HKIX Development and HKIX-R&E Updates at APAN 48

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HKIX Team

www.hkix.net
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What is HKIX?

- Established in Apr 1995, Hong Kong Internet eXchange (HKIX) is the main layer-2 Internet eXchange Point (IXP) in Hong Kong where various autonomous systems interconnect with one another and exchange traffic.
- HKIX is now owned and operated by the Hong Kong Internet eXchange Limited (a wholly-owned subsidiary of The Chinese University of Hong Kong Foundation Limited) in collaboration with Information Technology Services Centre of The Chinese University of Hong Kong.
- HKIX serves both commercial networks and R&E networks.
- The original goal is to keep intra-Hong Kong traffic within Hong Kong.
HKIX Today

- Supports both MLPA (Multilateral Peering) and BLPA (Bilateral Peering) over layer 2
- Supports IPv4/IPv6 dual-stack
- More and more non-HK participants
- 310+ different networks (autonomous systems) connected
- 510+ physical connections in total
  - 48 100GE, 310+ 10GE & 150+ GE
- 1.34+Tbps (5-min) total traffic at peak
- Annual Traffic Growth ~30%
Current HKIX Traffic
Daily Graph (5-min average)

- Incoming Traffic in Bits per Second
- Outgoing Traffic in Bits per Second

Maximal In: 1.255 T  Maximal Out: 1.246 T
Average In: 862.806 G  Average Out: 859.694 G
Current In: 1.047 T  Current Out: 1.039 T

The statistics was last updated on Thu Jul 25 00:30:09 2019
Current HKIX Traffic
Yearly Graph (1-day average)

Maximal 5 Minute Incoming Traffic
Maximal 5 Minute Outgoing Traffic
Incoming Traffic in Bits per Second
Outgoing Traffic in Bits per Second

Maximal In: 1.339 T  Maximal Out: 1.328 T
Average In: 696.769 G  Average Out: 692.755 G
Current In: 854.511 G  Current Out: 852.050 G

The statistics was last updated on Wed Jul 24 15:10:11 2019
New HKIX Dual-Core Two-Tier Spine-and-Leaf Architecture For 2014 and Beyond

HKIX1 Core Site @CUHK
HKIX1b Core Site @CUHK

Core Switch @HKIX1
Core Switch @HKIX1
Core Switch @HKIX1b
Core Switch @HKIX1b

Access Switch(es) @HKIX2
Access Switches @HKIX1
Access Switches @HKIX1b
Access Switch @HKIX-R&E

ISP 1
ISP 2
ISP 3
ISP 4
ISP 5
ISP 6
ISP 7

100GE/10GE/GE Links
n x 100GE/10GE Inter-Switch Links
n x 100GE/10GE Inter-Switch Links

HKIX1 Core Site @CUHK
HKIX1b Core Site @CUHK

Core Switch @HKIX1
Core Switch @HKIX1
Core Switch @HKIX1b
Core Switch @HKIX1b

Access Switch(es) @HKIX2
Access Switches @HKIX1
Access Switches @HKIX1b
Access Switch @HKIX-R&E

ISP 1
ISP 2
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ISP 4
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ISP 7

100GE/10GE/GE Links
n x 100GE/10GE Inter-Switch Links
n x 100GE/10GE Inter-Switch Links
1. **HKIX1** and **HKIX1b** are the two core sites of HKIX at CUHK while **HKIX2/3/3b/4/5** are HKIX satellite sites outside of CUHK.
2. HKIX participants are encouraged to connect to multiple sites for site resilience.
100GE Connections at HKIX

Total Number of 100G Ports Connected (2016 OCT - 2019 JUN)
HKIX 100GE Participants (1/2)

- Akamai
- Amazon
- ANSONNET
- AOFEI
- BGP Consultancy
- China Mobile HK
- China Mobile International
- CloudFlare
- Facebook
- Google
- HKBN
- Hurricane Electric
- Level 3
HKIX 100GE Participants (2/2)

- Limelight
- Microsoft
- Mytek
- Taobao
- Telin
- Telstra
- Tencent
- TVB
- Udomain
- Value
- XLC Global
- Yahoo
# HKIX’s 100GE participants at a glance

<table>
<thead>
<tr>
<th>Content Provider</th>
<th>ISP Regional</th>
<th>ISP Local</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tencent 腾讯</td>
<td>中国移动 International</td>
<td>PCCW® 震讯盈科</td>
</tr>
<tr>
<td>facebook</td>
<td>TELSTRA</td>
<td>电讯盈科</td>
</tr>
<tr>
<td>google</td>
<td>Level(3)</td>
<td>香港宽频 BREBBOBNOBNF</td>
</tr>
<tr>
<td>Yahoo!</td>
<td>Telin</td>
<td>香港宽频</td>
</tr>
<tr>
<td>TVB</td>
<td>Hurricane Electric Internet Services</td>
<td>ana</td>
</tr>
<tr>
<td>BGP Net</td>
<td>BGP Network (M) Sdn Bhd</td>
<td>China Mobile</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Retail &amp; Gaming</th>
<th>DDoS Provider</th>
<th>Data Centre</th>
<th>Others</th>
</tr>
</thead>
<tbody>
<tr>
<td>淘宝网 Taobao.com</td>
<td>Cloudflare</td>
<td>奥飞数据</td>
<td>MYTEK Trading</td>
</tr>
<tr>
<td>VALVE</td>
<td></td>
<td><a href="http://www.ofidec.com">www.ofidec.com</a></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>ANSON</td>
<td></td>
</tr>
</tbody>
</table>
HKIX-R&E – Special Support for R&E Networks Having Presence in HK

- HKIX helps those R&E Networks interconnect among themselves and with commercial networks without restrictions via HKIX-R&E switch at MEGA-i

- The main purpose is to facilitate those National R&E Networks having presence in Hong Kong to do interconnections among themselves \textit{and} do peering with commercial networks at HKIX more easily and at a lower cost.

- Started in 2008
- \textbf{Free of charge} (no port charge on HKIX-R&E switch and the connection to HKIX)
- Support GE/10GE/100GE Trunk Ports for R&E networks
- Support Point-to-point VLANs for R&E networks
  - For private interconnections among any 2 R&E networks
  - Jumbo Frame support
- Fiber Cross Connect to be provided by R&E networks
- 7x24 NOC support
- Operate by HKIX with the HKIX-R&E switch at MEGA-i
HKIX-R&E Network Diagram

HKIX

300+ Commercial Networks

Nordics
- NORDUnet

USA
- IU/TransPAC

CERNET

China
- CSTNET

Hong Kong
- HKOX

Taiwan
- ASNET

Japan
- APANJP/NICT/JGN-X

Korea
- KISTI/KREONET2

Korea
- NIA/KOREN

Philippine
- ASTI/PREGINET
HKIX-R&E Updates

• KISTI/KREONET2 upgrade to 100G at Jul/2019

• HKIX perfSONAR server upgrade to 10G
  – IP address: 202.45.188.76

• 100G Connections from MEGA-i to HKIX
  – Upgrade existing 4x10G connections to 2x100G at Feb/2019
HKIX 100GE R&E Participants

• APANJP/NICT/JGN-X
• CERNET
• KOREN
• KISTI/KREONET2 (Jul/2019)
**HKIX perfSONAR Server**

### Host Information
- **Organization:** the Hong Kong Internet Exchange (HKIX)
- **Address:** Hong Kong HK (map)
- **Administrator:** Ryan kg (ryan@hkix.net)

#### Services
<table>
<thead>
<tr>
<th>SERVICE</th>
<th>STATUS</th>
<th>VERSION</th>
<th>PORTS</th>
<th>SERVICE LOGS</th>
</tr>
</thead>
<tbody>
<tr>
<td>esmond</td>
<td>Running</td>
<td>2.1.3-1.07</td>
<td></td>
<td></td>
</tr>
<tr>
<td>lsregistration</td>
<td>Running</td>
<td>4.1.6-1.07</td>
<td></td>
<td></td>
</tr>
<tr>
<td>owamp</td>
<td>Running</td>
<td>3.5.8-1.07</td>
<td>861</td>
<td></td>
</tr>
<tr>
<td>pscheduler</td>
<td>Running</td>
<td>1.1.6-2.07</td>
<td></td>
<td></td>
</tr>
<tr>
<td>psconfig</td>
<td>Running</td>
<td>4.1.6-1.07</td>
<td></td>
<td></td>
</tr>
<tr>
<td>twamp</td>
<td>Running</td>
<td>3.5.8-1.07</td>
<td>862</td>
<td></td>
</tr>
</tbody>
</table>

#### Test Results
- **Search:**
- **Results for the last...**
  - 1 week

<table>
<thead>
<tr>
<th>SOURCE</th>
<th>DESTINATION</th>
<th>THROUGHPUT</th>
<th>LATENCY (MS)</th>
<th>LOSS</th>
</tr>
</thead>
<tbody>
<tr>
<td>204.45.188.76</td>
<td>nms1.10g.jp.apan.net</td>
<td>1.49 Gbps</td>
<td>25.7</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>204.181.249.186</td>
<td>293 Mbps</td>
<td>25.9</td>
<td>0.594%</td>
</tr>
<tr>
<td>204.45.188.76</td>
<td>ps.honk.kreonet2.net</td>
<td>901 Mbps</td>
<td>0.653</td>
<td>0.513%</td>
</tr>
<tr>
<td></td>
<td>134.75.253.98</td>
<td>n/a</td>
<td>147</td>
<td>0.476%</td>
</tr>
<tr>
<td>204.45.188.76</td>
<td>ps1.itc.fbk.de</td>
<td>n/a</td>
<td>19.5</td>
<td>0.001%</td>
</tr>
<tr>
<td></td>
<td>134.75.32.18</td>
<td>n/a</td>
<td>130</td>
<td>0.476%</td>
</tr>
<tr>
<td>204.45.188.76</td>
<td>ps1.itc.cuhk.edu.hk</td>
<td>n/a</td>
<td>1.33</td>
<td>0.003%</td>
</tr>
<tr>
<td></td>
<td>137.189.192.25</td>
<td>2.11 Gbps</td>
<td>0.380</td>
<td>0.522%</td>
</tr>
<tr>
<td>204.45.188.76</td>
<td>ps2.itc.cuhk.edu.hk</td>
<td>2.42 Gbps</td>
<td>0.734</td>
<td>0.0009%</td>
</tr>
<tr>
<td></td>
<td>137.189.192.49</td>
<td>1.24 Gbps</td>
<td>0.861</td>
<td>0.551%</td>
</tr>
</tbody>
</table>

**On-demand testing tools**
- Reverse ping
- Reverse traceroute
- Reverse tracepath
- Traceroute Visualization

**Other services**
- Global node directory
HKIX Planned Works for 2019

• Improved Stability
  – Better Control of Proxy ARP

• Improved Services
  – Rollout portal for HKIX participants / R&E participants
  – True 24x7 NOC (both email & hotline support)
  – Improve after-hour support
  – Introduce advanced Route Server functions
  – perfSONAR server
  – Automatic network filter update (support updates from IRR)
  – New HKIX Route Server

• Improved Security
  – ISO27001
  – Better support for DDoS mitigation
  – Implement MANRS IXP Programme for routing security
  – Implement RPKI on HKIX Route Servers to enhance routing security
HKIX Infrastructure @MEGA-i

MEGA-i

HKIX3b / HKIX-R&E Node at MEGA-i

Nexus N7706 Switch

3/F@HKIX-Mega-i Demarcation Panel
Fiber Patch Panel
N x100G

10G Participants
100G Participants

10G Links
15G Links
Fiber Cross Connect

Fabric Path

NREN

[10 NRENs connected]
http://www.hkix.net/hkix/RandE/participant.htm

HKIX

HKIX1
HKIX1b

(300+ ASNs connected)
http://www.hkix.net/hkix/participant.htm

Fabric Path

HKIX2 / CITIC
HKIX3 / MEGA 2
HKIX4 / NTT
HKIX5 / KDDI
Upgrade 4x10G to 2x100G @MEGA-i
Experience Sharing
Upgrade 4x10G to 2x100G @MEGA-i
Experience Sharing

- FabricPath Layer 2 IS-IS Metric:

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>10 GB</td>
<td>40</td>
</tr>
<tr>
<td>100 GB</td>
<td>4</td>
</tr>
</tbody>
</table>

- Tune 10G IS-IS Metric as 100G to maintain ECMP before enabling 100G interfaces:
  
  ```
  #interface Po10
  #fabricpath isis metric 4
  #interface Po20
  #fabricpath isis metric 4
  ```

- Enable 100G interfaces:
  
  ```
  #interface Po110
  #no shutdown
  #interface Po120
  #no shutdown
  ```

- Shutdown 10G interfaces:
  
  ```
  #interface Po10
  #shutdown
  #interface Po20
  #shutdown
  ```
HKIX Future Upgrade Plan

- Support of 400G connections
- Network traffic visibility
- Network automation
- EVPN (VXLAN)
  - Multiple vendors support
  - Unknown unicast suppression
  - VLAN translation
<table>
<thead>
<tr>
<th>IX name</th>
<th>Hong Kong Internet eXchange (HKIX)</th>
</tr>
</thead>
<tbody>
<tr>
<td>City, Country</td>
<td>Hong Kong</td>
</tr>
<tr>
<td>Point of Presence</td>
<td><strong>Core Sites:</strong></td>
</tr>
<tr>
<td></td>
<td>HKIX1 &amp; HKIX1b @CUHK</td>
</tr>
<tr>
<td></td>
<td><strong>HKIX-R&amp;E:</strong></td>
</tr>
<tr>
<td></td>
<td>HKIX-R&amp;E@MEGA-i</td>
</tr>
<tr>
<td></td>
<td><strong>Satellite Sites:</strong></td>
</tr>
<tr>
<td></td>
<td>HKIX2@CITIC, HKIX3/HKIX3b@iAdvantage, HKIX4@NTT, HKIX5@KDDI</td>
</tr>
<tr>
<td># of connected ASN</td>
<td>312</td>
</tr>
<tr>
<td>Peak traffic</td>
<td>1.34 Tbps</td>
</tr>
<tr>
<td>Route Servers</td>
<td>Yes (Cisco ASR1006)</td>
</tr>
<tr>
<td>Remarks</td>
<td>Website: <a href="https://www.hkix.net">https://www.hkix.net</a> PeeringDB: <a href="https://www.peeringdb.com/ix/42">https://www.peeringdb.com/ix/42</a></td>
</tr>
</tbody>
</table>

For enquiries, please email us at info@hkix.net
Thank You!

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