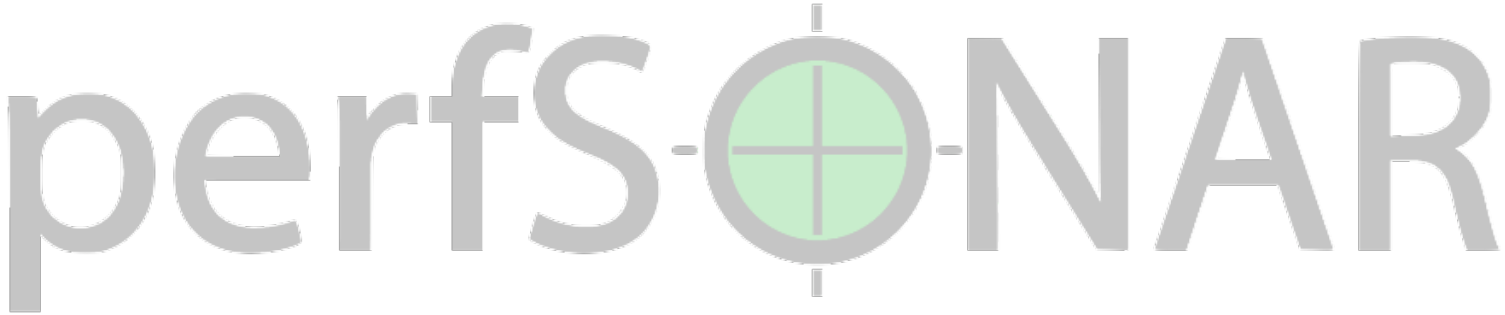

In the Wild: Real-world Troubleshooting with perfSONAR

2nd European perfSONAR User Workshop
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04/14/2021

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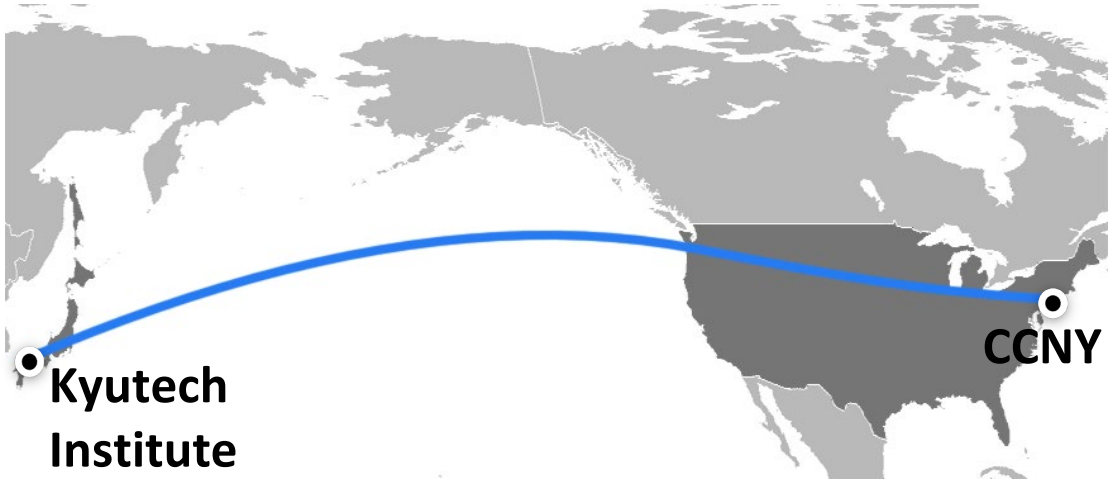
Packet Loss and Poor Performance

CCNY GRE Tunnel to JGN

City College of New York (CCNY) to Kyutech Institute (JGN)

Reported asymmetric, poor performance across GRE tunnel

- JGN → CCNY (TCP)
  - No packet loss
  - 79Mbps throughput
- CCNY → JGN (TCP)
  - 0.082% packet loss
  - 8Mbps throughput



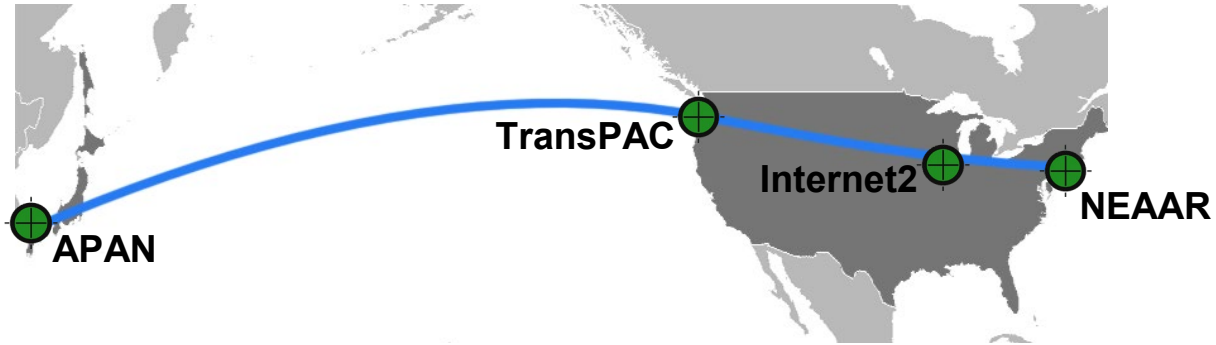
Tested UDP performance, however, was symmetric at 90Mbps either direction

Initial troubleshooting

Used perfSONAR nodes along the path to test to closest open node available-at ManLan.

Nodes located at

- APAN/Tokyo
- TransPAC/Seattle
- Internet2/Chicago
- NEAAR/ManLan



Testing to NYC showed good performance and no packet loss- indicating problem was likely within CCNY

Internal troubleshooting

- CCNY and EPOC engineers installed perfSONAR node in researcher's lab
- Tests from prior locations to lab showed same packet loss as original problem
- Verified issue within campus

Regional troubleshooting

- NYSERNet
  - Regional network for NY
  - Provides R&E connectivity for CCNY
  - Engineers installed a new CCNY pS node at campus edge
- Testing edge to lab
  - Packet fragmentation and MTU issues on the ingress path to CCNY
  - Packet loss isolated to specific segment of the CCNY campus network

Problem located

With this data

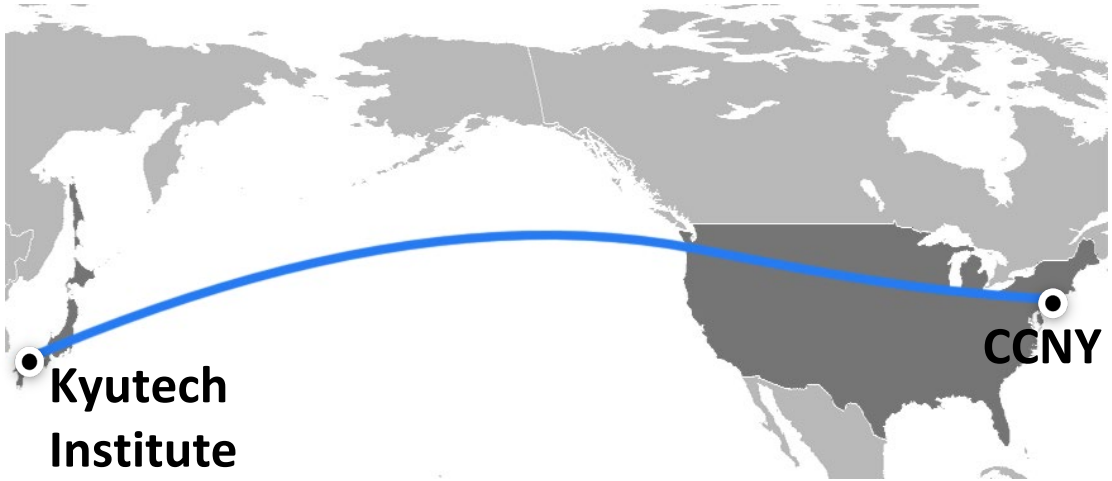
- CCNY engineers did additional local troubleshooting
- Cause identified as outdated network security device
- Replacement had been scheduled, expedited due to results

After replacement

- pS tests verified performance was greatly improved

Final Results

- CCNY/JGN GRE tunnel shows consistent, symmetric performance
- JGN → CCNY (TCP)
  - No packet loss
  - 80Mbps throughput
- CCNY → JGN (TCP)
  - No packet loss
  - 85Mbps throughput
  - 10-fold improvement



Takeaways

- Using perfSONAR outside of the network under test can be useful for troubleshooting
- Testing with different protocols can aid in diagnosis
- Partnership and data sharing is essential

perfSONAR

Routing and Congestion

Iowa State University

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The problem to be solved

IOWA STATE UNIVERSITY

- Performance issue between ISU and UCAR
  - ISU climate researcher required access to real time NOAA Earth observation data
- This use case required a minimum of 80Mbps sustained throughput, with 320Mbps being ideal
  - Intermittent rate decreases to 32Mbps were occurring
  - Performance had degraded slowly over time, with a significant decrease in the past few months

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Initial data gathering

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- ISU researcher, at the request of EPOC engineers, installed the perfSONAR toolkit on the file transfer server in his lab
  - Bandwidth tests looked good ISU > UCAR
  - UCAR > ISU tests revealed high numbers of packet retransmits and general poor performance
  - Trace routes revealed asymmetric routing

Digging deeper

IOWA STATE UNIVERSITY

- With these findings, we went back to the campus CI staff
  - ISU WAN network engineer confirmed recent changes to their Internet2 and GPN connections.
  - Evidence of packet fragmentation along the path was uncovered, with some jumbo frame packets being dropped or fragmented
  - Additional perfSONAR nodes were installed along the path to further isolate the issue.

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First steps toward resolution

IOWA STATE UNIVERSITY

- Based on the perfSONAR data gathered up to this point, it was determined that the issue was confined to the ISU network.
  - ISU engineers proceeded to update the operating systems on several pieces of network hardware
  - Configuration changes were also made to equipment along the path

These steps helped, but there was still progress to be made

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The final pieces

IOWA STATE UNIVERSITY

- Existing 10Gbps GPN provided link to Internet2 was found to be congested; upgraded to 100Gbps
- Replaced the entire switching infrastructure in Agronomy Hall with newer hardware
- Normalized the network path between Agronomy Hall and the campus core network to remove the routing asymmetry.

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And now, the moment we've all been waiting for…

perfSONAR

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- Average transfer rates rose to over 600Mbps
- The ISU researcher is once again able to process Earth observation data in real time

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Takeaways

- What seems like a simple problem may be multiple issues
  - Routing, bandwidth, and MTU settings all came into play
- Even when the network “worked”, the performance could have been better
  - We need to be able to see performance data over time, not at just a point in time