



# HKIX 100G Network & Internet Traffic due to World Cup

**HKNOG 6.1**

*Kenneth CHAN*

*HKIX*

[www.hkix.net](http://www.hkix.net)

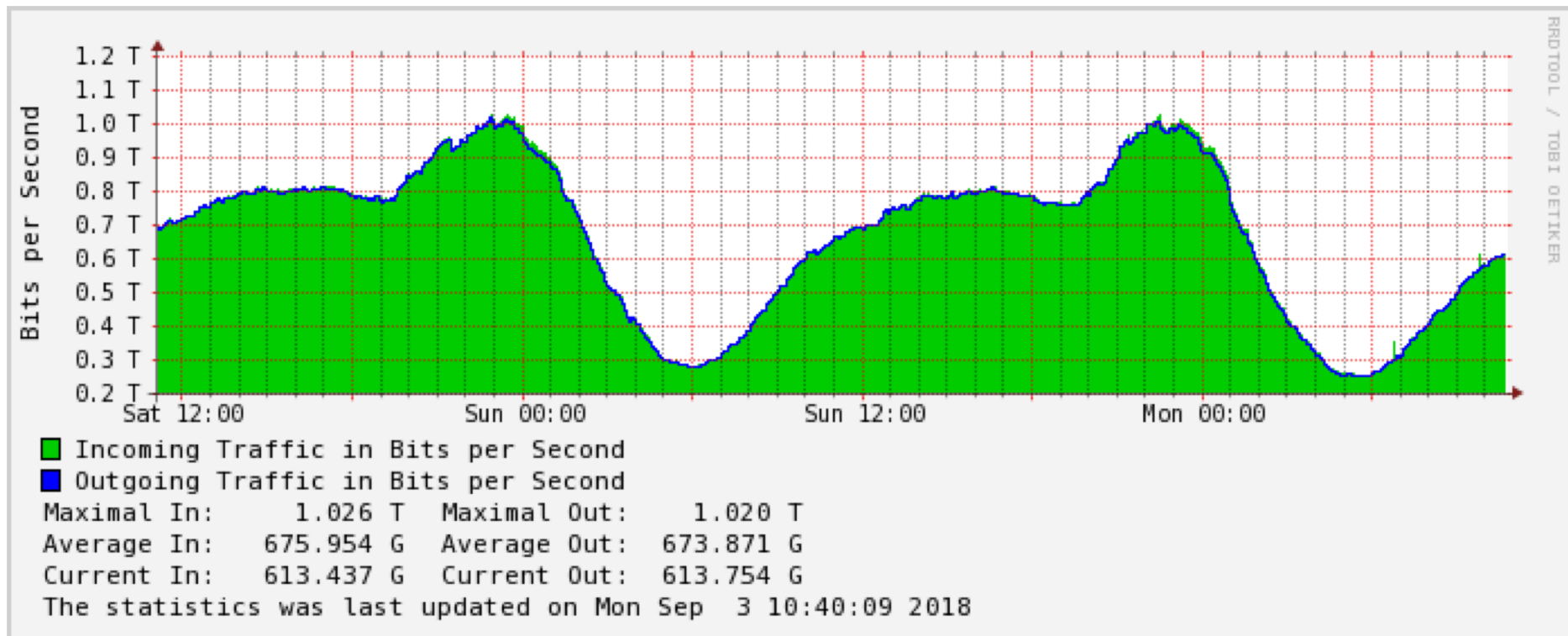
*7 Sep 2018*

# 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
- 290+ different networks (autonomous systems) connected
- 500+ physical connections in total
  - 30 **100GE**, 300+ **10GE** & 150+ **GE**
- 1.17+Tbps (5-min) total traffic at peak
- Annual Traffic Growth **~30%**

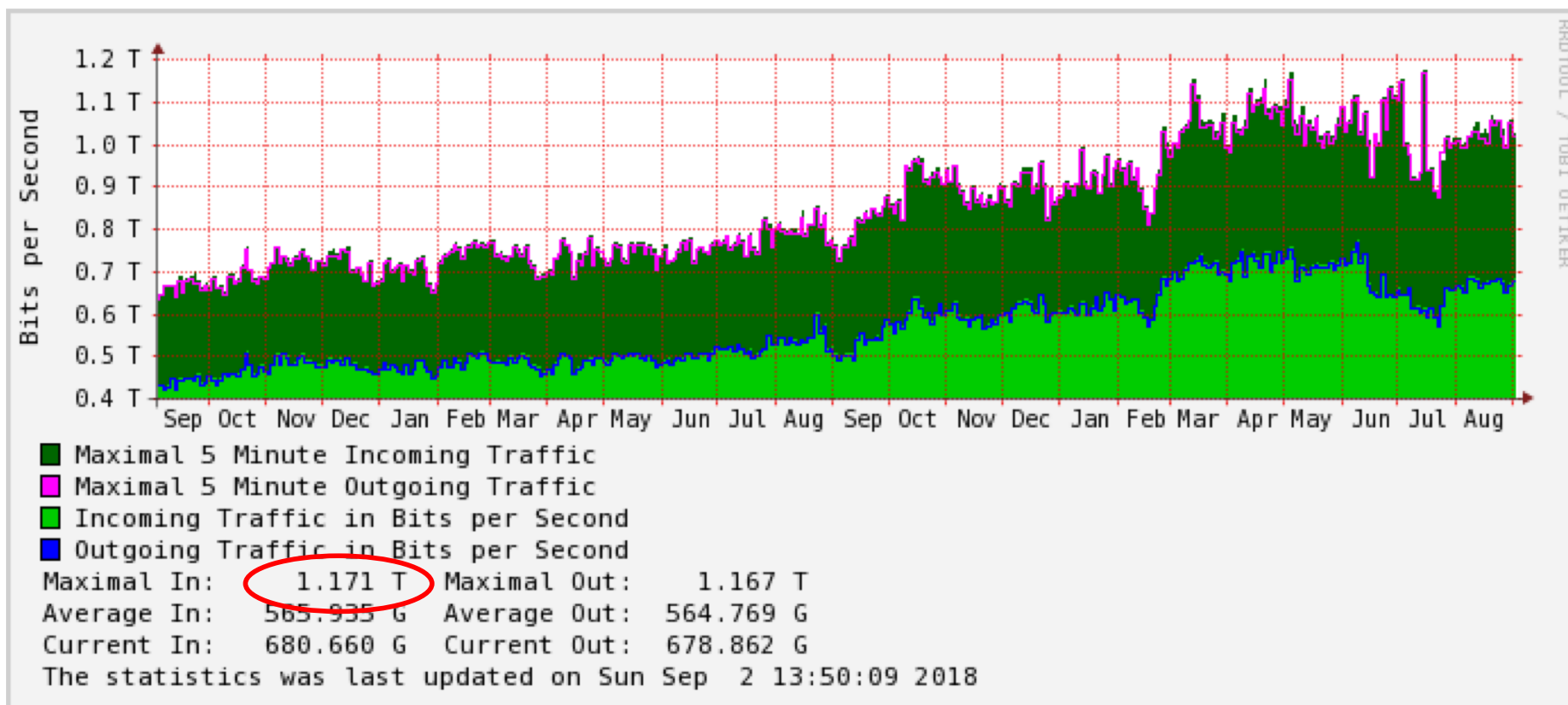
# Current HKIX Traffic

## Daily Graph (5-min average)



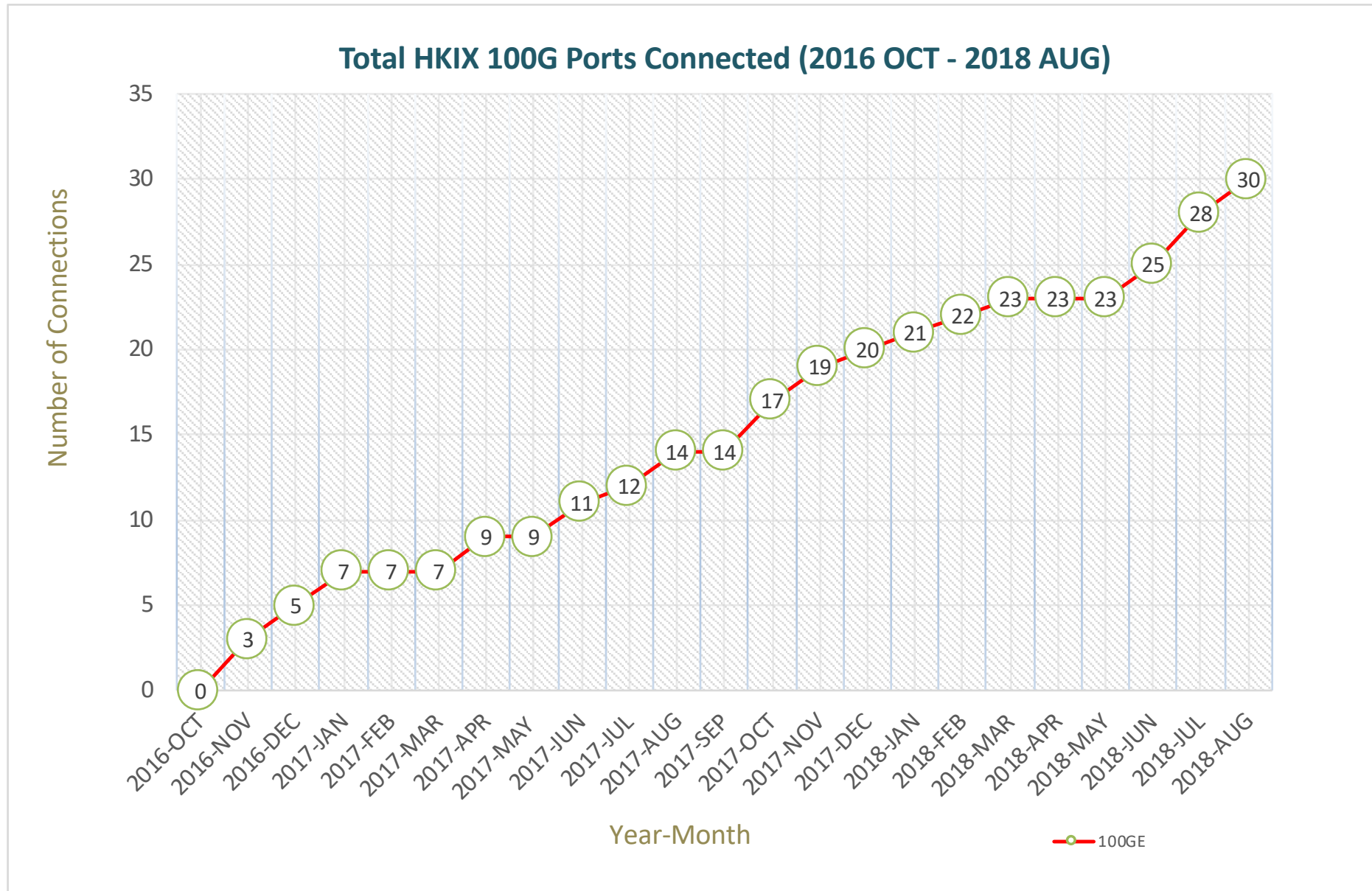
# Current HKIX Traffic

## Yearly Graph (1-day average)



Peak Traffic: 1.17T

# Trend of 100GE connections





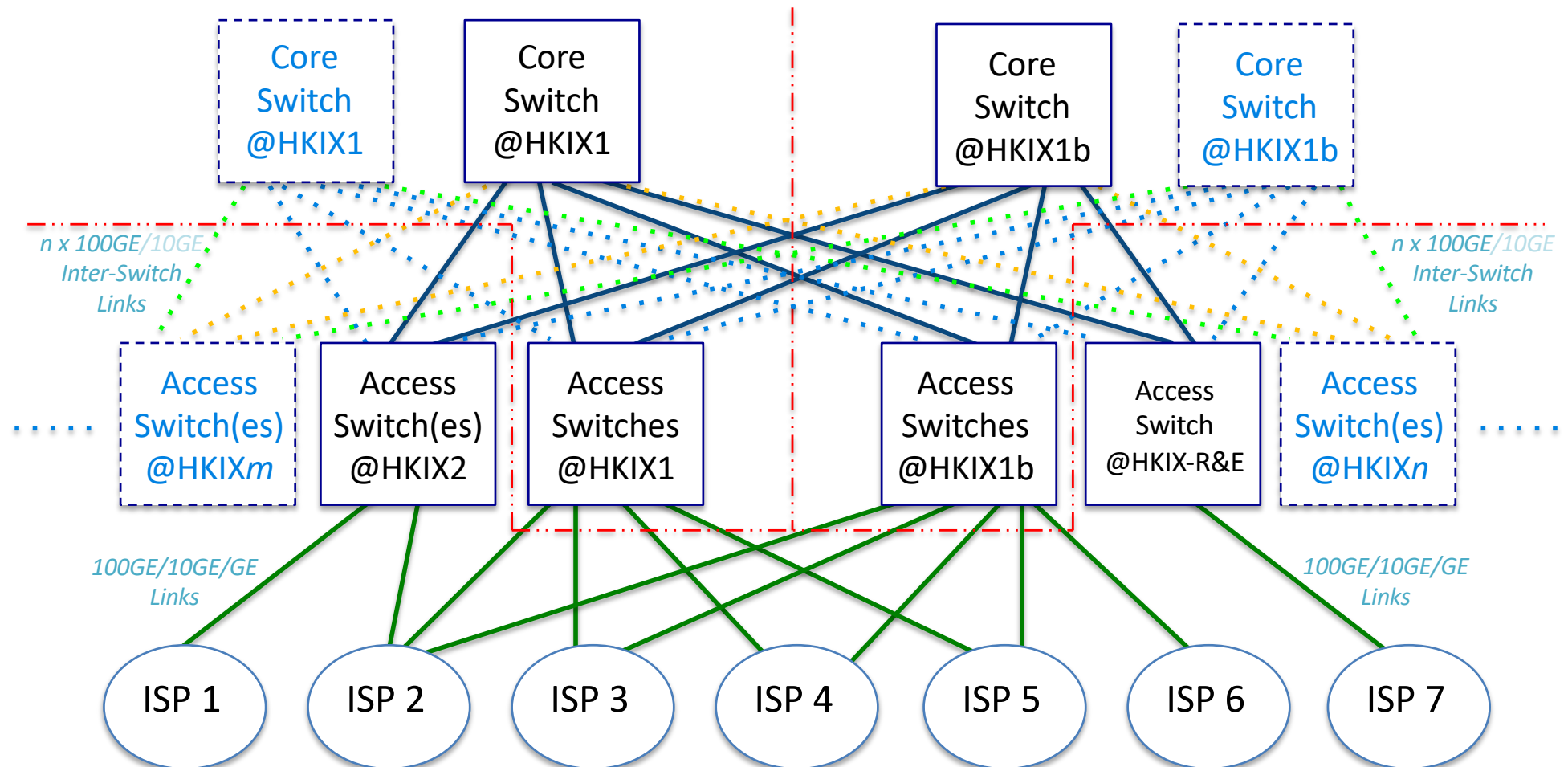
# HKIX 100GE Participants

- Akamai
- Amazon
- AOFEI
- BGP Consultancy
- China Mobile International
- CloudFlare
- Facebook
- Google
- HKBN
- Hurricane Electric
- Limelight
- PCCW IMS
- Telstra
- Tencent
- TVB
- Udomain
- Valve
- Yahoo

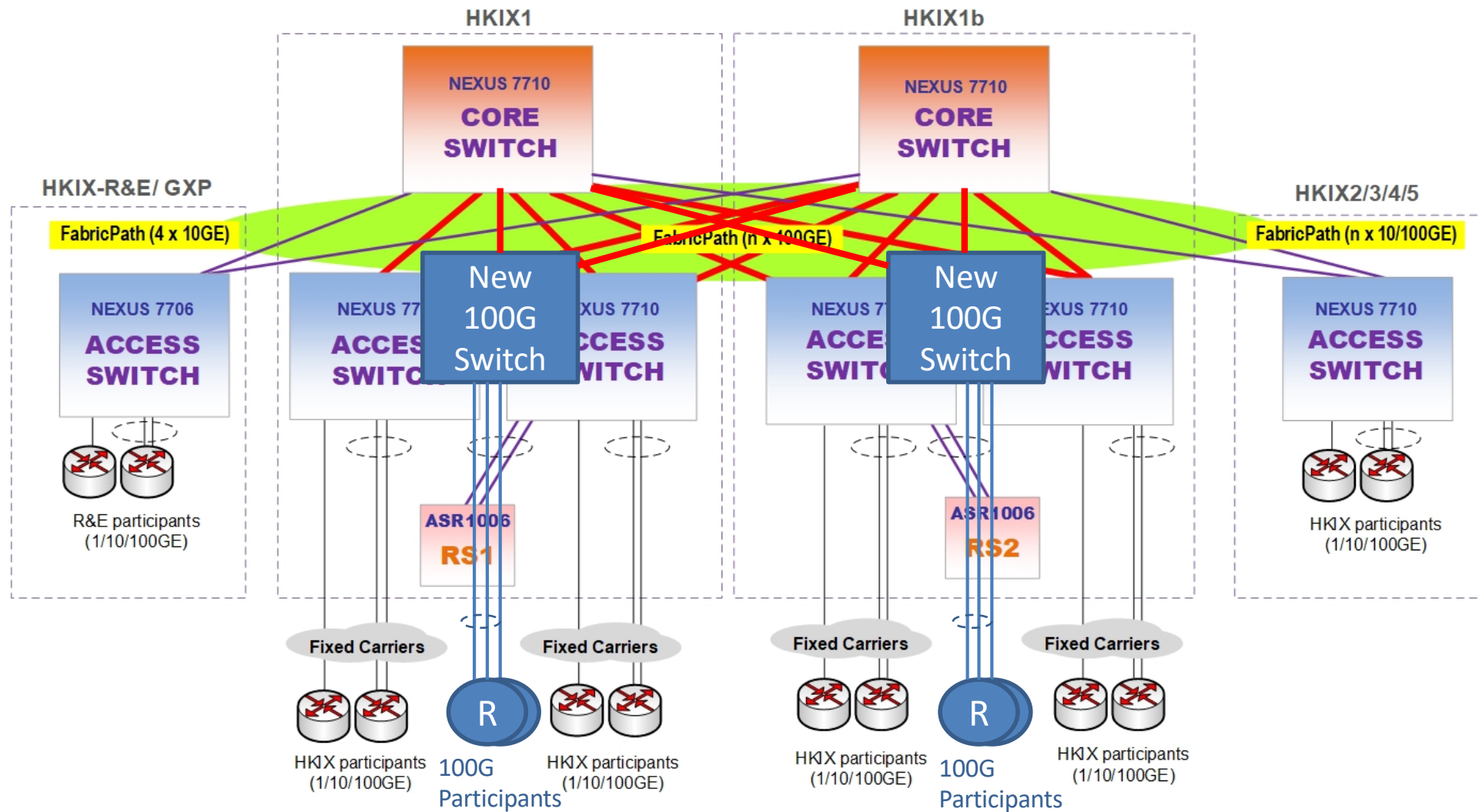
# New HKIX Dual-Core Two-Tier Spine-and-Leaf Architecture For 2014 and Beyond



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



## HKIX Network Diagram (Apr 2018)



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.





# 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
- 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
- ***HKIX1 and HKIX1b (the two HKIX core sites located within CUHK Campus) will continue to serve participants directly***

# Setup Multiple HKIX Satellite Sites

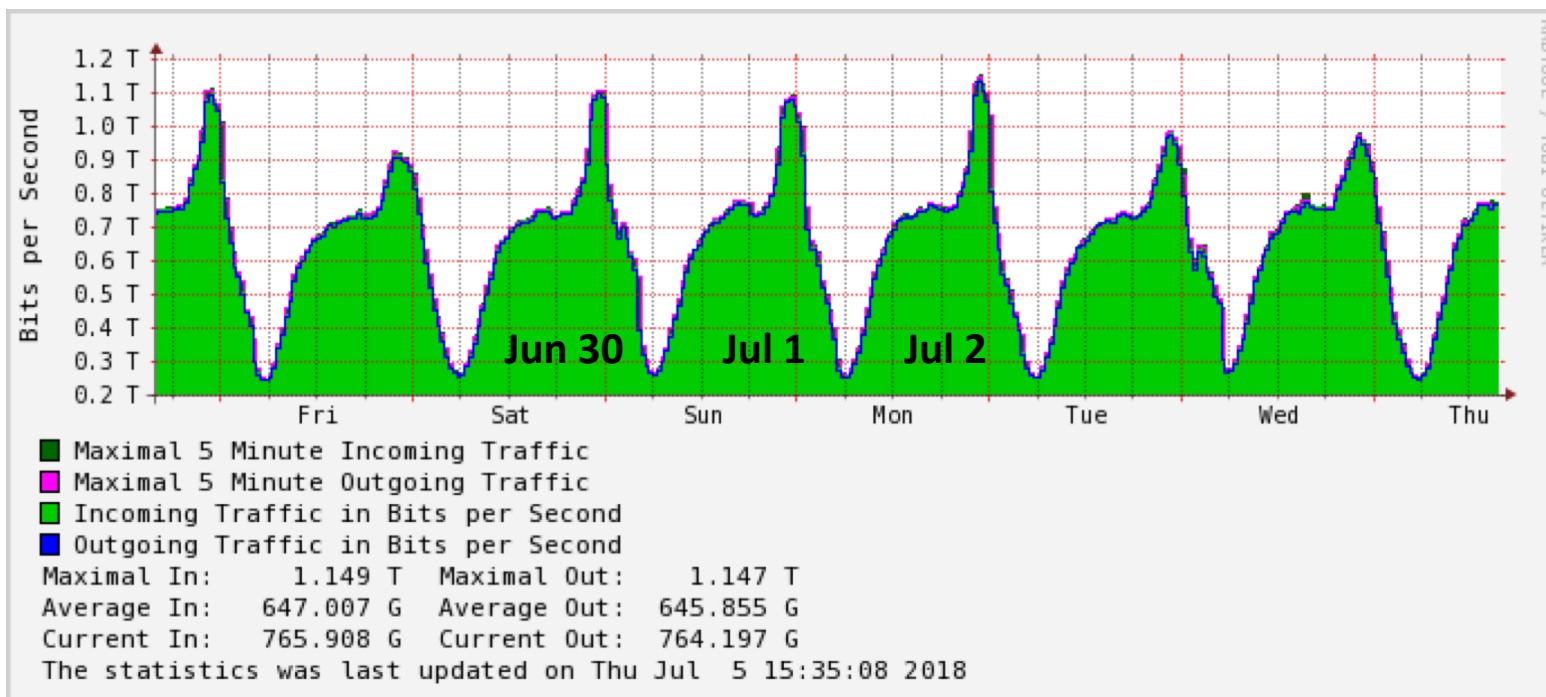
Hong Kong, 08 Feb 2017

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	<a href="#">CITIC Telecom International</a>	Kwai Chung	GE/10GE	
HKIX3	<a href="#">SUNeVision / iAdvantage</a>	Fo Tan	GE/10GE/100GE	100G Ready
HKIX4	<a href="#">NTT Com Asia</a>	Tseung Kwan O	GE/10GE/100GE	100G Ready
HKIX5	<a href="#">KDDI / Telehouse / HKCOLO.net</a>	Tseung Kwan O	GE/10GE/100GE	100G Ready

- 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 Traffic During World Cup Round of 16 Daily Graph (5-min average)



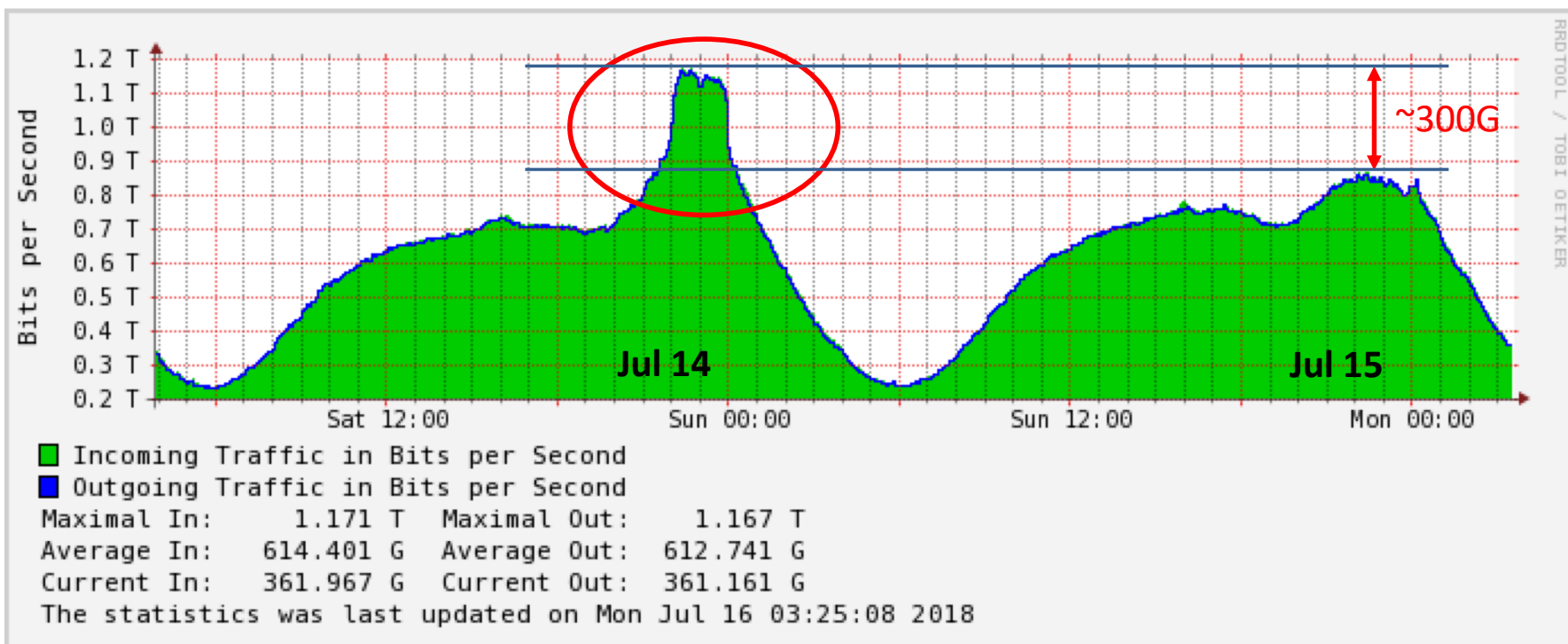
Round of 16	
30 Jun 2018 - 17:00 Local time Kazan Arena Kazan Match 50	France  Full-time <b>4-3</b> Argentina
01 Jul 2018 - 17:00 Local time Luzhniki Stadium Moscow Match 51	Spain  Full-time <b>1-1</b> Russia Russia win on penalties (3 - 4)
02 Jul 2018 - 18:00 Local time Samara Arena Samara Match 53	Brazil  Full-time <b>2-0</b> Mexico

**30 Jun 2018**  
22:00 HKT (Sat)

**1 Jul 2018**  
22:00 HKT (Sun)

**2 Jul 2018**  
23:00 HKT (Mon)

# HKIX Traffic During World Cup Final Games Daily Graph (5-min average)



## Play-off for third place

14 Jul 2018 - 17:00 Local time  
 Saint Petersburg Stadium  
 St. Petersburg  
 Match 63

Belgium



Full-time

**2-0**



England

**14 Jul 2018**  
 22:00 HKT (Sat)

## Final

15 Jul 2018 - 18:00 Local time  
 Luzhnik Stadium  
 Moscow  
 Match 64

France



Full-time

**4-2**



Croatia

**15 Jul 2018**  
 23:00 HKT (Sun)

# HKIX Planned Works for 2018/19

- Improved Stability
  - Better Control of Proxy ARP
  - [New Route Server for peering](#)
- 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
  - Automatic network filter update (support updates from IRR)
- 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](#)

# Better Control of Proxy ARP

Proxy ARP was detected at **Fri Aug 31 11:56:16 HKT 2018 (UTC+8)** .

## **Proxy ARP Information**

Proxy ARP	
Router Name	primary
VRF	
MAC Address	000B.60A1.A41B
IP Address(es)	123.255.97.90 (Attacker) 123.255.97.91
Action	
Status	Port shutdown is disabled
Switch Name	hkix0g14esb
Port Number	1/41
Port Description	🤪

- Automatic Detection of Proxy ARP (implemented)
  - Based on duplicated IPv4 ARP entries learned on HKIX Route Servers
- Automatic shutdown switch port of HKIX peer causing Proxy ARP (will be implemented)
- Email notification to NOC of HKIX peer causing Proxy ARP

# Better Control of Proxy ARP

- Recommendation:
  - Disable Proxy ARP **COMPLETELY!!**
  - No restricted or unrestricted Proxy ARP
- Cisco IOS:
  - Configuration at interface:
    - *no ip proxy-arp*
  - Verification:
    - *show ip interface | include Proxy ARP*
    - *“Proxy ARP is disabled”*
- Juniper JUNOS:
  - Proxy ARP is not enabled by default
  - So do **NOT** configure restricted or unrestricted mode Proxy ARP



# L2 Control for HKIX Peering LAN

- Traffic Allowed in HKIX Peering LAN:
  - Ethernet Types
    - 0x0800 - IPv4
    - 0x0806 - ARP
    - 0x86dd - IPv6
  - Unicast Only
    - No multicast or broadcast except ARP broadcast
  - Port Security Always On
    - One MAC address one port

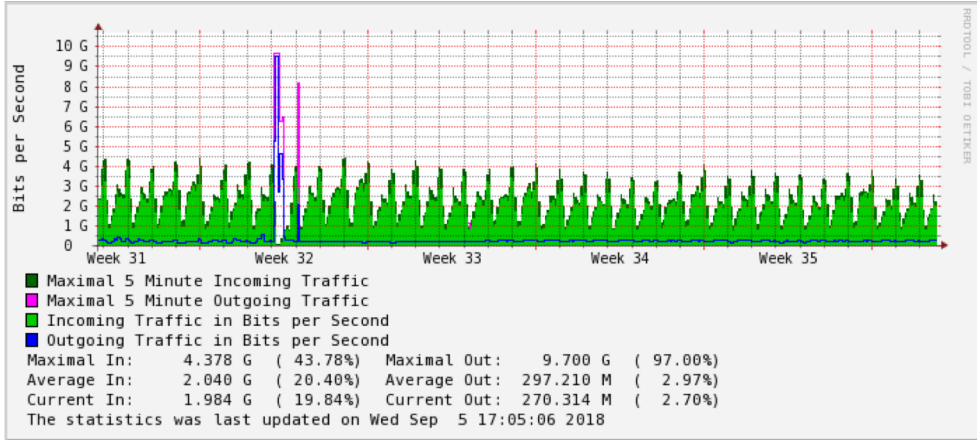
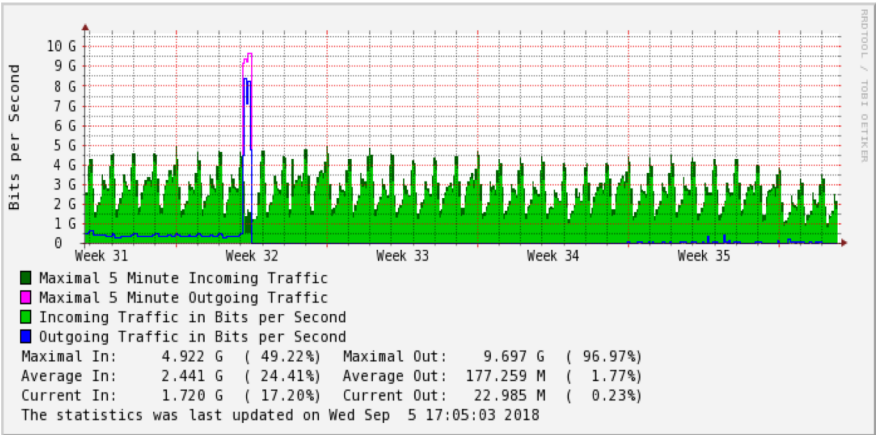


# Advanced Route Server Feature

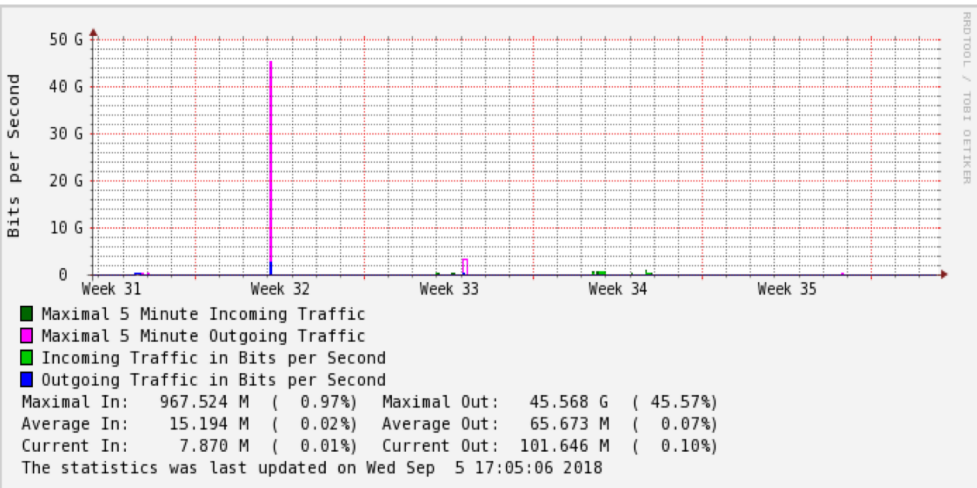
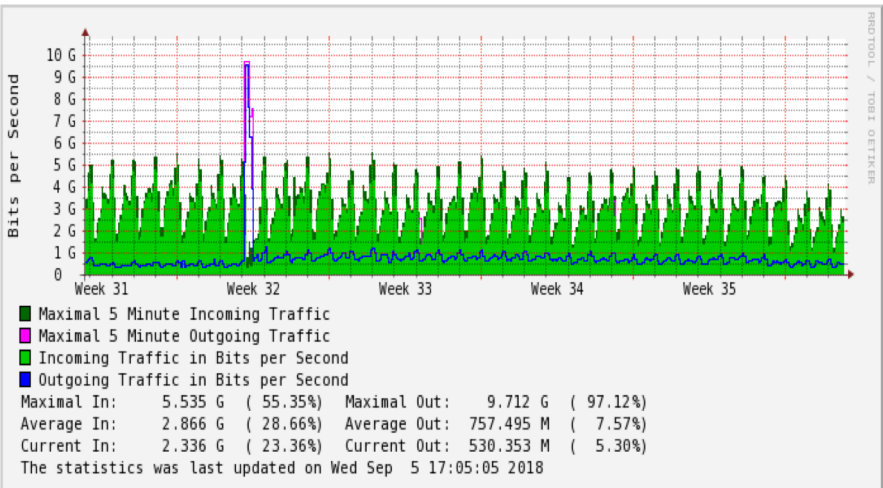
Feature	BGP Standard Community
Send prefix to all	4635:4635
Send prefix to \$Peer-AS only	4635:\$Peer-AS
Do not send prefix to all	0:4635
Do not send prefix to \$Peer-AS	0:\$Peer-AS

- Production in Q1 2018
- Support 2-byte AS numbers only
- Default sending prefix to all if no BGP community is tagged

# DDoS Attack Towards a HKIX Participant on 9 Aug 2018



Total of Traffic ~75Gbps



# 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

<http://www.hkix.net/hkix/anti-ddos.htm>

No. of ASNs Participated : 43

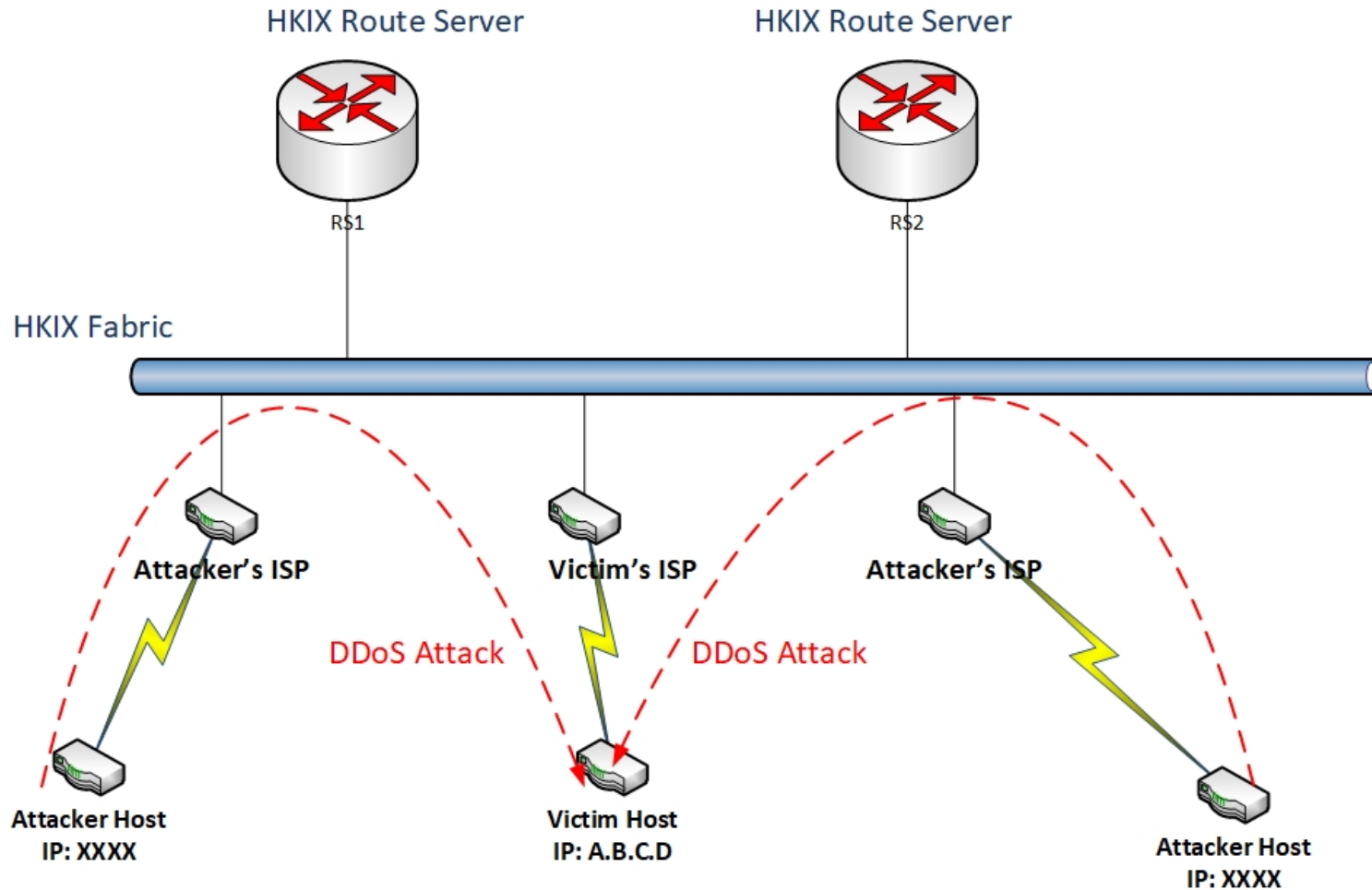
## How it works?

- 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:

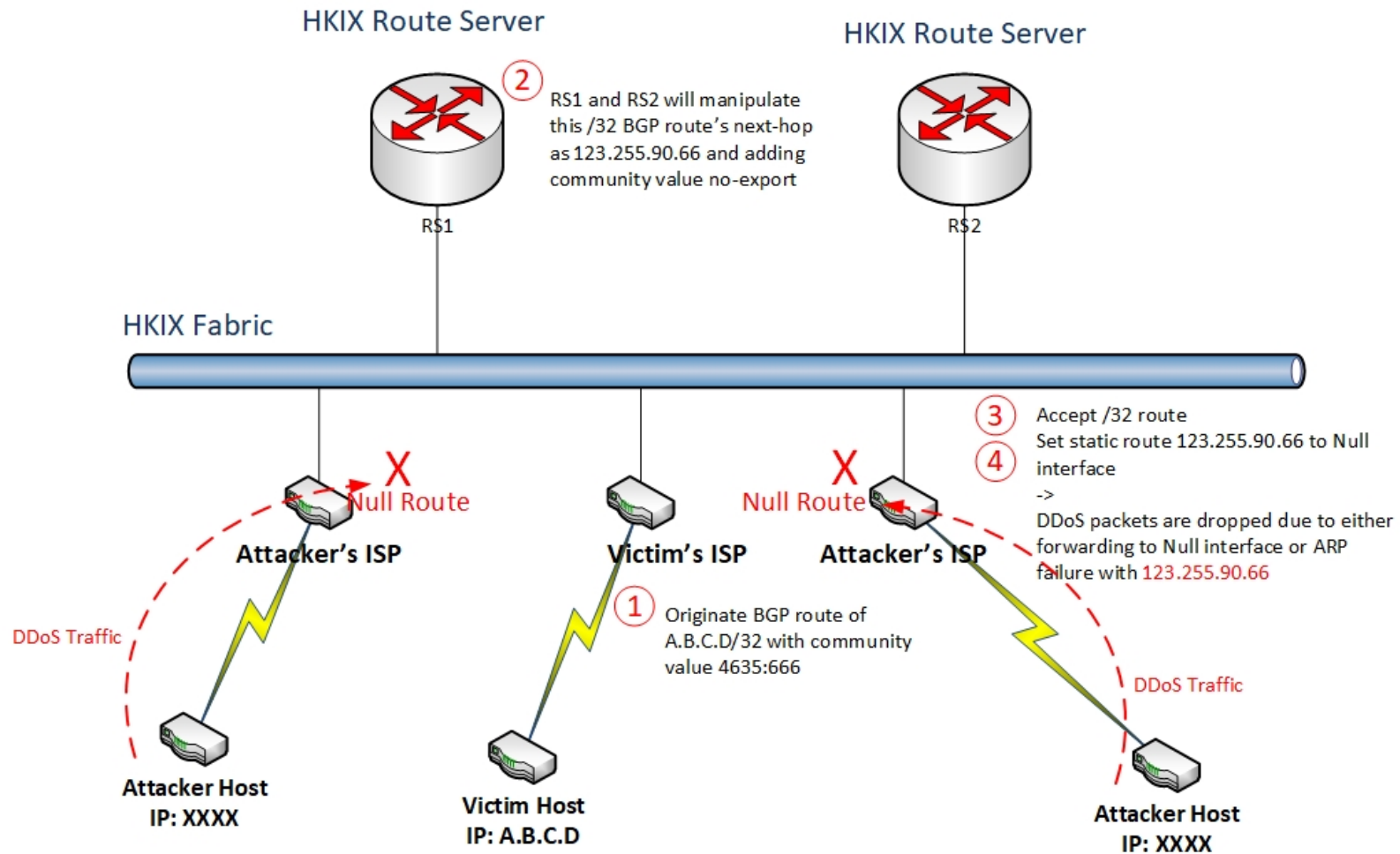
- Only the victim (/32) will be unreachable via HKIX network while saving the others
- The DDoS traffic will be black-holed at the side of the participating routers which are closer to the DDoS traffic sources

# Support of Blackholing for Anti-DDoS on HKIX Route Servers (BEFORE)



# Support of Blackholing for Anti-DDoS

## on HKIX Route Servers (AFTER)



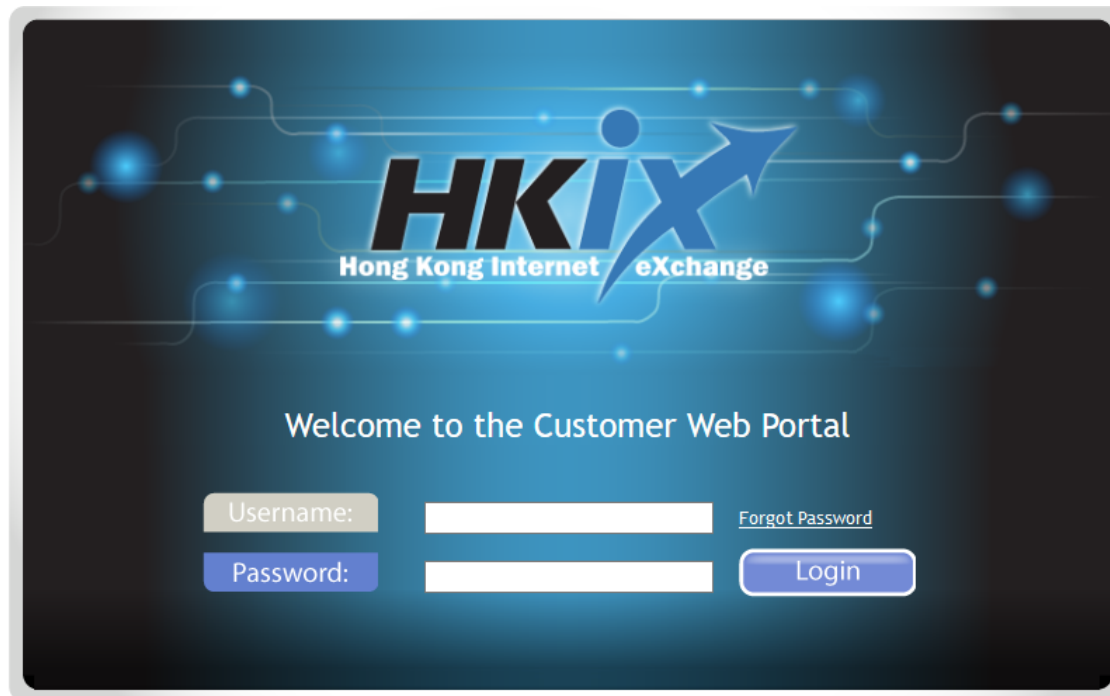
# Support of Blackholing for Anti-DDoS on HKIX Route Servers

Enhancement of RTBH on HKIX route servers :

- Only registered members can tag the blackhole routes
- Only /32 is accepted for the prefix (e.g. victim's IP address)
- Announce your own network prefix only (**very important!!!**)
- Register your **AS-Set** in internet routing database and use **IRR filtering** on HKIX route servers (it can minimize the risk from accidentally announced a black-holing route that you are not allowed to advertise)
- HKIX may shutdown the connection if improper use of the RTBH reported

# Portal for HKIX Participants

- Login Page (URL: <https://portal.hkix.net/>)

A screenshot of the HKIX Customer Web Portal login page. The page has a dark blue background with a glowing network pattern of lines and nodes. At the top center is the HKIX logo, which includes the text 'Hong Kong Internet eXchange' below the 'HKIX' text. Below the logo, the text 'Welcome to the Customer Web Portal' is displayed. Underneath, there are two input fields: 'Username:' and 'Password:'. The 'Username:' label is in a light blue box, and the 'Password:' label is in a darker blue box. To the right of the 'Username:' field is a link for 'Forgot Password'. To the right of the 'Password:' field is a blue 'Login' button.

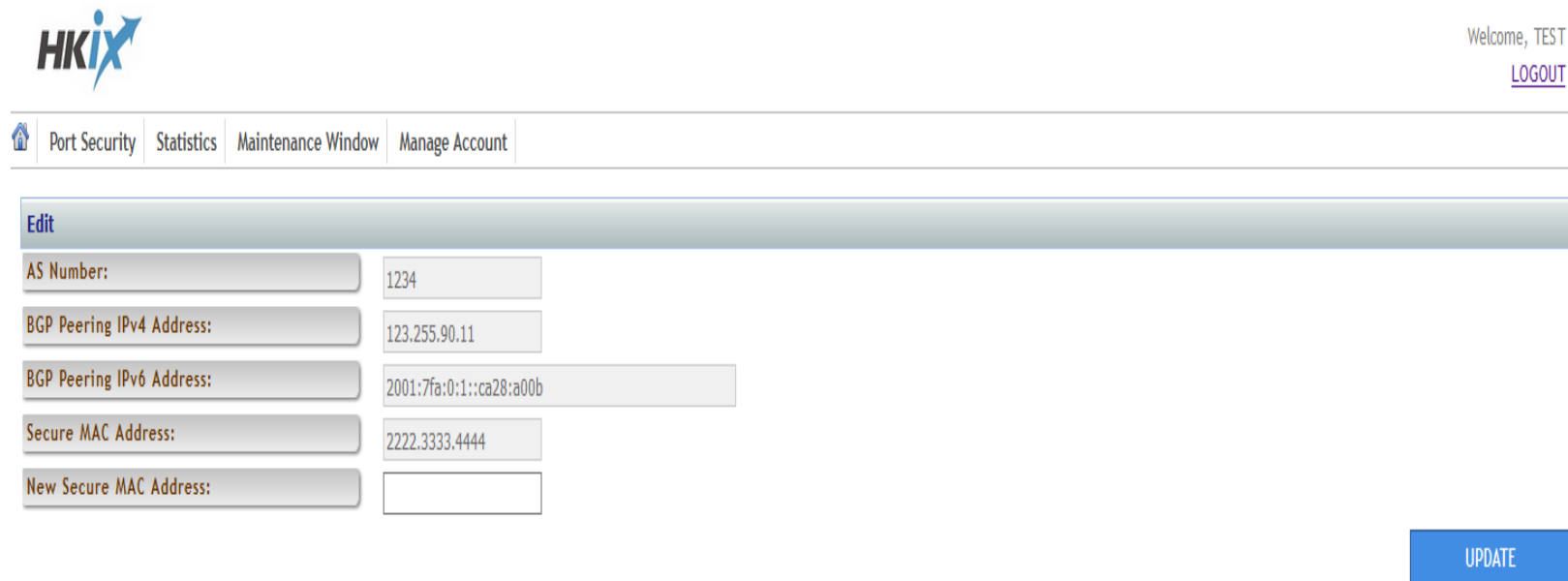
# Portal for HKIX Participants

- <https://portal.hkix.net>
- Basic Functions (Currently Available)
  1. Change Port Security
  2. MRTG Statistics
    - Physical port
    - LAG port
    - Aggregated per Customer
  3. Schedule Maintenance Window
- Planning Features
  - Port Application
  - Site Access Application
  - Filter Update
  - Fault Case Reporting



# HKIX Portal – Port Security

- Change port security




The screenshot shows the HKIX Portal interface for Port Security configuration. At the top left is the HKIX logo. At the top right, it says "Welcome, TEST" and has a [LOGOUT](#) link. Below the header is a navigation bar with links for "Port Security", "Statistics", "Maintenance Window", and "Manage Account". The main content area is titled "Edit" and contains five input fields for configuration:

AS Number:	1234
BGP Peering IPv4 Address:	123.255.90.11
BGP Peering IPv6 Address:	2001:7fa:0:1::ca28:a00b
Secure MAC Address:	2222.3333.4444
New Secure MAC Address:	<input type="text"/>

At the bottom right of the form is a blue "UPDATE" button.

# HKIX Portal – MRTG Statistics

- Review an individual statistics / HKIX total statistics


Welcome, TEST [LOGOUT](#)

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[Home](#)
[Port Security](#)
[Statistics](#)
[Maintenance Window](#)
[Manage Account](#)

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**Port Statistics**

HKIX Total Statistics  
Aggregated by 1234  
123.255.90.11 / 2001:7fa:0:1::ca28:a00b

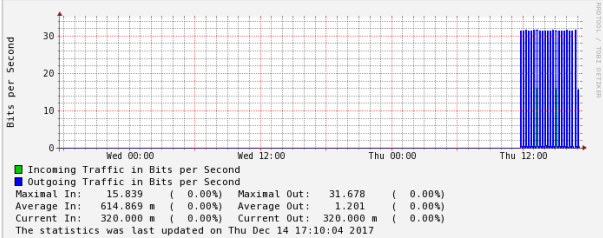
### Traffic Analysis for 1234

IPv4: 123.255.90.11  
 IPv6: 2001:7fa:0:1::ca28:a00b  
 Speed: 1 Gbits/s  
 Port Type: Non-LACP

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The statistics were last updated: **Thu Dec 14 17:15:04 2017**

#### 'Daily' graph (5 Minute Average)



**Incoming Traffic in Bits per Second**  
**Outgoing Traffic in Bits per Second**

Maximal In:	15.839	( 0.00%)	Maximal Out:	31.678	( 0.00%)
Average In:	614.869	m ( 0.00%)	Average Out:	1.201	( 0.00%)
Current In:	320.000	m ( 0.00%)	Current Out:	320.000	m ( 0.00%)

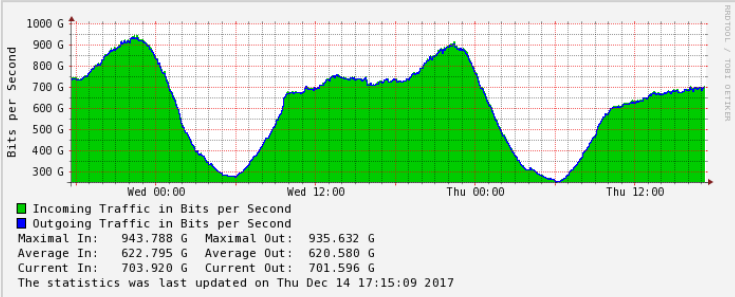
The statistics was last updated on Thu Dec 14 17:10:04 2017

### HKIX Switching Statistics

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The statistics were last updated: **Thu Dec 14 17:15:09 2017**

#### 'Daily' graph (5 Minute Average)



**Incoming Traffic in Bits per Second**  
**Outgoing Traffic in Bits per Second**

Maximal In:	943.788	G	Maximal Out:	935.632	G
Average In:	622.795	G	Average Out:	620.580	G
Current In:	703.920	G	Current Out:	701.596	G

The statistics was last updated on Thu Dec 14 17:15:09 2017

# HKIX Portal - Maintenance Window

- Schedule Maintenance Window



The screenshot shows the 'Add Scheduled Maintenance Window' form in the HKIX portal. The form includes the following fields and elements:

- Start Time (GMT +8):** 12/15/2017 12:00
- End Time (GMT +8):** 12/15/2017 16:00
- Description:** Software update for our router.
- Ports:** A table with two rows of ports and their corresponding actions.

Port	Action
123.255.90.11/2001:7fa:0:1::ca28:a00b	Select
123.255.90.11/2001:7fa:0:1::ca28:a00b	Remove

At the bottom right of the form, there is a blue button labeled 'ADD'.



Contact [provision@hkix.net](mailto:provision@hkix.net) for your portal account. It's free!



# 24x7 HKIX NOC

- Full operation starting from 1-Jan-2017
- Contact us at [noc@hkix.net](mailto:noc@hkix.net) for operational related matters
- Use Fault Reporting Form to open a ticket  
[www.hkix.net](http://www.hkix.net) -> [Fault Case Report Form](#)
- 24x7 NOC hotline: 6890-9900 (effective from 1-Oct-2018)
- Keep your contact point at HKIX updated for operational and security incident reporting

# Some Useful Operational Tips

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## HKIX Participants SHOULD NOT:

- Announce route not owned by you or your customers
- Perform testing or looping on HKIX networks
- Announce full/default route to HKIX route servers
- Advertise HKIX peering LAN to other networks
- Forward link-local protocols to HKIX Peering LAN
  - *IRDP*
  - *ICMP redirects*
  - *IEEE 802 Spanning Tree*
  - *Vendor proprietary protocols such as discovery protocols: CDP, EDP*
  - *VLAN/ Trunk protocols: VTP, DTP*
  - *Interior routing protocol broadcasts (e.g. OSPF, ISIS, IGRP, EIGRP)*
  - *BOOTP/DHCP*
  - *PIM-SM*
  - *PIM-DM*
  - *DVMRP*
  - *ICMPv6 ND-RA*
  - *UDLD*
  - *L2 Keepalives*



# Some Useful Operational Tips

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## HKIX Participants SHOULD DO:

- Make sure proxy ARP is disabled
- Establish BGP MLPA peering with BOTH HKIX route servers
- Notify HKIX NOC for schedule maintenance in advance so that we will not treat your BGP session down as failure
- Monitor the growth of number of prefixes from our route servers and adjust your max prefix setting accordingly
- Monitor the utilization of your links closely and do upgrade before they are full
- Do your own route / route6 / as-set objects on IRRDB and keep them up-to-date
- Do update your contact and peering info in PeeringDB





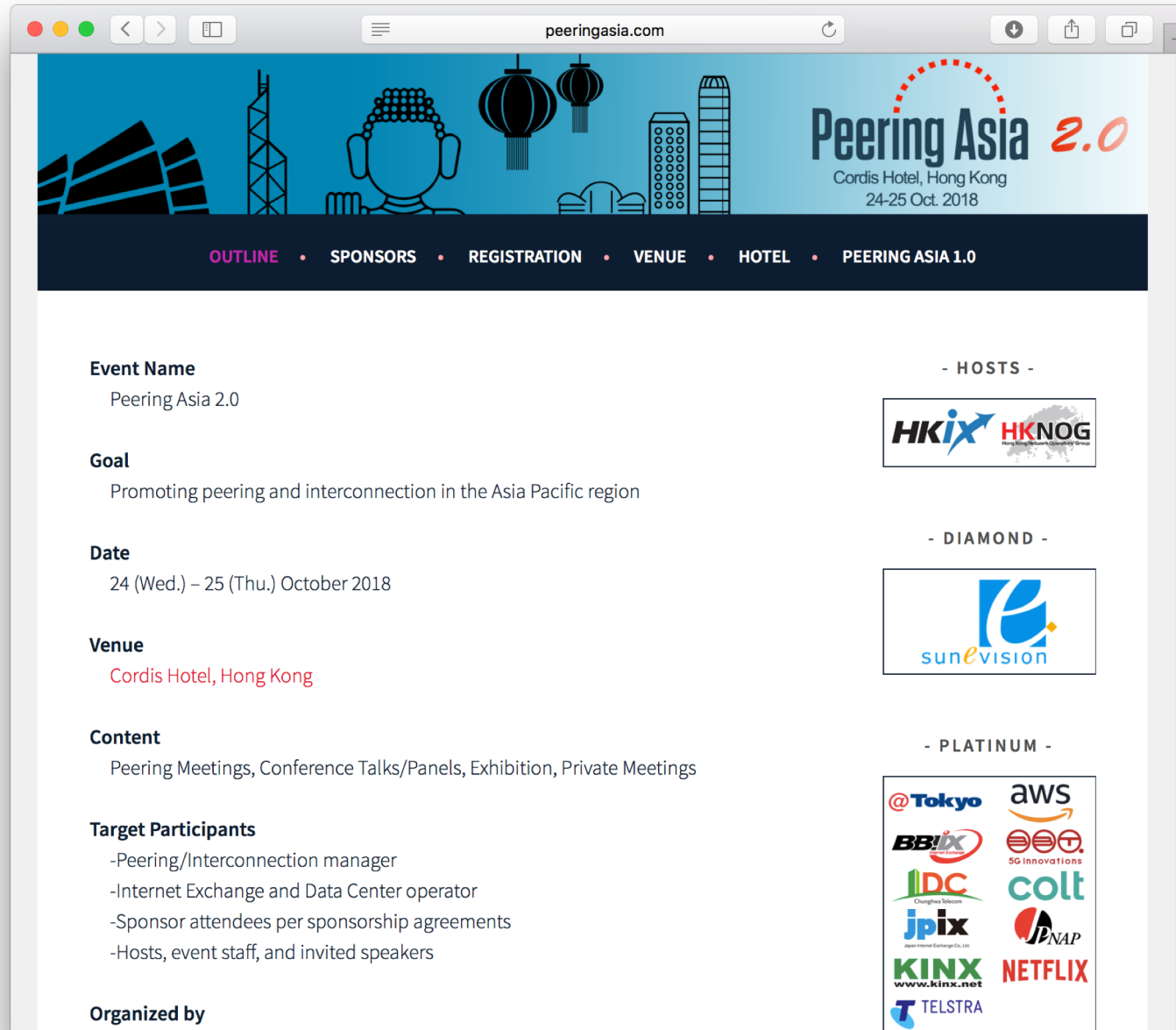
# **Peering Asia 2.0**

## **Hong Kong co-host by**

### **HKIX and HKNOG**

24<sup>th</sup> – 25<sup>th</sup> October, 2018

# Peering Asia 2.0 Web Site



The screenshot shows a web browser window with the URL 'peeringasia.com'. The page features a blue header with a graphic of a Buddha head, lanterns, and buildings. The event title 'Peering Asia 2.0' is prominently displayed, along with the location 'Cordis Hotel, Hong Kong' and dates '24-25 Oct. 2018'. A navigation menu includes links for 'OUTLINE', 'SPONSORS', 'REGISTRATION', 'VENUE', 'HOTEL', and 'PEERING ASIA 1.0'. The main content area is divided into two columns. The left column lists event details: Event Name (Peering Asia 2.0), Goal (Promoting peering and interconnection in the Asia Pacific region), Date (24 (Wed.) – 25 (Thu.) October 2018), Venue (Cordis Hotel, Hong Kong), Content (Peering Meetings, Conference Talks/Panels, Exhibition, Private Meetings), and Target Participants (Peering/Interconnection manager, Internet Exchange and Data Center operator, Sponsor attendees per sponsorship agreements, Hosts, event staff, and invited speakers). The right column lists sponsors under three categories: Hosts (HKIX and HKNOG), Diamond (sun@vision), and Platinum (@Tokyo, aws, BBIX, 3iG, IDC, colt, jpix, JPNAP, KINX, NETFLIX, and TELSTRA).

**Event Name**  
Peering Asia 2.0

**Goal**  
Promoting peering and interconnection in the Asia Pacific region

**Date**  
24 (Wed.) – 25 (Thu.) October 2018

**Venue**  
Cordis Hotel, Hong Kong

**Content**  
Peering Meetings, Conference Talks/Panels, Exhibition, Private Meetings

**Target Participants**  
-Peering/Interconnection manager  
-Internet Exchange and Data Center operator  
-Sponsor attendees per sponsorship agreements  
-Hosts, event staff, and invited speakers

**Organized by**

**- HOSTS -**  
HKIX HKNOG

**- DIAMOND -**  
sun@vision

**- PLATINUM -**  
@Tokyo aws  
BBIX 3iG  
IDC colt  
jpix JPNAP  
KINX NETFLIX  
TELSTRA



# Peering Asia 2.0 details

- Date : 24<sup>th</sup> to 25<sup>th</sup> October ( Wed & Thu )
- Venue : Cordis Hotel, Hong Kong
  - » Conference capacity of 250+
  - » 35+ tables for peering meeting
  - » 14+ rooms for private meeting
  - » Walking distance to wide range of accommodation choices
  - » Walking distance to subway & train stations
  - » Surround by numerous restaurants and bars

**REGISTER  
NOW!**

Please visit our web site at [www.peeringasia.com](http://www.peeringasia.com) for details



# Thank You!

For enquiries, please contact us at  
**[info@hkix.net](mailto:info@hkix.net)**