HKIX Development and HKIX-R&E Updates at APAN 54

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HKIX Team

www.hkix.net
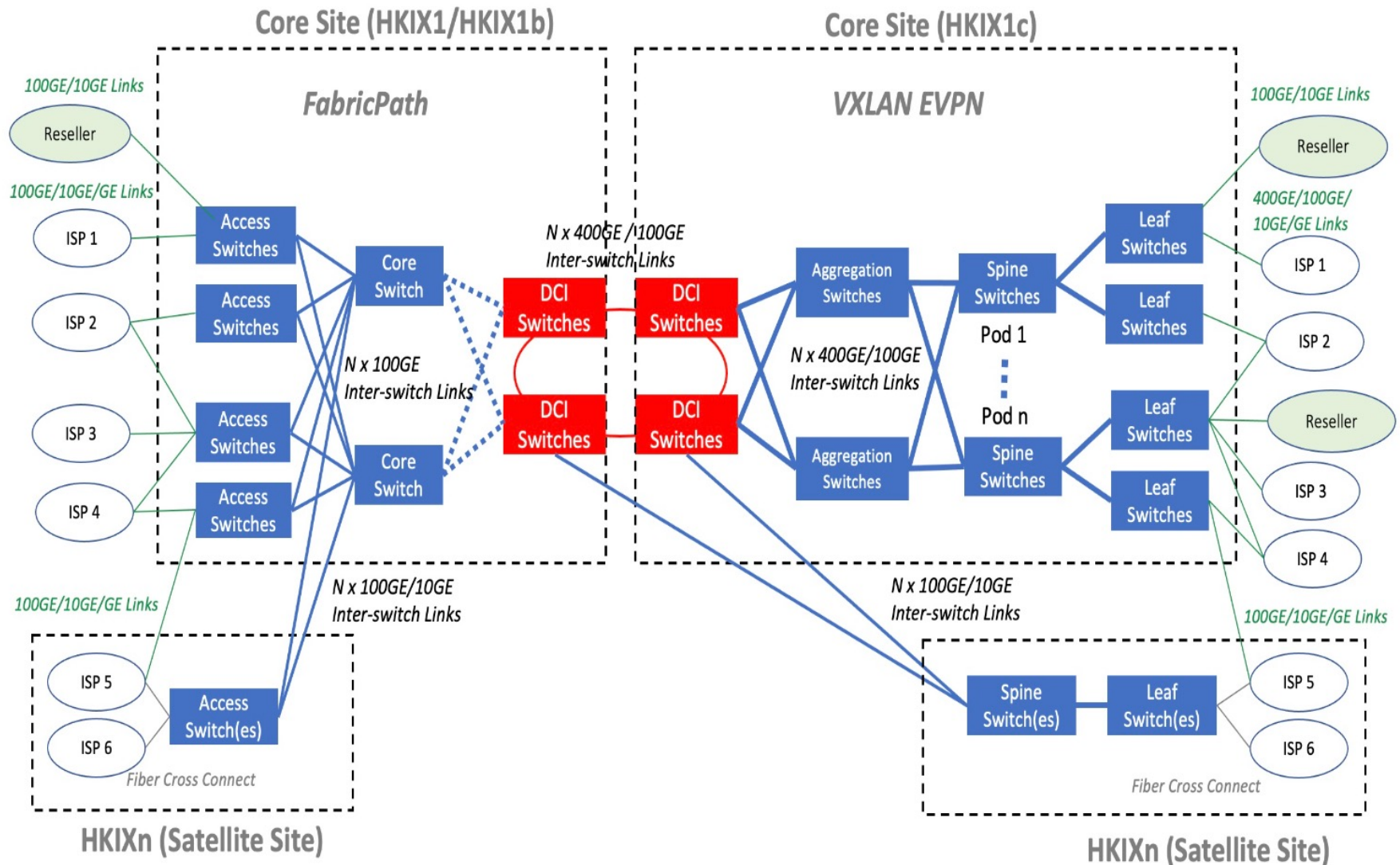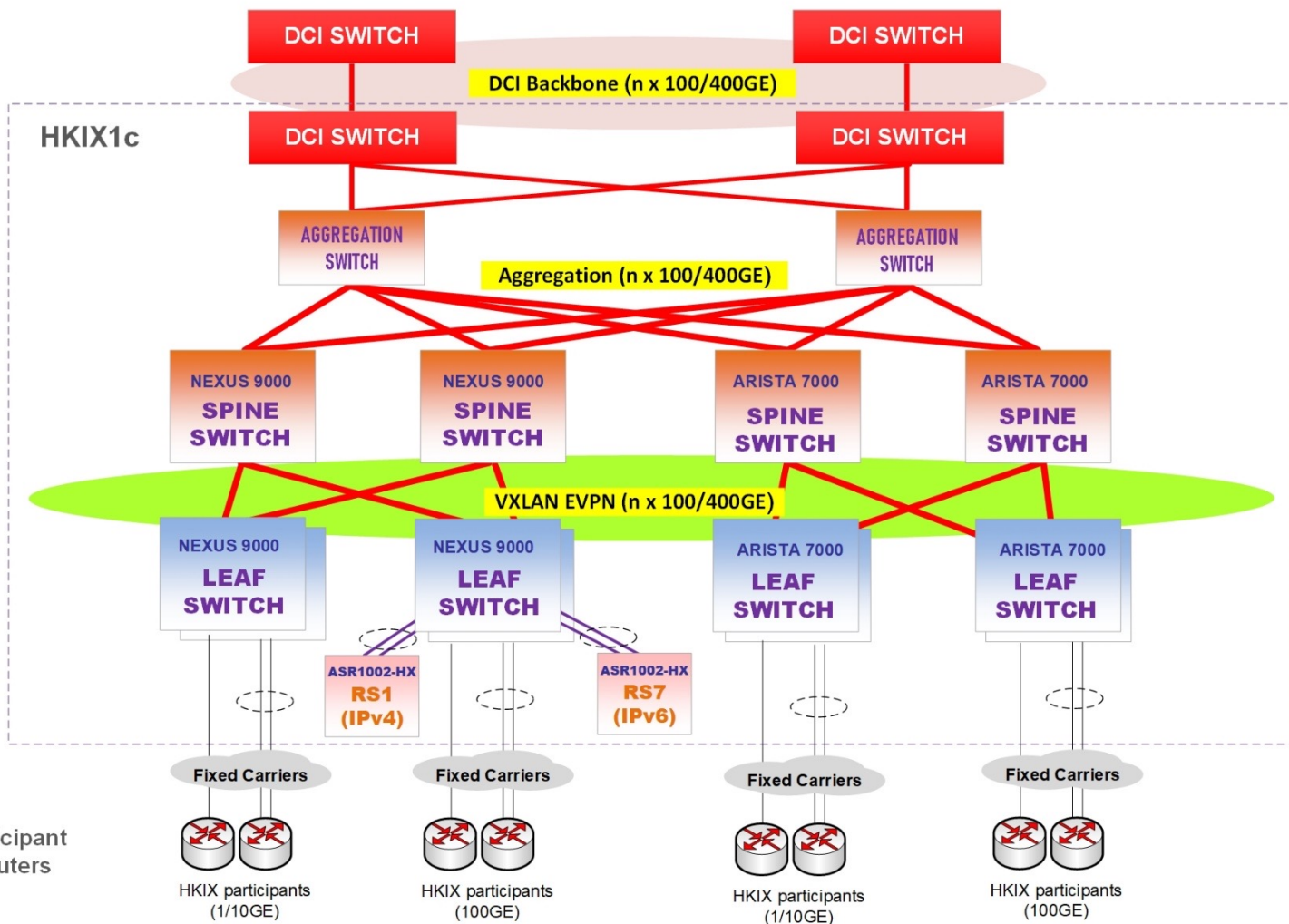
22-26 Aug 2022 (Jiana, China)

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

HKIX New Architecture (2021 and Beyond)

Core Site (HKIX1/HKIX1b)

Core Site (HKIX1c)

100GE/10GE Links

FabricPath

VXLAN EVPN

100GE/10GE Links

Reseller

Reseller

100GE/10GE/GE Links

400GE/100GE/
10GE/GE Links

ISP 1

Access Switches

Core Switch

N x 400GE /100GE
Inter-switch Links

Leaf Switches

ISP 1

ISP 2

Access Switches

DCI Switches

DCI Switches

Aggregation Switches

Spine Switches

Leaf Switches

ISP 2

N x 100GE
Inter-switch Links

Pod 1

ISP 3

Access Switches

DCI Switches

DCI Switches

N x 400GE/100GE
Inter-switch Links

Pod n

Leaf Switches

Reseller

ISP 4

Access Switches

Core Switch

Aggregation Switches

Spine Switches

Leaf Switches

ISP 3

ISP 4

100GE/10GE/GE Links

N x 100GE/10GE
Inter-switch Links

N x 100GE/10GE
Inter-switch Links

100GE/10GE/GE Links

ISP 5

Access Switch(es)

Spine Switch(es)

Leaf Switch(es)

ISP 5

ISP 6

ISP 6

Fiber Cross Connect

Fiber Cross Connect

HKIXn (Satellite Site)

HKIXn (Satellite Site)
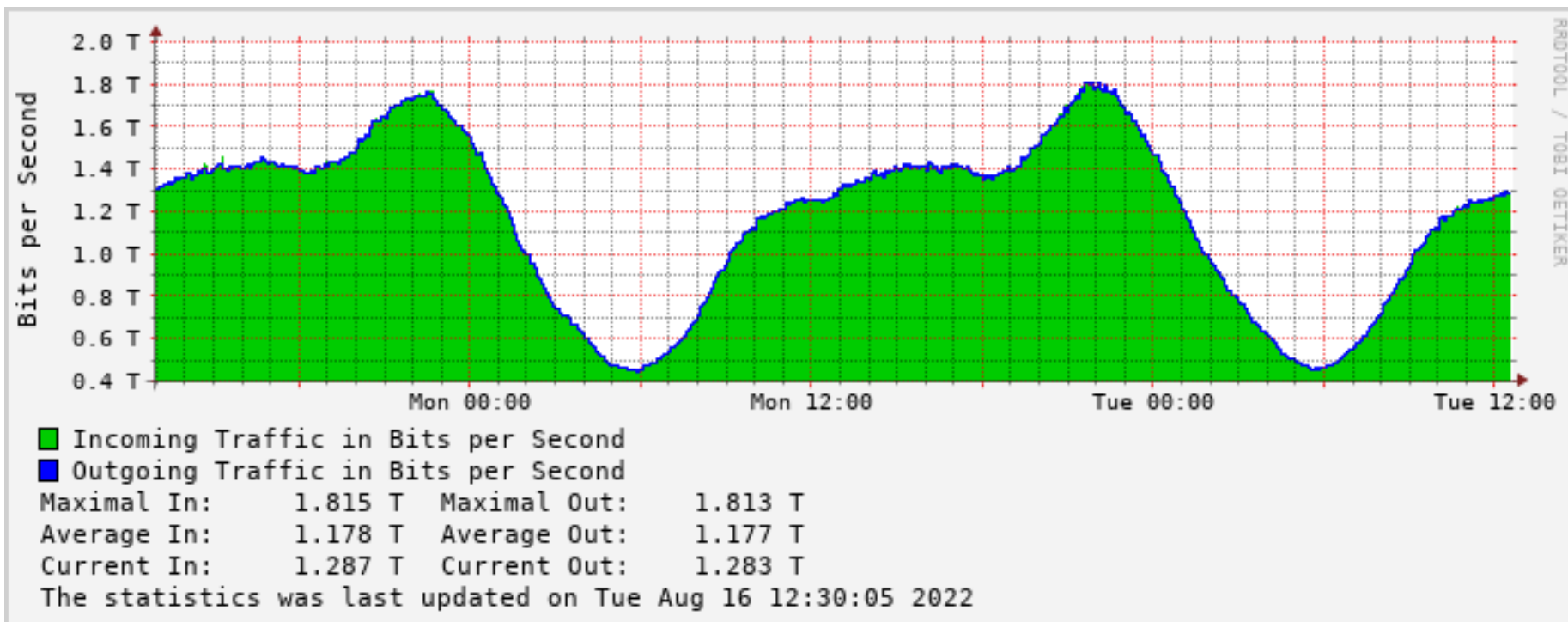
HKIX1c Network Diagram (Nov 2021)

1. **HKIX1** and **HKIX1b** are the two core sites of HKIX at CUHK while **HKIX1c** is the core site and **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 Today

- Supports both MLPA (Multilateral Peering) and BLPA (Bilateral Peering) over layer 2
- Supports IPv4/IPv6 dual-stack
- More and more non-HK participants
- 340+ different networks (autonomous systems) connected
- 550+ physical connections in total
  - 117 **100GE**, 310+ **10GE** & 110+ **GE**
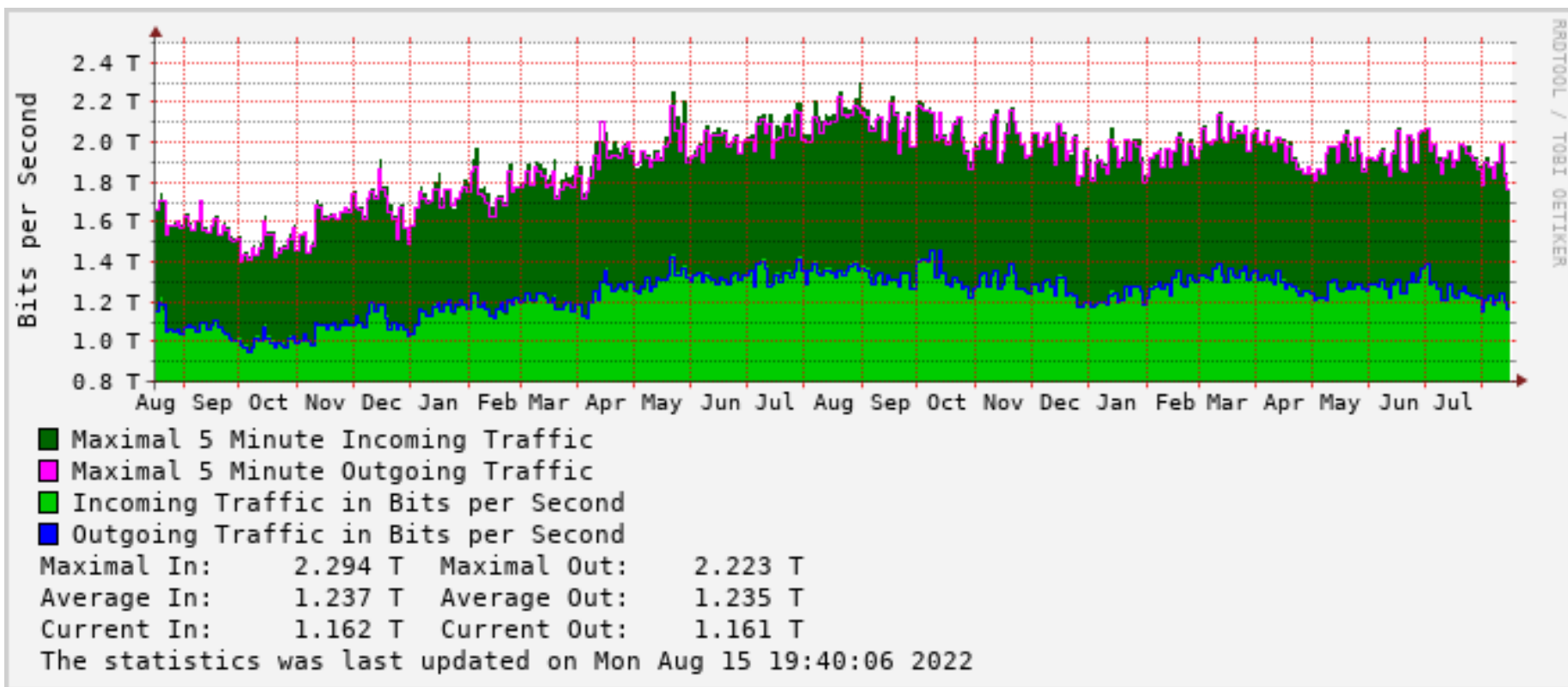- 2.29+Tbps (5-min) total traffic at peak
- Annual Traffic Growth ~30%

Current HKIX Traffic
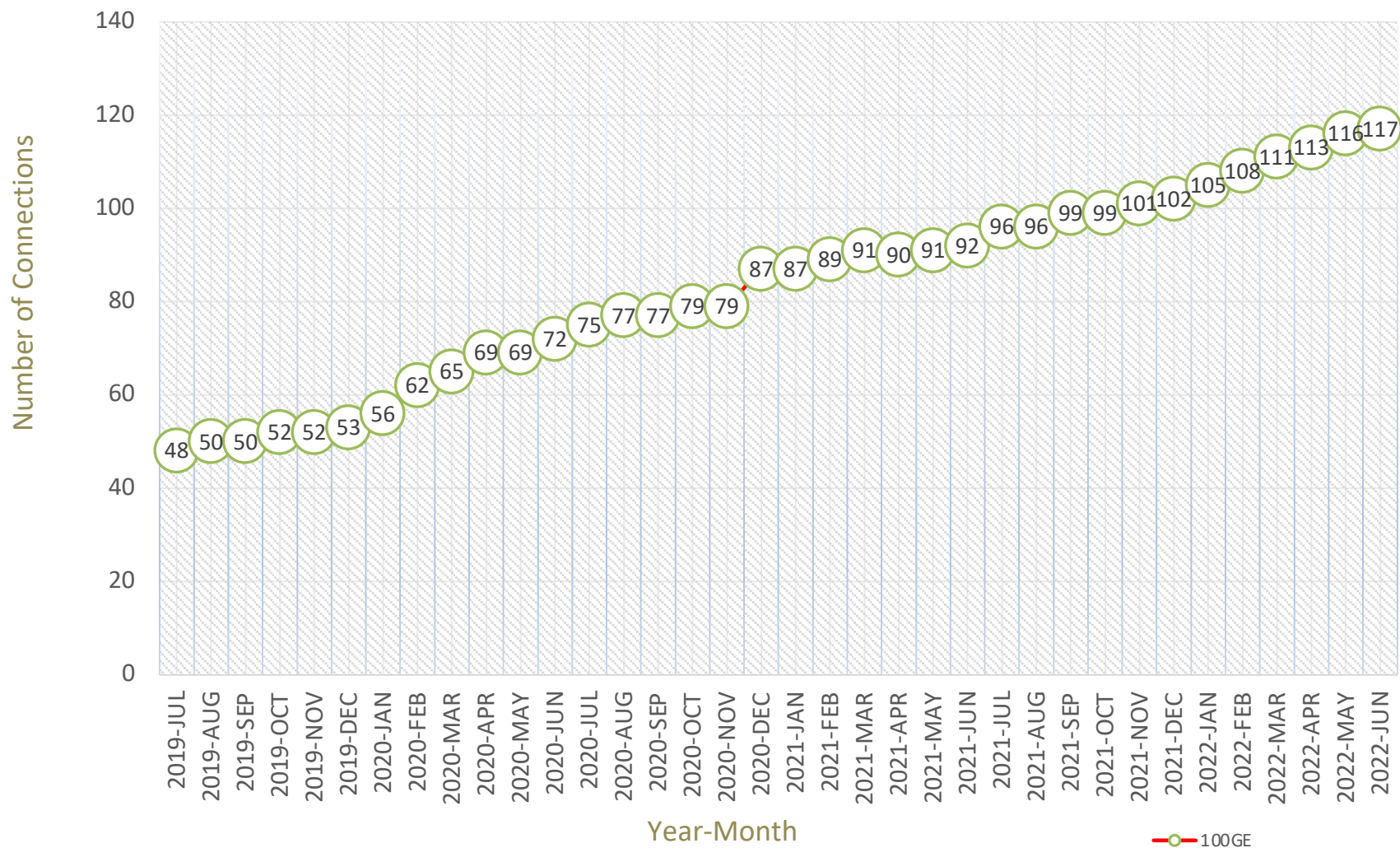# Daily Graph (5-min average)

Current HKIX Traffic
Yearly Graph (1-day average)

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

Maximal In: 2.294 T   Maximal Out: 2.223 T
Average In: 1.237 T   Average Out: 1.235 T
Current In: 1.162 T   Current Out: 1.161 T
The statistics was last updated on Mon Aug 15 19:40:06 2022

100GE Connections at HKIX

Total HKIX 100G Ports Connected (2019 JUL - 2022 JUN)

Number of Connections vs Year-Month

Data points: 48, 50, 50, 52, 52, 53, 56, 62, 65, 69, 69, 72, 75, 77, 77, 79, 79, 87, 87, 89, 91, 90, 91, 92, 96, 96, 99, 99, 101, 102, 105, 108, 111, 113, 116, 117

X-axis (Year-Month): 2019-JUL, 2019-AUG, 2019-SEP, 2019-OCT, 2019-NOV, 2019-DEC, 2020-JAN, 2020-FEB, 2020-MAR, 2020-APR, 2020-MAY, 2020-JUN, 2020-JUL, 2020-AUG, 2020-SEP, 2020-OCT, 2020-NOV, 2020-DEC, 2021-JAN, 2021-FEB, 2021-MAR, 2021-APR, 2021-MAY, 2021-JUN, 2021-JUL, 2021-AUG, 2021-SEP, 2021-OCT, 2021-NOV, 2021-DEC, 2022-JAN, 2022-FEB, 2022-MAR, 2022-APR, 2022-MAY, 2022-JUN

Legend: 100GE

HKIX 100GE Participants (1/3)

- ACORUS NETWORKS
- Advanced Wireless Network
- Akamai
- Akari Networks
- Alpha Networks
- Amazon
- BGP Consultancy
- BIGO TECHNOLOGY
- Bytedance
- China Mobile HK
- China Mobile Hong Kong Company Limited
- China Mobile International Limited
- China Unicom
- CloudFlare
- Continent 8 Technologies
- CONVERGE ICT SOLUTION
- Dataweb Global Group
- DDoS-Guard
- DITO Telecommunity
- Diyixian

HKIX 100GE Participants (2/3)

- Edge Network Services (Facebook)
- FPT TELECOM
- Google
- G-Core labs
- Globe Telecoms
- HKBN
- HUAWEI INTERNATIONAL
- Hurricane Electric
- Hutchison Global
- Hutchison Telephone
- I3D.net
- Limelight Networks
- Microsoft
- MYTEK
- Nathosts
- Netflix
- Nexus Guard
- Oriental Power
- PCCW Global
- PCCW IMS

- PCCW-HKT
- RETN
- SK Broadband
- SKYCable
- TAOBAO
- Tcloudnet
- Telin
- Telstra
- TVB
- Udomain
- Valve
- Vocom International Telecommunication
- XLC Global
- Yahoo!
- Zenlayer
- Zscaler

HKIX's 100GE participants at a glance -1

Content Provider

Tencent 腾讯

facebook

Google

YAHOO!

TVB

BGP Net
BGP Network (M) Sdn Bhd

BIGO

G·CORE LABS

NETFLIX

Akamai

amazon

Microsoft

ByteDance

zscaler

i3D.NET
PERFORMANCE HOSTING

SKYCABLE

Limelight

TCLOUDNET

ISP Regional

TELSTRA

AWN

Telin
by Telkom Indonesia

HURRICANE ELECTRIC
INTERNET SERVICES

CONVERGE

FPT

中国移动 China Mobile International

PCCW Global

China unicom 中国联通

RETN

SK broadband

DITO TELECOMMUNITY

VOCOM

Globe

HKIX's 100GE participants at a glance -2

ISP Local	Retail & Gaming	Anti-DDoS Provider	Data Centre	Others
HKT	Taobao.com	CLOUDFLARE	UDomain	HUAWEI
netvigator / HONG KONG BROADBAND NETWORK	VALVE	NEXUSGUARD	ALPHANETWORKS Solution Pte Ltd	XLC GLOBAL / f5
China Mobile		DDOS-GUARD	zenlayer	CONTINENT8 technologies
HGC 寬頻			DYnet by NEOLINK	DGG Dataweb Global Group
3			NATHOSTS	MYTEK Trading

Multiple HKIX Satellite Sites

- Allow participants to **connect to HKIX more easily** **at lower cost** 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
- 1st batch of resellers is allowed to connect Satellite site only
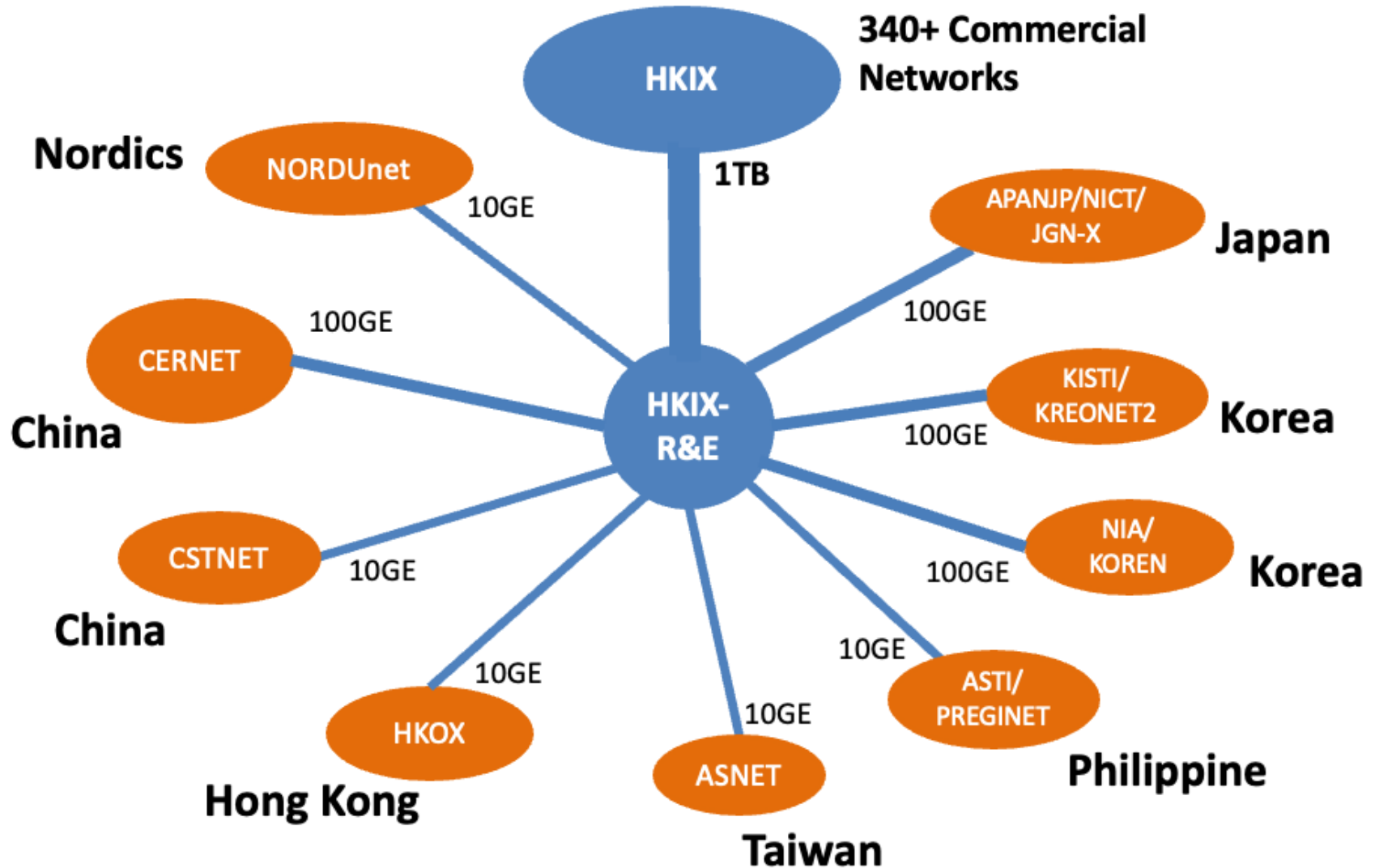- Resellers can connect to HKIX core sites now

If you are interest be one of our resellers, please contact info[@]hkix.net.
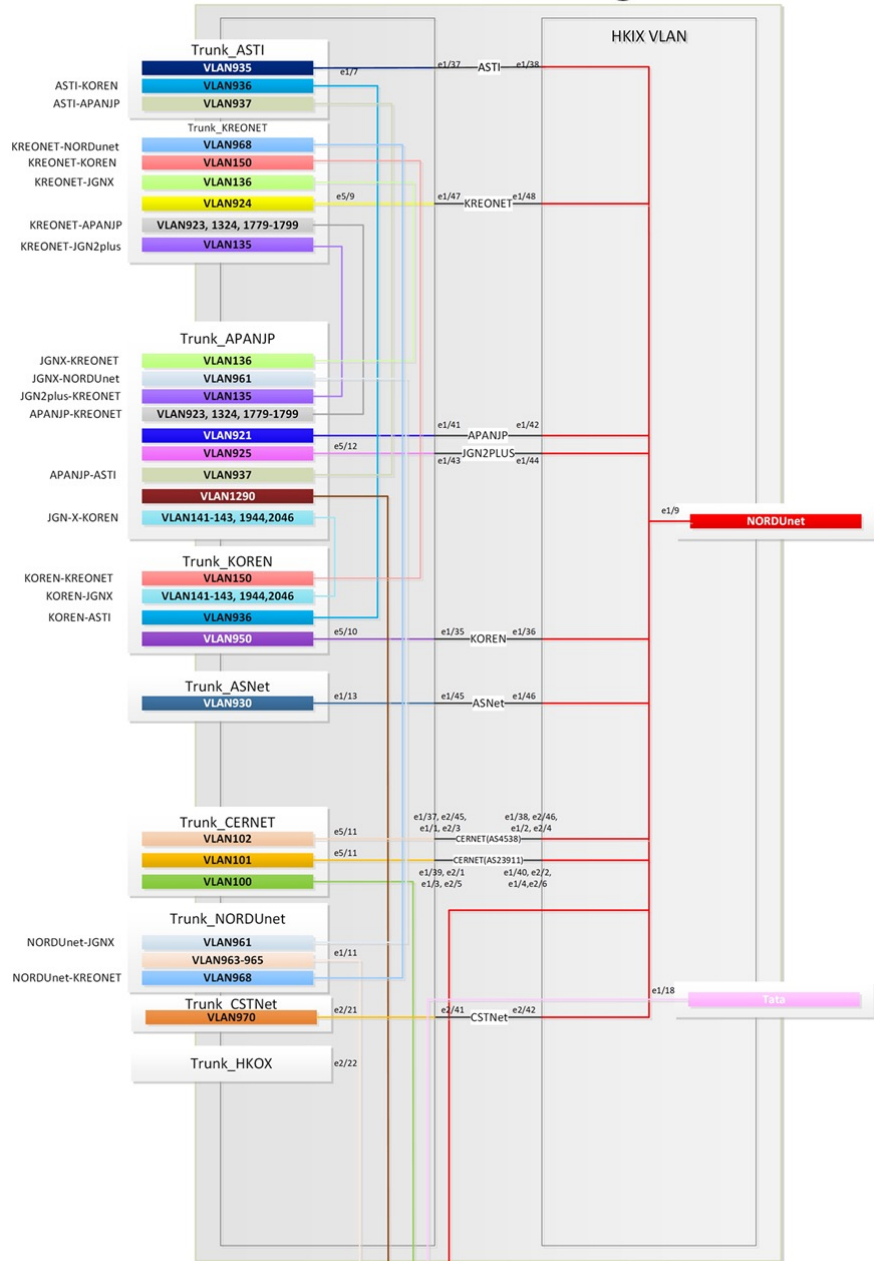
HKIX-R&E – Special Support for R&E Networks Having Presence in HK

- **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	e1/7
ASTI-KOREN	VLAN936
ASTI-APANJP	VLAN937

ASTI   e1/37   e1/38

Trunk_KREONET

KREONET-NORDunet	VLAN968
KREONET-KOREN	VLAN150
KREONET-JGNX	VLAN136
	VLAN924	e5/9
KREONET-APANJP	VLAN923, 1324, 1779-1799
KREONET-JGN2plus	VLAN135

KREONET   e1/47   e1/48

Trunk_APANJP

JGNX-KREONET	VLAN136
JGNX-NORDUnet	VLAN961
JGN2plus-KREONET	VLAN135
APANJP-KREONET	VLAN923, 1324, 1779-1799
	VLAN921
	VLAN925	e5/12
APANJP-ASTI	VLAN937
	VLAN1290
JGN-X-KOREN	VLAN141-143, 1944,2046

APANJP   e1/41   e1/42
JGN2PLUS   e1/43   e1/44

e1/9   NORDUnet

Trunk_KOREN

KOREN-KREONET	VLAN150
KOREN-JGNX	VLAN141-143, 1944,2046
KOREN-ASTI	VLAN936
	VLAN950	e5/10

KOREN   e1/35   e1/36

Trunk_ASNet

VLAN930	e1/13

ASNet   e1/45   e1/46

Trunk_CERNET

VLAN102	e5/11
VLAN101	e5/11
VLAN100	

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

Trunk_NORDUnet

NORDUnet-JGNX	VLAN961
	VLAN963-965
NORDUnet-KREONET	VLAN968	e1/11

Trunk_CSTNet

VLAN970	e2/21

e1/18   Tata

CSTNet   e2/41   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 **1T** (10x100G) in Q4/2021
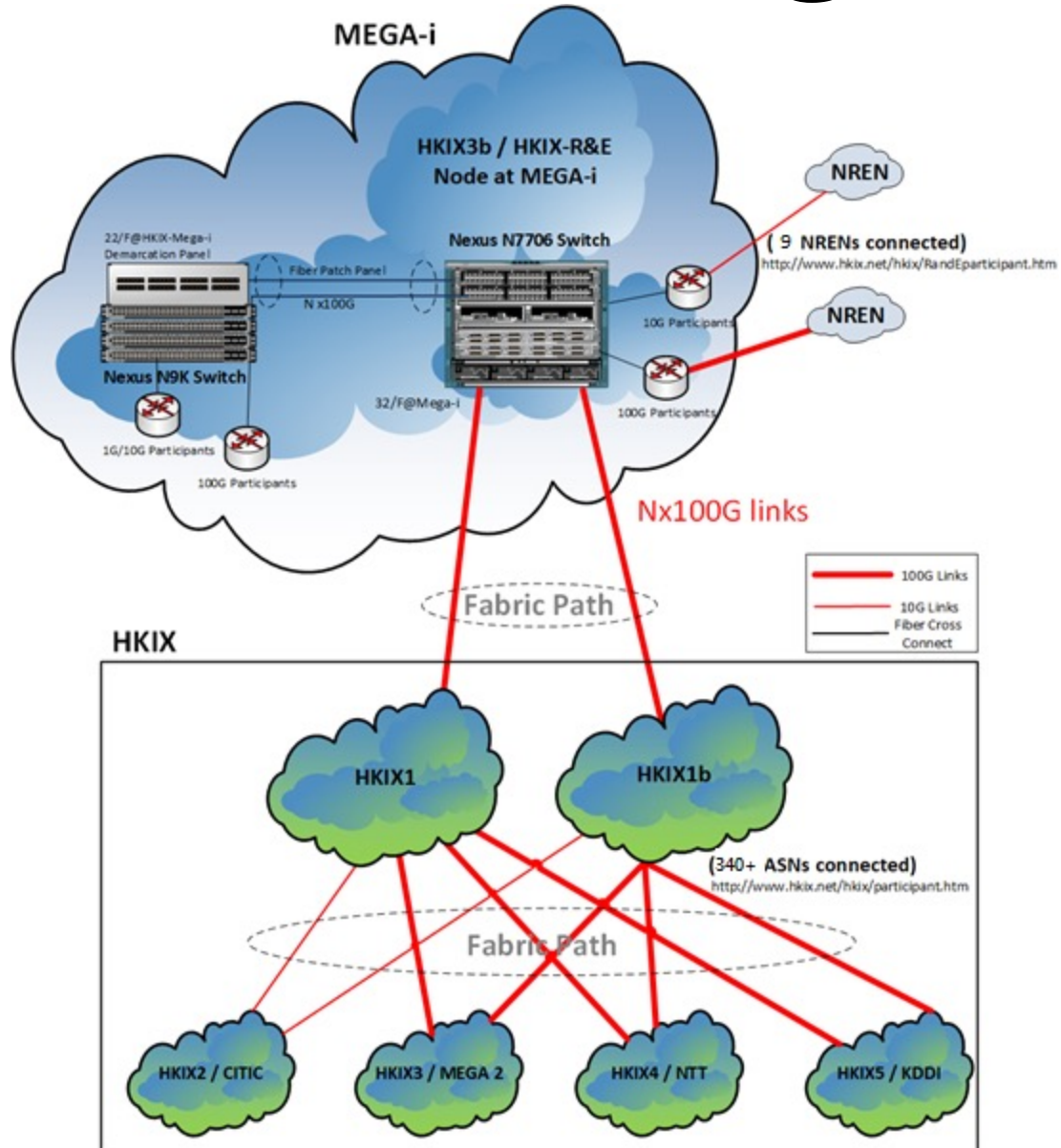
HKIX-R&E Connections at MEGA-i

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 2022-23

- **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
  - 100GE Connections at HKIX
  - Automatic network filter update (support updates from IRR)
  - HKIX New Core Site
  - Network Operations & Command Center (NOCC) Setup in Cyberport
  - HKIX CRM Upgrade
  - 400GE Support at HKIX Core Sites
  - Enhanced portal services for participants
  - New open-source route server implementation
  - NTP server for HKIX participants
  - DWDM and dark fiber Between HKIX Core Sites
  - HKIX1 migration to HKIX1b/HKIX1c
  - OOKLA speed test node deployment at HKIX1c

* Working In Progress

# HKIX Planned Works for 2022-23

- **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
  - Create AS-SET of HKIX
  - Implement security operations center (SOC)
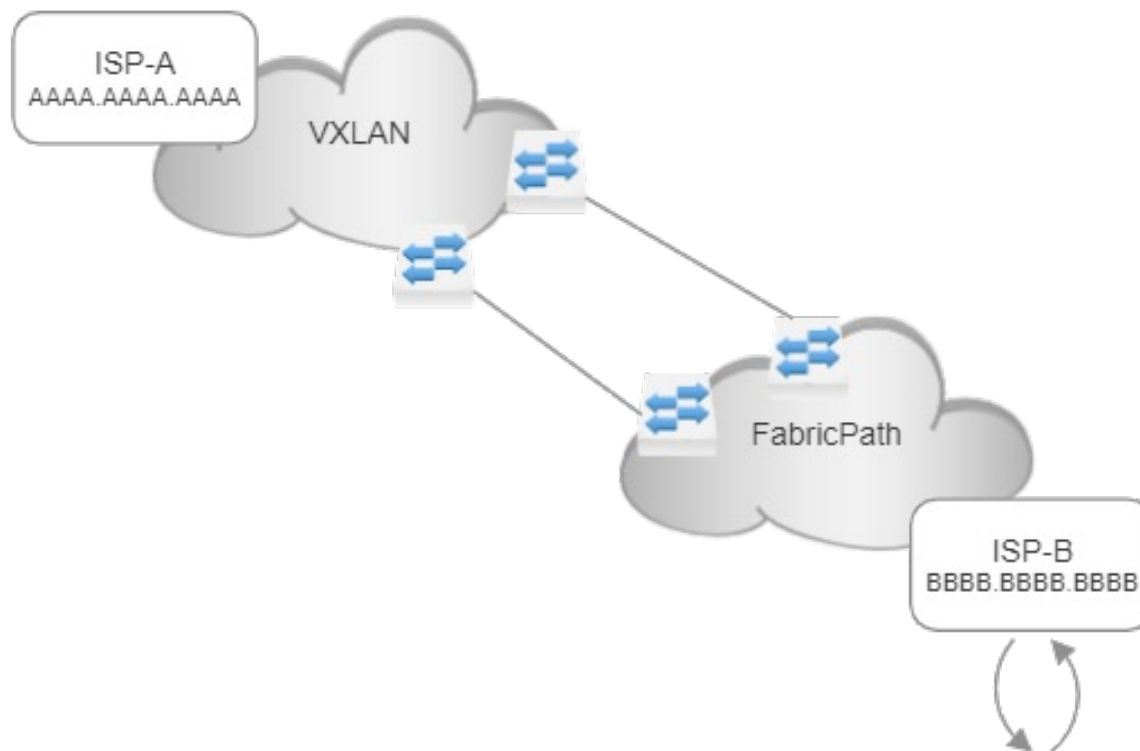
  * Working In Progress

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
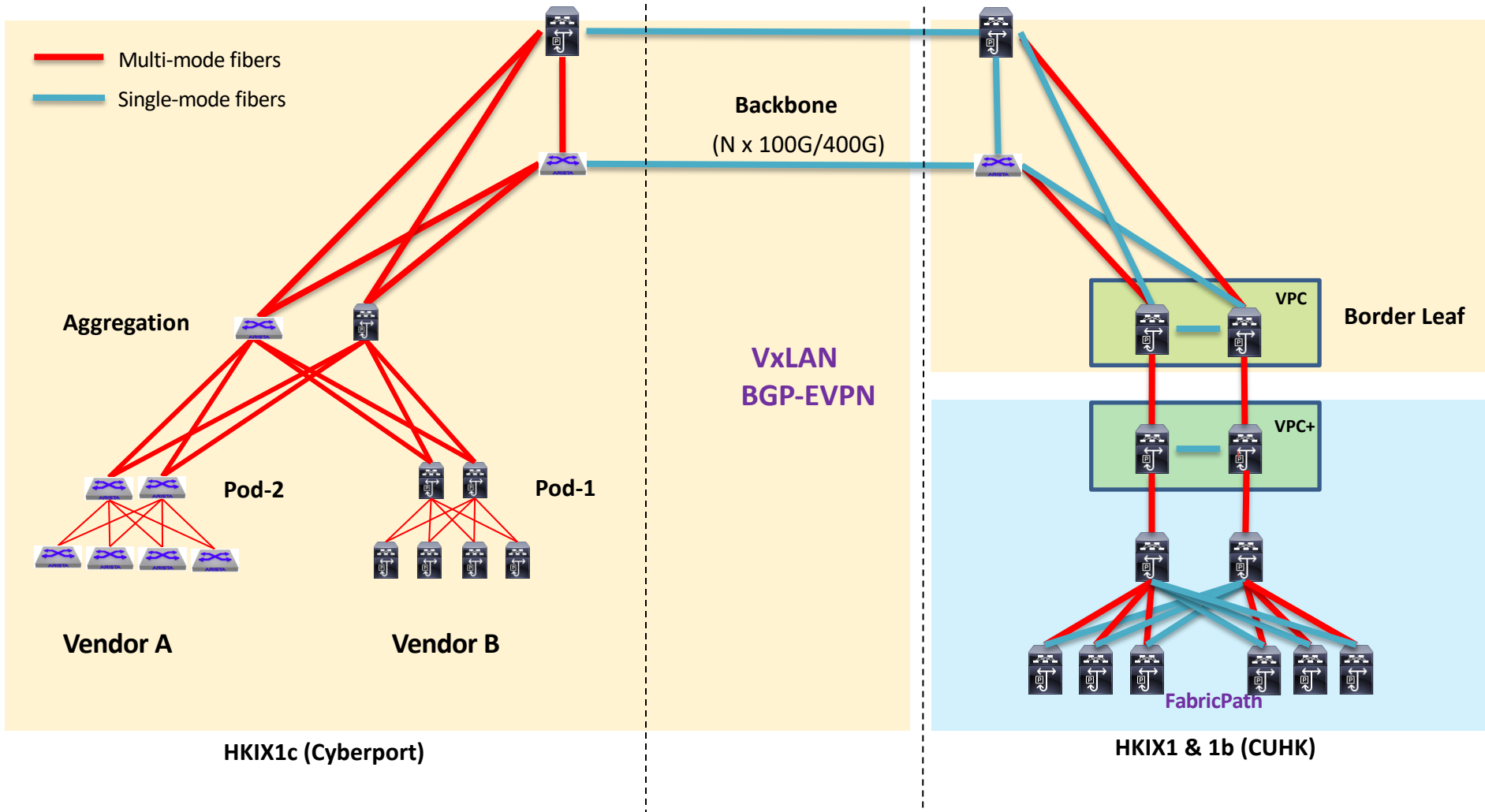
HKIX VXLAN EVPN deployment

HKIX VXLAN EVPN deployment

- Issue:
  - ISP-B loop-back traffic source from ISP-A
- Problem 1:
  - FabricPath switch port's port-security is ON but cannot prevent its MAC learning of AAAA.AAAA.AAAA
- Problem 2:
  - VXLAN border leaf switches will not correct its CAM table when the looped traffic stopped
  - Syslog
    - %L2RIB-2-L2RIB_LOCAL_LEARNT_MAC_PRESENT_AS_REMOTE_STATIC: Locally learnt MAC AAAA.AAAA.AAAA in topology: # already present as remote static

HKIX VXLAN EVPN deployment

- Workaround:
  - EEM script at VXLAN border leaf switches to run below command when detect the syslog message
    - clear mac address-table dynamic address <mac-address>

- Solution:
  - Equipment vendor plan to release OS that will correct CAM table when the looped traffic stopped

HKIX

IX name	Hong Kong Internet eXchange (HKIX)
City, Country	Hong Kong
Point of Presence	**Core Sites:** **HKIX1** & **HKIX1b** @CUHK / **HKIX1c** @Cyberport **HKIX-R&E:** HKIX-R&E@MEGA-i **Satellite Sites:** **HKIX2**@CITIC, **HKIX3/HKIX3b**@iAdvantage, **HKIX4**@NTT, **HKIX5**@KDDI
# of connected ASN	345
Peak traffic	2.29Tbps
Route Servers	Yes (Cisco ASR1002-HX) for IPv4 and IPv6
RPKI / MANRS	Yes (both)
Remarks	Website: https://www.hkix.net PeeringDB: https://www.peeringdb.com/ix/42 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