Trends in Asia Internet as seen from Hong Kong

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What Providers Care About

- Cost
- Performance
- Resilience
- Interconnections
- Security

- The market is highly competitive
- Most providers are searching for their own niche services which make them look different from their competitors for survival
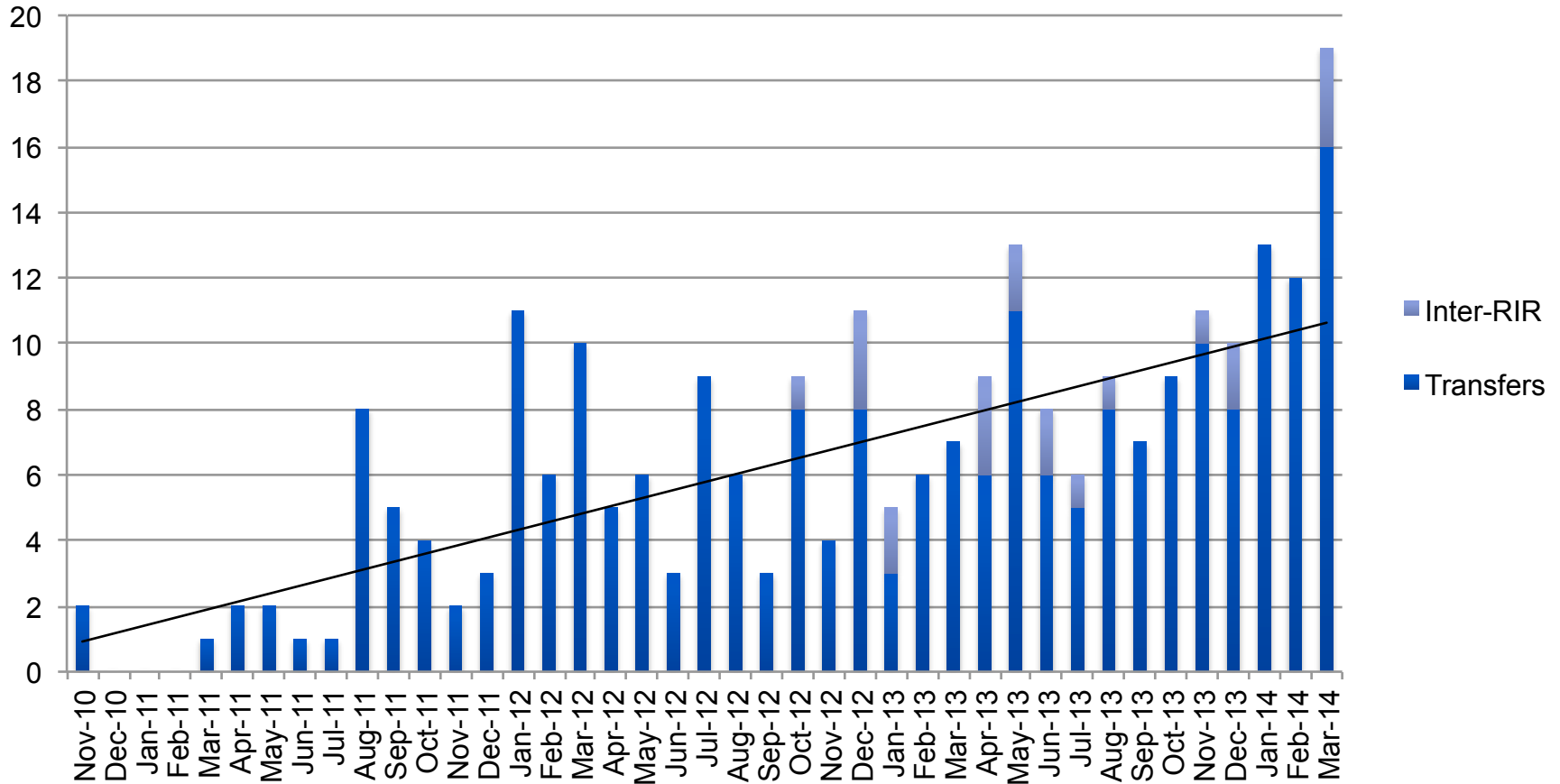
IPv4 Addresses

- Running out globally
- New policy for address distribution from IANA returned pool (APNIC prop-105)
  - One more /22 for each APNIC/JPNIC member
  - In addition to one /22 from the last /8 pool
- Still have to demonstrate the needs
- New APNIC/JPNIC members can enjoy this also

IPv4 Address Transfers
# by APNIC

Source: APNIC

Trend of IPv4 Addresses

- Growing Trend is more and more end-users (enterprises) are getting their own portable IPv4 addresses
  - up to 2 x /22 directly from APNIC/JPNIC plus buying from market
  - Still need to demonstrate needs
  - Easy referral at MyAPNIC for ISPs to refer customers to join APNIC as members
- Consult JPNIC if necessary!!!

# ASN Delegations by APNIC
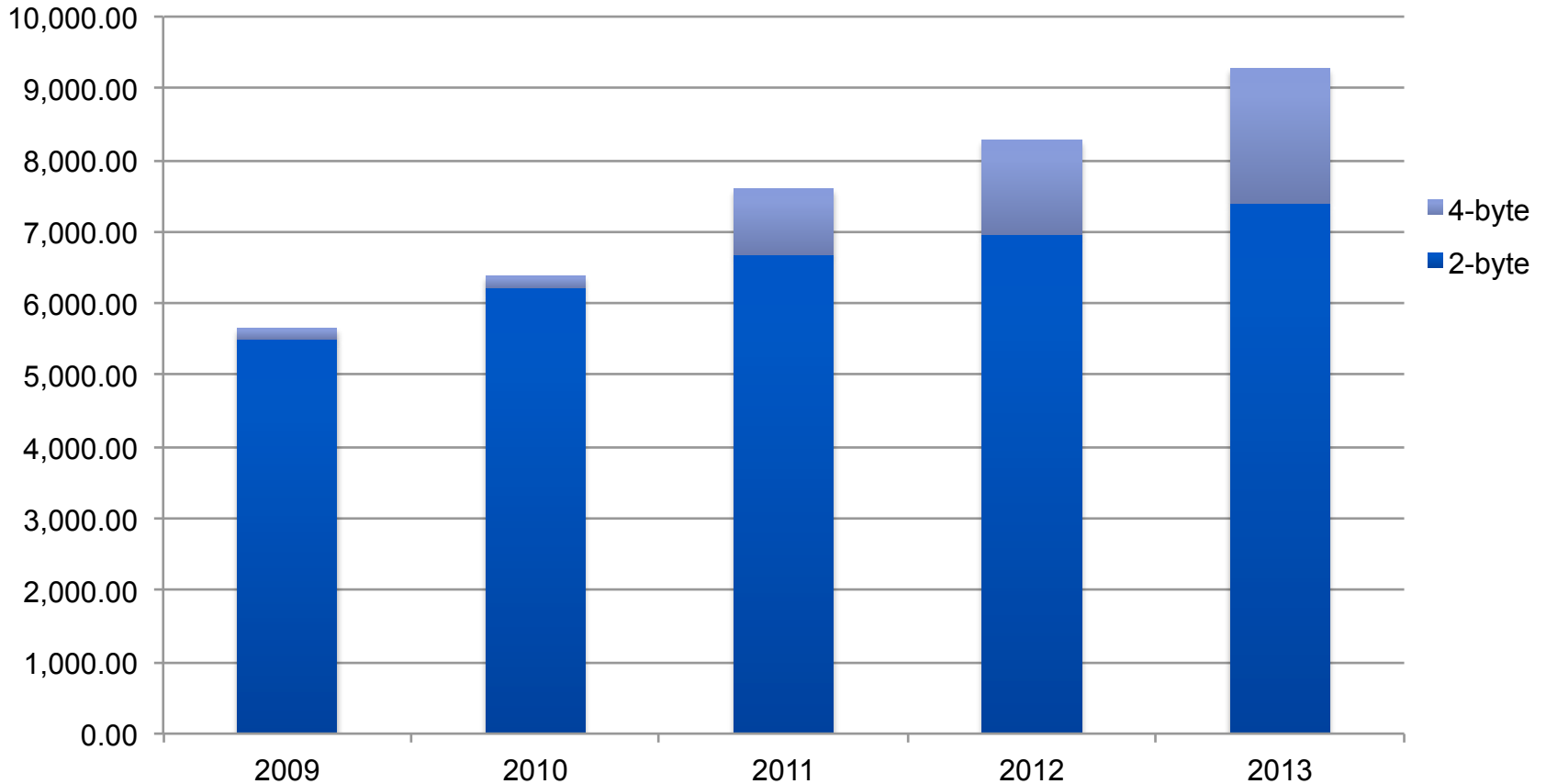
Source: APNIC

ASN

- 4-byte ASN (Autonomous System Number) is slowly becoming the norm
- APNIC is assigning more 4-byte ASN than 2-byte ASN now
- Support from equipment vendors is mature
- More and more large enterprises are running BGP with their own ASN and IP addresses
  - For multi-homing
- ASN is now transferrable (APNIC prop-107)
  - Still need to justify the use based on ASN policy

IPv6 Delegations by APNIC
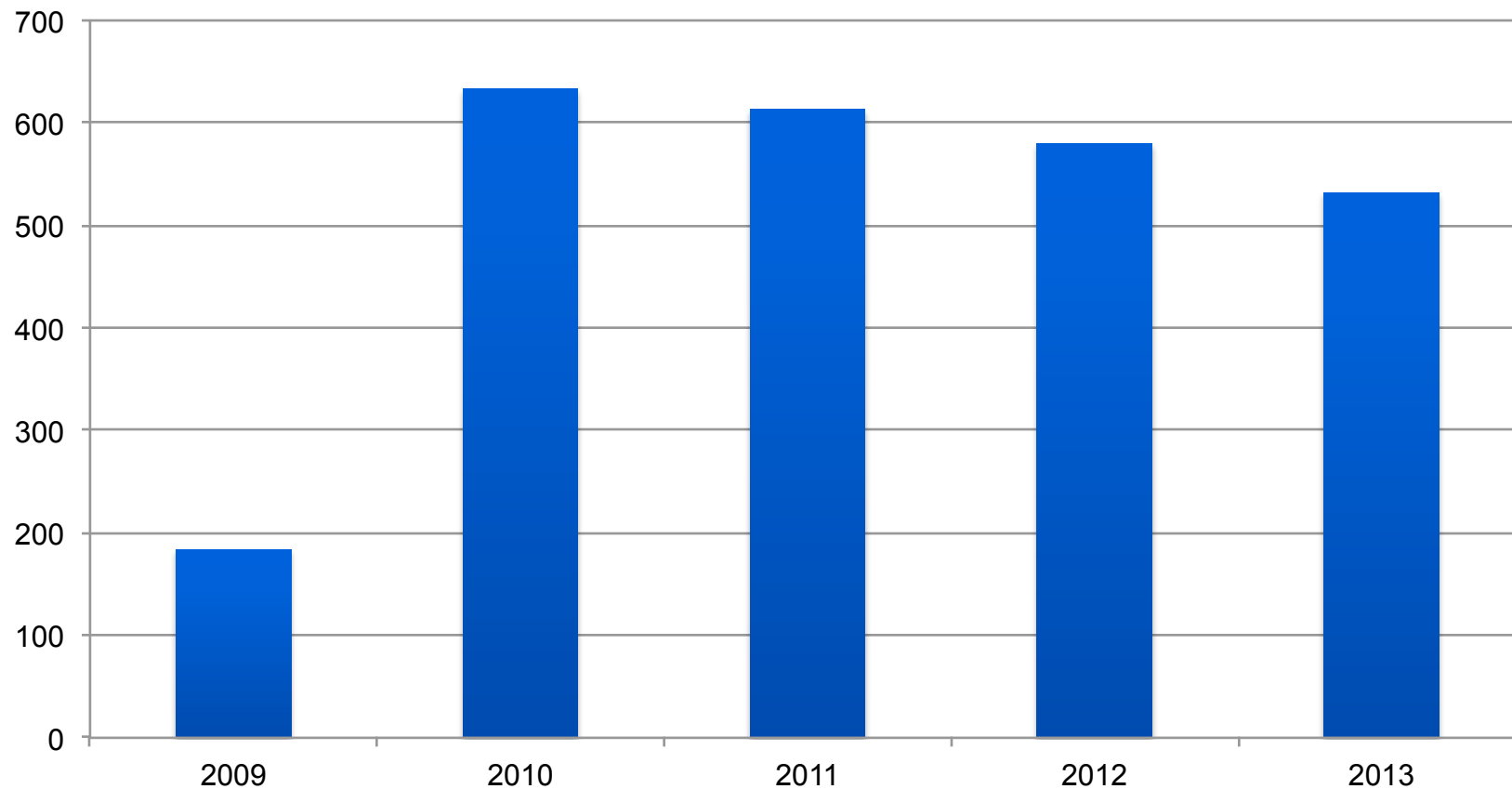
Source: APNIC

IPv6 Deployment

- Deployment is growing but slowly although IPv4 addresses are running out globally

- Total IPv6 traffic vs total Internet traffic is still within single digit percentage-wise

- Access providers are most reluctant to deploy
  - Possibility of IPv4 transfers and wide-spread use of NATs (of various kinds) are holding them back

- Accelerated deployment will only be observed when the cost of keeping running IPv4 is higher than the cost of deploying IPv6

DDoS Attacks

- There are more and more DDoS attacks with different motives
- DNS Amplification
  - DNSSEC helps a bit on amplification factor, unfortunately
- NTP Amplification
- Random DNS queries on targeted domain names
  - Relevant DNS servers are suffered
- *HK suffered a lot recently*
- Follow the best practices!!!
  - BCP38/RFC2827 for network ingress filtering
  - BCP46/RFC3013 for Recommended Internet Service Provider Security Services and Procedures
  - BCP30/RFC2505 for Anti-Spam Recommendations for SMTP MTAs
  - Disable open DNS resolvers and NTP servers
  - Response-Rate-limiting on DNS servers

DNS

- More and more TLDs (some are IDN-TLDs) being approved by ICANN
  - TLD registries and registrars need good global infrastructure
  - They tend to use anycast more and more
- Anycast is important to improve resilience of authoritative DNS infrastructure
  - Not just for root/TLDs but also for individual DNs
  - Not just globally but also locally
  - We need more anycast DNS service providers which have good infrastructure world-wide and locally
- DNS infrastructure is something very special and very critical
  - Traditional network admins and system admins do not put much energy on DNS infrastructure
  - Need real DNS professionals to run it
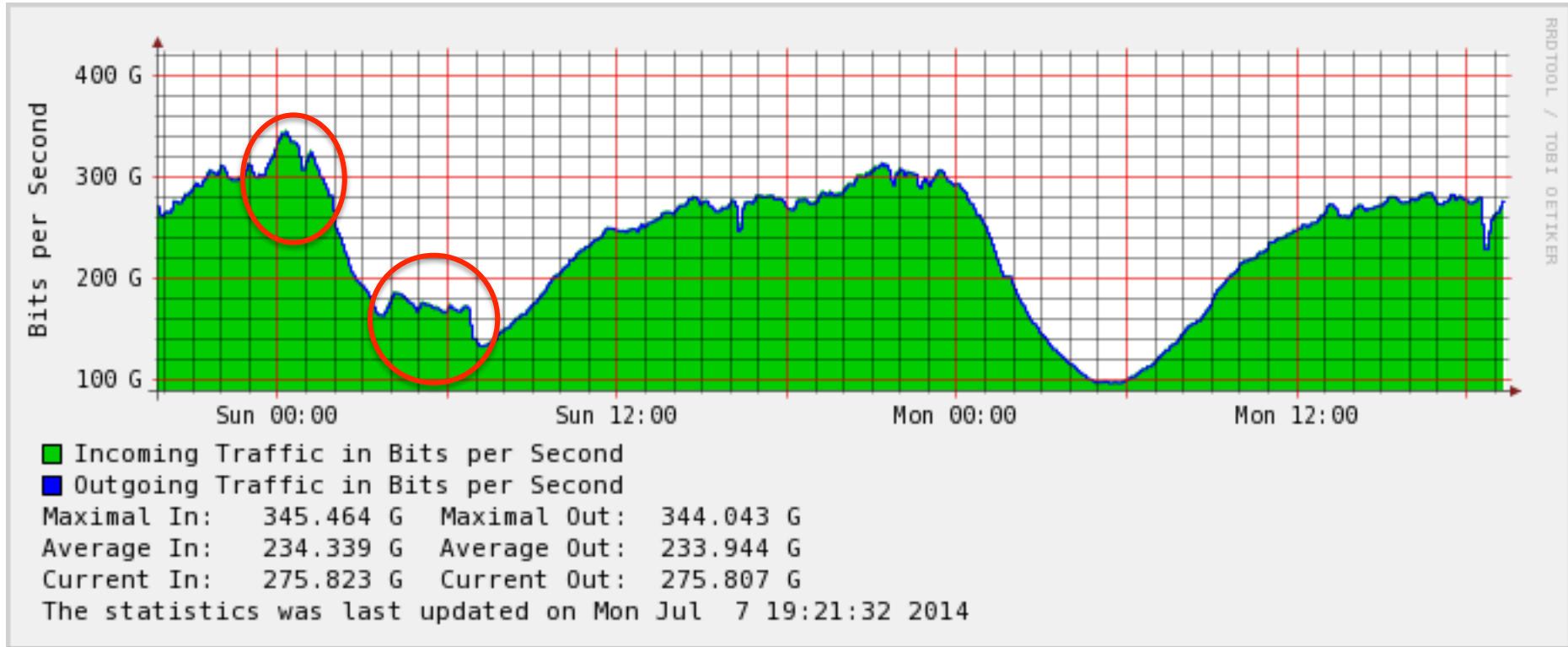- DNSSEC adoption rate is still low

Growth of HD Video Content

- More and more free/paid HD video content from **<u>official sources</u>**
  - In addition to questionable/illegal sources
- Global examples are:
  - NBA
  - World Cup 2014

World Cup Effect at HKIX

05 JUL 2014 - 13:00 Local time
QUARTER-FINALS
Estadio Nacional
Brasilia

FULL-TIME

ARGENTINA 1-0 BELGIUM

05 JUL 2014 - 17:00 Local time
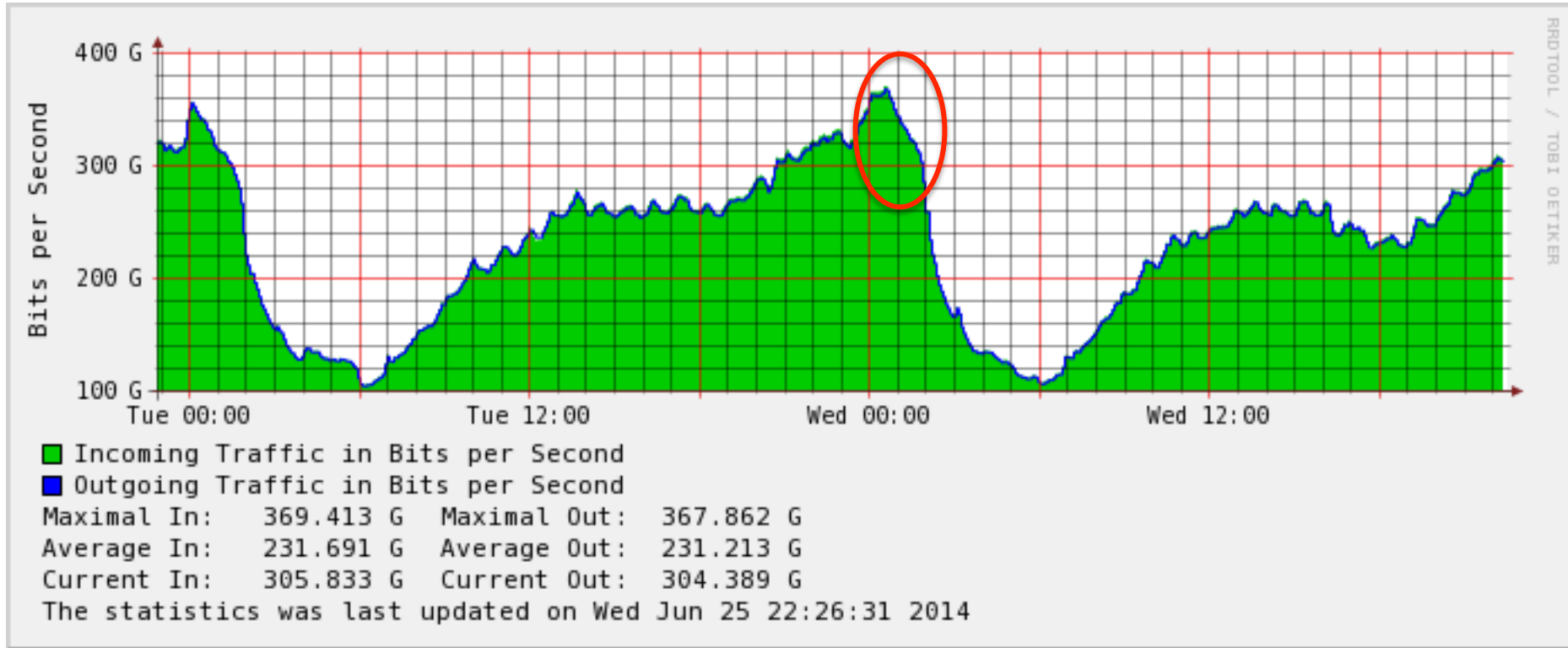**QUARTER-FINALS**
Arena Fonte Nova
Salvador

FULL-TIME

NETHERLANDS 0-0 COSTA RICA

Netherlands win on penalties (4 - 3)

www.hkix.net

HKIX Traffic Record

www.hkix.net

Broadband Penetration

- Japan, Hong Kong and South Korea have the highest broadband penetration within Asia
- These 3 economies also have the highest average connection speed within Asia *(source: Akamai)*
- FTTH plays a big role here
- Hong Kong ISP market is largely market driven
  - Broadband ISPs do not have incentive to do FTTH for low-density buildings
  - 4G/LTE is an option for those low-density buildings
- Mobile: 4G/LTE usage is growing very fast because of proliferation of smartphones and mobile hotspots
  - Voice over LTE and Voice over WiFi (WiFi Calling on iOS 8) are coming which may change the voice market

FTTH

- Fiber-to-the-Home (FTTH) for >= 100Mbps high-speed Internet access
- Once fibers are laid, it will be easily upgradable to higher bandwidth (up to 1Gbps)

- Home networks need to upgraded too
- WiFi needs to be upgraded to 802.11ac from 802.11n in order to enjoy the higher bandwidth provided
  - Should not just rely on 2.4GHz channels because of heavy congestion and interference
- To extend high-speed network to every corner of your home, you can use GE over Cat5e/Cat6 cabling and use multiple WiFi Access Points which support different WiFi channels (5GHz and 2.4GHz dual-band)
- But If you cannot use Cat5e/Cat6 cabling, you may use power-line network (up to 500Mbps)
  - Using WiFi to extend network at home is less preferred

100G in Operations

- For supporting FTTH and continuous growth of HD video content, backbone links need to be even faster

- Multiple 10G's may not be enough at certain locations

- Having higher and higher demands for 100G as backbone links

- Prices of 100G optics are dropping slowly but gradually and this helps the adoption of 100G

Local Peering

- Local peering is important to Internet development of any economy
  - Faster local data and content delivery
- However, peering with big local incumbents continues to be hard
- They are more willing to peer with outsiders when they are farther away from their homelands
  - Paid peering is still what they want
- It is a hard game to play especially if you are dealing with local incumbents which do not care about their own network performance

Network Expansion to Overseas

- To improve overall connectivity and performance for customers
  - It is a global trend to go overseas for better interconnections
- Set-up equipment (POPs) at major Internet hub locations and do interconnections
  - Tokyo, Hong Kong and Singapore are the main hubs in Asia
  - But other economies are trying to join the club
- Alternate model for access providers is to connect to IXPs remotely by using Ethernet over SDH/MPLS
  - Some special providers provide such remote IXP connection services specifically
- But for cloud/content services providers, they have to set up servers everywhere in order to get closer to the end users
  - Same for anycast DNS service providers
  - This helps the data center business all around the world

CDN

- More players joining the CDN (Content Delivery Network) market

- Local CDN service providers tend to become regional and global gradually

- They have to set up infrastructure everywhere in order to get closer to the eye-balls

Cloud Services

- Growing market
  - Not just for global players but also for local players
- More and more customers are starting to adopt cloud services to off-load themselves as part of their out-sourcing exercise
- Users rely on Internet even more
  - Previously intranet traffic become routing through Internet
- Cloud services providers need good interconnections everywhere so as to serve their customers better

Data Centers

- With the high growth of cloud service providers, CDN service providers and big content providers, data centers around the world are running out of space
  - Anycast DNS service providers and TLD registries/registrars also need space globally but their need is relatively small
- More data centers are being built
- Facilitate easy private interconnections within data centers
- For data centers with multiple locations, they tend to provide carrier services for their customers across different locations

IXPs

- IXPs continue to play a key role for interconnections among ISPs and other internet players
  - Both JPIX & HKIX have long history
- **IXPs must have enough spare capacity so that they are not vulnerable to DDoS themselves**
- Larger IXPs are mostly serving global market
  - Support of 100G is becoming essential
  - Use of 100G starts from inter-switch links
- Some IXPs to expand overseas with independent layer-2 infrastructure
  - Some even provide layer-3 transit services (full or partial transit)
- **IXPs and data centers are natural partners**
- Newer IXPs in Asia
  - But it is hard for them to grow if it is without the support of the local incumbents which dominate the local ISP markets

What is HKIX?

- HKIX is a public Internet Exchange Point (IXP) in Hong Kong
- HKIX is the main IXP in HK where various networks can interconnect with one another and exchange traffic
  - Not for connecting to the whole Internet
- HKIX was a project initiated by ITSC (Information Technology Services Centre) of CUHK (The Chinese University of Hong Kong) and supported by CUHK in Apr 1995 as a community service
  - Still fully supported and operated by CUHK
- HKIX serves both commercial networks and R&E networks
- The original goal is to keep intra-HongKong traffic within Hong Kong
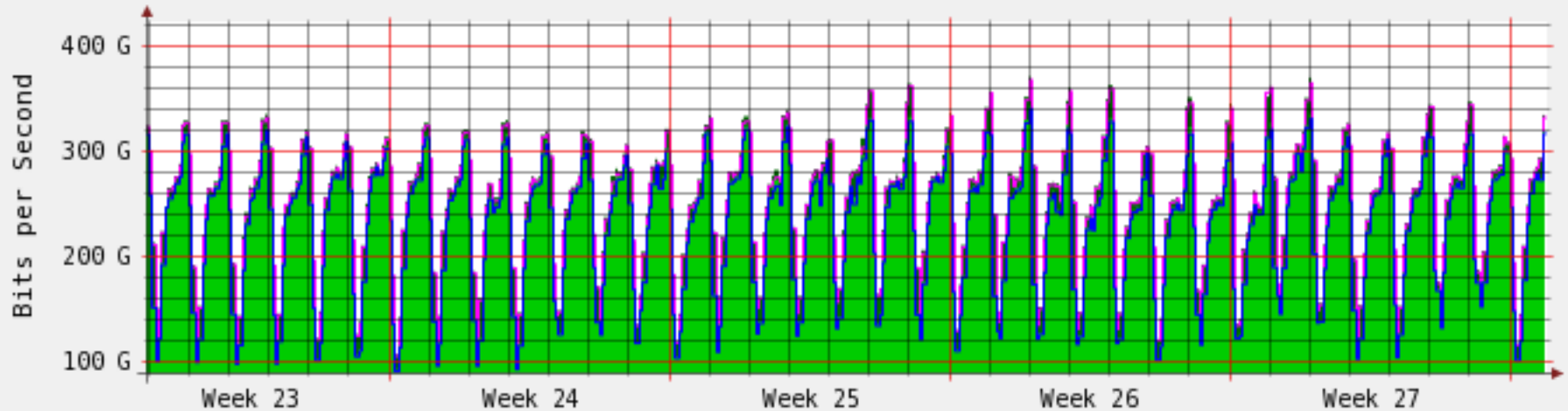
HKIX Today

- Supports both MLPA (Multilateral Peering) and BLPA (Bilateral Peering) over layer 2

- Supports IPv4/IPv6 dual-stack

- Accessible by all local loop providers

- Neutral among ISPs / telcos / local loop providers / data centers / content providers / cloud services providers

- More and more non-HK participants

- >240 ASNs connected

- >370 connections in total
  - ~130 10GE connections

- ~370Gbps (5-min) total traffic at peak

- Annual Traffic Growth = 30% to 40%

Monthly Traffic Statistics

Yearly Traffic Statistics
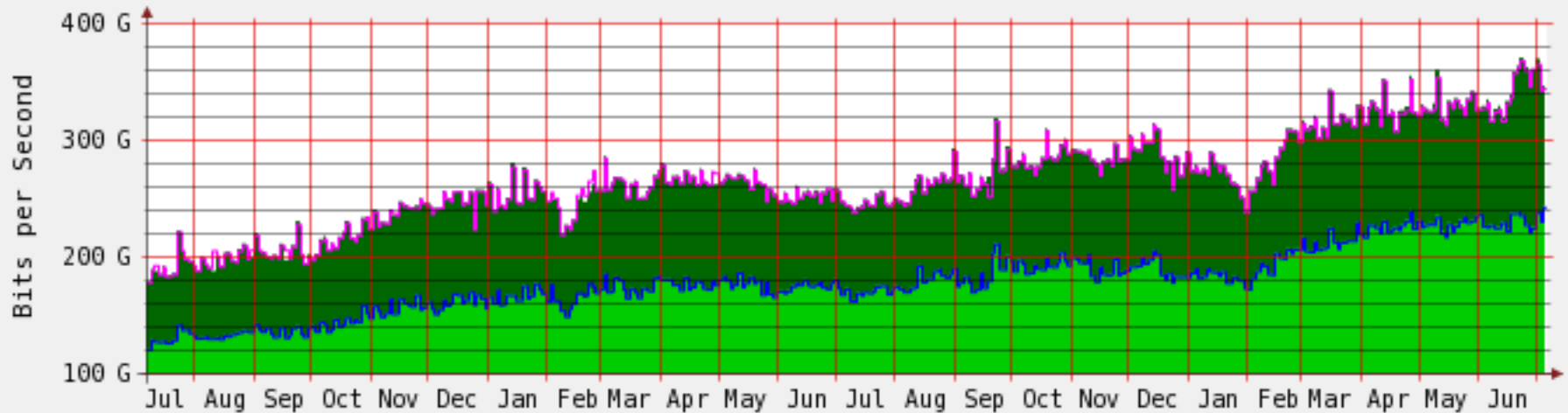
Help Keep Intra-Asia Traffic within Asia

- 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, Bhutan, Qatar and other Asian countries
- We now have more non-HK routes than HK routes
  - On our MLPA route servers
  - Even more non-HK routes over BLPA
- We do help keep intra-Asia traffic within Asia
- In terms of network latency, Hong Kong is a good central location in Asia
  - ~50ms to Tokyo
  - ~30ms to Singapore
- HKIX is good for intra-Asia traffic

Values of HKIX to Hong Kong

- A key information infrastructure bringing faster and cheaper connectivity to Hong Kong citizens
- A key component for developing Hong Kong as an Internet hub in Asia
- A key component for helping Hong Kong's competitiveness in the cyber world
- A key component in facilitating competition in the telecommunication sector
- Considered as Critical Internet Infrastructure in Hong Kong

HKIX's Advantages

- Neutral
  - Treat all partners equal, big or small
  - Accessible by all local loop providers
  - Neutral among ISPs / telcos / local loop providers / data centers / content providers / cloud services providers
- Trustable
  - Respect business secrets of every partner / participant
- Not for Profit

2013 and Beyond?

- A lot of new data centers will be in operations in Hong Kong starting 2013
- More and more cloud / content services providers setting up presence in Hong Kong
- What will happen to the industry and the market?

- **HKIX must be well-prepared for the possibly higher growth**

CUHK's Vision

- CUHK has a strategic uniqueness in running HKIX in a long-term
- While CUHK does not have a service provider role, we are still obligated to continue managing it as a public service
- HKIX is very much like road infrastructure and airport in Hong Kong
- Support from HKSAR Government is needed to make it prosper, and to maintain it as an Asian internet hub

- **HKSAR Government has provided one-off funding for capital expenses of network equipment upgrade in 2013-14**

HKIX in 2013-14

- Have started simple port charge model since Jan 2013

- Maintain as not-for-profit operations
  - Target for fully self-sustained operations for long-term sustainability

- Deploying new highly-scalable 2-tier dual-core architecture within CUHK by 4Q2014 taking advantage of the new data center inside CUHK campus
  - HKIX1 site + HKIX1b site as Core Sites
    - Fiber distance between 2 Core Sites: <2km
  - Provide site/chassis/card resilience
  - Support 100GE connections
  - Scalable to support >6.4Tbps total traffic using 100GE backbone links primarily and FabricPath

- **Ready to support HKIX2/3/4/5/6/etc as satellite sites having Access Switches only which connect to Core Switches at both Core Sites using FabricPath**
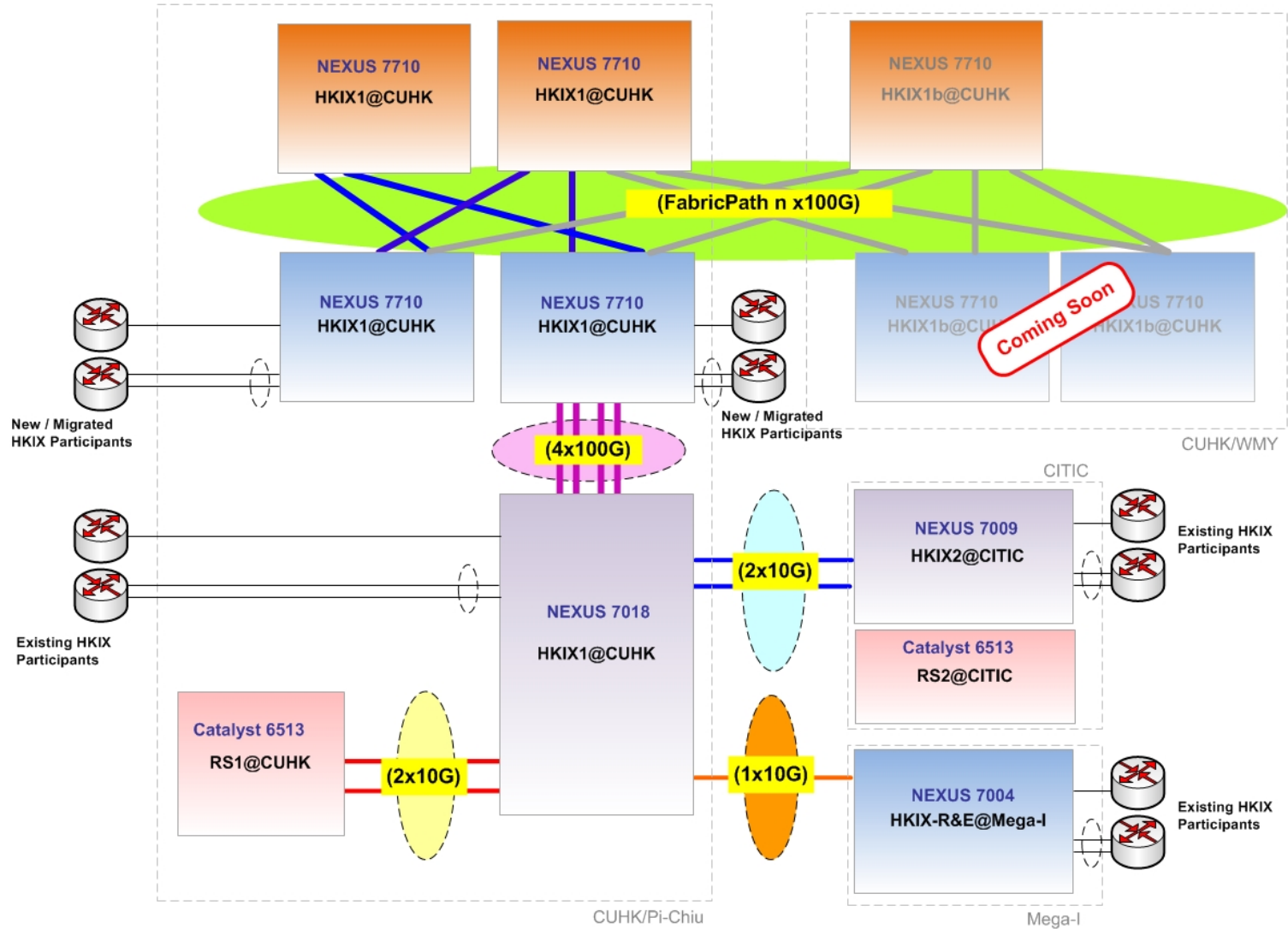
The New HKIX Architecture
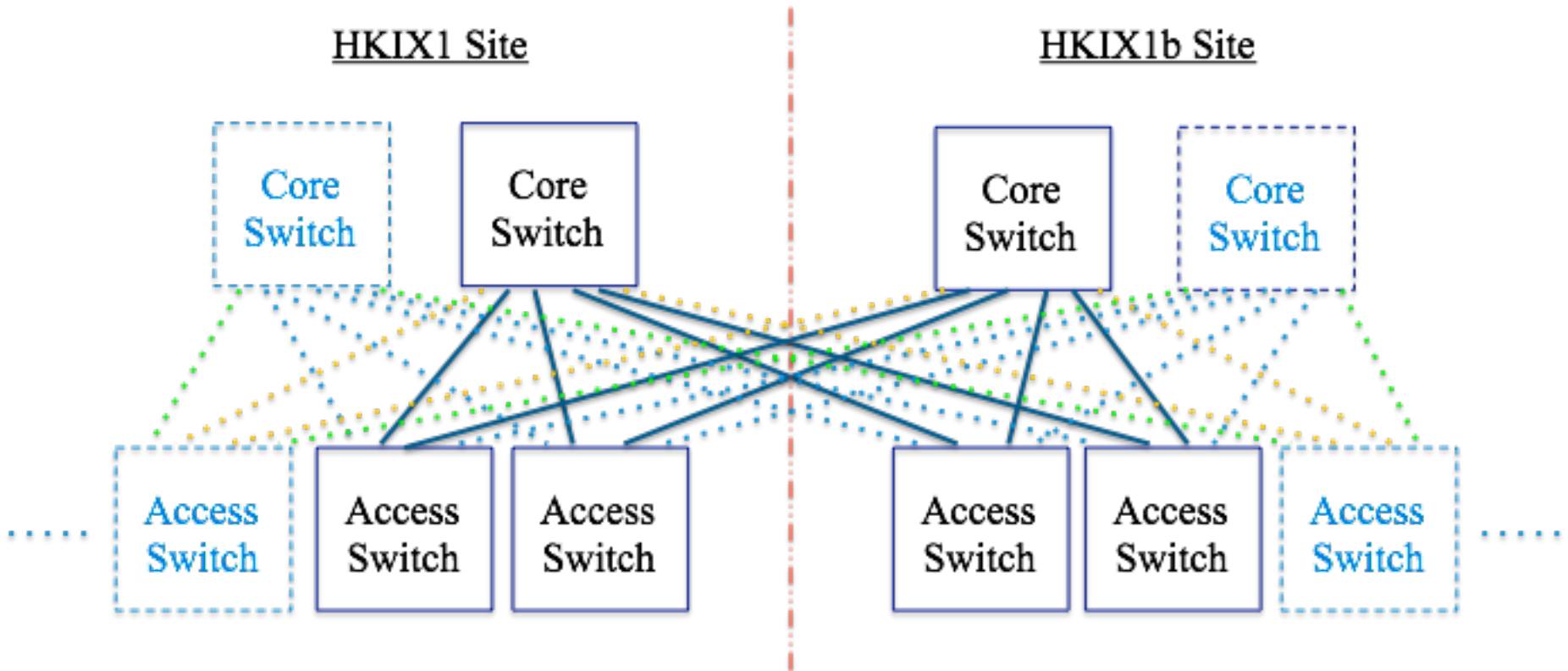
HKIX Network Diagram (July 2014)

NOGs

- Network Operators' Groups (NOGs) are being established everywhere in Asia
  - To exchange knowledge and information
    - Best practices, new trends and so on
  - To enhance overall quality of Internet infrastructure
    - Performance, security, stability and so on
  - To help do trouble-shooting and solve problems together when needed
- Regional NOGs
  - NANOG, APRICOT/APOPS, SANOG, MENOG
- Local NOGs
  - JANOG, AusNOG, NZNOG, MYNOG, SGNOG, IDNOG, BDNOG are all active
  - PHNOG is being revitalized

- HKNOG is being formed
  - Did half-day trial events twice (HKNOG 0.1 & 0.2)
  - Planning to have HKNOG 1.0 on Sep 1 (TBC)

- Support from APNIC for NOGs in Asia Pacific

Thank you!