TransPAC3 update

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What is TransPAC?

• A high-performance connection between the North American research & education networks to the Asia-Pacific research & education networks in support especially of science research
• Partners are Global Research NOC at Indiana University (USA) and APAN-JP (Tokyo)
  • Joint, coordinated operation
  • Matching complementary circuits with mutual backup
  • Transparent measurement and monitoring
  • Lots of burstable capacity (“headroom”) to support high-performance science flows
  • Support for leading-edge network technologies
TransPAC Tokyo-Los Angeles
What is TransPAC3?

- A high-performance (10Gb/s Ethernet) connection between the North American research & education networks to the Asia-Pacific research & education networks in support especially of science research
- Terminates in Tokyo and Los Angeles
- Tokyo end operated by APAN-JP
- Los Angeles end operated by Global Research NOC at Indiana University
- Funded by US National Science Foundation IRNC2 program (award OCI-0962973) for 2010-2014.
The new TransPAC3 circuit

- Circuit provided by KDDI-America
- Uses *TGN-Pacific* cable system
- Unprotected (pre-emptable)
- Complementary (and with mutual backup) with JGN2+ Tokyo-LOSA circuit
- Terminates in KDDI POPs in Los Angeles, Tokyo
- Testing in March 2011, full turnup by 1 April
The new TransPAC3 router

- TransPAC2 used a Juniper T-series router
- MX series allows native layer2 and layer3 functions, high-performance bridging or routing as needed
- A design goal for TransPAC3 was to integrate dynamic circuit functions more deeply into the service—MX allows that.
- More heavily-instrumented for data-gathering (see John Hicks talk for details)
What are the significant differences between TransPAC2 and TransPAC3?

**Before 2011 (TransPAC2):**
- Juniper T-series router
- OC192 (SONET)
- ‘tunneled’ dynamic circuits, static ‘vlans’
- Dual-stack native ipv4, ipv6
- Netflow for ipv4, not ipv6

**New for TransPAC3:**
- Juniper MX router
- 10GE (LAN-PHY)
- Option for added capacity (>10G) as use justifies
- Native dynamic circuits
- True dynamic circuit capability
- Dual-stack native v4/6
- Netflow for v4 and v6
Continuing services and functions

- Line-rate 10GE
- 10G Complementary backup connection to JGN2+
- 10G Connection to Pacific Wave exchange point
- 10G Connection to Internet, NLR, ESnet, other major R&E networks
- Continued connection to Internet “ION” DCN service
- Native, line-speed ipv4 and ipv6 routing and transport
- Monitoring and measurement of interfaces, traffic, flows (adding ipv6 netflow)
TransPAC connections

1. TransPAC connection to Tokyo
   - APAN (AS7660)
   - APAN path-matrix server

2. JGN
   - APAN (AS7660)

3. PacificWave exchange point
   North America:
   - CENIC (AS2153)
   - PNWGP (AS101)
   - Internet2 (AS11537)
   - NLR (AS19401)
   - Ultralight (AS32361)
   - NASA NREN (AS24)

Other Asia-Pacific:
- REANNZ (AS38018)

Research tools:
- Route-views (AS6447)
- ARBOR (AS22388)
TransPAC2 traffic levels (2008-Feb 2011)
for 2010 (1-day samples): I/O max 7.4/6.3Gbs; avg 0.9/1.3Gbs

(using 1 day averages)

rtr.losa.transpac2.net--so-0/0/0.0 -- oc192 to APAN Tokyo XP

Tue Jan 1 2008 00:00 to Tue 22 Feb 2011 00:00:00 CST
TransPAC2 traffic levels (last 12 months)
(1-day samples): I/O max 1.6/9.1 Gbs; avg 0.6/1.0 Gbs

trl.losa.transpac2.net--xe-0/0/0 -- 10GE to Tokyo XP
Sun Aug 1 2010 00:00 to Mon 22 Aug 2011 00:00:00 IST
This report shows the in, out, and total traffic for a selected interface, broken down by ASN. The traffic is a combination of peer and origin traffic.

### Interface 'xe-0/0/0.259' ASNs (All)

<table>
<thead>
<tr>
<th>AS NAME</th>
<th>ASN</th>
<th>INPUT</th>
<th>OUTPUT</th>
<th>TOTAL</th>
</tr>
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<tbody>
<tr>
<td>APAN-JP</td>
<td>7660</td>
<td>131.00 Mbps</td>
<td>755.00 Mbps</td>
<td>886.00 Mbps</td>
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<tr>
<td>ASNET</td>
<td>9264</td>
<td>17.00 Mbps</td>
<td>228.00 Mbps</td>
<td>245.00 Mbps</td>
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<tr>
<td>CN03-BJ1K-AS-AP</td>
<td>23911</td>
<td>23.00 Mbps</td>
<td>293.00 Mbps</td>
<td>316.00 Mbps</td>
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<tr>
<td>TEIN2-JP</td>
<td>24287</td>
<td>5.23 Mbps</td>
<td>258.00 Mbps</td>
<td>263.23 Mbps</td>
</tr>
<tr>
<td>EPX-CERNET-BKB</td>
<td>4538</td>
<td>23.00 Mbps</td>
<td>174.00 Mbps</td>
<td>197.00 Mbps</td>
</tr>
<tr>
<td>TANET2-TW</td>
<td>7539</td>
<td>5.25 Mbps</td>
<td>129.00 Mbps</td>
<td>144.25 Mbps</td>
</tr>
<tr>
<td>TEIN2-NORTH-AP</td>
<td>24489</td>
<td>1.60 Mbps</td>
<td>176.00 Mbps</td>
<td>177.60 Mbps</td>
</tr>
<tr>
<td>CSTNET-AS-AP</td>
<td>7497</td>
<td>19.00 Mbps</td>
<td>126.00 Mbps</td>
<td>126.02 Mbps</td>
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<tr>
<td>NCU-TW</td>
<td>18420</td>
<td>1.51 Mbps</td>
<td>77.00 Mbps</td>
<td>78.51 Mbps</td>
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<tr>
<td>NTU-TW</td>
<td>17716</td>
<td>2.72 Mbps</td>
<td>59.00 Mbps</td>
<td>61.72 Mbps</td>
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<tr>
<td>EPX-TANET-ASN1</td>
<td>1659</td>
<td>7.15 Mbps</td>
<td>50.00 Mbps</td>
<td>57.15 Mbps</td>
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<tr>
<td>TEIN2-SOL-AP</td>
<td>14480</td>
<td>2.43 Mbps</td>
<td>83.00 Mbps</td>
<td>85.43 Mbps</td>
</tr>
</tbody>
</table>
Dynamic circuits

• TransPAC, with our APAN-JP partners, has supported layer2 ‘pseudowire’ circuits over the TransPAC circuit since 2008.

• 2008-now we provide statically-created vlans (no support for true *dynamic* layer2 on the trans-Pacific backbone)

• In TransPAC3, the MX router will interoperate with IDC and dynamic-circuit software allowing circuits to be built and torn down dynamically, on demand and as needed

• Layer2 and layer3 coexist across the same JP-US path
Looking forward...

• Continued support for high-performance production networking

Add:

• Improved integration with dynamic ‘lightpath’ protocols e.g. ION
• Support for OpenFlow and other GENI experimental networks (probably *not* logical routers)
• Support for other NGI protocols as needed
• Better interaction with DICE, GLIF and other NGI/FIT efforts
Transpac supplementary projects

- Some support for PERN (Pakistan NREN) connection to APAN
  - Karachi-Singapore-Tokyo
  - Starting in mid-2008
- Some support for CERnet-led connection to North America
  - Starting in late 2011
  - National Science Foundation support for US contribution
  - CERnet 10Gbs connection to Los Angeles, planned to include both CERnet and CSTnet traffic
Part II: Telepresence technology introduction
Telepresence technology

- New technologies occasionally bring new network requirements
- Of growing interest to the R&E networks recently is Cisco TelePresence, with hundreds of sites in R&E, growing steadily
- How does its technology affect our networks?
Telepresence technology

• Hierarchical in nature
  • Codec ‘registers’ with call manager
  • Call manager manages end systems, arranges for trunking and call ‘routing’ decisions
  • SIP signaling: TCP (UDP) port 5060
  • UDP media flows on ports 16384 – 32768
  • Deterministic paths—always follows trunk hierarchy

• Hierarchy leads to ‘exchanges’
  • Several commercial exchanges
  • Only one exchange today (so far) for R&E
Cisco Telepresence characteristics

- Very high quality and production values
  - 1080p resolution
  - Large screens (67” [170cm] or larger)
  - High-quality audio
  - Super-simple intuitive operation
- Very high data-compression
  - ~4-5 Mbs per screen, so data volume not large
  - Therefore very sensitive to packet loss
    - QoS may be indicated if there is loss
  - Also sensitive to jitter and latency, working well in our high-performance networks
Cisco Telepresence in R&E

- APAN countries connected to R&E exchange:
  - China
  - Singapore
  - Thailand
  - Australia
- Other countries:
  - Austria, UK, Canada, Slovakia, Holland, Brazil, Portugal, UAE
- In US: 53 state systems/universities/schools/labs, ~230 systems connected
- 2 connections to 7 commercial exchanges
While Telepresence systems worldwide can connect to a central global R&E exchange and work with each other, both media flows and support/’community’ relationships suggest local connections are better.

Logical locations:
- Multiple locations in Asia, especially China
- Australia—announced for late 2011 (AARnet)
- Europe, multiple locations
- Latin America
- Africa
- Middle East

Leverage existing NREN relationships to federate TP, highest possible function, provide mutual support.
Thank you!