



HKIX Updates at JPIX User Meeting

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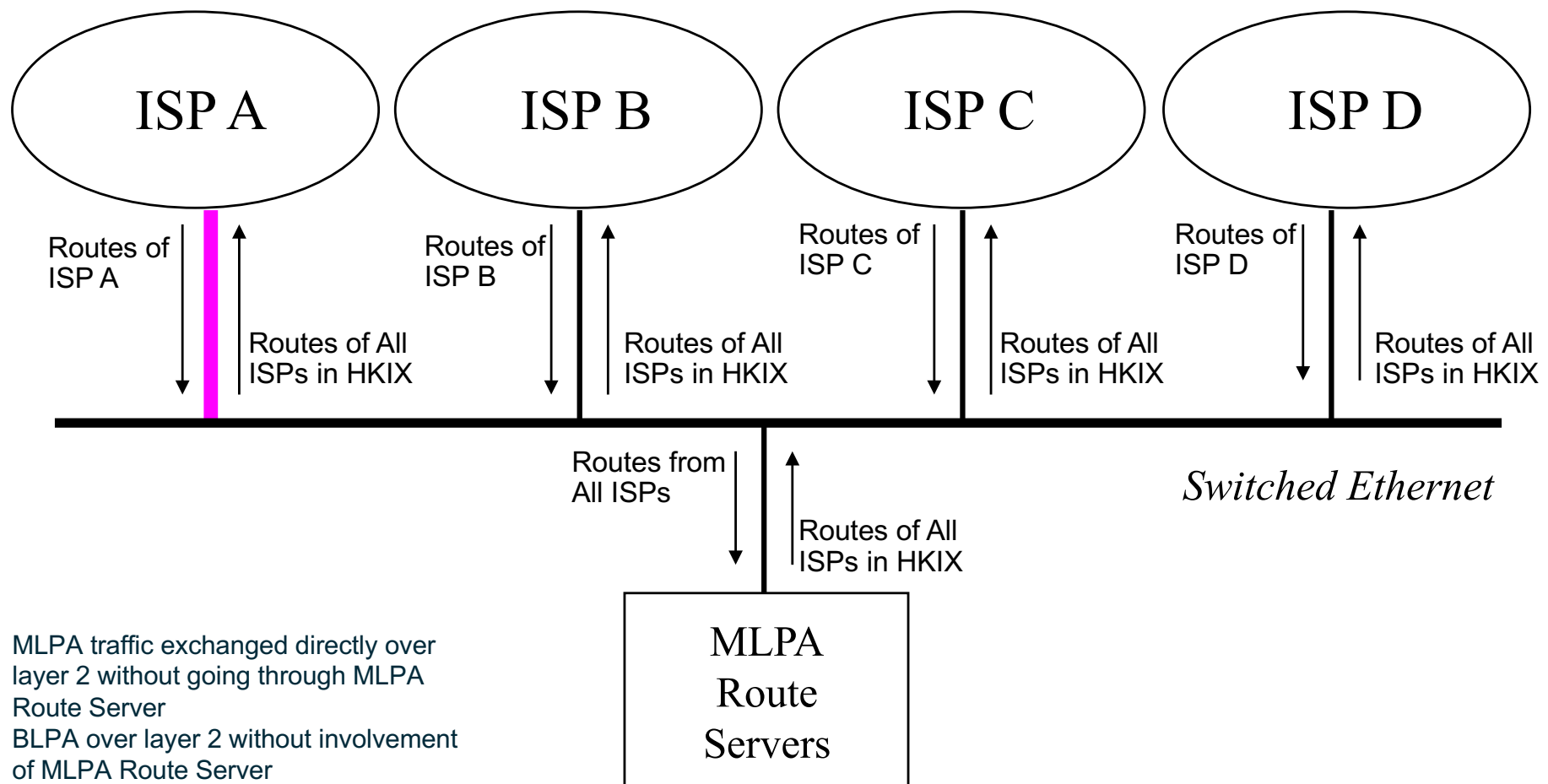
About me

- Team Lead of HKIX
- Planning, design and implementation of HKIX infrastructure and supporting systems
- In charge of full HKIX operations including business operations and technical operations and 24x7 Network Operations Centre
- Joined CUHK in 1992 and serving HKIX since 2001
- Projects included implementing the 1st 6513 switch for HKIX, setup HKIX2, HKIX-R&E, deployed the 1st 7018 switch in Hong Kong, deployed the 1st 7710 switch for 100GE connections, setup HKIX1b secondary site and HKIX3/4/5 satellite sites

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 Model — MLPA over Layer 2 + BLPA



- MLPA traffic exchanged directly over layer 2 without going through MLPA Route Server
- BLPA over layer 2 without involvement of MLPA Route Server
- Supports both IPv4 and IPv6 over the same layer 2 infrastructure

Help Keep Intra-Asia Traffic within Asia

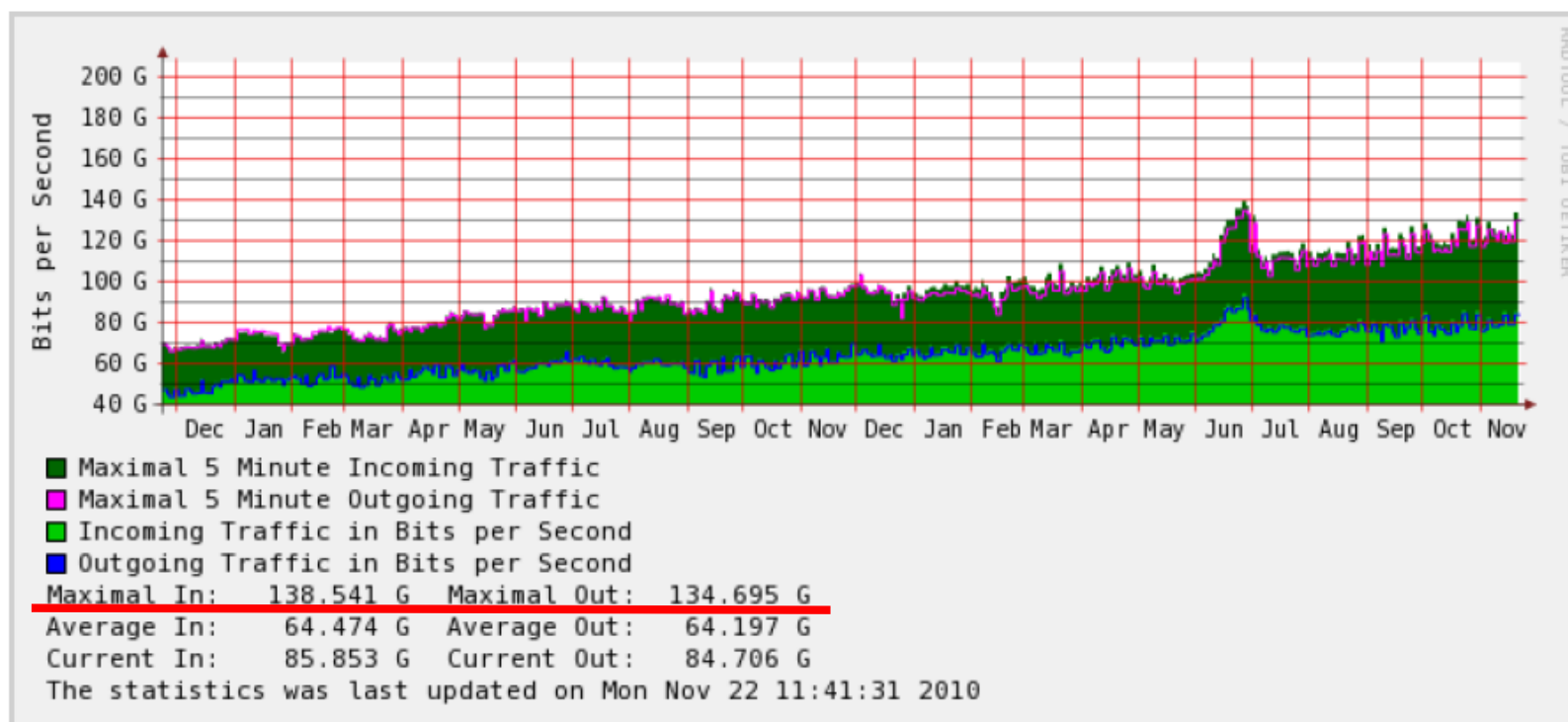
- We have almost all the Hong Kong networks
- So, we can attract participants from Mainland China, Taiwan, Korea, Japan, Singapore, Malaysia, Thailand, Indonesia, Philippines, Vietnam, India and other Asian countries
- We now have more non-HK routes than HK routes
- We do help keep intra-Asia traffic within Asia
- In terms of network latency, Hong Kong is a good central location in Asia
- HKIX does help HK maintain as one of the Internet hubs in Asia
- HKIX supports both domestic and international traffic

HKIX Today

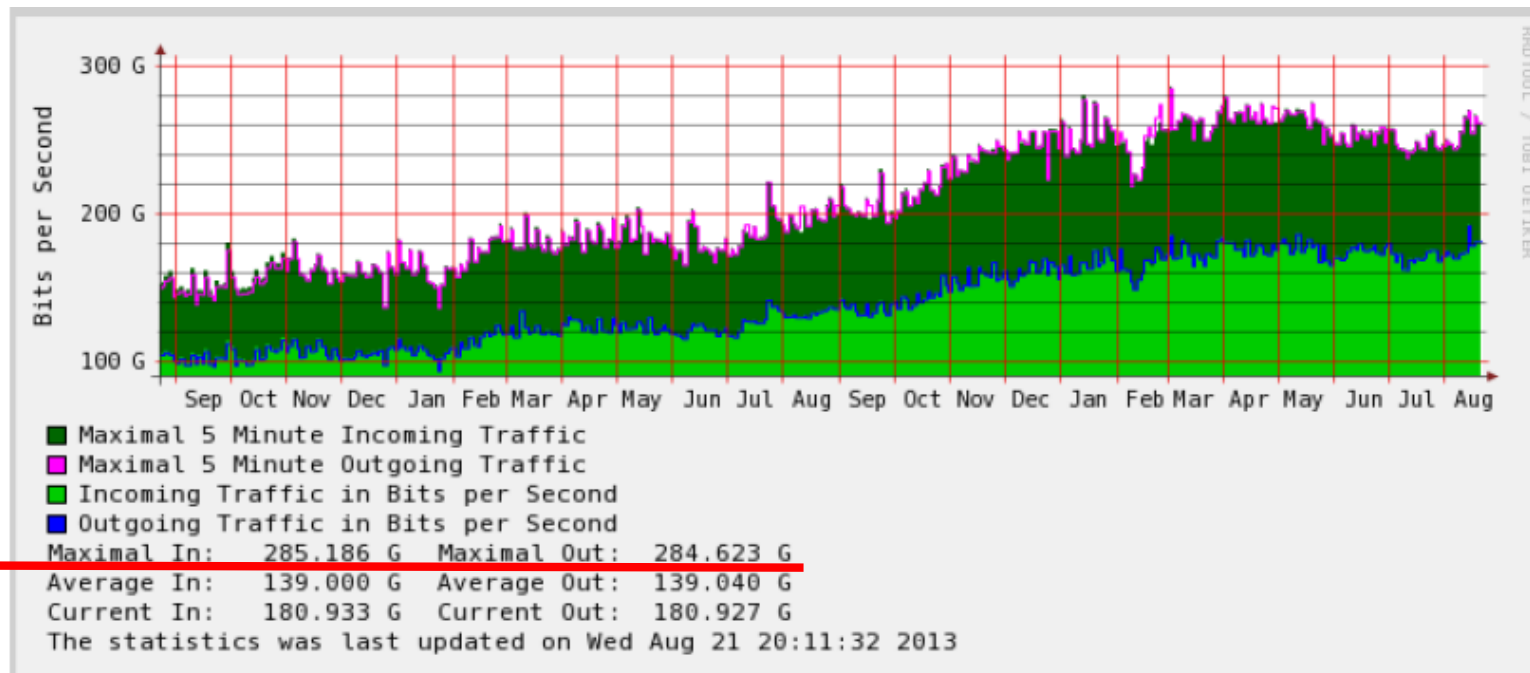
- Supports both MLPA (Multilateral Peering) and BLPA (Bilateral Peering) over layer 2
- Supports IPv4/IPv6 dual-stack
- More and more non-HK participants
- 270+ different networks (autonomous systems) connected
- 500+ physical connections in total
 - 11 **100GE**, 290+ **10GE** & 200+ **GE**
- 780+Gbps (5-min) total traffic at peak
- Annual Traffic Growth = **30+%**

Historical Statistics for HKIX's Traffic (1)

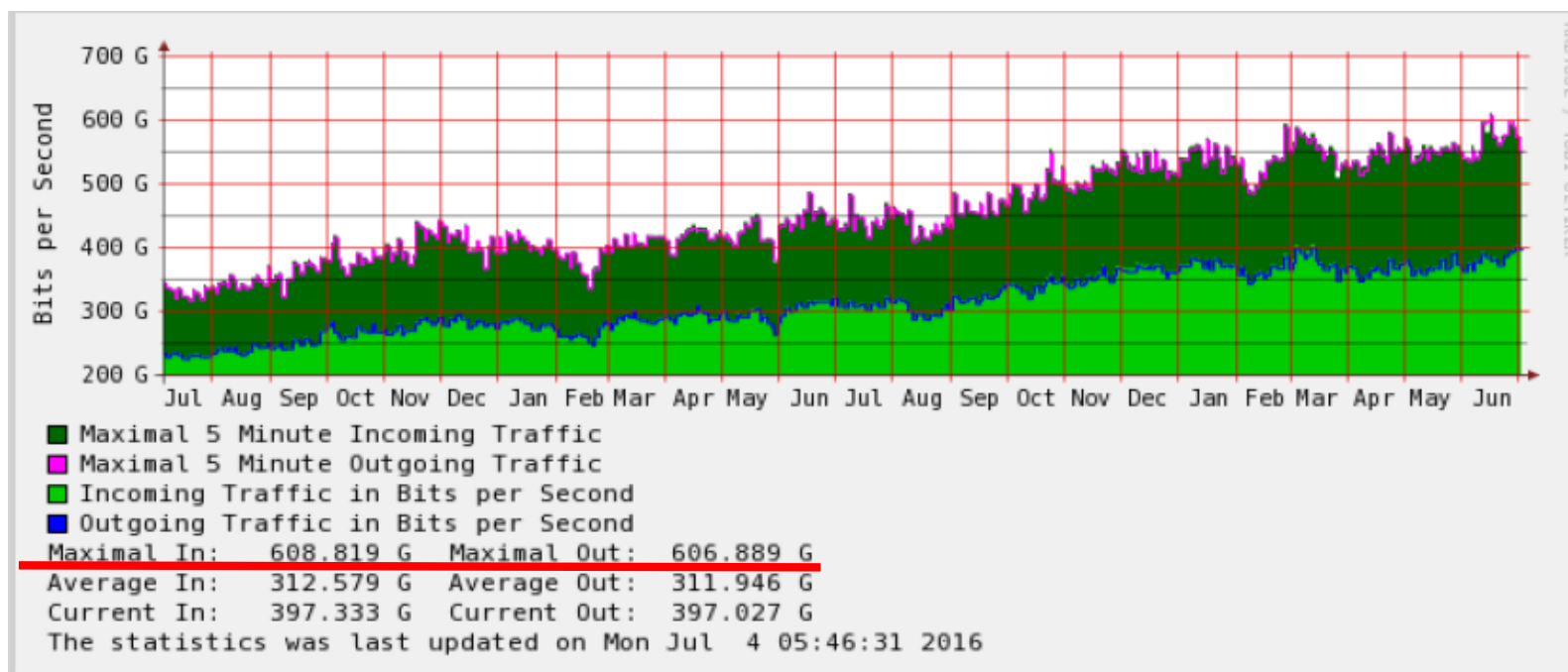
Year 2010



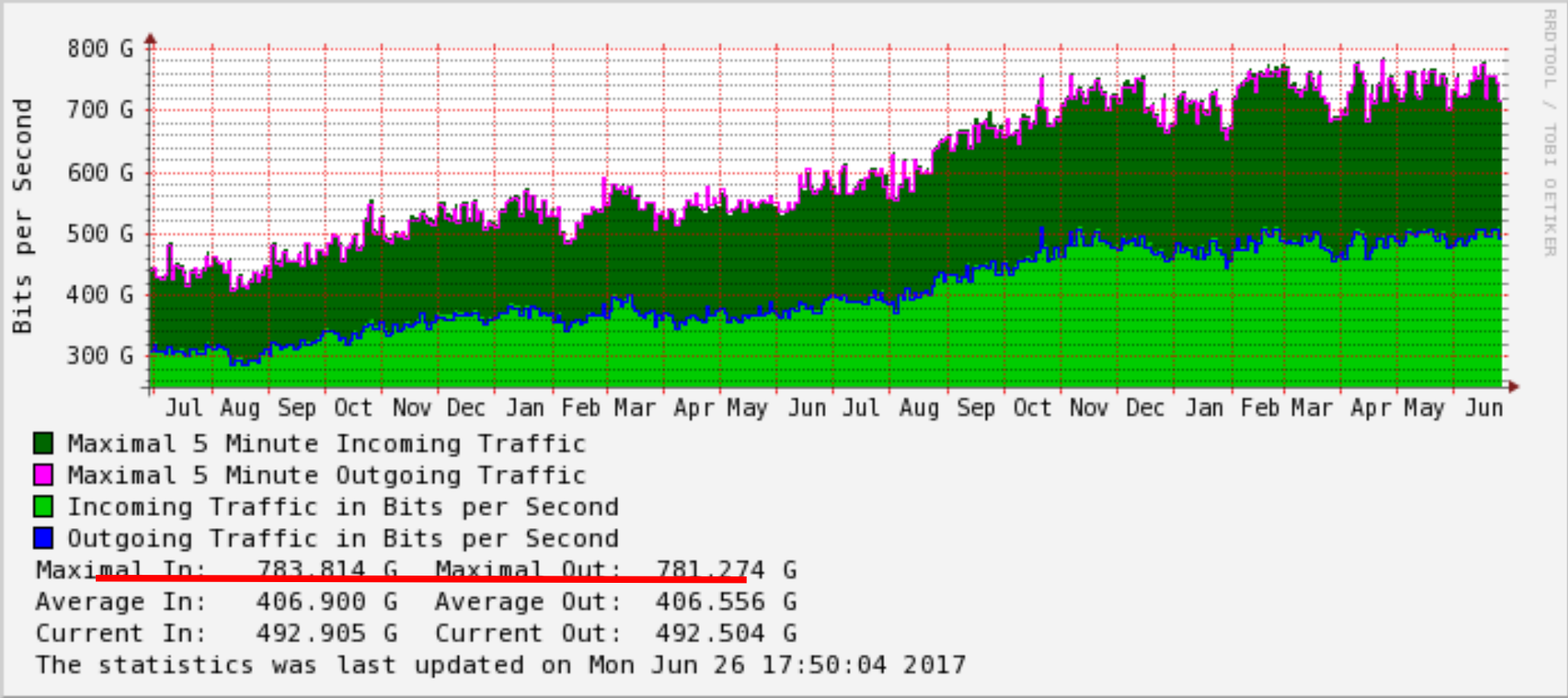
Historical Statistics for HKIX's Traffic (2) Year 2013



Historical Statistics for HKIX's Traffic (3) Year 2016



Yearly Traffic Statistics 2017

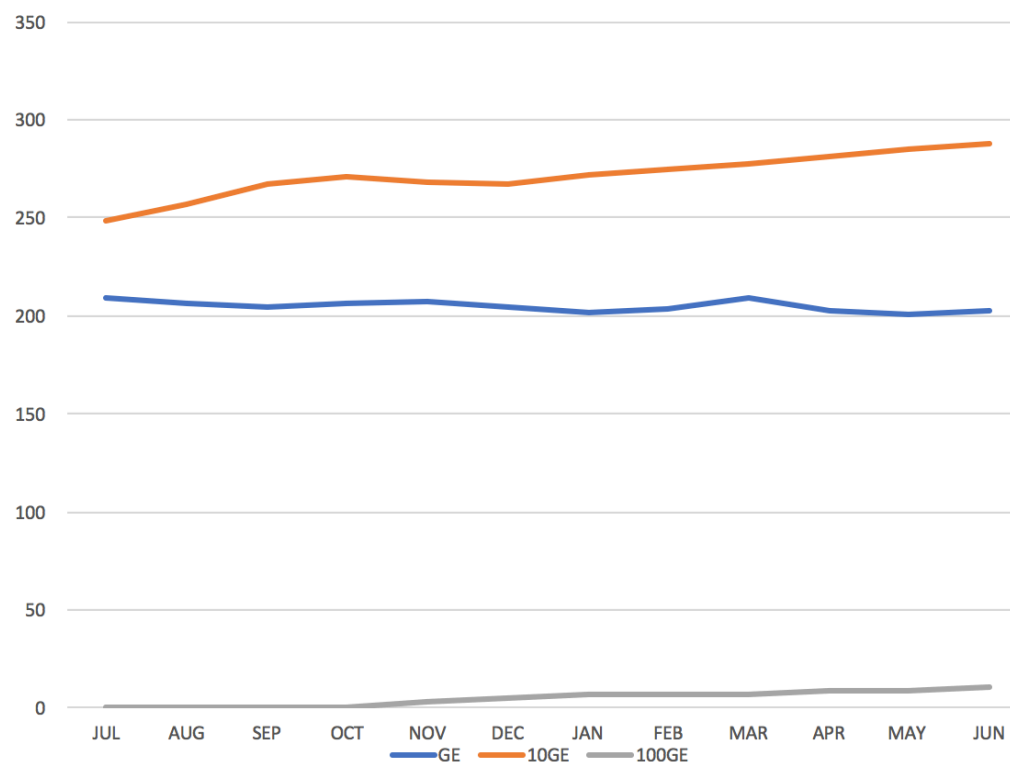




HKIX Ports Connected

	16' JUL	AUG	SEP	OCT	NOV	DEC	17' JAN	FEB	MAR	APR	MAY	JUN
GE	209	206	205	206	207	205	202	204	209	203	201	203
10GE	249	257	267	271	268	267	272	275	278	281	285	288
100GE	0	0	0	0	3	5	7	7	7	9	9	11

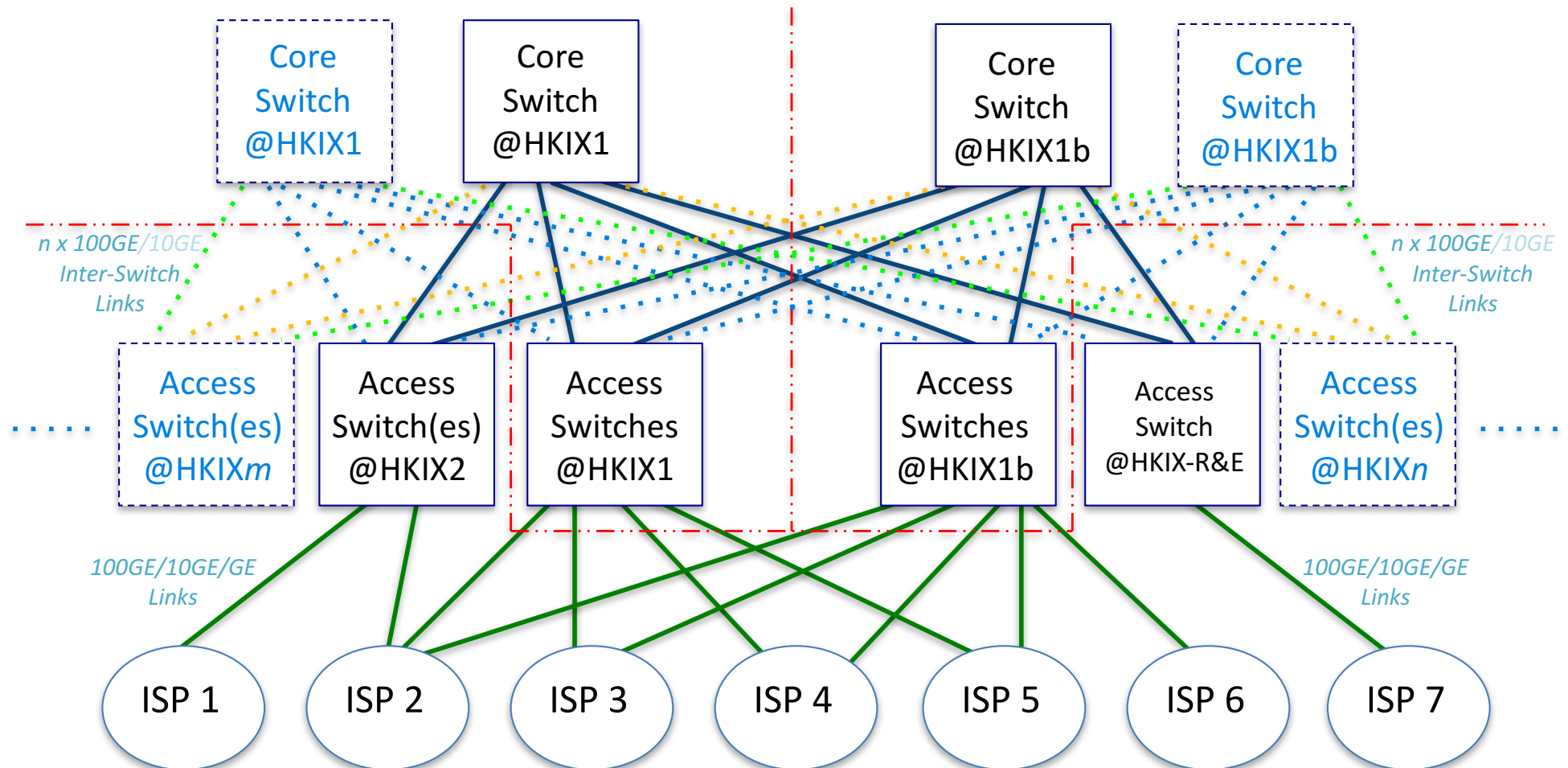
Number of HKIX Ports Connected (2016 JUL - 2017 JUN)



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



HKIX1 Core Site @CUHK -----(<2km)----- HKIX1b Core Site @CUHK



Setting up

Multiple HKIX Satellite Sites

- Allow participants to connect to HKIX more easily **at lower cost** from those satellite sites in Hong Kong
- Open to commercial data centres in HK which fulfil minimum requirements so as to maintain neutrality which is the key success factor of HKIX
- Create a win-win situation with satellite site collaborators
- To be named HKIX2/3/4/5/6/etc

Recent updates:

- HKIX2 has already been migrated from old model to new Satellite Site model
- HKIX3/4/5 sites are **Ready for Service** now
- ***HKIX1 and HKIX1b*** (the two HKIX core sites **located within CUHK Campus**) will continue to serve participants directly



Setting up Multiple HKIX Satellite Sites

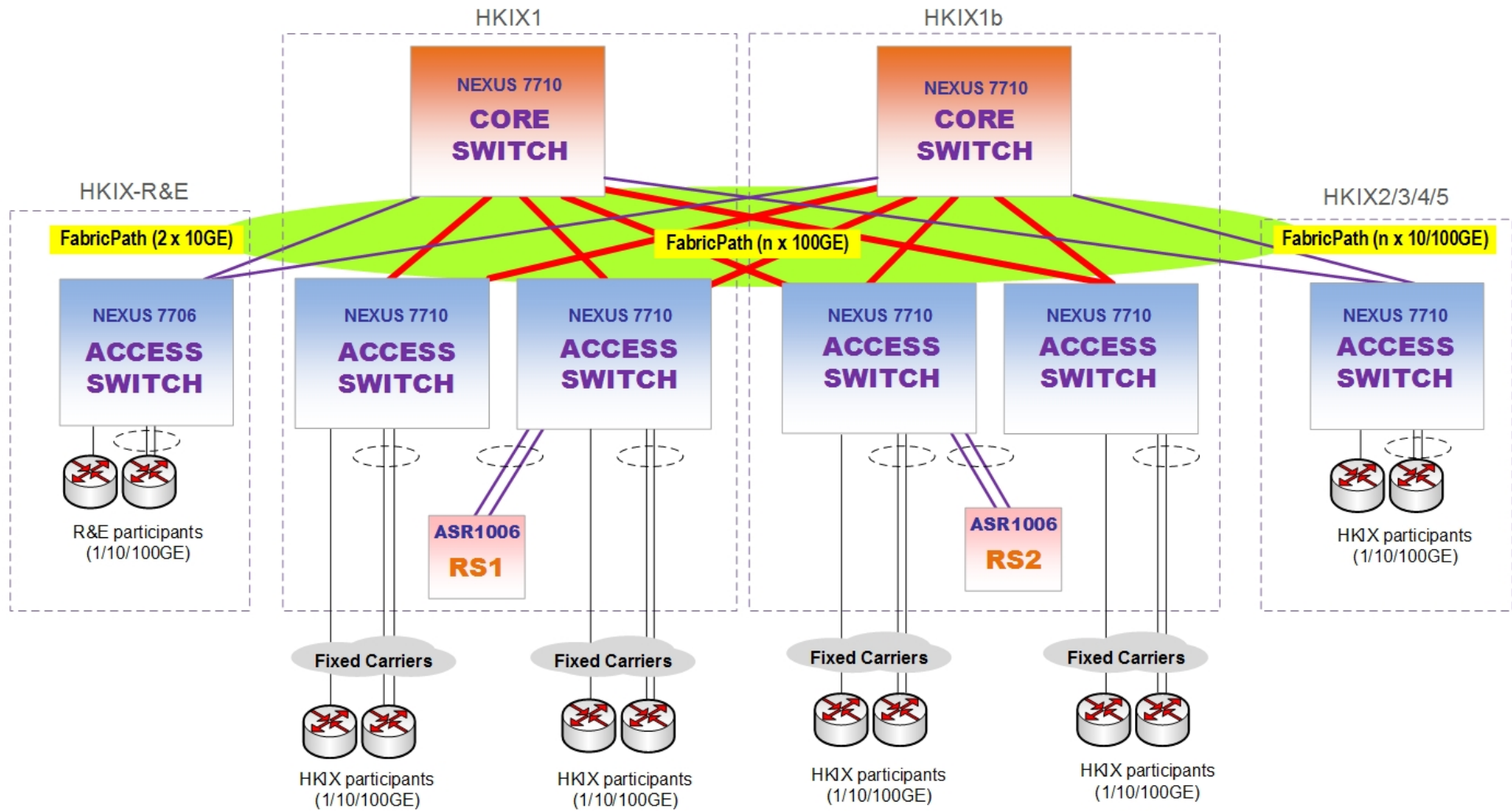
Hong Kong, 08 Feb 2017

HKIX announces that 3 new satellite sites will be established in collaboration with 3 commercial data centres which provide colocation services as well as easy connections to HKIX.

Satellite Site	Satellite Site Collaborator	District	Ports Supported	Status
HKIX2	CITIC Telecom International	Kwai Chung	GE/10GE	Ready for Service
HKIX3	SUNeVision / iAdvantage	Fo Tan	GE/10GE/100GE	Ready for Service 28 Feb 2017
HKIX4	NTT Com Asia	Tseung Kwan O	GE/10GE/100GE	Ready for Service 19 Jun 2017
HKIX5	KDDI / Telehouse / HKCOLO.net	Tseung Kwan O	GE/10GE/100GE	Ready for Service 24 Mar 2017

- For connections to HKIX at Satellite Sites, **special connection charges** will be charged by relevant operators, in addition to the **port charges** charged by HKIX.
- For HKIX participants not co-located at HKIX satellite sites, they can still connect to any of the two HKIX core sites, i.e. HKIX1 and HKIX1b sites by local loops via local loop providers.

HKIX Network Diagram (Jun 2017)



1. **HKIX1** and **HKIX1b** are the two core sites of HKIX at CUHK while **HKIX2/3/4/5** are HKIX satellite sites outside of CUHK.
2. HKIX participants are encouraged to connect to multiple sites for site resilience.

Support of Blackholing for Anti-DDoS on HKIX Route Servers

HKIX route servers support **Remote Triggered Black Hole Filtering (RTBH)** for announcement of black-hole filtering

No. of ASNs Participated : 33

How it works?

- The victim's address must be included in the participant filter on the HKIX route servers for BGP announcement
- Participant tag the /32 prefix with **4635:666** for its customer
- HKIX route servers set the prefix with next hop 123.255.90.66
- Other HKIX participants accept the /32 prefix and set the next hop address for 123.255.90.66 to null

Expected Results:

- Only the victim (/32) will be unreachable via HKIX network while saving the others
- The DDoS traffic will be black-holed at the side of the participating routers which are closer to the DDoS traffic sources

Support of Hiding AS4635 on HKIX Route Servers



- Hiding AS4635 (ASN of HKIX RS) on the AS Path in the BGP announcement
- Support both IPv4 and/or IPv6

Steps:

1. Disable BGP Enforce the First Autonomous System Path on **your** HKIX peering router
 - configuration:

```
Router(config)# router bgp <Your-ASN>
Router(config-router)# no bgp enforce-first-as
```
2. Notify HKIX for hiding AS4635 in the BGP announcement
3. Soft reset the BGP session
4. HKIX will hide the AS4635 on the AS Path for the IPv4 and/or IPv6 routes sending from HKIX route servers to your HKIX peering

Planned Works in 2017

- Improved Stability
 - *Better Control of Proxy ARP*
 - *More L2 ACL on HKIX peering LAN*
- Improved Services
 - *Set up Satellite Sites in multiple commercial Data Centre*
 - *Set up portal for HKIX participants*
 - *True 24x7 NOC*
 - *Improve after-hour support*
 - *Introduce advanced Route Server functions*
- Improved Security
 - *ISO27001*
 - *Better support for DDoS Mitigation*

Hong Kong Internet Trends

- A lot of new data centers will be put into operations in Hong Kong
- More and more cloud / content providers setting up presence in Hong Kong
- Rise of live video, watching concerts and ball games on mobile devices
- Cross-border e-commerce platform becomes an ecosystem
- Growth of Internet of Things (IoT) projects and rise of cross-industry IoT deployments

HKIX's Advantages

- **Location**
 - Hong Kong is a good central location in Asia
~50ms to Tokyo and ~30ms to Singapore
- **Neutral**
 - Treat all partners equal, big or small
 - Neutral among ISPs / telcos / local loop providers/ data centers / content providers / cloud services providers
- **Trustable**
 - Treat all partners fair and consistent
 - Respect business secrets of every partner / participant
- **High Performance**
 - No internal performance bottleneck, no internal packet loss
- **Not for Profit**
 - Charging mainly for equipment upgrade and long-term sustainability, not for profit-making



Thank You!

For enquiries, please contact us at
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