



HKIX Upgrade Plan in 2013

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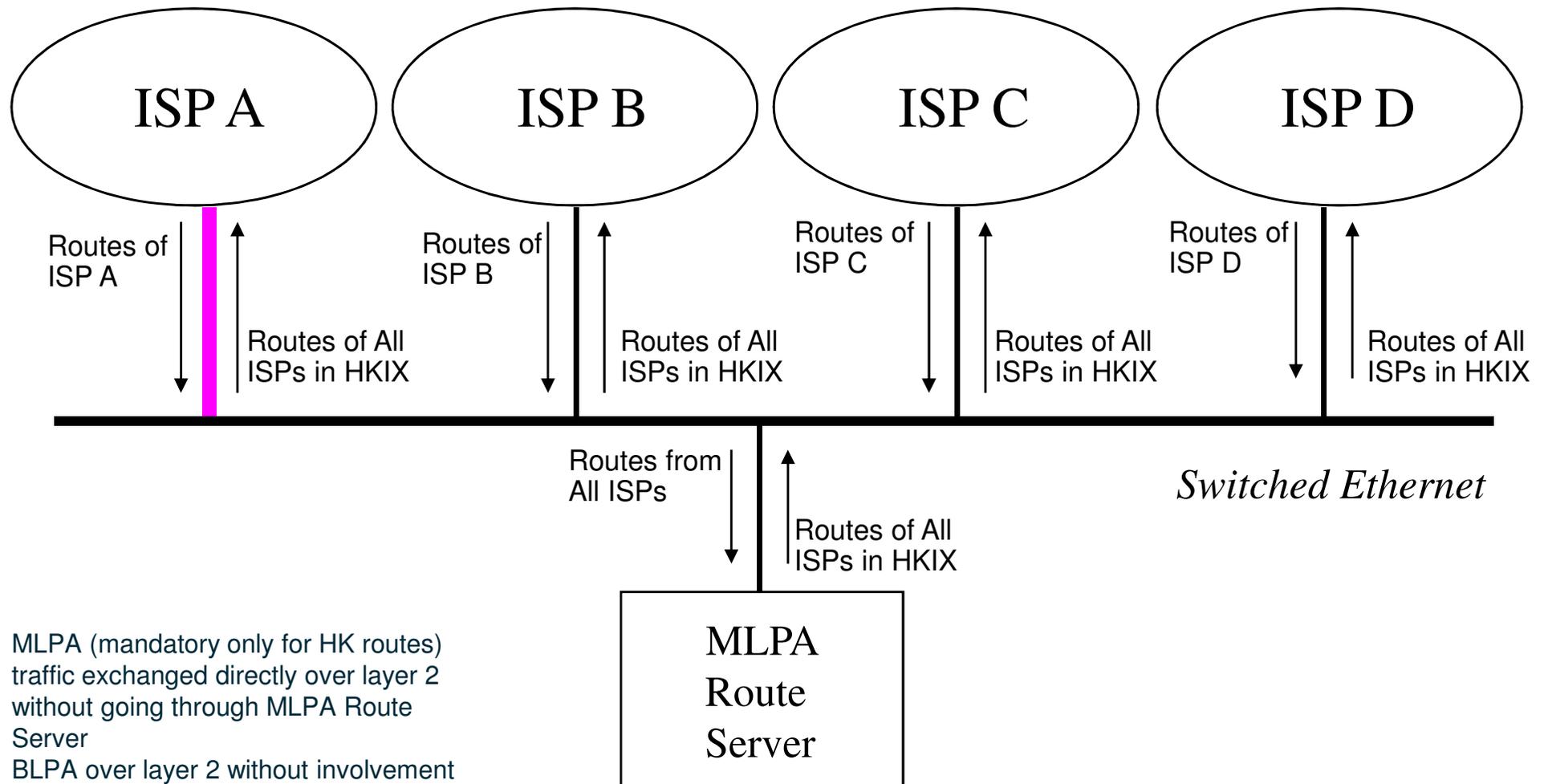
What is HKIX?



- 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 of CUHK 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**



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



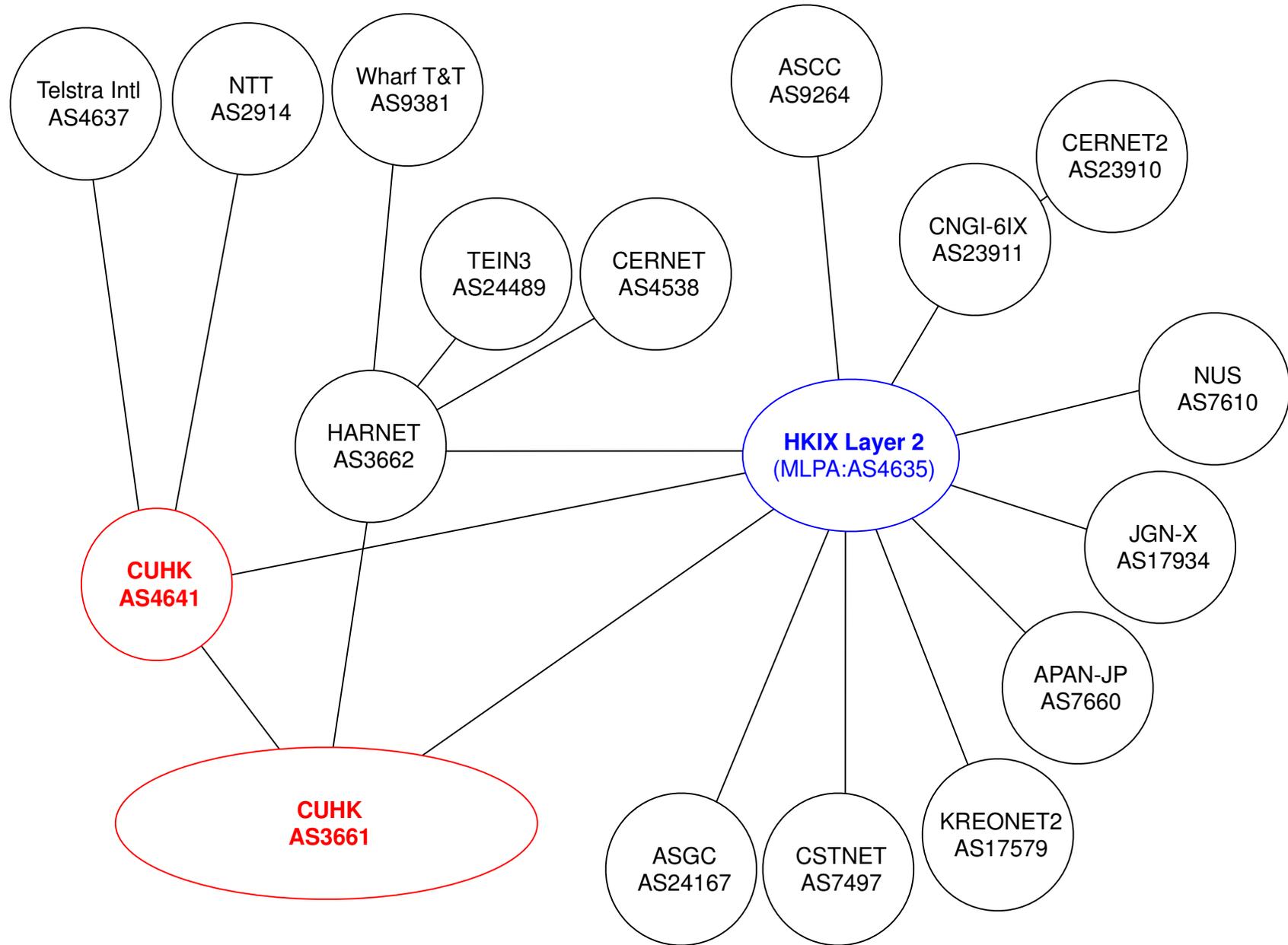
HKIX Brief History



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



Network Interconnections **HKIX** at CUHK – IPv4 & IPv6 Dual Stack





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 1 Jan 2013**
 - E/FE/GE – US\$120/port/month (with no one-time charge)
 - 10GE – US\$1,000/port/month (plus one-time charge)
- Co-location service for strategic partners only is chargeable
- 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



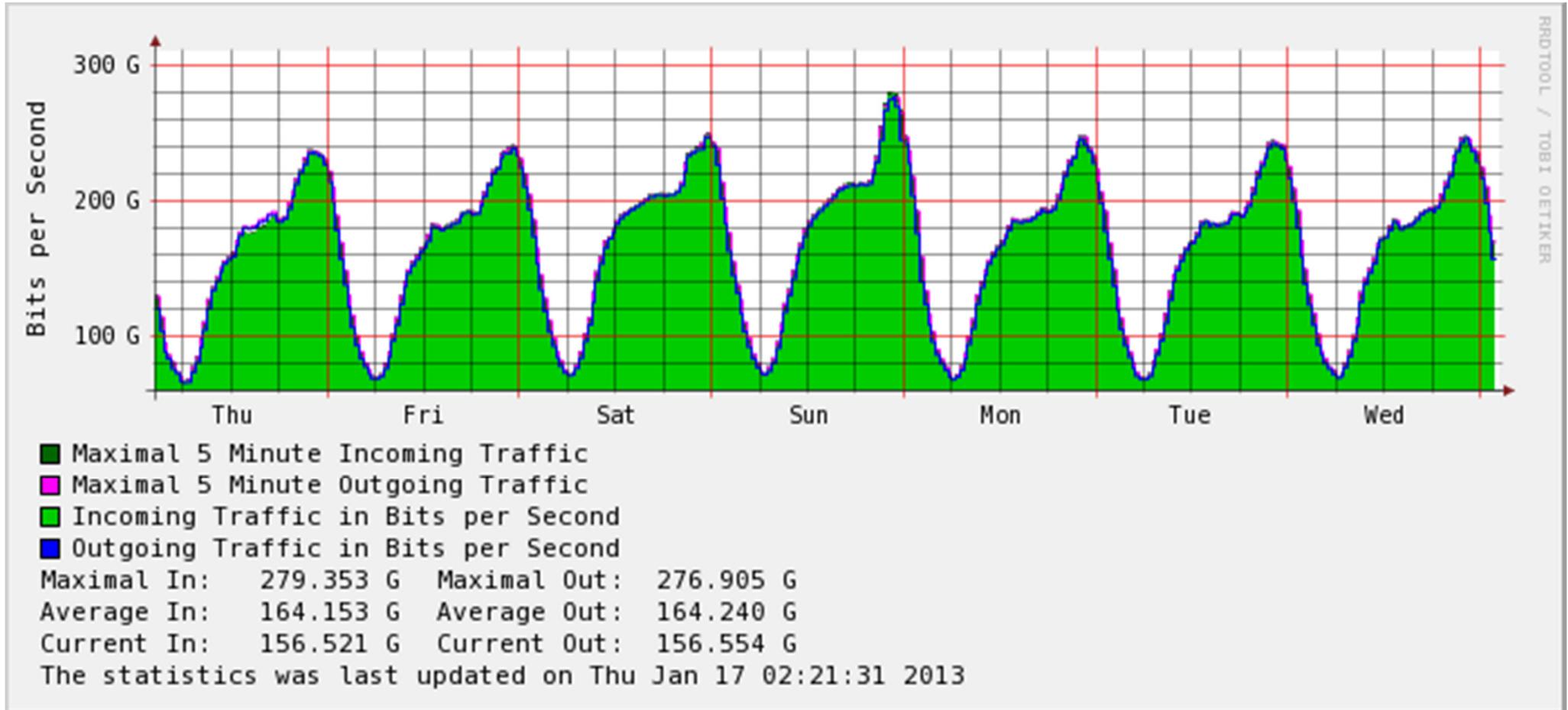
Connection Updates



- **>279 Gbps (5-min) traffic at peak**
- **>190 ASNs connected**
 - **>112 ASNs (>58%) are IPv6 enabled**
- **>65 x 10GE connections**
- **>270 x E/FE/GE connections**
- **Annual Growth = 30% to 40%**

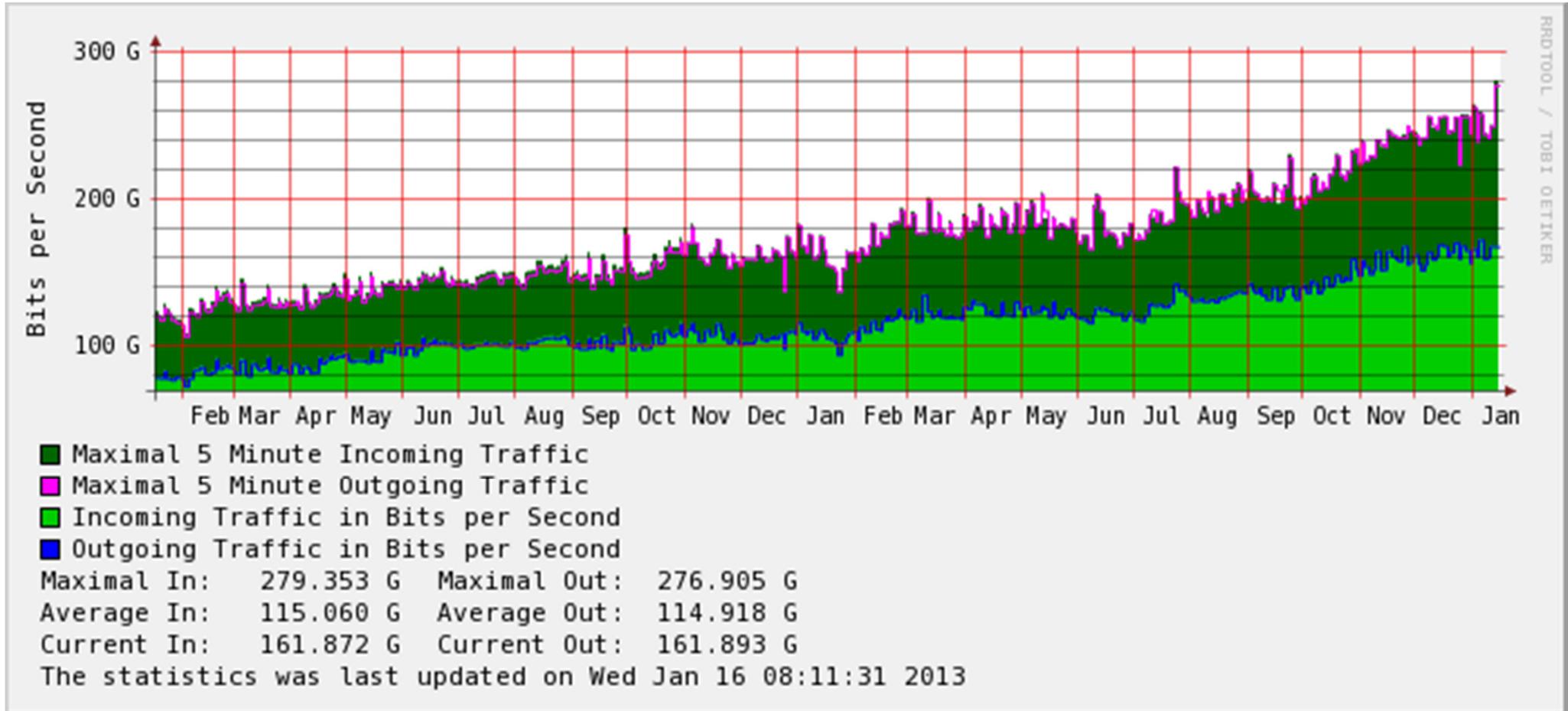


Some Statistics – Weekly Traffic





Some Statistics – Yearly Traffic

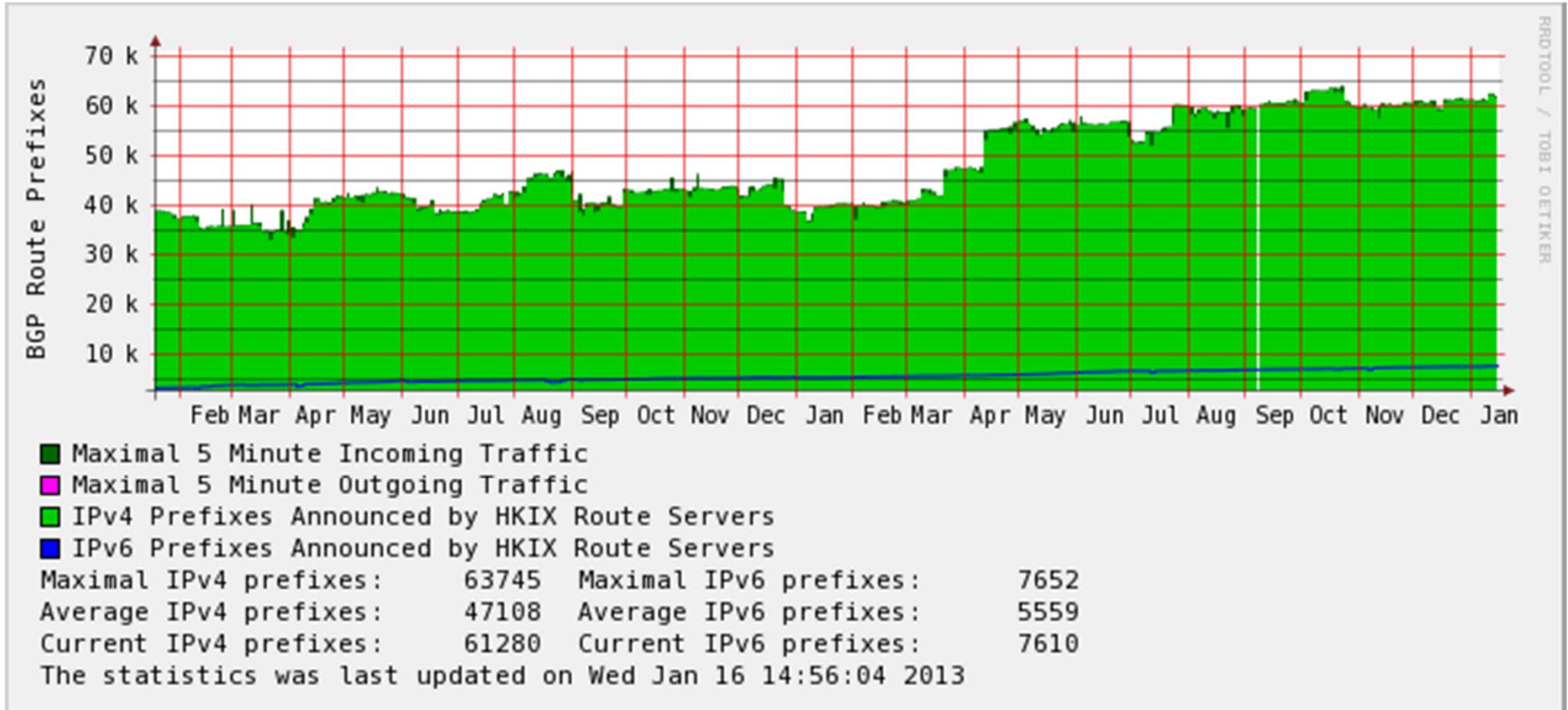


Percentage of IPv6 Traffic via HKIX (1-day Average)





Some Statistics - Number of Routes on MLPA





Local Loop Operators at HKIX





Help Keep Intra-Asia Traffic within Asia



- We have participants from Mainland China, Taiwan, Korea, Japan, Singapore, Malaysia, Thailand, Indonesia, Philippines, India, Bhutan, Qatar and other Asian countries
- We have more non-HK routes than HK routes on our MLPA route servers
 - Even more non-HK routes over BLPA
- 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 Participants – Beyond Asia





Our Advantages



- Neutrality
 - Treating all partners alike, big or small
 - No settlement for exchange of traffic
 - Accessible to all local loop operators
 - Neutral among ISPs / telcos / local loop providers / data centers / content providers / cloud services providers
- Confidentiality
 - 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 to connect
- What will happen to the industry and the market?



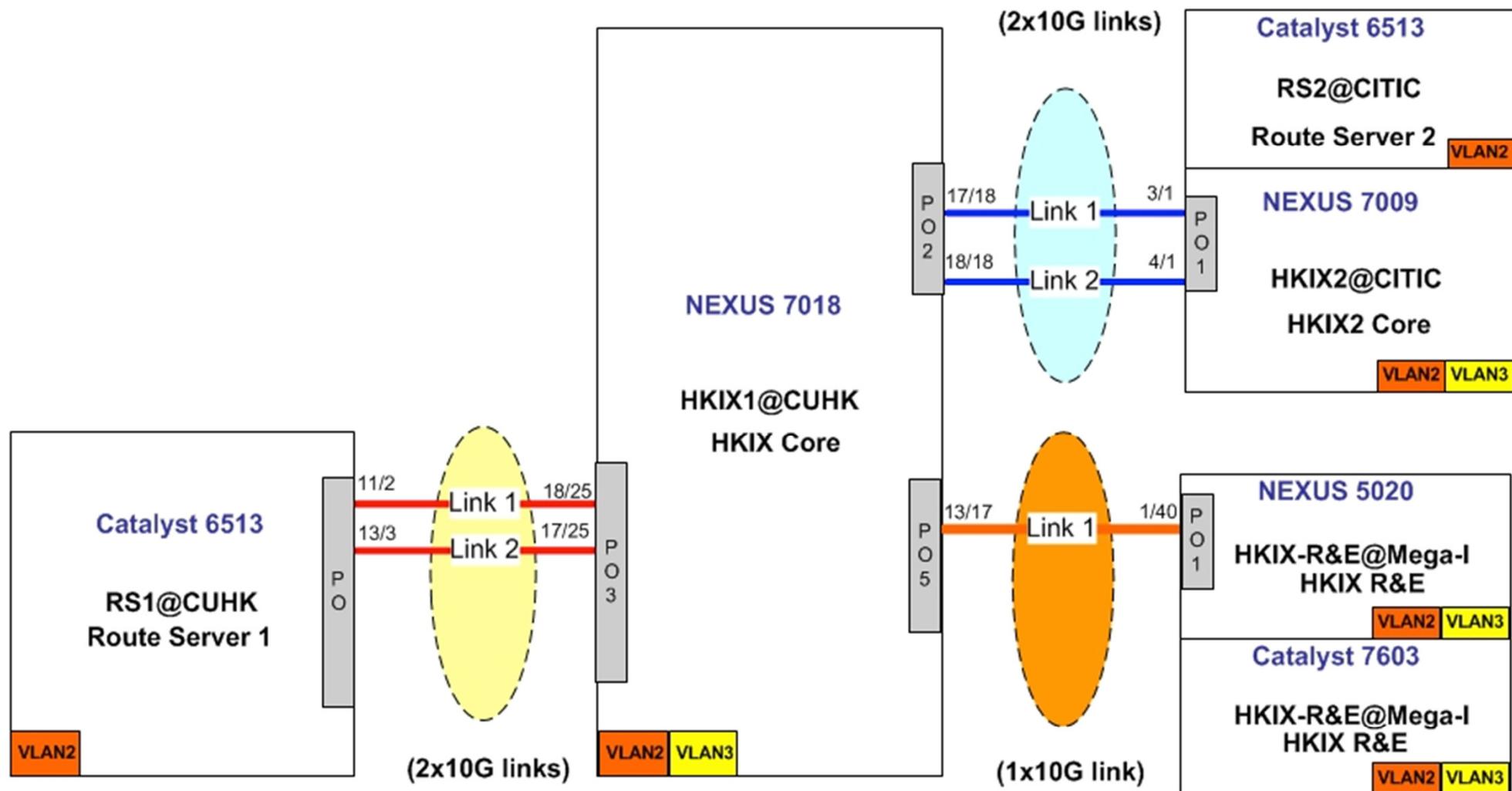
In Need of



Continuous Upgrades for HKIX

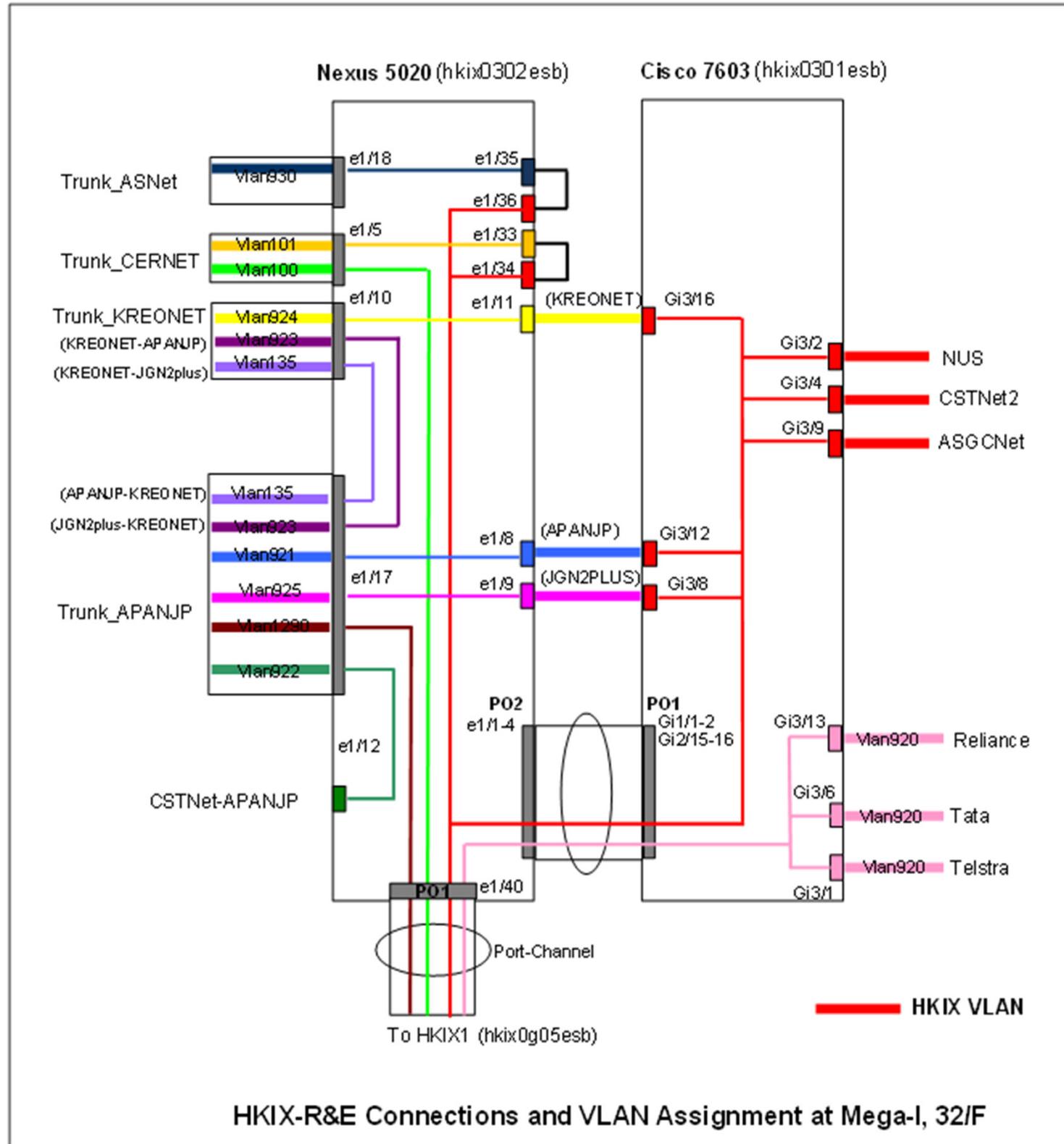
- Peak total traffic hit 280Gbps level and is growing continuously
- Not many ports left at HKIX1 for new connections
- Need to support 40GE/100GE interfaces soon
- Resilience is becoming a bigger concern to HKIX participants
- We cannot afford any performance bottleneck
- We must cope with the continuous technology changes

HKIX Network Diagram (Current)



Customer VLANs

- VLAN2 202.40.161/23
- VLAN3 For Ping Test



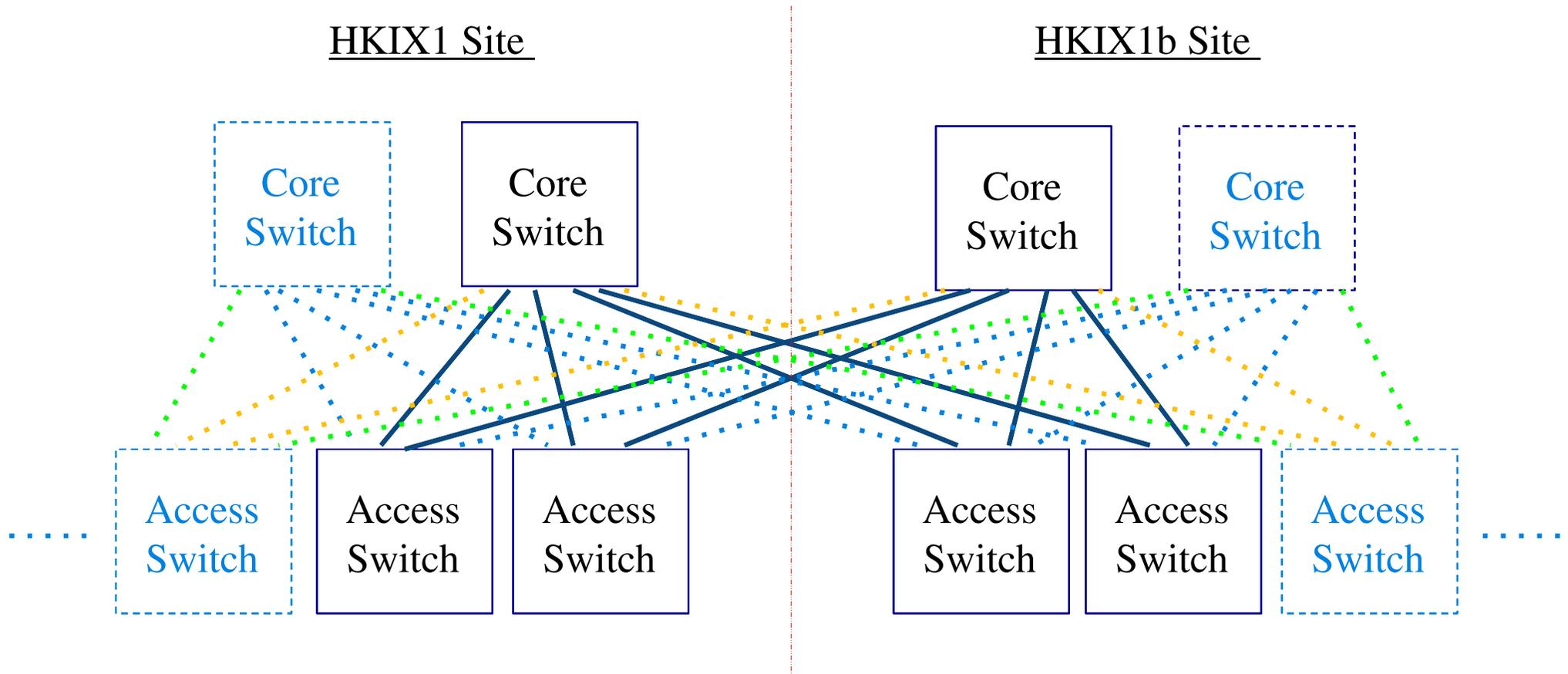


The Plan



- Establish **Dual Core** within CUHK in 2013 taking advantage of the new data center in campus
 - HKIX1 site + HKIX1b site (fiber distance: ~1.5km)
 - Provide site resilience, chassis resilience in addition to card resilience
 - Support 40GE/100GE connections
- Government to provide one-off funding for capital expenses of network equipment for the upgrade in 2013
- In order to ensure fully self-sustained operations in long term, gradually changing to simple port charge model starting Jan 2013
- *Long-Term Plan*
 - *HKIX2, HKIX3, HKIX4, HKIX5 and so on at major commercial data centers as satellite sites for ease of connections*

Possible New HKIX Infrastructure





The Design

- 2-Tier Design for scalability
 - Have to sustain the growth in the next 4+ years (support >2Tbps traffic level)
 - Core Switches at core sites only
 - No interconnections among core switches
 - Access/Edge Switches to serve connections from participants at HKIX1 & HKIX1b
 - Also at satellite sites
 - Little over-subscription between each access/edge switch and the core switches
 - MPLS/VPLS, TRILL or something similar to be used among the switches
 - Load balancing is important
- Card/Chassis/Site Resilience
 - LACP support across chassis???
- 40GE/100GE optics support
 - LR4 for 10km over SMF? 10x10 MSA???
 - ER4???
 - Support of local loop providers is key
- Port Security / L2 ACL is key
 - Over LACP and/or VLAN Trunk?
- Have to control Unknown-Unicast-Flooding traffic better



The Services

- Support R&E networks better
- Limited Colo at new HKIX1b site
 - For strategic partners only
- Special VLANs
 - For private interconnections among any 2 parties
 - One specifically for interconnections among R&E networks
 - Jumbo Frame support



The Migration

- Tendering exercise will be commenced soon
- Target Production Date
 - 4Q2013
- Existing switches will probably connect to the access/edge switches, instead of the core switches, to avoid the possible integration issues
- Migration will be painful and will take years
 - Up to 2 years hopefully



Thank you!