Japan to South Korea Route Efficiency
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Audience: General
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ABOUT EPOC
Over the last decade, the scientific community has experienced an unprecedented shift in the way research is performed and how discoveries are made. Highly sophisticated experimental instruments are creating massive datasets for diverse scientific communities and hold the potential for new insights that will have long-lasting impacts on society. However, scientists cannot make effective use of this data if they are unable to move, store, and analyze it. The Engagement and Performance Operations Center was established in 2018 as a collaborative focal point for operational expertise and analysis and is jointly led by Indiana University (IU) and the Energy Sciences Network (ESnet). EPOC provides researchers with a holistic set of tools and services needed to debug performance issues and enable reliable and robust data transfers. By considering the full end-to-end data movement pipeline, EPOC is uniquely able to support collaborative science, allowing researchers to make the most effective use of shared data, computing, and storage resources to accelerate the discovery process.

EPOC supports six main activities:

- *Roadside Assistance and Consultations* via a coordinated Operations Center to resolve network performance problems with end-to-end data transfers;
- *Application Deep Dives* to work more closely with application communities and understand full workflows for diverse research teams in order to evaluate bottlenecks and potential capacity issues;
- *Network Analysis enabled by the NetSage* monitoring suite to proactively discover and resolve performance issues;
- *Data Transfer Testing/ Data Mobility Exhibition* to check transfer times against known good end points;
- *Provision of managed services* via support through the IU GlobalNOC and our Network Partners;
- *Coordinated Training* to ensure effective use of network tools and science support.

Japan to Korea Route Efficiency

During routine NetSage traffic analysis of the TransPAC-PacWave 100G circuit between Seattle and Tokyo, EPOC engineers noticed that regular data transfers between the National Institute of Informatics (NII) in Tokyo, Japan, and the Pohang University of Science and Technology (POSTECH) in Pohang, South Korea, were transiting the TransPAC router in Seattle, and could be seen on the TransPAC NetSage Portal (https://transpac.netsage.global). As shown in Figure 1, 3.5TB of data were transferred between NII and POSTECH via the US between December 1, 2020, and March 31, 2021.

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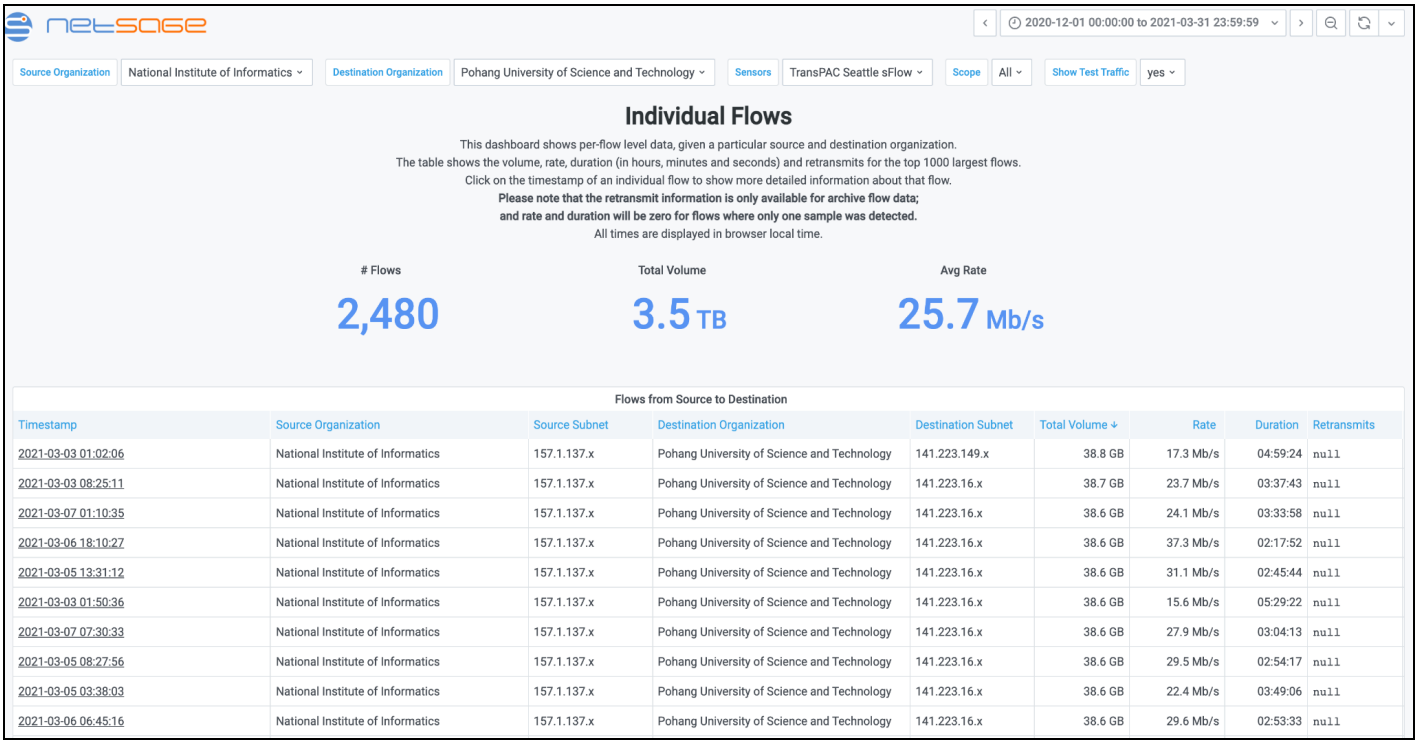

Timestamp	Source Organization	Source Subnet	Destination Organization	Destination Subnet	Total Volume ↓	Rate	Duration	Retransmits
2021-03-03 01:02:06	National Institute of Informatics	157.1.137.x	Pohang University of Science and Technology	141.223.149.x	38.8 GB	17.3 Mb/s	04:59:24	null
2021-03-03 08:25:11	National Institute of Informatics	157.1.137.x	Pohang University of Science and Technology	141.223.16.x	38.7 GB	23.7 Mb/s	03:37:43	null
2021-03-07 01:10:35	National Institute of Informatics	157.1.137.x	Pohang University of Science and Technology	141.223.16.x	38.6 GB	24.1 Mb/s	03:33:58	null
2021-03-06 18:10:27	National Institute of Informatics	157.1.137.x	Pohang University of Science and Technology	141.223.16.x	38.6 GB	37.3 Mb/s	02:17:52	null
2021-03-05 13:31:12	National Institute of Informatics	157.1.137.x	Pohang University of Science and Technology	141.223.16.x	38.6 GB	31.1 Mb/s	02:45:44	null
2021-03-03 01:50:36	National Institute of Informatics	157.1.137.x	Pohang University of Science and Technology	141.223.16.x	38.6 GB	15.6 Mb/s	05:29:22	null
2021-03-07 07:30:33	National Institute of Informatics	157.1.137.x	Pohang University of Science and Technology	141.223.16.x	38.6 GB	27.9 Mb/s	03:04:13	null
2021-03-05 08:27:56	National Institute of Informatics	157.1.137.x	Pohang University of Science and Technology	141.223.16.x	38.6 GB	29.5 Mb/s	02:54:17	null
2021-03-05 03:38:03	National Institute of Informatics	157.1.137.x	Pohang University of Science and Technology	141.223.16.x	38.6 GB	22.4 Mb/s	03:49:06	null
2021-03-06 06:45:16	National Institute of Informatics	157.1.137.x	Pohang University of Science and Technology	141.223.16.x	38.6 GB	29.6 Mb/s	02:53:33	null

Figure 1: NetSage Dashboard showing data flowing between NII and POSTECH between December 1, 2021 and March 31, 2021. Available online at: https://transpac.netsage.global/grafana/d/-l3_u8nWk/individual-flows?orgId=1&from=1606798800000&to=1617249599000&var-src=National%20Institute%20of%20Informatics&var-dest=Pohang%20University%20of%20Science%20and%20Technology&var-sensors=TransPAC%20Seattle%20sFlow&var-country_scope=All&var-is_net_test=yes.

In March, 2021, EPOC staff reached out to engineers at the Korea Research Environment Open Network (KREONET), a South Korean research and education network, to inform them of these findings and to request help running tests to gather more information on these data transfers.

KREONET engineers ran tests to confirm the routing issue. Their initial trace routes showed that the traffic was using a Japanese-funded SINET link to reach the Asia Pacific Advanced Network (APAN) exchange point in Tokyo, which then routed the traffic over the TransPAC-Pac Wave 100G circuit between Tokyo and Seattle, and continued via the Internet2 US domestic circuit from Seattle to the StarLight exchange in Chicago. At StarLight, the traffic was routed over the KREONET link back to Asia and POSTECH, as shown in Figure 2. Data transfers in the other direction, from POSTECH to NII, were routed as expected using KREONET and the pan-Asian regional network, TEIN*CC, to get from Pohang to Hong Kong and then from Hong Kong to Tokyo. Latency for the traffic routed via the US was 203MS round-trip time (RTT), which was more than double the latency of traffic routed via TEIN*CC , only 101.5MS RTT.

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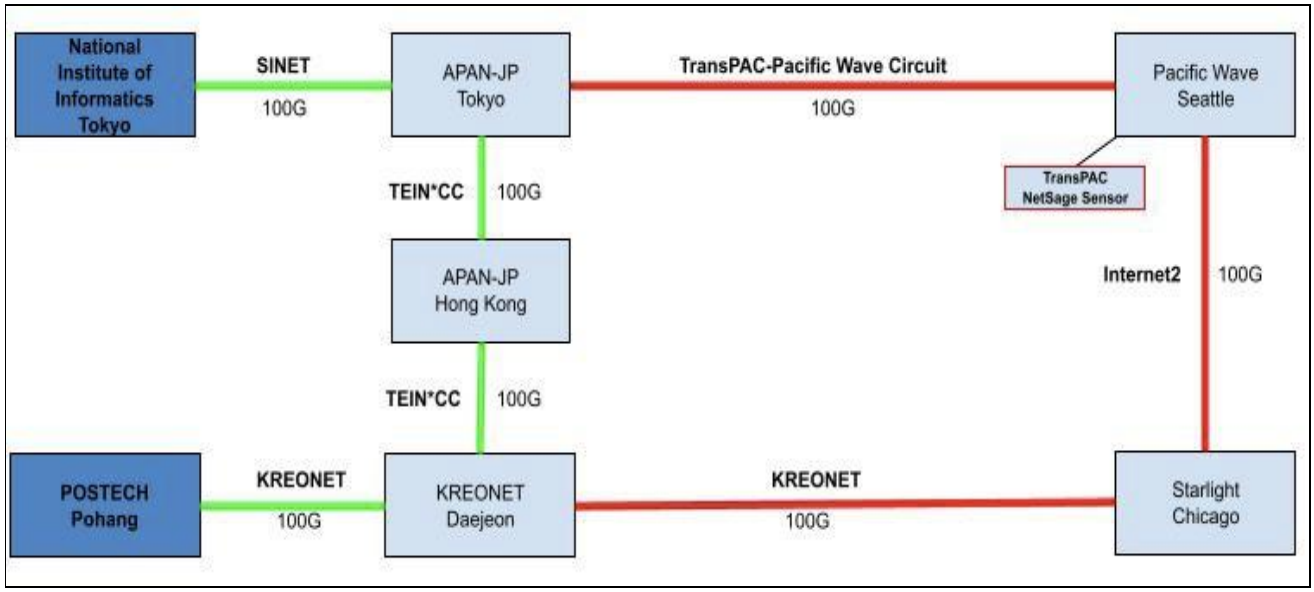

Figure 2: A diagram showing how the traffic was routed from the National Institute of Informatics (NII) to POSTECH, at first via the US, shown with a Red line, and then later staying in Asia, shown with a Green line.

KREONET engineers made several BGP adjustments, including removing the announcement of prefixes from the KREONET router in Hong Kong towards the APAN-JP router in Hong Kong. KREONET engineers also changed the filter rules on the KREONET router in Daejeon, South Korea, to ensure the more efficient path was used.

Once these adjustments were made, EPOC staff worked with KREONET engineers to re-run tests and to monitor NetSage for changes in the flow data. These tests showed that the BGP adjustments had moved the traffic routed via the US to the more efficient route, reducing the RTT for these flows by half.

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