# HKIX Development and HKIX-R&E Updates at APAN 52

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*HKIX Team*
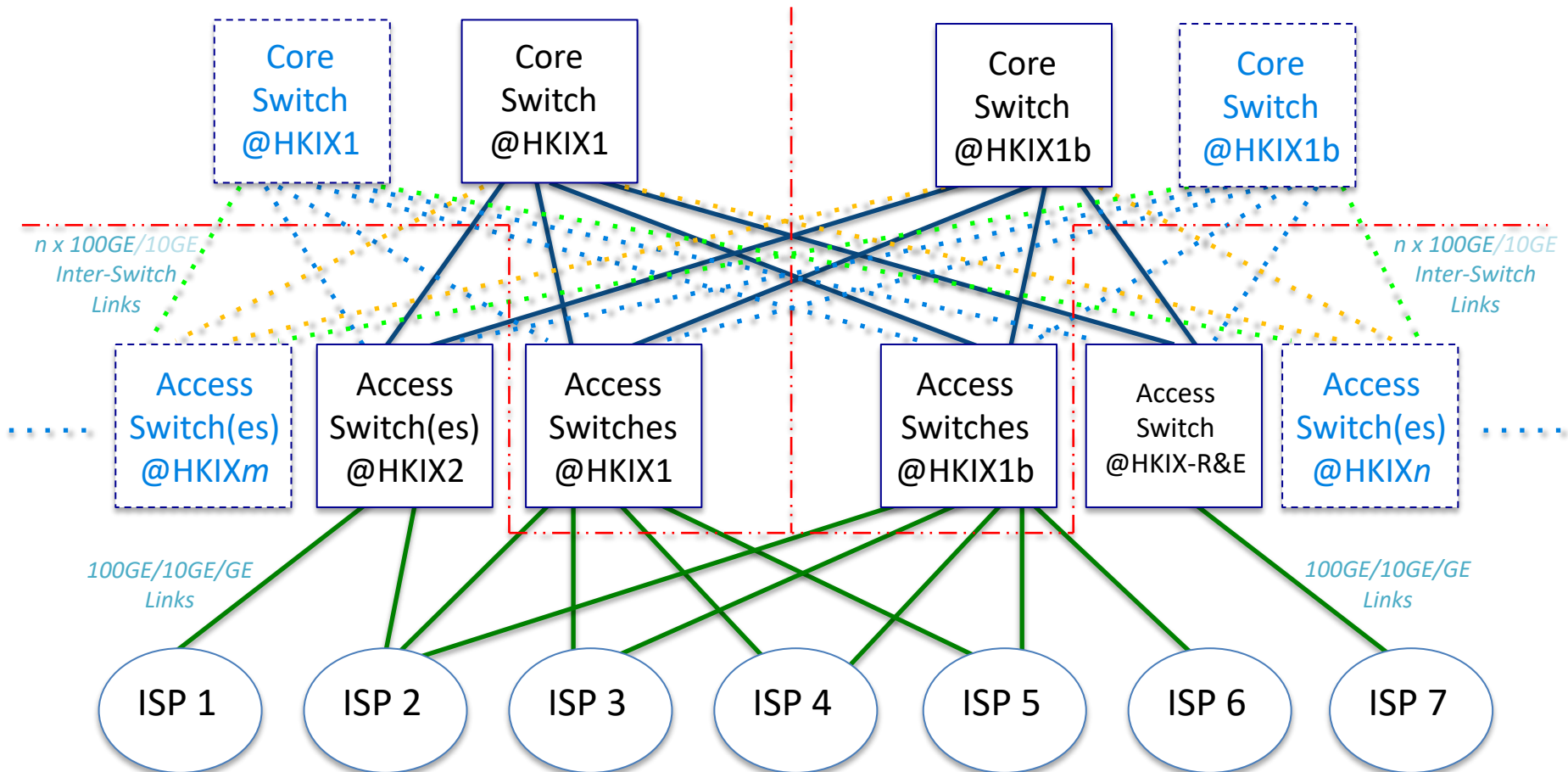
# What is HKIX?

- 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 Research and Education (R&E) networks

- The original goal is to keep intra-Hong Kong traffic within Hong Kong

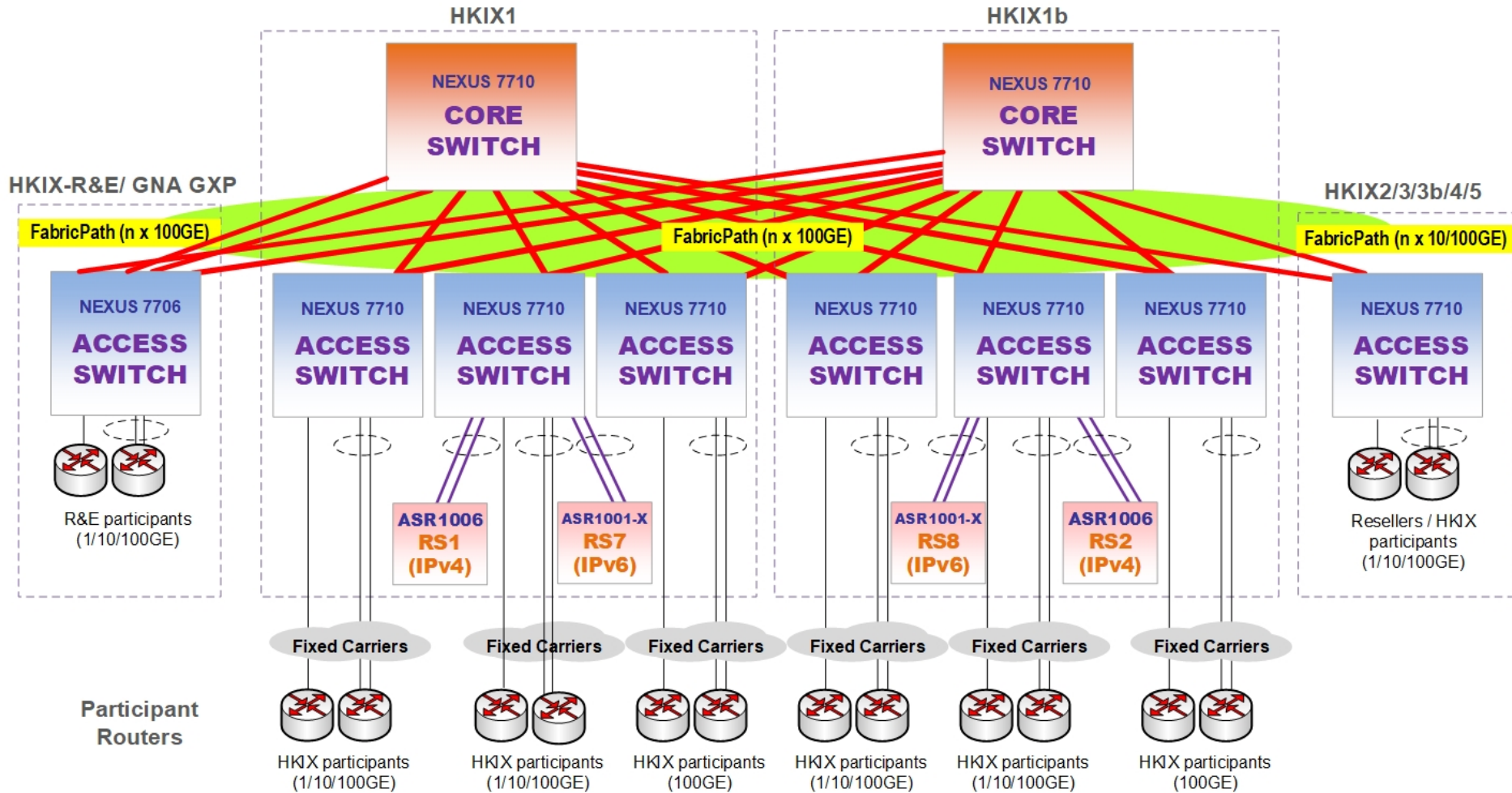# New HKIX Dual-Core Two-Tier Spine-and-Leaf Architecture For 2014 and Beyond

# HKIX Network Diagram (Jul 2020)



HKIX1

HKIX1b

**NEXUS 7710 CORE SWITCH**

**NEXUS 7710 CORE SWITCH**

HKIX-R&E/ GNA GXP

FabricPath (n x 100GE)

FabricPath (n x 100GE)

HKIX2/3/3b/4/5

FabricPath (n x 10/100GE)

**NEXUS 7706 ACCESS SWITCH**

R&E participants (1/10/100GE)

**NEXUS 7710 ACCESS SWITCH**

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Resellers / HKIX participants (1/10/100GE)

ASR1006 **RS1 (IPv4)**

ASR1001-X **RS7 (IPv6)**

ASR1001-X **RS8 (IPv6)**

ASR1006 **RS2 (IPv4)**

Fixed Carriers

Fixed Carriers

Fixed Carriers

Fixed Carriers

Fixed Carriers

Fixed Carriers

**Participant Routers**

HKIX participants (1/10/100GE)

HKIX participants (1/10/100GE)

HKIX participants (100GE)

HKIX participants (1/10/100GE)

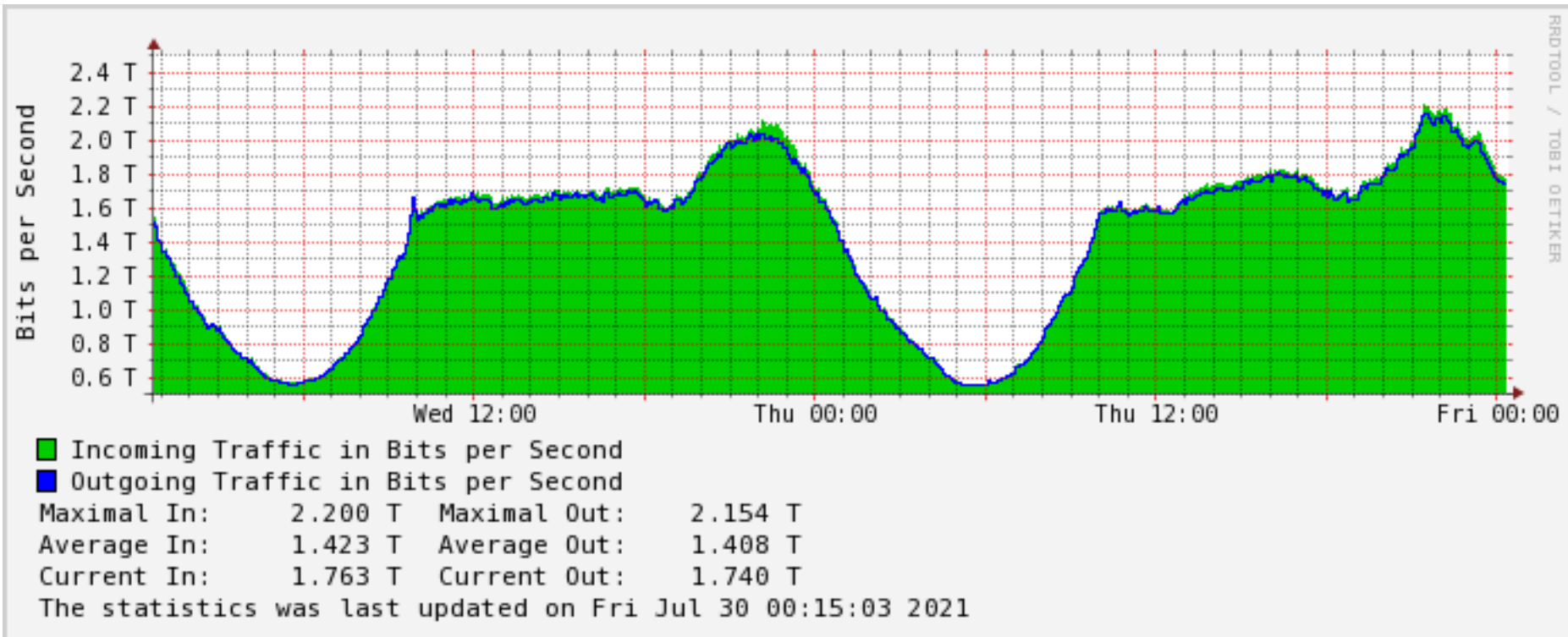HKIX participants (1/10/100GE)

HKIX participants (100GE)

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.

**HKIX**

# 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

- 330+ different networks (autonomous systems) connected

- 560+ physical connections in total
  - 96 **100GE**, 340+ **10GE** & 130+ **GE**

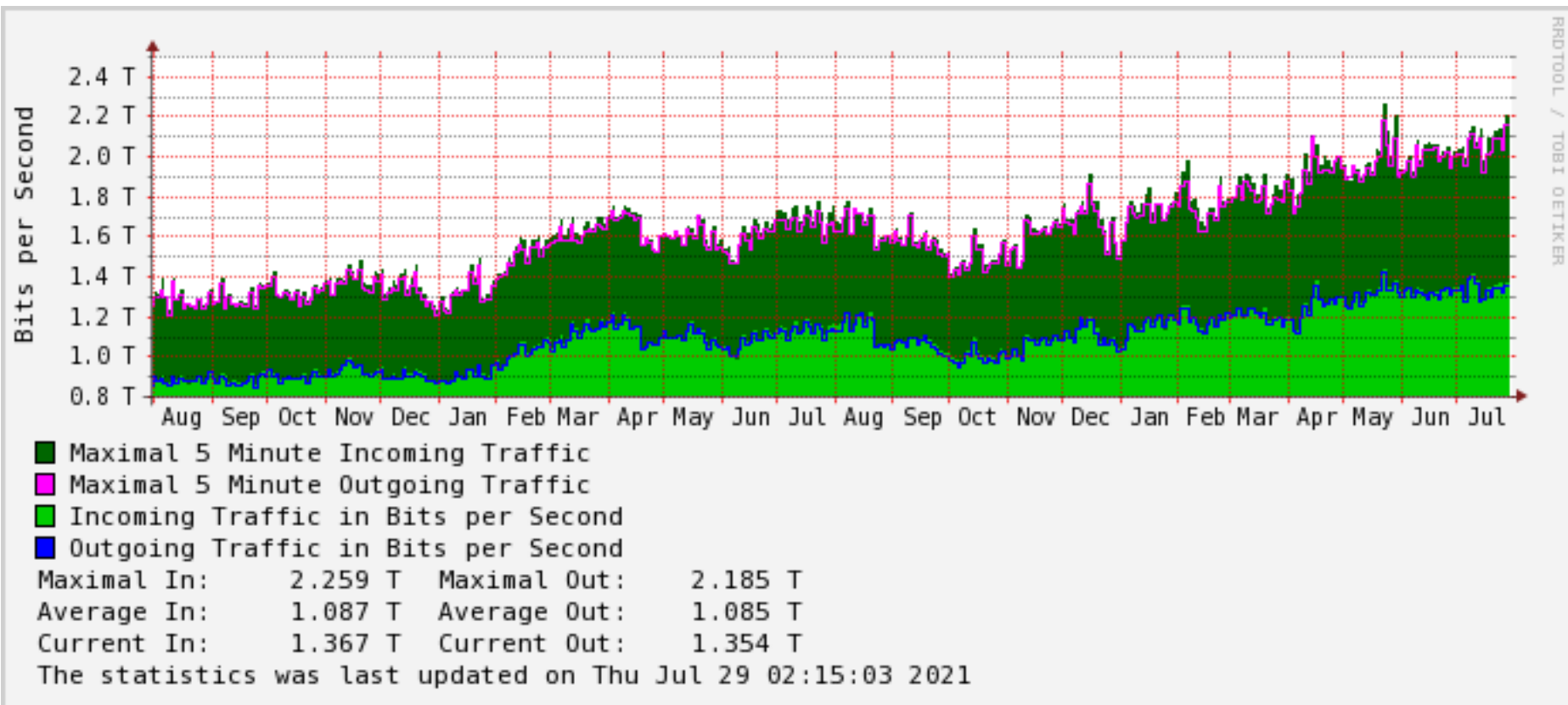- 2.26+Tbps (5-min) total traffic at peak

- Annual Traffic Growth ~30%
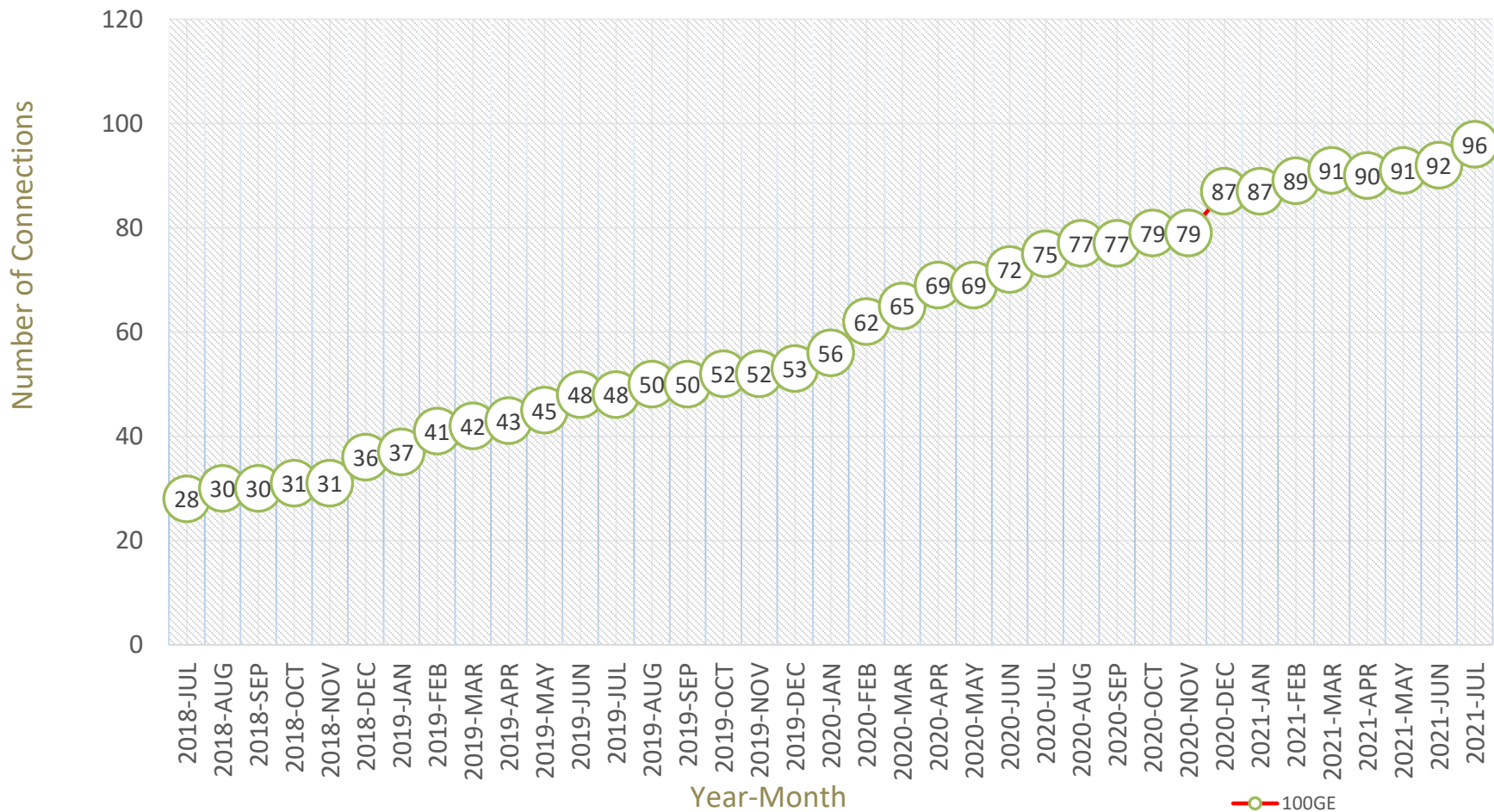
# Current HKIX Traffic
# Daily Graph (5-min average)

# Current HKIX Traffic
# Yearly Graph (1-day average)

# 100GE Connections at HKIX



Total HKIX 100G Ports Connected (2018 JUL - 2021 JUL)

# HKIX 100GE Participants (1/2)

- Akamai
- Alpha Network
- Amazon
- BGP Consultancy
- BIGO
- China Mobile HK
- China Mobile International
- CloudFlare
- Continent
- Converge ICT Solution
- Dataweb Global Group
- DDoS-Guard
- DITO Telecommunity
- Facebook
- FPT Telecom
- G-Core Labs
- Google
- HGC
- HKBN
- HKT
- Huawei International
- Hurricane Electric
- Hutchison Telephone
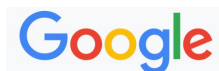
# HKIX 100GE Participants (2/2)

- Limelight
- Microsoft
- Mytek
- Netflix
- Netvigator
- NexusGuard
- PCCW Global
- RETN
- SK Broadband
- Sky Cable
- Taobao
- Telin
- Telekom Malaysia HK
- Telstra
- Tencent
- TVB
- Udomain
- Unicom
- Value
- XLC Global
- Yahoo
- Zscaler

# HKIX's 100GE participants at a glance -1

**Content Provider**



**ISP Regional**



**ISP Local**

# HKIX's 100GE participants at a glance -2

| Retail & Gaming | Anti-DDoS Provider | Data Centre | Others |
|---|---|---|---|
| 淘宝网 Taobao.com | CLOUDFLARE | UDomain | HUAWEI |
| VALVE | NEXUSGUARD | ALPHANETWORKS Solution Pte Ltd | XLC GLOBAL |
| | DDOS-GUARD | | CONTINENT8 technologies |
| | | | DGG Dataweb Global Group |
| | | | MYTEK Trading |

# Multiple HKIX Satellite Sites

- Allow participants to **connect to HKIX more easily** <span style="color:red">**at lower cost**</span> with cross connect from those satellite sites in Hong Kong
- Collaborate with multiple data centres in HK which fulfilled our requirements so as to maintain neutrality which is the key success factor of HKIX
- Create a win-win situation with satellite site collaborators
- Named HKIX2/3/4/5/6/etc

Latest updates:
  - HKIX2 has been migrated from old model to HKIX Satellite Site
  - HKIX3/4/5 are new satellite sites and they are **Ready for Service** now
  - HKIX3b is an extension of HKIX3 for resilience
- *HKIX1* and *HKIX1b* are the two HKIX core sites *located within CUHK Campus* and *HKIX1c* is the new core site at Cyberport*

# HKIX Reseller Program

- To provide one-stop-shop service by HKIX Resellers
- Non exclusive arrangement / resellers can be IXPs, Data Centres, local and regional ISPs
- Support Shared Port / Dedicated Port mode
- 1$^{st}$ batch of resellers is allowed to connect Satellite site only
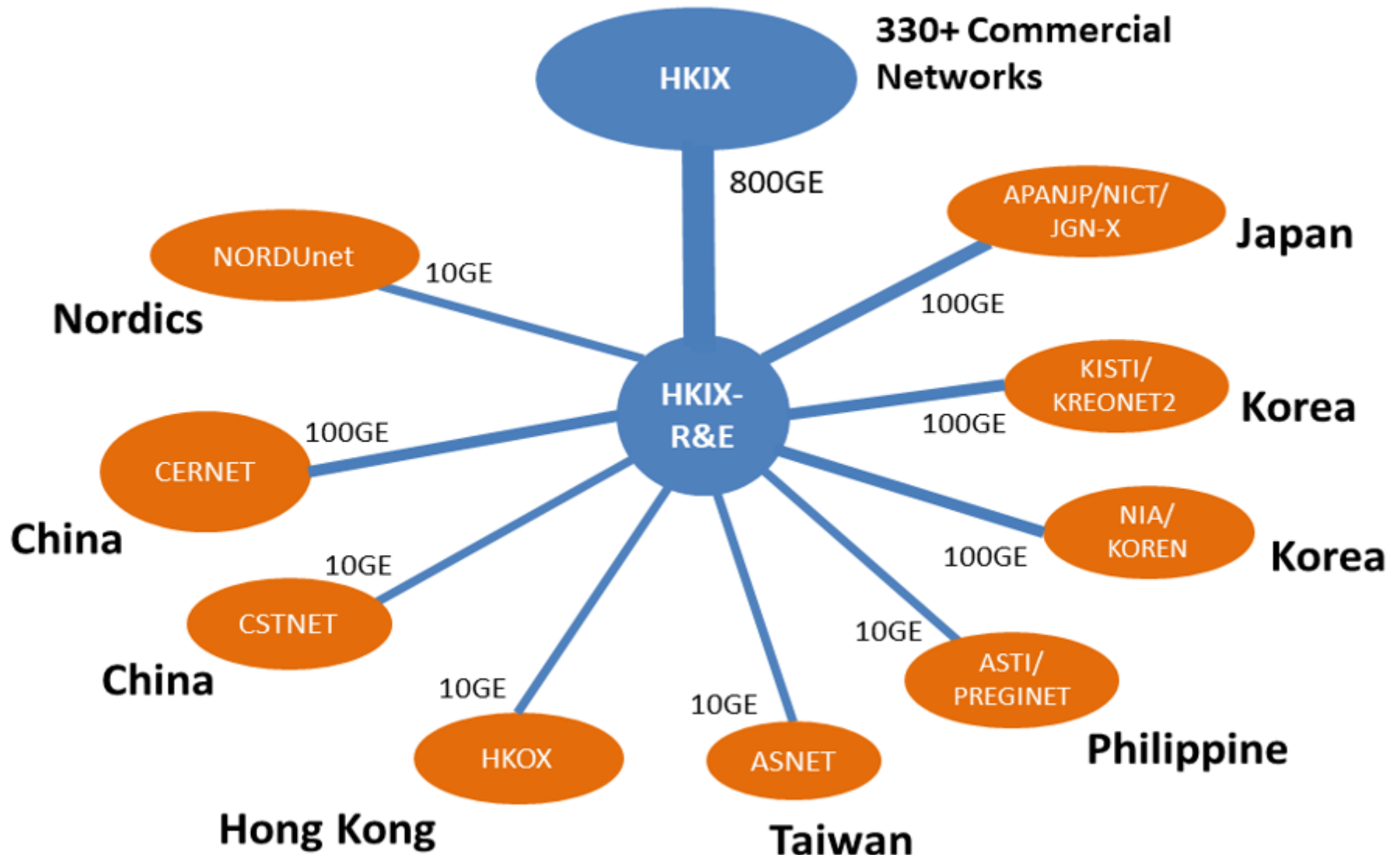- Resellers can connect to HKIX core sites now

If you are interest be one of our resellers, please contact info[@]hkix.net.

# HKIX-R&E – Special Support for R&E Networks Having Presence in HK
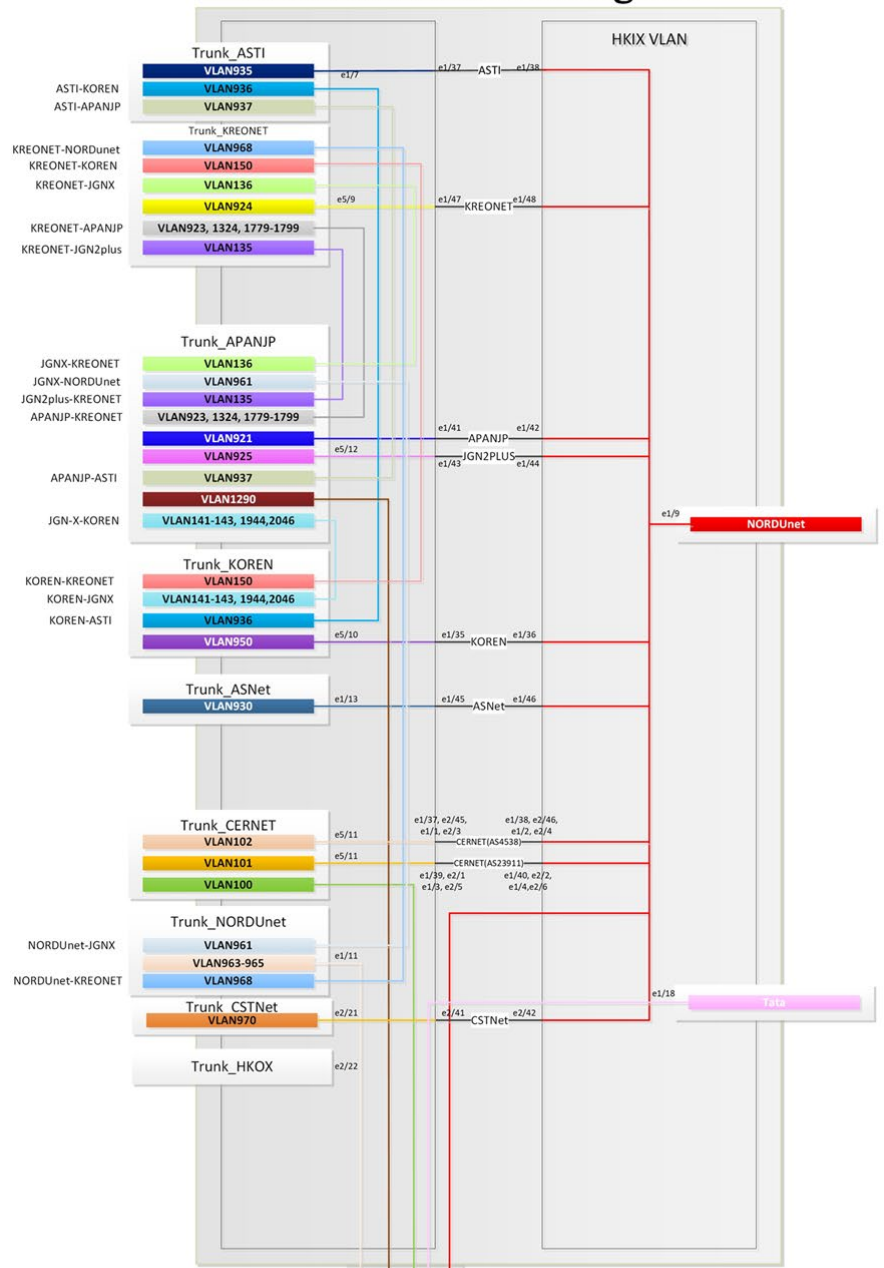
- **HKIX helps those R&E Networks interconnect among themselves and with <u>commercial networks</u> without restrictions via HKIX-R&E switch at MEGA-i**

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

- Started in 2008
- **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
- Support R&E equipment colocation at HKIX/CUHK

# HKIX-R&E Network Diagram

# HKIX-R&E Network Diagram



HKIX VLAN

**Trunk_ASTI**
- VLAN935
- ASTI-KOREN — VLAN936
- ASTI-APANJP — VLAN937

e1/7    e1/37 — ASTI — e1/38

**Trunk_KREONET**
- KREONET-NORDunet — VLAN968
- KREONET-KOREN — VLAN150
- KREONET-JGNX — VLAN136
- VLAN924
- KREONET-APANJP — VLAN923, 1324, 1779-1799
- KREONET-JGN2plus — VLAN135

e5/9    e1/47 — KREONET — e1/48

**Trunk_APANJP**
- JGNX-KREONET — VLAN136
- JGNX-NORDUnet — VLAN961
- JGN2plus-KREONET — VLAN135
- APANJP-KREONET — VLAN923, 1324, 1779-1799
- VLAN921
- VLAN925
- APANJP-ASTI — VLAN937
- VLAN1290
- JGN-X-KOREN — VLAN141-143, 1944,2046

e1/41    e1/42 — APANJP-
e5/12    e1/43 — JGN2PLUS — e1/44

e1/9 — NORDUnet

**Trunk_KOREN**
- KOREN-KREONET — VLAN150
- KOREN-JGNX — VLAN141-143, 1944,2046
- KOREN-ASTI — VLAN936
- VLAN950

e5/10    e1/35 — KOREN — e1/36

**Trunk_ASNet**
- VLAN930

e1/13    e1/45 — ASNet — e1/46

**Trunk_CERNET**
- VLAN102
- VLAN101
- VLAN100

e1/37, e2/45,    e1/38, e2/46,
e1/1, e2/3       e1/2, e2/4
e5/11 — CERNET(AS4538)
e5/11 — CERNET(AS23911)
e1/39, e2/1    e1/40, e2/2,
e1/3, e2/5     e1/4,e2/6

**Trunk_NORDUnet**
- NORDUnet-JGNX — VLAN961
- VLAN963-965
- NORDUnet-KREONET — VLAN968

e1/11

**Trunk_CSTNet**
- VLAN970

e1/18 — Tata

e2/21    e2/41 — CSTNet — e2/42

**Trunk_HKOX**

e2/22

**FabricPath**

**To HKIX1/HKIX1b**

Transit VLAN (Not HKIX-R&E related)

HKIX VLAN

Version: 20210713

# HKIX-R&E Updates

- Nx100G Connections from MEGA-i to HKIX
  - Upgraded to **800G** (8x100G) in SEP/2020
  - Will be upgraded to **1T** (10x100G) in Q4/2021
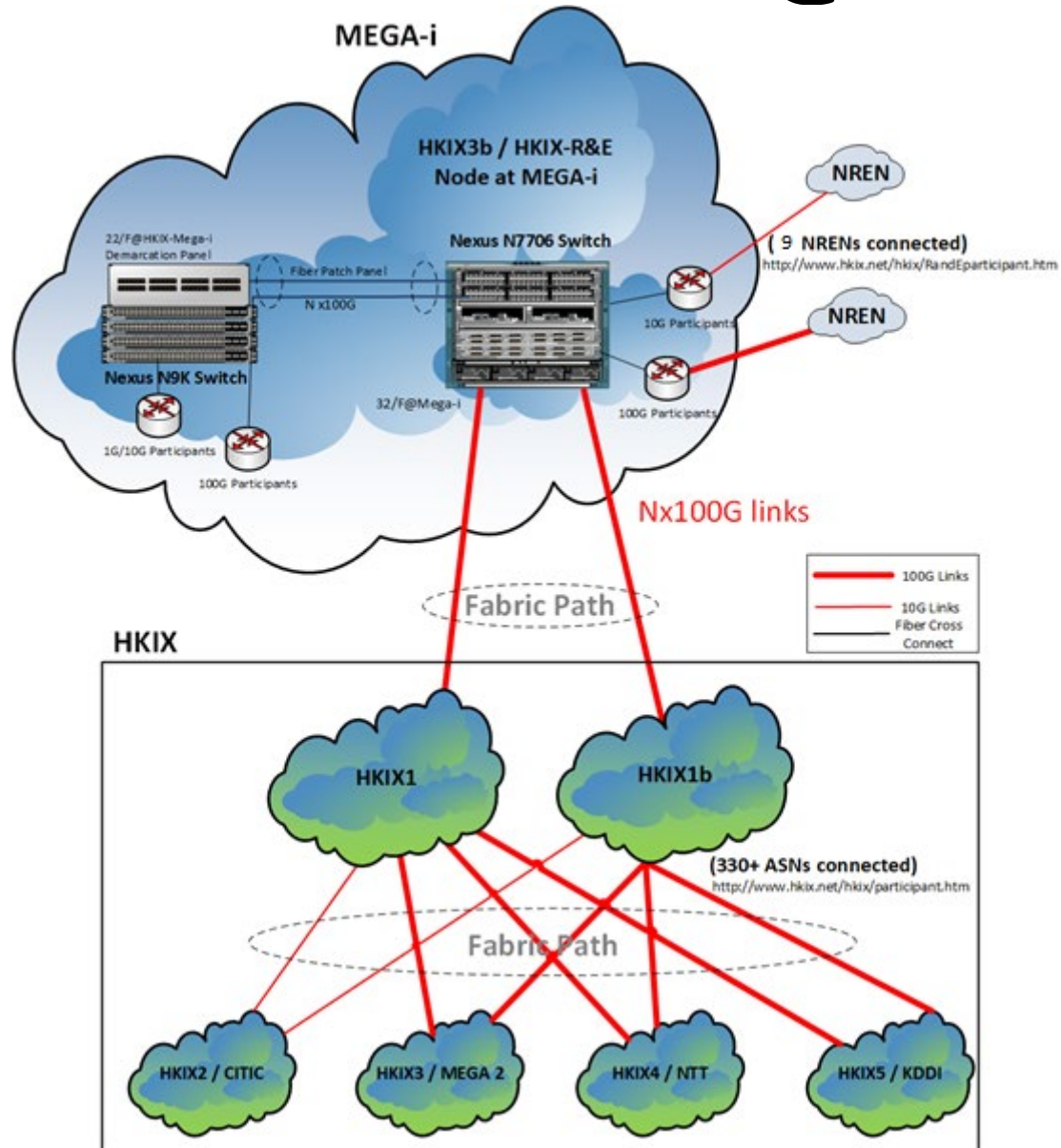
# HKIX-R&E Connections at MEGA-i

**100GE :**

- APANJP / NICT / JGN-X

- CERNET

- NIA / KOREN

- KISTI / KREONET2

**10GE :**

- ASNET

- ASTI / PREGINET

- CSTNET

- HKOX

- NORDUnet

# HKIX Infrastructure @MEGA-i

# HKIX Planned Works for 2021

- **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 Servers
  - NTP server for HKIX participants
  - HKIX New Core Site
  - DWDM Setup Between HKIX Core Sites
  - Network Operations & Command Center (NOCC) Setup in Cyberport
  - HKIX CRM Upgrade
  - VM Infrastructure Enhancement and Expansion

\* Working In Progress

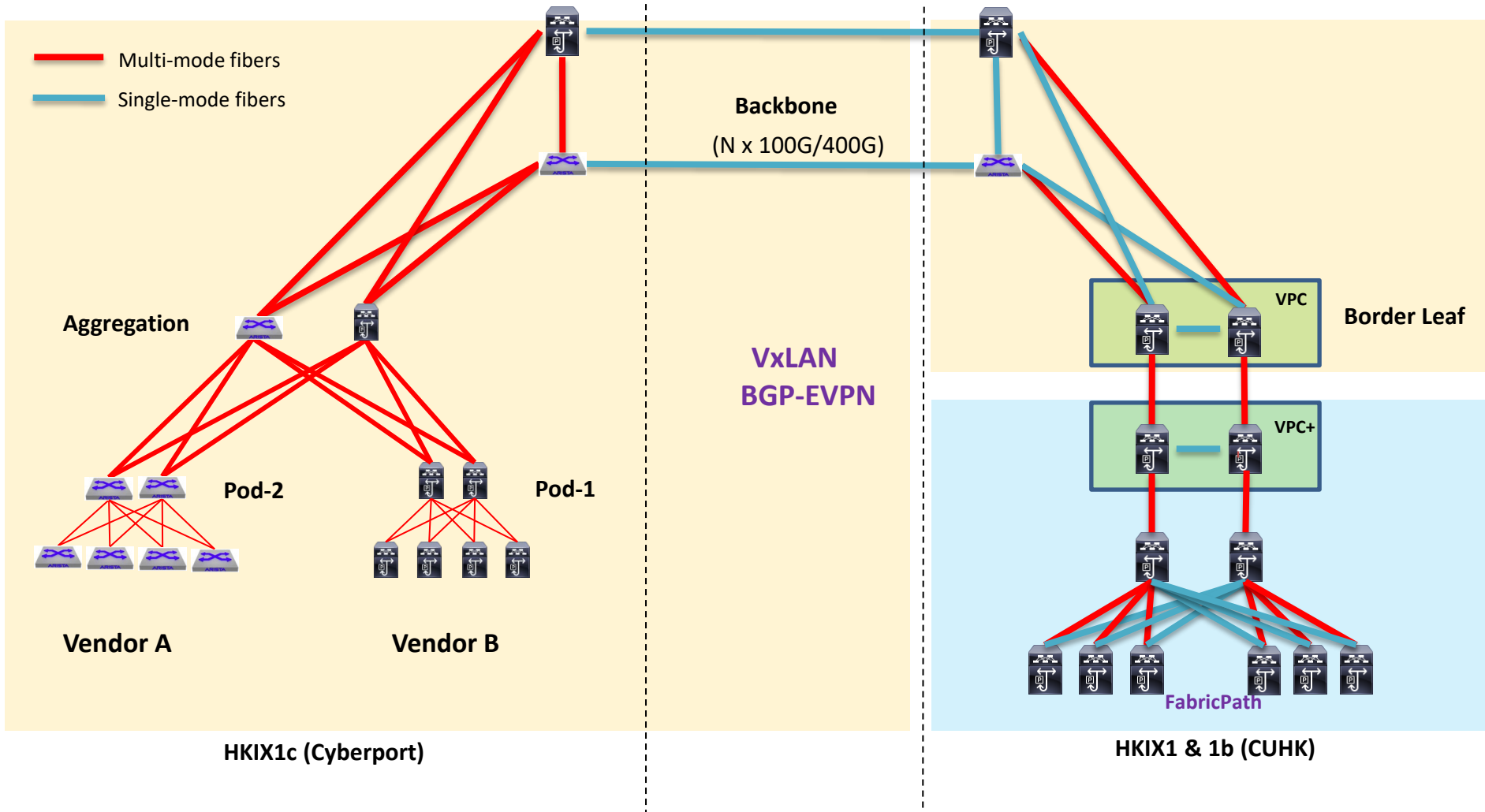# HKIX Planned Works for 2021

- **Improved Security**
    - ISO27001
    - Better support for DDoS mitigation
    - Implement RPKI on HKIX Route Servers to enhance routing security
    - Implement MANRS IXP Programme for routing security
    - Implement security operations center (SOC)
    - Create AS-SET of HKIX

* Working In Progress

# HKIX Future Upgrade Plan

- HKIX-R&E switch upgrade to support of 400G connections

- Network traffic visibility

- Network automation with multiple vendors support

# HKIX VXLAN EVPN deployment



Multi-mode fibers

Single-mode fibers

Backbone

(N x 100G/400G)

VxLAN
BGP-EVPN

Aggregation

Pod-2

Pod-1

Vendor A

Vendor B

VPC

Border Leaf

VPC+

FabricPath

HKIX1c (Cyberport)

HKIX1 & 1b (CUHK)

# HKIX VXLAN EVPN deployment

- Underlay routing protocol:
  - BGP vs IGP (OSPF/ISIS)
- Link/Loopback/Management IP assignment
- Interoperability between vendors

# HKIX

| | |
|---|---|
| IX name | Hong Kong Internet eXchange (HKIX) |
| City, Country | Hong Kong |
| Point of Presence | **Core Sites:**<br>**HKIX1** & **HKIX1b** @CUHK / **HKIX1c** @Cyberport<br><br>**HKIX-R&E:**<br>HKIX-R&E@MEGA-i<br><br>**Satellite Sites:**<br>**HKIX2**@CITIC, **HKIX3/HKIX3b**@iAdvantage, **HKIX4**@NTT, **HKIX5**@KDDI |
| # of connected ASN | 335 |
| Peak traffic | 2.26Tbps |
| Route Servers | Yes (Cisco ASR1002-HX) for IPv4 and IPv6 |
| RPKI / MANRS | Yes (both) |
| Remarks | Website: https://www.hkix.net<br>PeeringDB: https://www.peeringdb.com/ix/42<br>Resellers: https://www.hkix.net/hkix/Resellers.htm |

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

# Thank You!

**For enquiries, please contact us at**
## info [@] hkix.net