



Hong Kong Internet eXchange (HKIX)

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What is HKIX?

- [Hong Kong Internet eXchange \(HKIX\)](#) is the main layer-2 Internet Exchange Point (IXP) in HK where various autonomous systems can interconnect with one another and exchange traffic
- 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
- **HKIX serves both commercial networks and R&E networks**
- The original goal is to keep intra-HongKong traffic within Hong Kong



21st Anniversary of HKIX



- HKIX started with thin coaxial cables in Apr 1995
- Participants had to put co-located routers at HKIX sites in order to connect
- It was a free service
- HKIX started very early, well before incumbent telcos started to do ISP business, so that is why HKIX can be successful



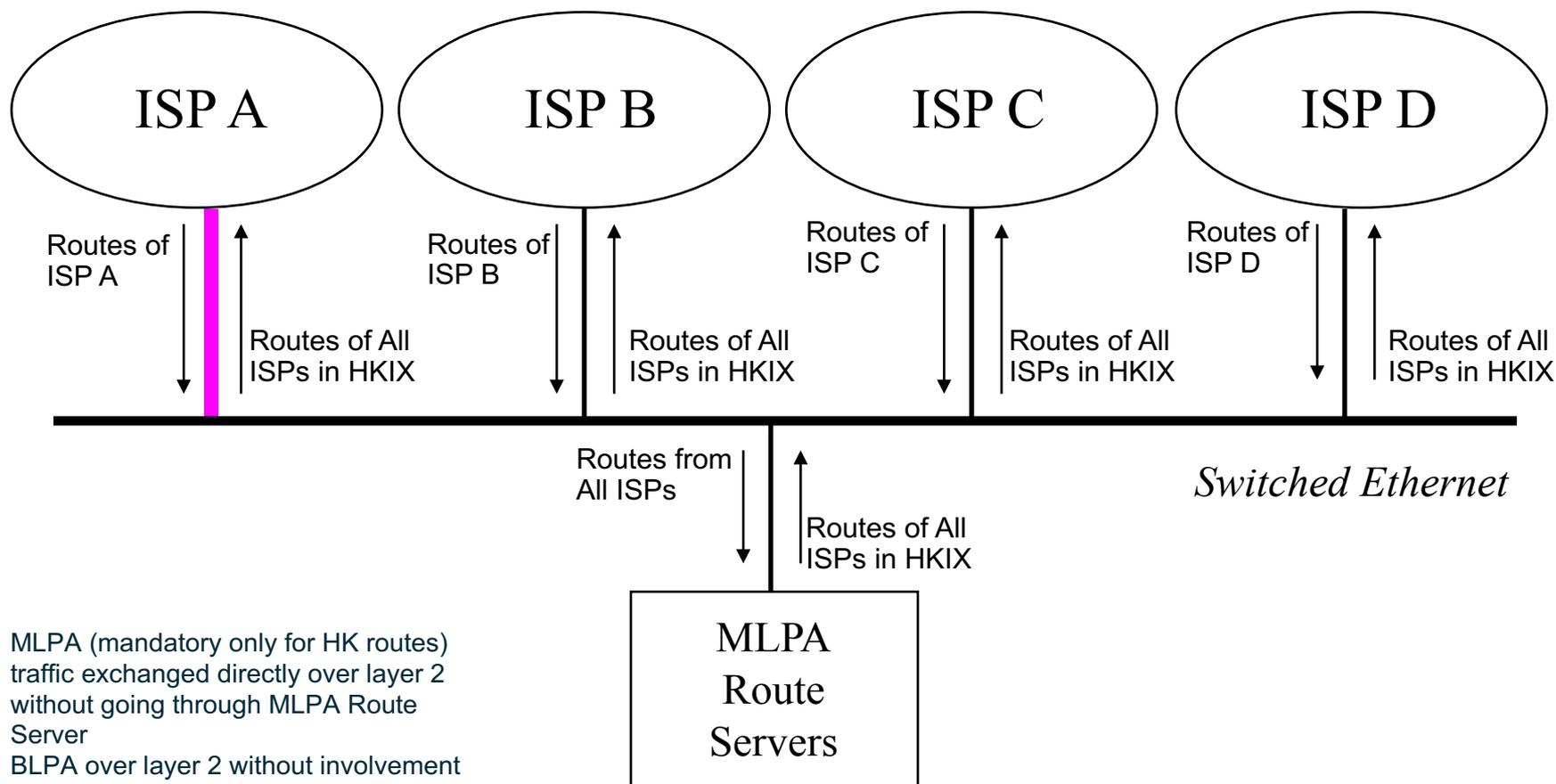
Requirements to Connect



- Have AS (Autonomous System) number and IP address block(s) allocated/assigned by RIR (Regional Internet Registry)
- Be able to run BGP4 routing protocol
- Have global Internet connectivity independent of HKIX facilities
- Provide its own local circuit(s) to HKIX Access Switch(es)
- Agree to do Multilateral Peering for Hong Kong routes



HKIX Model — MLPA over Layer 2 + BLPA



- MLPA (mandatory only for HK routes) 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



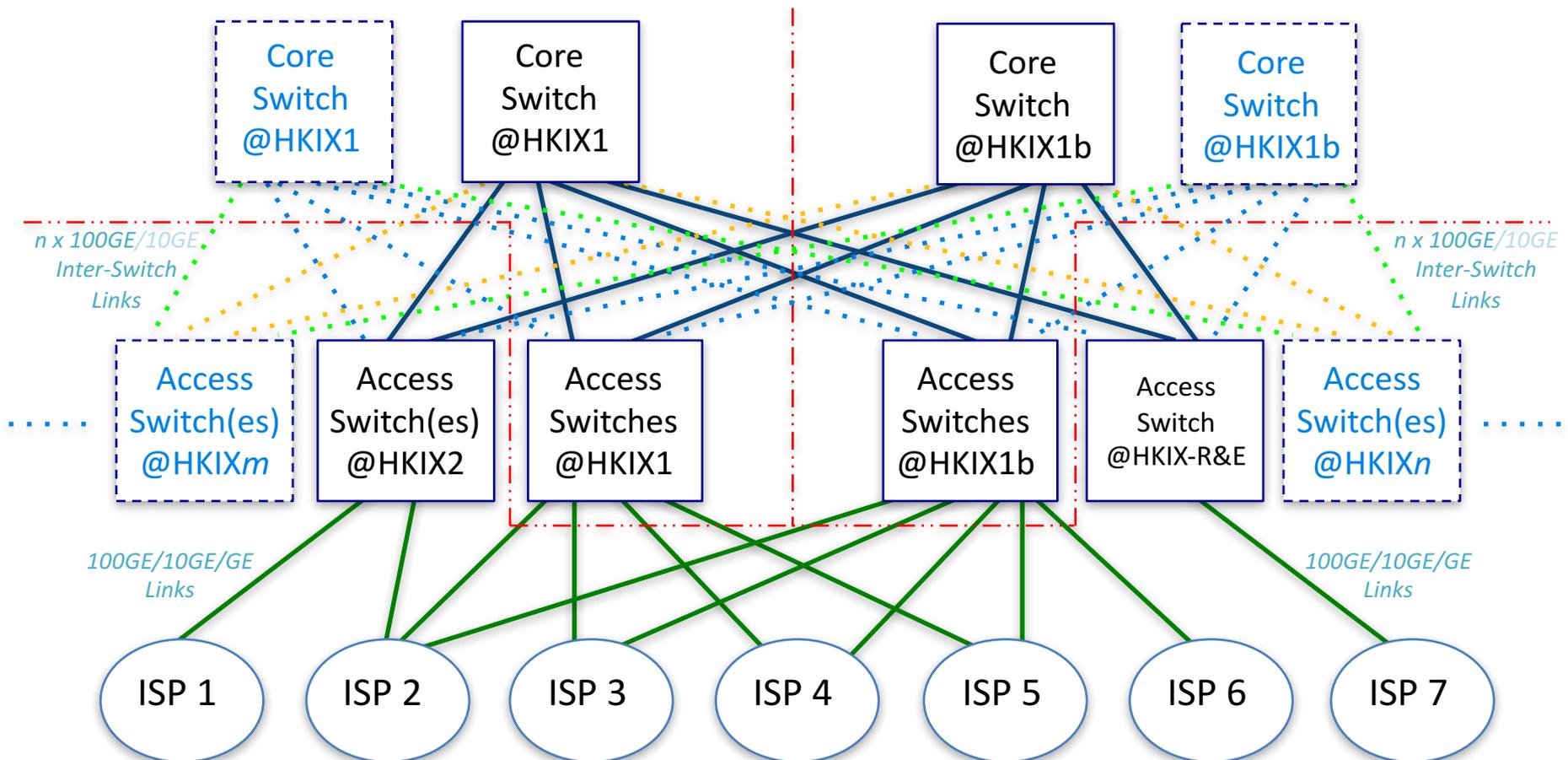
- We have almost all the Hong Kong networks
- So, we can attract participants from Mainland China, Taiwan, Korea, Japan, Singapore, Malaysia, Thailand, Indonesia, Philippines, Vietnam, India, Bhutan and other Asian countries
- We now have more non-HK routes than HK routes
- We do help keep intra-Asia 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**



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



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



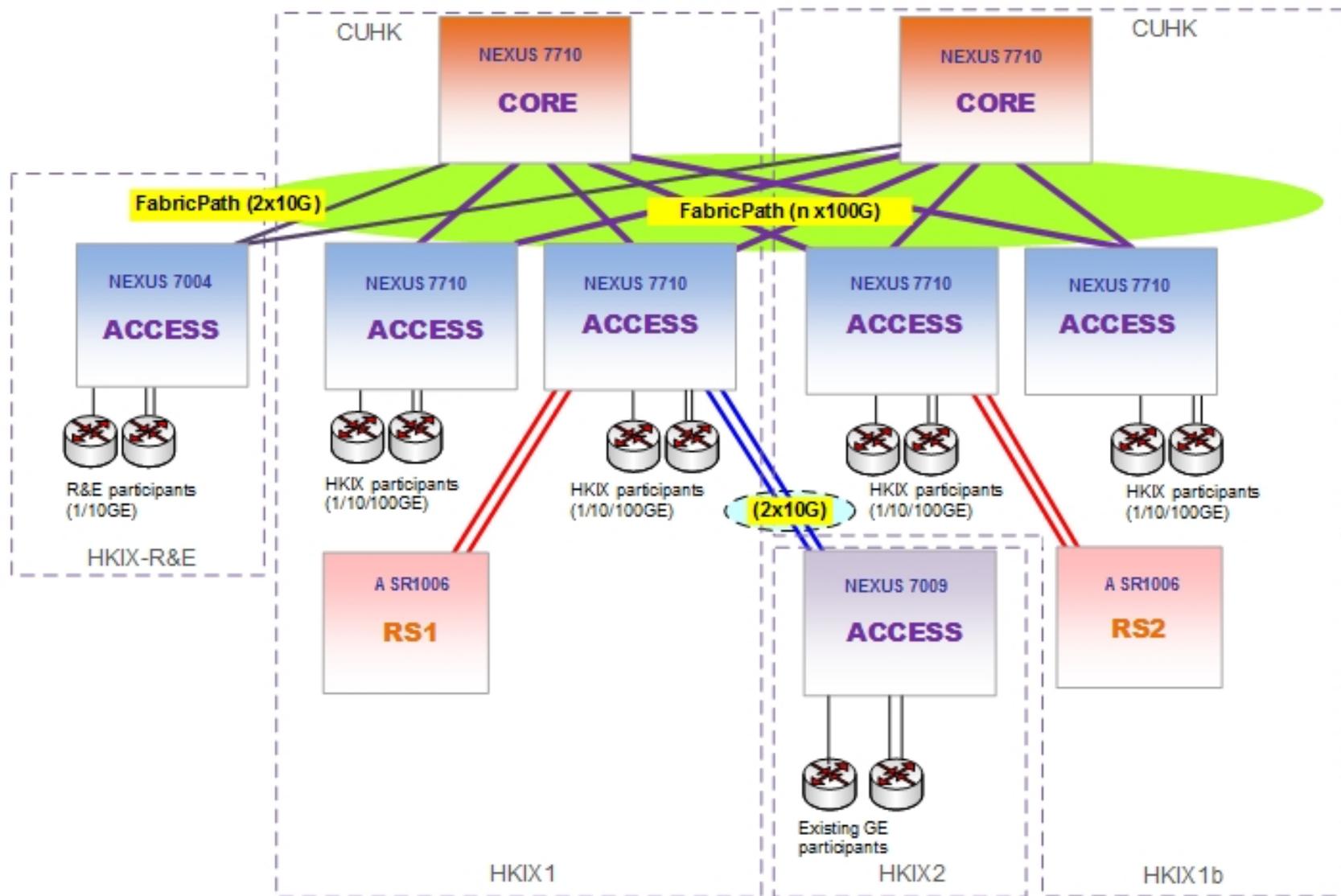


One Very Critical Point for an IXP



- An IXP must NOT be vulnerable to DDoS attack itself
- Congestion at one port must NOT cause trouble to any other ports
- After the upgrade, HKIX has achieved that

HKIX Network Diagram (JUL 2015)



1. HKIX1 and HKIX1b are the two core sites of HKIX. HKIX participants are encouraged to connect to both sites for site resilience.
2. For those participants which connect to only one of the two core sites, HKIX1b instead of HKIX1 will be assigned for better load balancing.



Principles of HKIX

- Neutral
 - Treat all partners equal, no matter 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
- Long-Term Sustainable
 - Charging mainly for long-term sustainability, not for profit-making
- Bridging R&E Networks and Commercial Networks



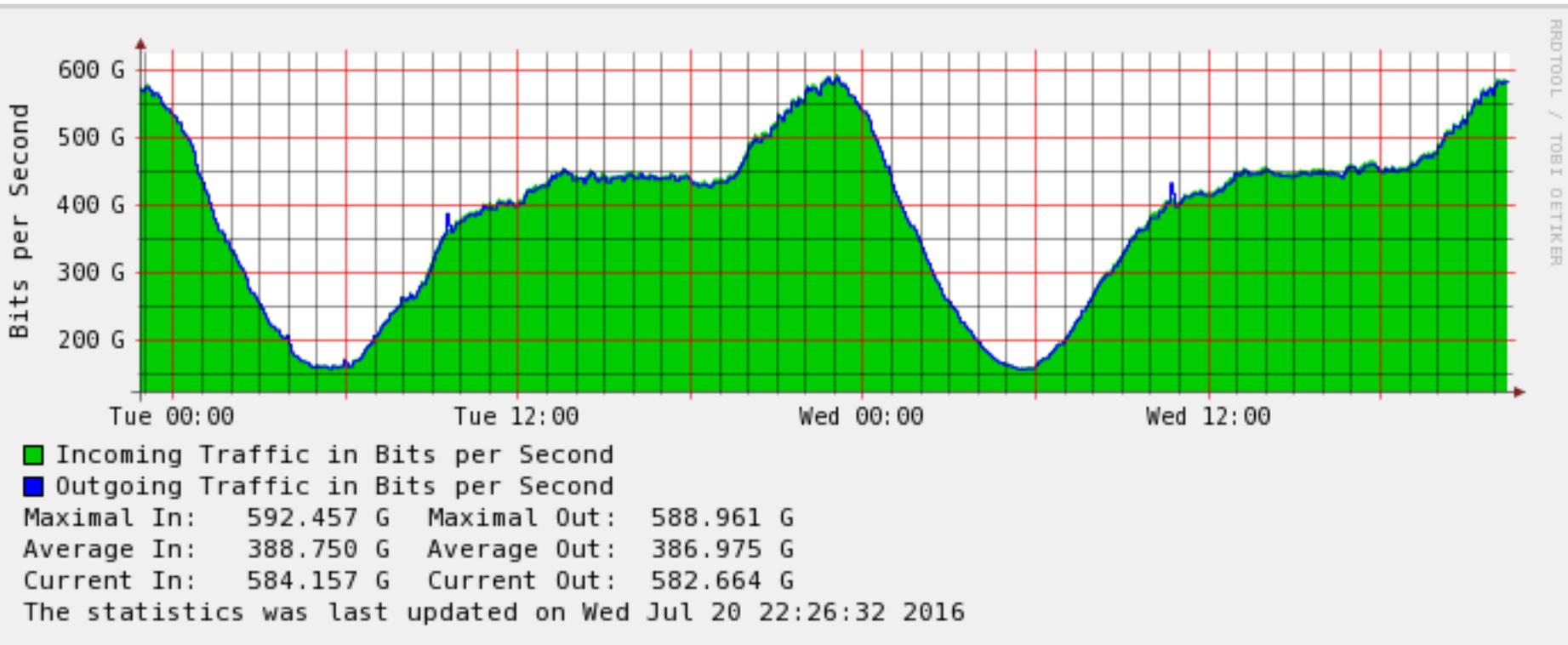
HKIX Today



- Supports both MLPA (Multilateral Peering) and BLPA (Bilateral Peering) over layer 2
- Supports IPv4/IPv6 dual-stack
- More and more non-HK participants
- ~240 autonomous systems connected
- ~460 connections in total
 - ~250 10GE & ~210 GE
- 600+Gbps (5-min) total traffic at peak
- Annual Traffic Growth = 30+%

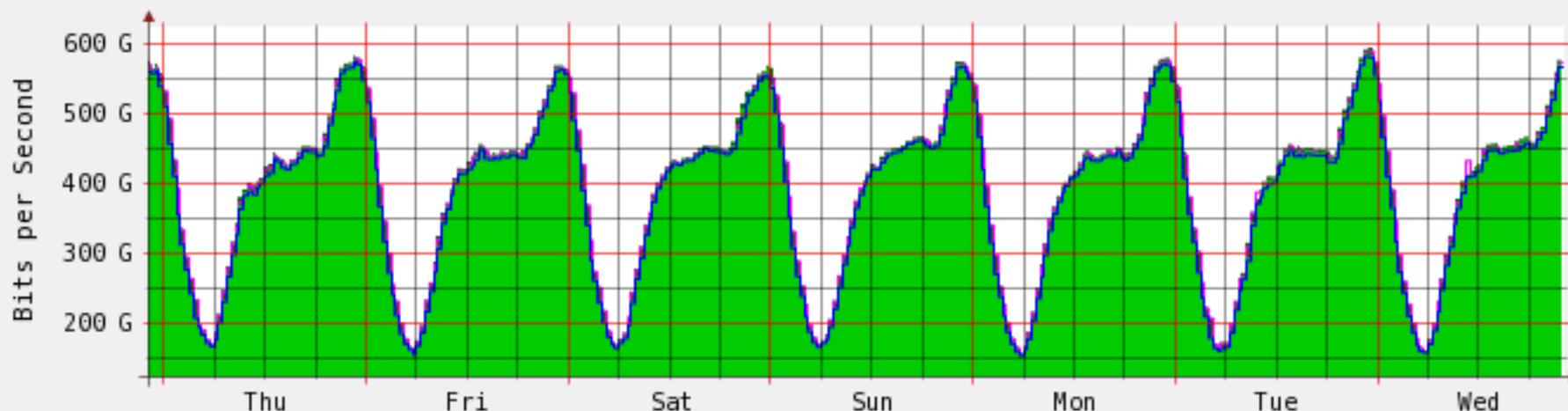


Daily Traffic Statistics





Weekly Traffic Statistics



■ Maximal 5 Minute Incoming Traffic

■ Maximal 5 Minute Outgoing Traffic

■ Incoming Traffic in Bits per Second

■ Outgoing Traffic in Bits per Second

Maximal In: 592.457 G Maximal Out: 588.961 G

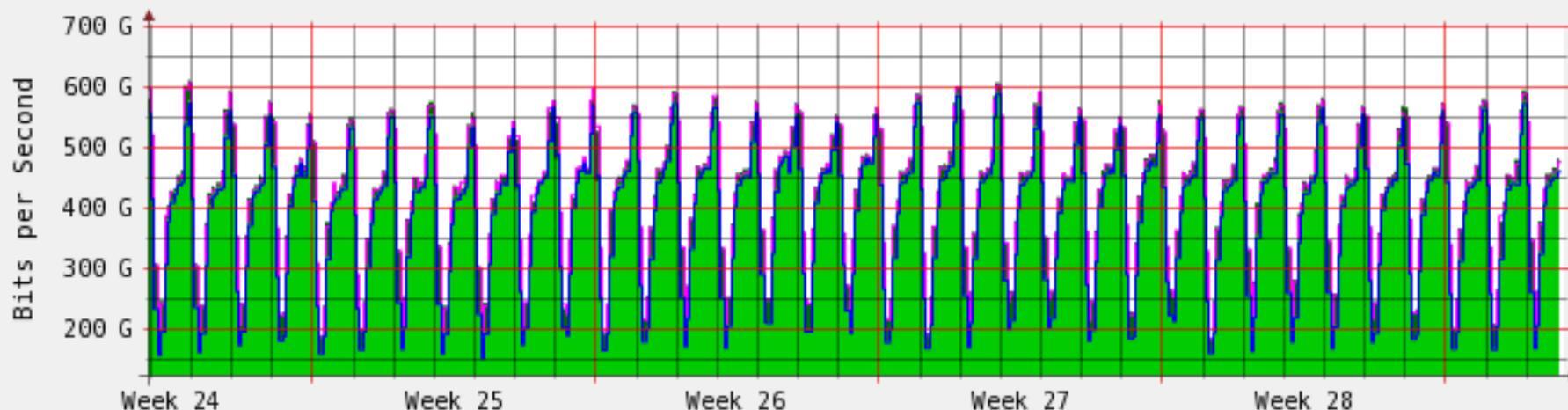
Average In: 388.209 G Average Out: 386.954 G

Current In: 569.591 G Current Out: 566.619 G

The statistics was last updated on Wed Jul 20 22:01:31 2016



Monthly Traffic Statistics



■ Maximal 5 Minute Incoming Traffic

■ Maximal 5 Minute Outgoing Traffic

■ Incoming Traffic in Bits per Second

■ Outgoing Traffic in Bits per Second

Maximal In: 608.819 G Maximal Out: 606.889 G

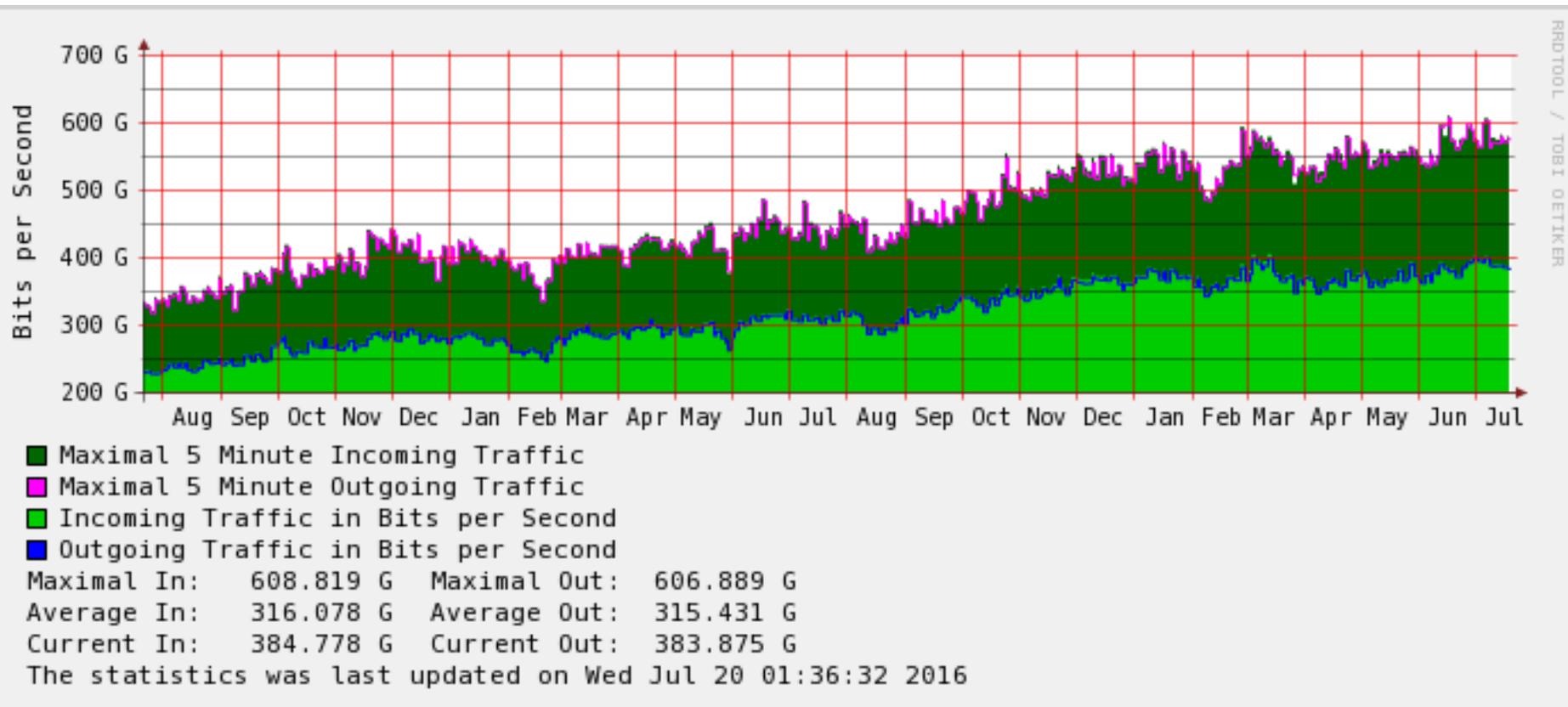
Average In: 387.375 G Average Out: 386.843 G

Current In: 462.577 G Current Out: 460.099 G

The statistics was last updated on Wed Jul 20 21:56:32 2016



Yearly Traffic Statistics





Charging Model



- An **evolution** from free-of-charge model adopted at the very beginning, to penalty-based charging model based on traffic volume for curbing abuse, to now simple port charge model for fairness and sustainability
- **Have started simple port charge model since 01 Jan 2013**
- Still not for profit
 - HKIX Ltd (100% owned by CUHK) to sign agreement with participants
 - Target for fully self-sustained operations for long-term sustainability



HKIX Charge Table (v1.3)

Standard Port Charges						NRC		MRC	
Port	Interface	Standard Interface	Availability			HKD	USD	HKD	USD
			HKIX1	HKIX1b	Satellite Sites				
GE	T	Yes	Yes			Waived		936	120
	SX	Yes			Yes				
	LX/LH	Yes		Yes	Yes				
	EX	No		Yes		9,360	1,200		
	ZX	No		Yes		15,600	2,000		
10GE	SR	Yes			Yes	10,140	1,300	7,800	1,000
	LR	Yes	Yes	Yes	Yes	17,940	2,300		
	ER	No	Yes	Yes		39,000	5,000		
	ZR	No	Yes	Yes		62,400	8,000		
100GE	LR4	Yes	Yes	Yes	Some	78,000	10,000	31,200	4,000
	ER4-Lite	No	Yes	Yes		312,000	40,000		

- <http://www.hkix.net/hkix/Charge/ChargeTable.htm>



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
- Intend to create win-win situation with satellite site collaborators
- To be named HKIX2/3/4/5/6/etc
 - HKIX2 already confirmed - being migrated from old architecture to new architecture
- *HKIX1 and HKIX1b (the two HKIX core sites **located within CUHK Campus**) will continue to serve participants directly*



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 – Member of IILG



- Considered as Critical Internet Infrastructure in HK
- Internet Infrastructure Liaison Group (IILG)
 - Coordinated by OGCIO of HKSARG
 - Members
 - OGCIO
 - OFCA
 - Hong Kong Police
 - HK Computer Emergency Response Team (HKCERT)
 - Major Carriers / ISPs
 - HKIRC
 - **HKIX**



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 HKIX prosper, and to maintain Hong Kong as an Asian internet hub**
- **Many thanks to HKSAR Government for providing one-off funding for capital expenses of network equipment upgrade in 2013-14**



Thank You!