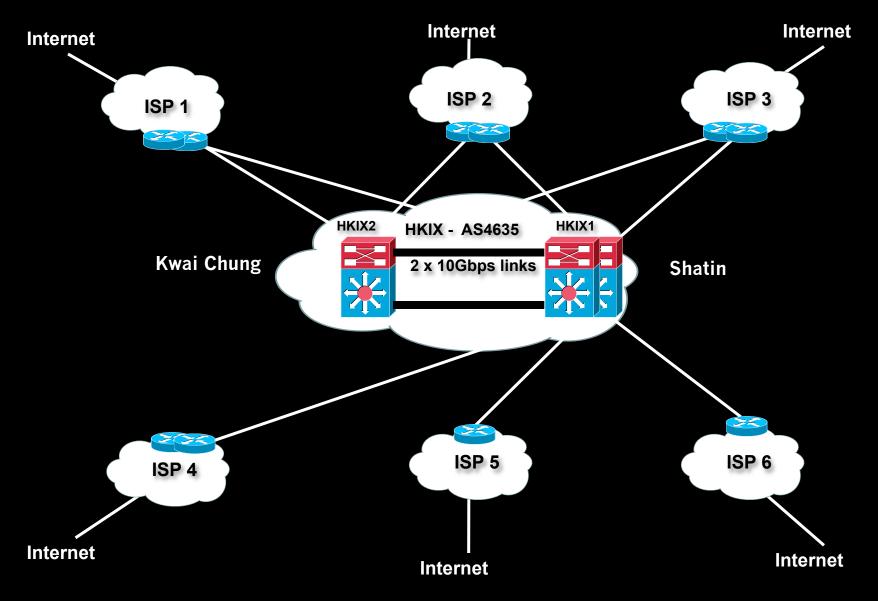# Hong Kong Internet Exchange (HKIX)
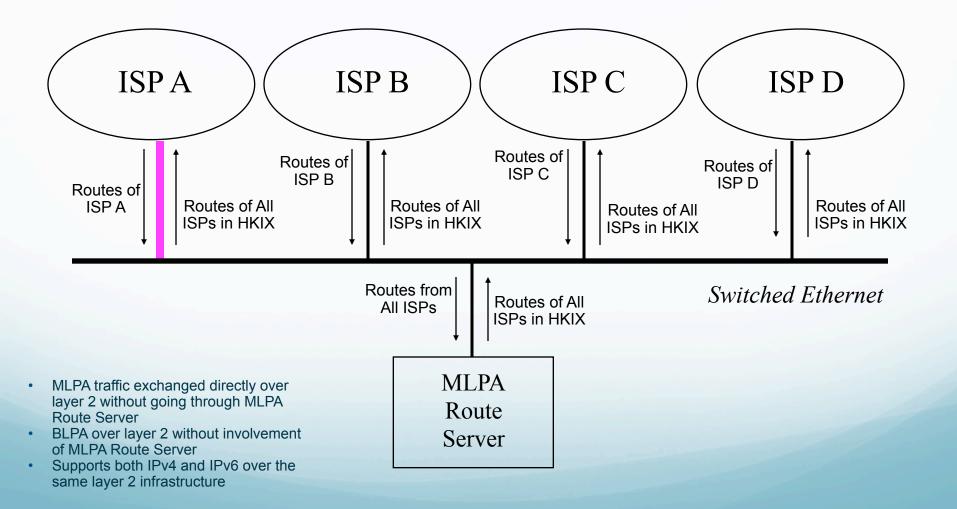
http://www.hkix.net/

What is HKIX?

- HKIX is a public Internet Exchange Point (IXP) in Hong Kong

- HKIX is the main Interconnection point in HK where ISPs in HK can interconnect with one another and exchange inter-ISP traffic
  - Not for connecting to the whole Internet

- HKIX was a project initiated by ITSC and supported by CUHK in Apr 1995 as a community service
  - Still fully supported and operated by CUHK

Current HKIX Infrastructure

HKIX Model — MLPA over Layer 2
(with BLPA support)

ISP A   ISP B   ISP C   ISP D

Routes of ISP A

Routes of All ISPs in HKIX

Routes of ISP B

Routes of All ISPs in HKIX

Routes of ISP C

Routes of All ISPs in HKIX

Routes of ISP D

Routes of All ISPs in HKIX

Routes from All ISPs

Routes of All ISPs in HKIX

Switched Ethernet

MLPA Route Server

- 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

HKIX1 at ITSC of CUHK

ITSC of CUHK

HKIX Brief History

- **Sep 1991:** CUHK set up the 1st Internet link in HK to NASA Ames in US

- **Jul 1992:** The HK Academic & Research Network (HARNET) IP-based Backbone was set up and JUCC/HARNET took over the management of the Internet link

- **Late 1993:** 2 commercial ISPs (HK Supernet and HKIGS) were set up with their own links to US

- **1994:** More ISPs were set up; ITSC of CUHK saw the needs of setting up a local exchange point and started negotiating with individual ISPs

- **April 1995: ISPs started connecting to CUHK and HKIX was established**

- **2004:** Started supporting IPv6 and 10GE for traffic exchange and established a secondary site of HKIX (i.e. HKIX2)

- **2006:** International Network Services Providers and R&E networks were allowed to connect without telecom license

- **Present:** Ranked #15 in the World on Wikipedia according to traffic volume; Ranked #2 in Asia Pacific

HKIX Policies for Joining

- **Membership requirements:**
  - Local ISPs with proper licenses (PNETS or FTNS)
    - Or, Research & Education Networks
    - Or, International Network Services Providers
      - Must warrant not to conduct ISP business in Hong Kong (otherwise they need to have PNETS license)
  - Have global Internet connectivity independent of HKIX facilities
  - Provide its own local circuit to HKIX
  - Must agree to do MLPA for Hong Kong routes

HKIX2

- Announced on 25 Nov 2004

- HKIX2 site in Kwai Chung as redundant site of HKIX
  - Moved from Admiralty in May/Jun 2012

- Linked up to HKIX1 by 2 x 10GE links

- IX portion managed by ITSC of CUHK

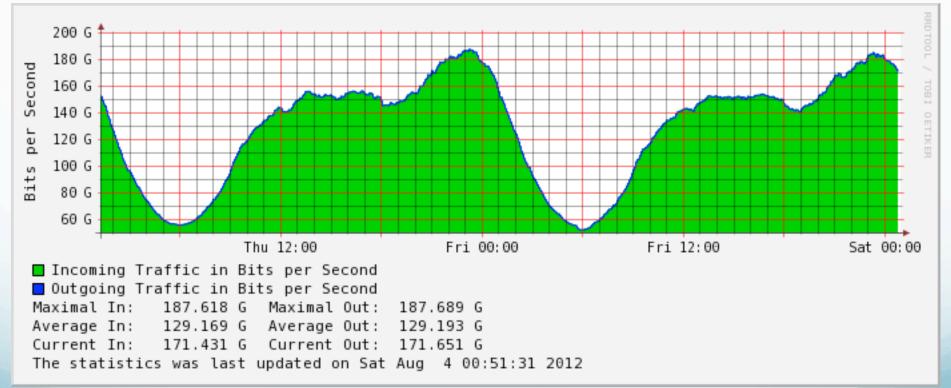- Same policies same charging model as HKIX

Current Charging Model

- An evolution from the free-of-charge model adopted at the very beginning
- HKIX provides two GE ports at each HKIX site for each member free of charge as Basic Setup
    - No formal agreement is needed for Basic Setup
- Requesting for 10GE ports or additional GE ports involves formal agreement
    - If port utilization is lower than 50%, there will be charges
        - If higher, no charges
        - This is to curb abuse
- Co-location service is chargeable
- Not for profit
    - HKIX Ltd (100% owned by CUHK) to sign agreement with participants
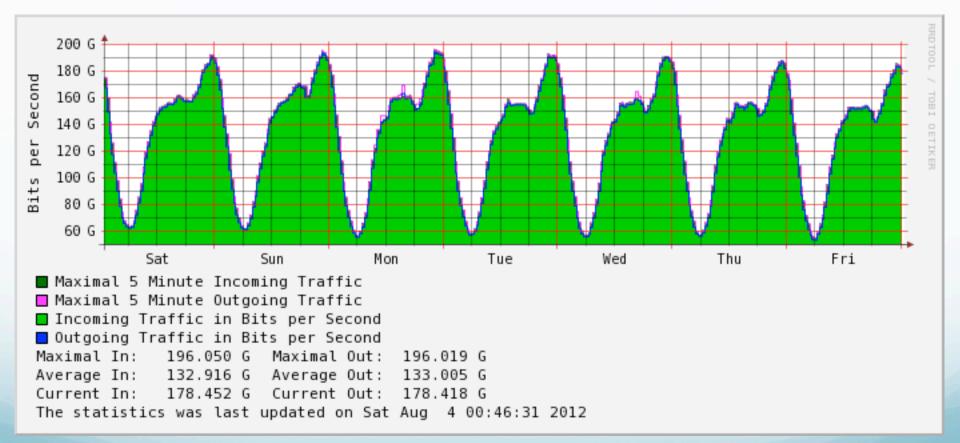   - Target for self-sustained operations

Connection Updates

- **> 220 Gbps (5-min) traffic at peak**
- **> 170 AS'es connected**
- **> 50 x 10GE connections**
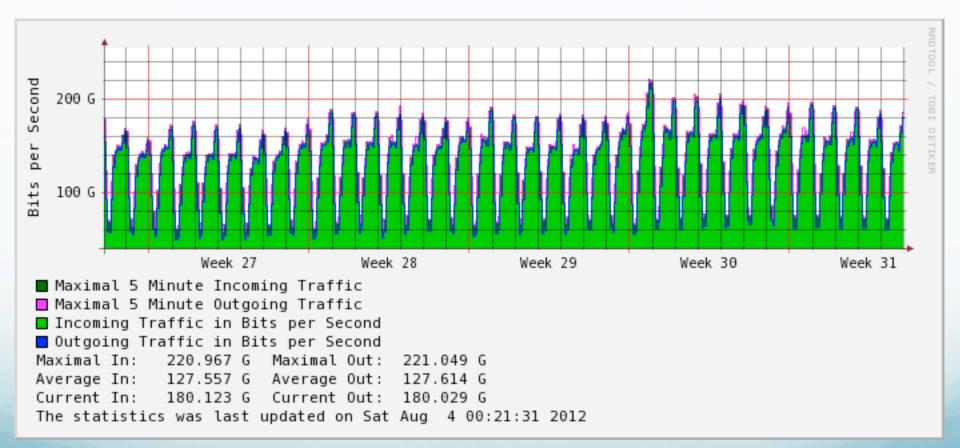- **> 250 x 10ME/100ME/GE connections**

Some Statistics - Daily

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

Maximal In:	187.618 G	Maximal Out:	187.689 G
Average In:	129.169 G	Average Out:	129.193 G
Current In:	171.431 G	Current Out:	171.651 G

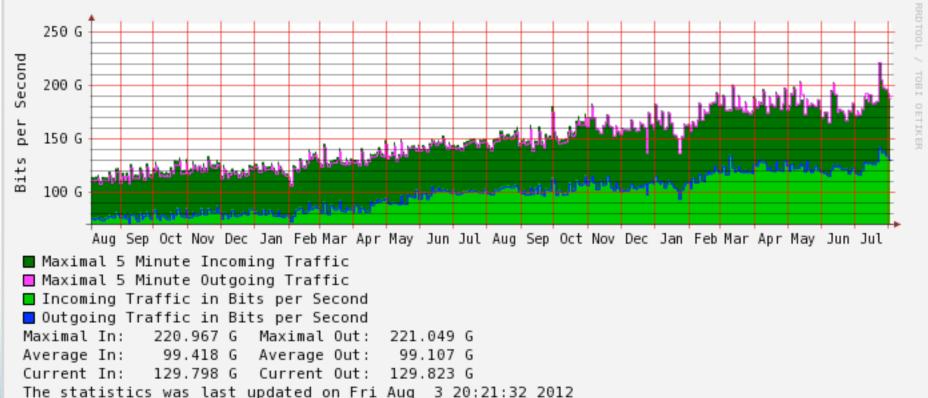The statistics was last updated on Sat Aug 4 00:51:31 2012
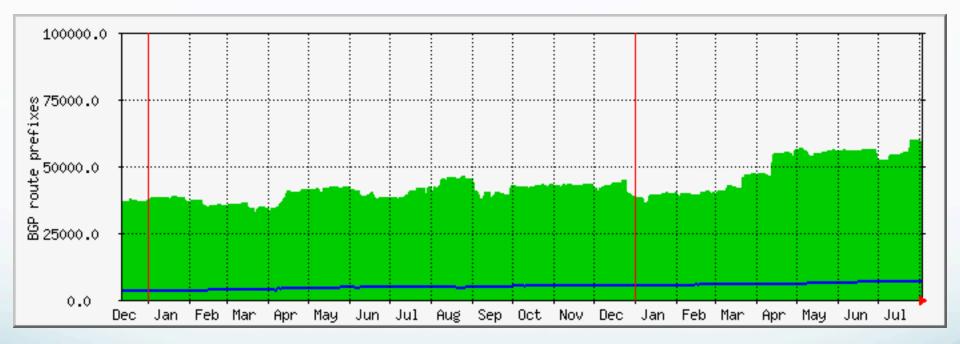
Some Statistics - Weekly

Some Statistics - Monthly

Some Statistics - Yearly

Some Statistics - Number of Routes on MLPA

HKIX Members - PNETS/FTNS Licensees

HKIX Members – Miscellaneous

FTNS Operators at HKIX
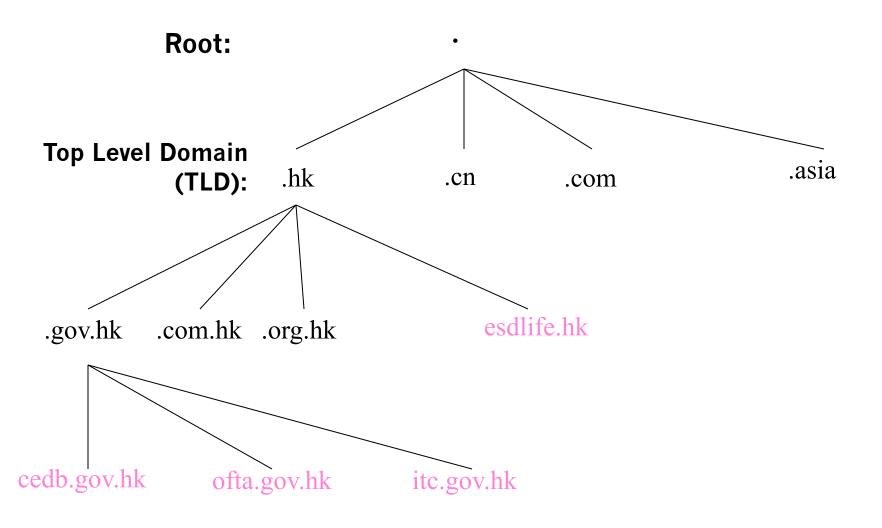
HKIX Members – Beyond Asia

Help Keep Intra-Asia Traffic within Asia

- We have members from Mainland China, Taiwan, Korea, Japan, Singapore, Malaysia, Thailand, Indonesia, Philippines, India, Bhutan, Qatar and other Asian countries

- We have more non-Hong Kong routes than Hong Kong routes

- So, 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

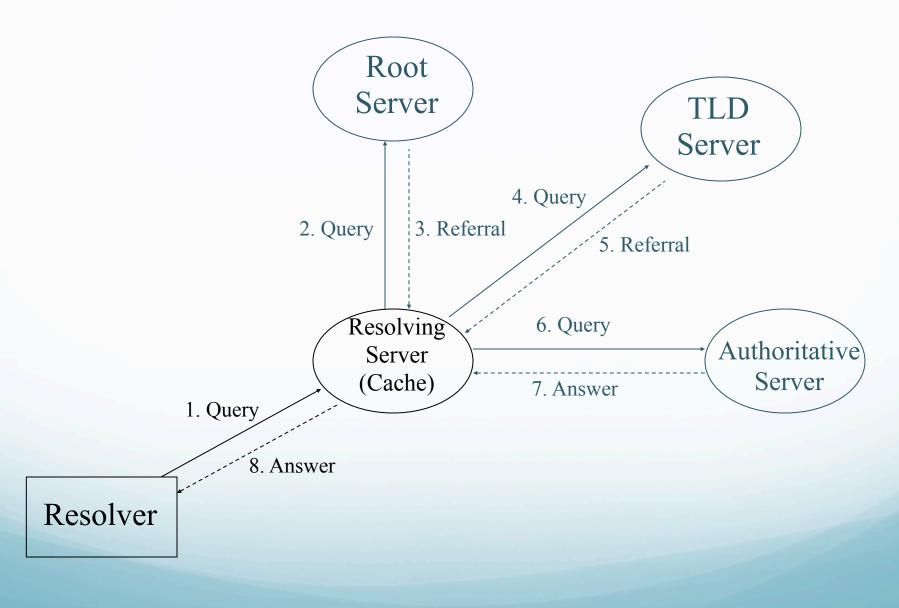- HKIX helps HK be ahead of Singapore in terms of Internet hub in Asia

HKIX – Member of IILG

- Considered as Critical Internet Infrastructure in HK

- Internet Infrastructure Liaison Group (IILG)
  - Coordinated by OGCIO of HKSARG
  - Members
    - OGCIO
    - OFTA
    - Hong Kong Police
    - HK Computer Emergency Response Team (HKCERT)
    - Major FTNS operators / ISPs
    - HKIRC
    - **HKIX**

Domain Name (DNS) Hierarchy

Root: .

Top Level Domain (TLD):   .hk   .cn   .com   .asia

.gov.hk   .com.hk   .org.hk   esdlife.hk

cedb.gov.hk   ofta.gov.hk   itc.gov.hk
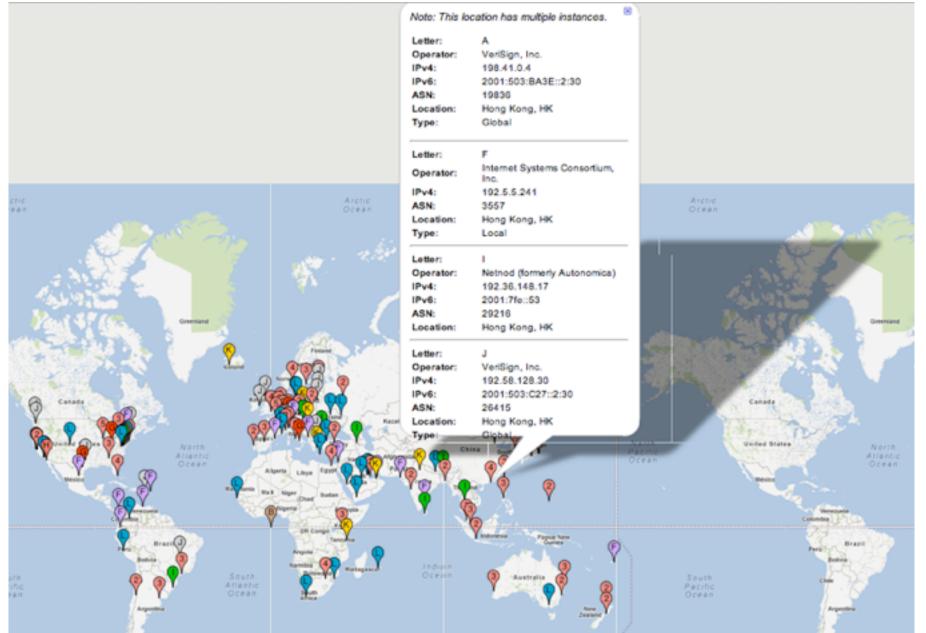
DNS Resolution

DNS Root Servers Co-located at HKIX

Submarine Cable Disaster in Dec 2006

- Due to Earthquake in South of Taiwan (Luzon Strait) on **26 Dec 2006**
- Most cable systems going through Luzon Strait were cut then
- HK was almost isolated from Global Internet
- Restoration was done slowly and gradually
- Cable repair finally complete in late Jan 2007
- Lessons learnt:
  - Cable route diversity must be observed
    - Should not rely totally on cables of East routing which all go through Luzon Strait
    - Should be prepared to pay more for cables of West/North/South routing for better reliability
  - **DNS infrastructure in HK had to be improved**
    - **.com, .net and .org TLD servers could not be found on HKIX MLPA route server**
  - **HKIX (layer 2 part) could be used for acquiring temporary IP transit services during emergency period**

Authoritative TLD Servers in HK

- As important as Root Servers
- Anycast is getting more and more popular at TLD level
- During the disaster, we had Root Servers F & I connected to HKIX so .hk, .mo and .cn are fine
  - .com/.net/.org were half dead even though IP connectivity among HK, Macau and Mainland China was fine
  - Although there was anycast servers in HK serving .org and others, they did not have connectivity to HKIX MLPA so could not help the situation!
- We spend effort to encourage set-up of DNS server instances of major TLDs in Hong Kong with connection to HKIX MLPA (plus BLPA over HKIX) to improve DNS performance for the whole Hong Kong and neighboring economies
- The authoritative servers of the following TLDs are connecting to HKIX directly:
  - .com, .net, .org, .asia, .info, .hk, .mo, .*.tw, .sg, .my and many others

IPv6 at HKIX

- IPv4 address space is really running out
  - APNIC region first
  - http://www.apnic.net/__data/assets/pdf_file/0018/33246/Key-Turning-Point-in-Asia-Pacific-IPv4-Exhaustion_English.pdf

- CUHK/HKIX is committed to help Internet development in HK

- IPv6 supported by HKIX since Mar 2004

- HKIX participates in initiatives to push for IPv6 development in HK together with ISOC-HK, IPv6 Forum HK Chapter and DotAsia

- Today, >60% of HKIX participants have IPv6 enabled
  - Expect more will do so as IPv6 deployment becomes more and more urgent

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

- A successful business model for the liberalization

Our Edges

- Neutrality
  - Treating all partners alike, big or small
  - No settlement for exchange of traffic
  - Accessible to all local FTNS operators
  - ISP / telco / data centre / content provider neutral
- Confidentiality
  - Respect business secrets of every partner
- Not for Profit
  - Still a free service for basic setup
  - Never compete with our partners

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

- Support from HKSARG is needed to make it prosper, and to maintain it as an Asian information hub

- *HKIX is very much like road infrastructure and airport in Hong Kong*

2013 and Beyond?

- A lot of new data centers will be in operations starting 2013

- What will happen to the industry and the market?
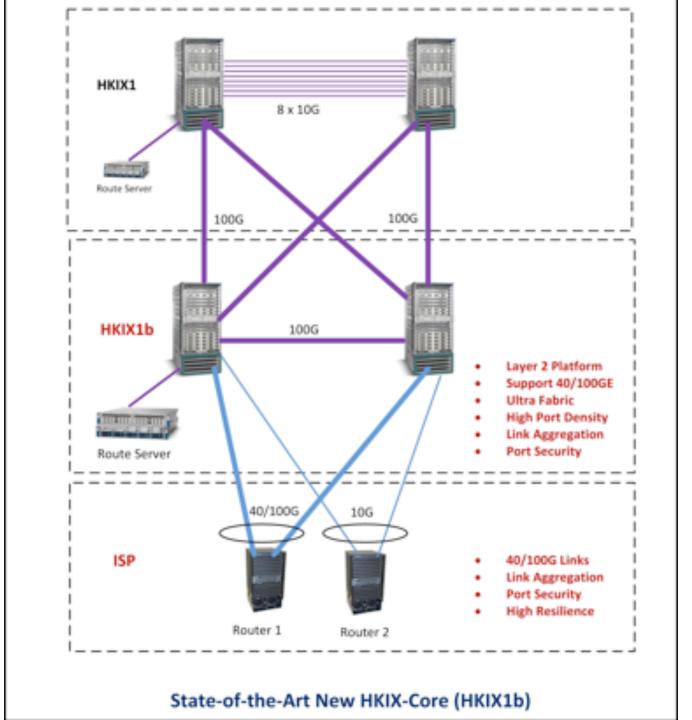
In Need of Continuous Upgrades for HKIX

- Peak total traffic hit 220Gbps level and is growing continuously

- Not many ports left at HKIX1 for new connections
  - Only ~10 10GE ports and ~40 FE/GE ports available
  - ~50 10GE ports and ~230 FE/GE ports are being used to serve >170 participants

- Need to support 40G/100G interfaces soon

- Resilience is becoming a bigger concern to HKIX participants

- **<u>We cannot afford any performance bottleneck</u>**

- **<u>We must cope with the continuous technology changes</u>**

Problems Faced

- Although HKIX is charging for services
  - Current charging model is evolved from original free model
  - Income can cover Operating Expenses mainly
    - Including manpower

- HKIX needs to spend **Capital Expenses** to upgrade the core equipment <u>from time to time</u>
  - Which is getting more and more expensive because the equipment is high-end high-speed equipment and high availability is important

- <u>**The current income level cannot cover such level of Capital Expenses needed which are growing continuously**</u>

The Plan

- Establish **Dual Core** within CUHK <u>in 2013</u> taking advantage of new data center
  - HKIX1 + HKIX1b
  - Provide site resilience, chassis resilience in addition to card resilience
  - Support 40G/100G connections
- Government to provide one-off funding for capital expenses of network equipment at HKIX1b
- In order to ensure self-sustained operations, will gradually change to simple port charge model starting 2013
- *Possible Long-Term Plan*
  - *HKIX2, HKIX3, HKIX4, HKIX5 and so on at major commercial data centers as satellite sites for ease of connections*

HKIX1

8 x 10G

Route Server

100G   100G

HKIX1b

100G

Route Server

- Layer 2 Platform
- Support 40/100GE
- Ultra Fabric
- High Port Density
- Link Aggregation
- Port Security

ISP

40/100G   10G

Router 1   Router 2

- 40/100G Links
- Link Aggregation
- Port Security
- High Resilience

State-of-the-Art New HKIX-Core (HKIX1b)

Questions?