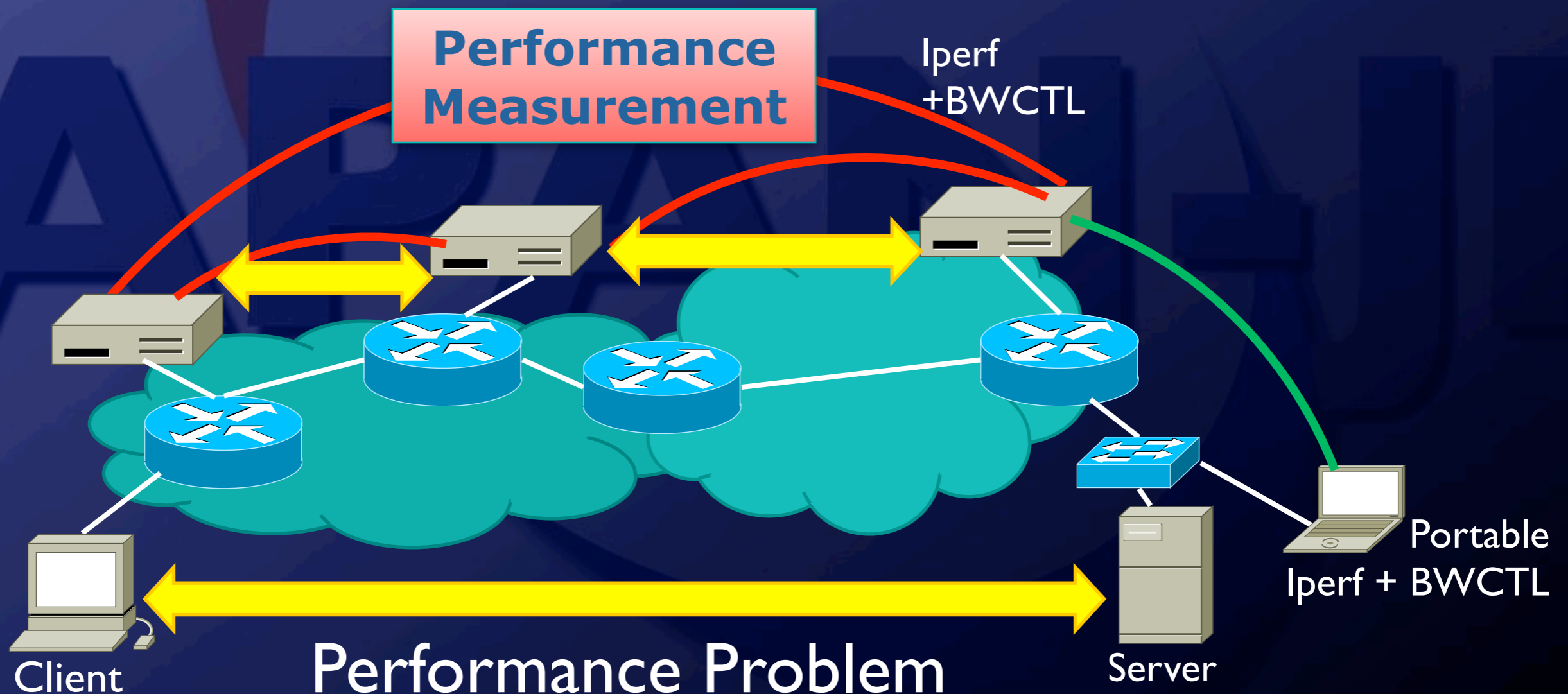
Measurement

❖ Iperf(BWCTL)

- STEP 1   Identification
  - Measure the network performance hop-by-hop
  - Identify the suspect part.

- STEP 2 Measurement by UDP
  - Measure the UDP throughput performance by increasing the bandwidth gradually. (10Mbps, 100Mbps,,,)
  - Check the available bandwidth, packet loss and reordering.

- STEP 3 Measurement by TCP
  - Measure the TCP throughput performance with the window size for BDP(Bandwidth Delay Product).
  - Measure the TCP throughput performance by Increasing the window size gradually
  - Check the TCP throughput performance and the tolerance for bursty traffic.

Measurement(cont.)

❖Result and probable cause

Result	Probable cause
Intermittent packets loss are occurred in the result of UDP measurement	Degradation of circuits or links . Influence of traffic congestion.
Many packets loss are occurred when UDP measurement traffic is more than a certain bandwidth	There is Bottleneck or traffic congestion.
TCP throughput doesn't reach the available bandwidth measured by UDP	A queue overflow is occurred by burst traffic such as TCP. (*)

(*) Iperf generates the UDP traffic with little jitter.
Average jitters of UDP measurement by Iperf are following.
1Mbps – 0.9us , 10Mbps – 0.4us, 100Mbps – 1.1us, 500Ms – 1.2us

PerfSONAR

- PerfSONAR is
  - perfSONAR is an infrastructure for network performance monitoring, making it easier to solve end-to-end performance problems on paths crossing several networks.
  - Joint project - ESnet, GEANT2, Internet2, RNP and other participants.
  - http://www.perfsonar.net/

- It enables to
  - Do performance measurement across the multi-domain network.
  - Exchange the network status data with standardized format

NOCs and users are able to
- monitor the network status across the domain
- visualize the network data for their own purpose

perfSONAR

Diagram of PerfSONAR
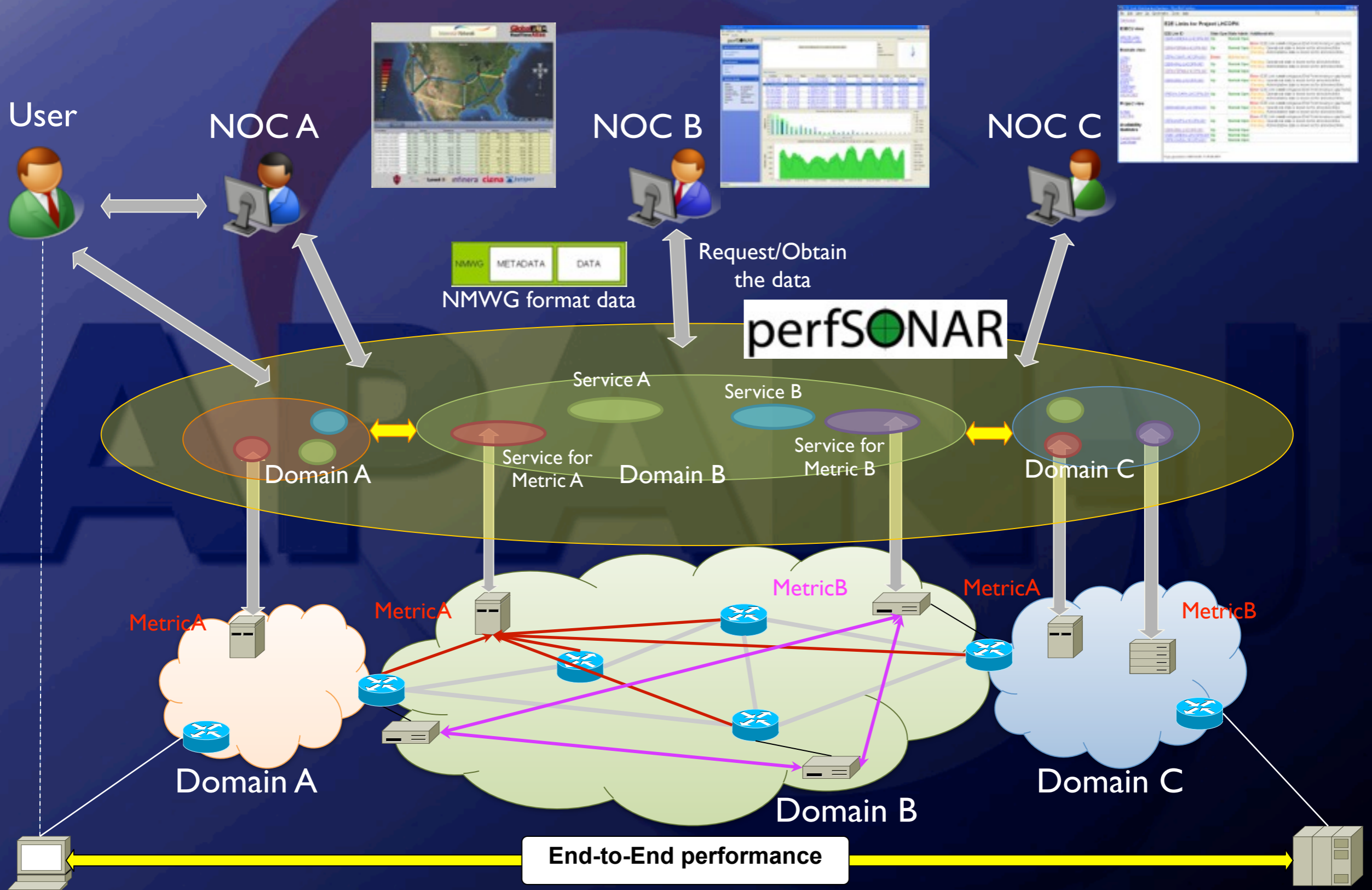
Conclusion

- Telemedicine is one of the key applications for advanced networks.

- DVrelay is very useful software for universities in Japan where native multicast network is not really developed.

- Site engineer should care for not only network connectivity but also network performance for video & sound quality of stream application.

- NOCs should make effort to provide the high performance backbone network with advanced operation tools and support site engineer.

- New technology, such as perfSONAR, will create a better network environment for the demonstration of telemedicine.