



Hong Kong Internet Exchange (HKIX)

<http://www.hkix.net>

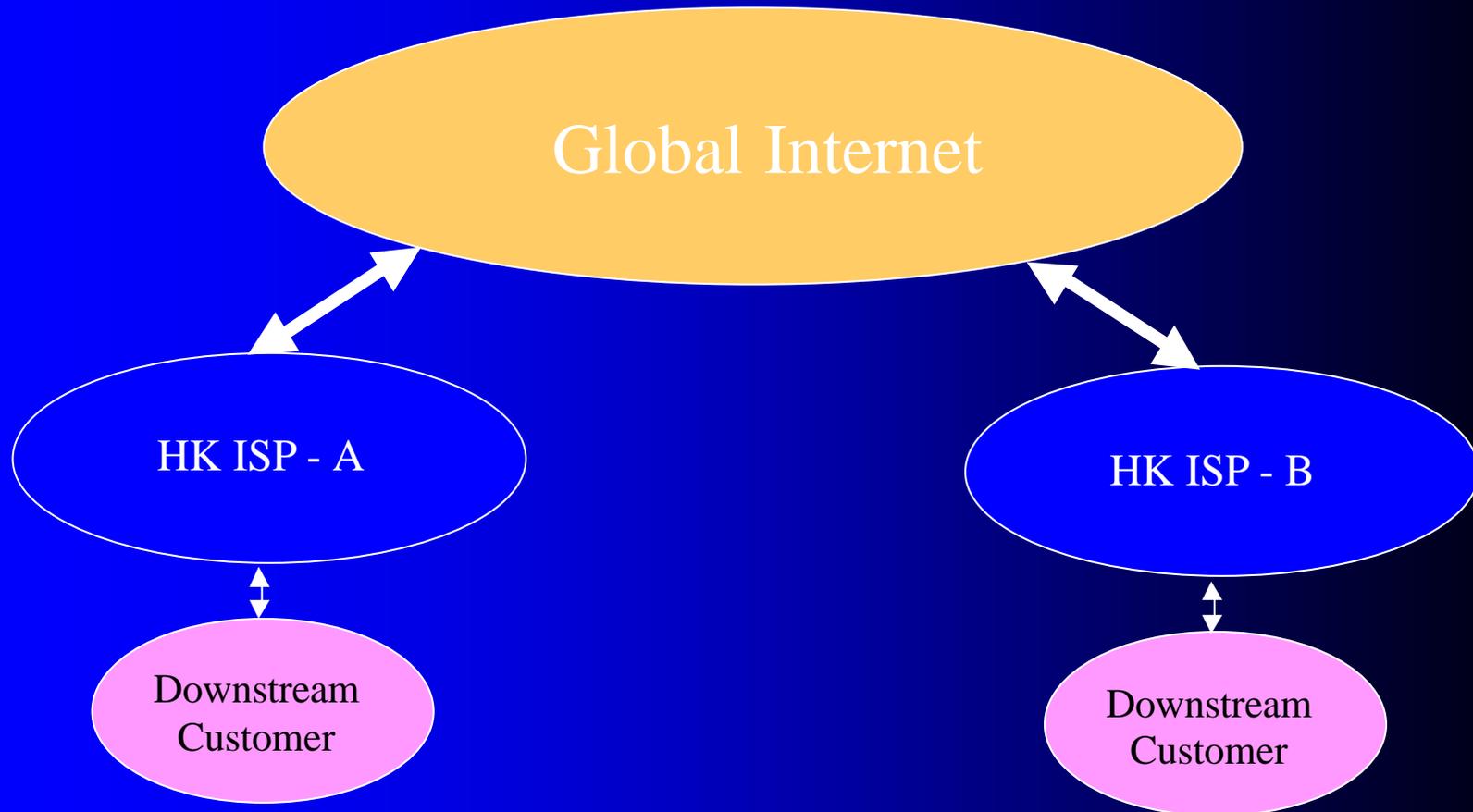
Hong Kong Internet Exchange

- What is HKIX ?
- The Evolution of HKIX
- Present Situation
- Conclude with some forecast

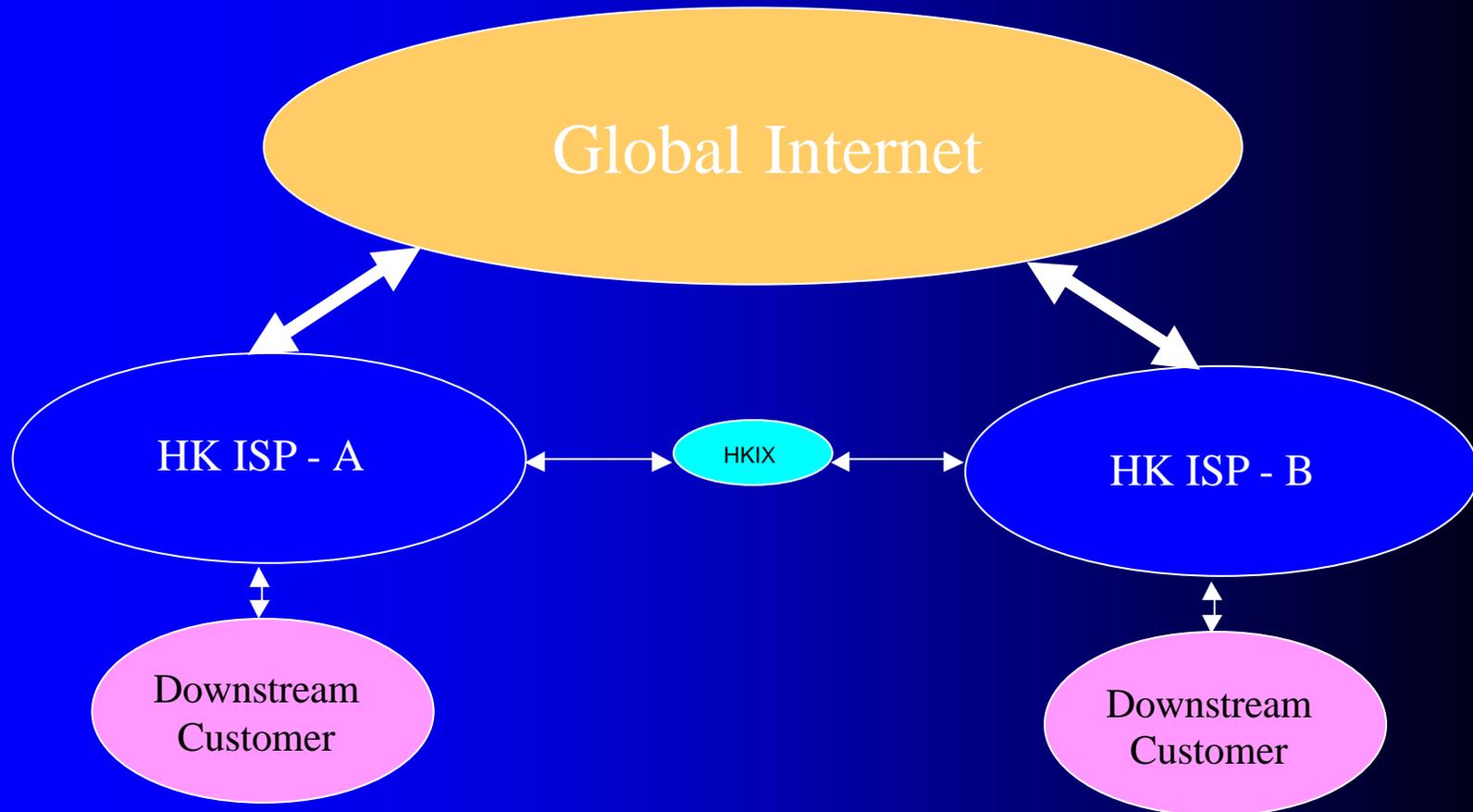
What is HKIX?

- HKIX is the major Internet traffic Exchange Point in HK
- At HKIX inter-ISP traffic can be exchanged
- The concept is similar to the NAP in US
 - MAE-West California operated by WCOM
 - MAE-East Wash. DC operated by WCOM
 - Chicago NAP operated by Ameritech
 - New York NAP operated by Sprint

Without Local Exchange Points



The Role of HKIX



Similar Internet Exchange Set-up

- USA – Major NAPs
 - MAE-West California, MAE-East Wash. DC operated by WCOM
 - Chicago NAP operated by Ameritech
 - New York NAP operated by Sprint
 - Nap of the Americas – operated by Terremark
- China - TerreNAP (Beijing), ShangHai IX (SHIX)
- UK - MaNAP, LINX, LoNAP, ScotIX...
- Japan - JPIX, Media Exchange (TTNet), NSPIXP, NSPIX2, NSPIX3
- Korea - KINX, KIX, KTIX
- Taiwan - TWIX
- Singapore - SingTel IX
- HKSAR – HKIX, Level3, Pilhana

Benefit of HKIX

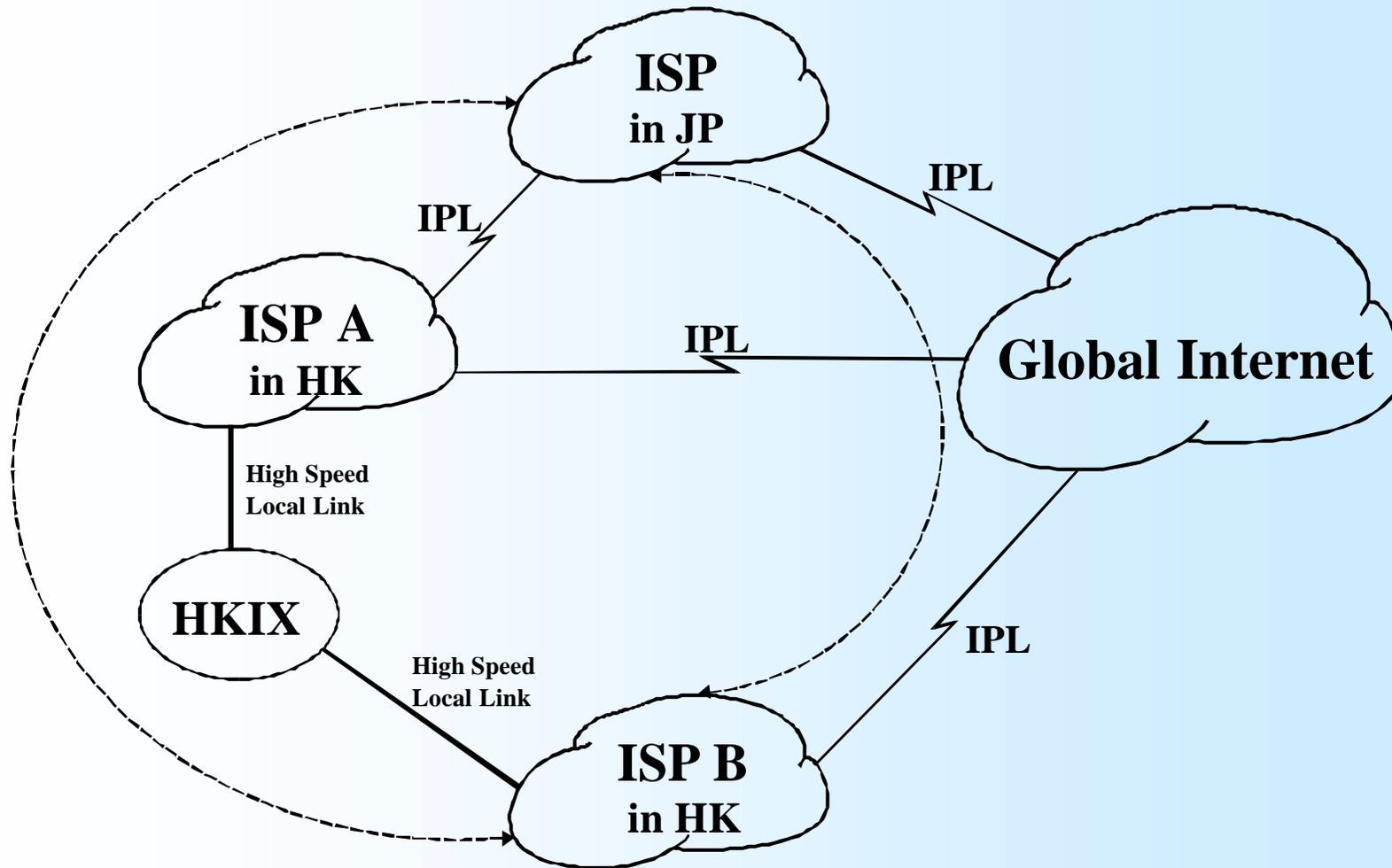
- Internet is still pretty much US-centric, though intra-regional connections or backbones are being set up in Asia Pacific.
- Setting up local Internet exchanges for intra-country or intra-city traffic is very important for faster and healthier Internet development within that country or city.
- It also reduces the loading to the Internet cores.
- HKIX is a short cut mainly for routing of intra-Hongkong traffic providing **faster and less expensive** paths to local sites in its early stage.
- Currently, there is a trend for Large ISPs to use HKIX to exchange Intra-AP Internet traffic.

HKIX: Exchange of Intra-AP Traffic

- Intra-AP backbones / connections being established by many global / regional service providers
- Intra-AP circuits are expensive. To maximize their return on investment for their links to HK, they can allow their clients in other AP countries to communicate with HKIX participants via HKIX. Further on, intra-AP traffic can be exchanged via HKIX.
- Digital Island, AT&T GNS, PSINet, Equant, PCCW & UUNET are doing this for their customers or partners overseas.
- HKIX as Asia hub?

Intra-AP Internet Traffic Via HKIX

Nov 00



Evolution of HKIX - part I

- **Sep 91:** CUHK set up a 64Kbps Internet link to US
- **Early 92:** Other Universities joined
- **Jul 92:** JUCC/HARNET took up the management
- **Late 92:** HARNET T1-Ring Backbone was set up
- **Sep 93:** HARNET-US link upgraded to 128Kbps
- **Late 93:** 2 commercial ISPs (HK Supernet and HKIGS) were set up with their own 64Kbps links to US

Evolution of HKIX - part II

- Late 93: HK Supernet connected to HARNET via UST; No local connections between HKIGS and HARNET/HK Supernet
- Sep 94: HKIGS together with its downstreams connected to HARNET via CUHK using a T1 link; Still no local connections between HKIGS and HK Supernet
- Early 95: More ISPs were set up. CSC/ITSU of CUHK saw the needs of setting up a local exchange point and started negotiating with individual ISPs.
- **April 95: ISPs started to connect to CUHK and HKIX was established.**
- **Nov 01: 81 ISPs connected to HKIX (max. 87)**

Technical Aspects of HKIX- part I

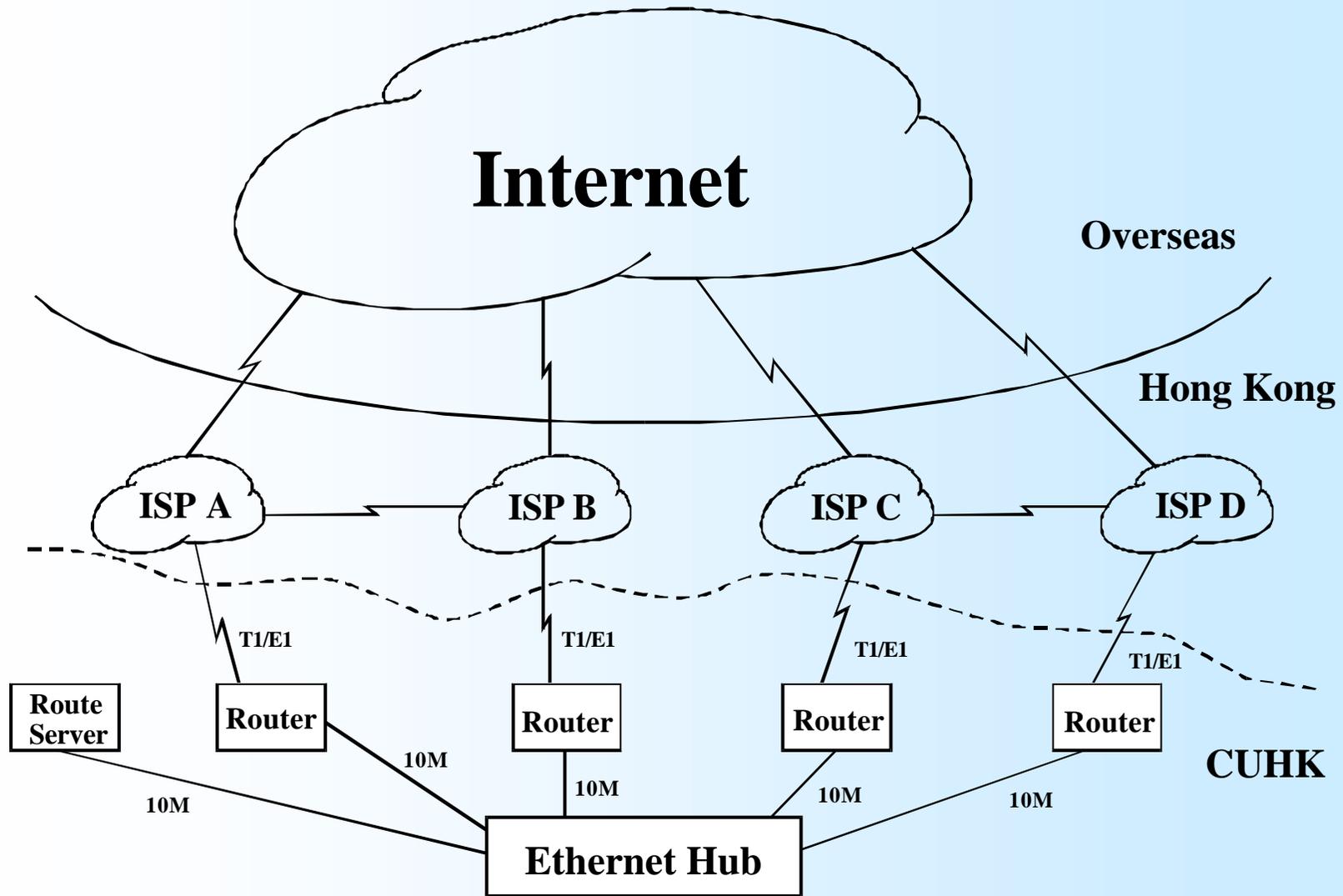
- Provide space (shared racks), electricity, air-conditioning, core equipment and manpower for coordination and operations
- Very much like a Facility Management Center **but provide space for routers only**
- Just an Ethernet segment interconnecting routers of participants initially; Upgraded to **an Ethernet switch in Dec 95**
- Use Border Gateway Protocol 4 (BGP4) for distributing routing information
- A Cisco router is used as a route server / reflector for simplicity of peering
- Routing information distribution controlled by IP network prefix or Origin AS access lists in the route server

Technical Aspects of HKIX- part II

- HKIX does not provide Internet connectivity
- Mandatory Multi-Lateral Peering Agreement (MLPA) for routes within Hong Kong for greatest possible benefits to all
- ITSC manages the route server for MLPA.
- Minimum connection speed to HKIX is T1 (1.5Mbps) starting from July 96

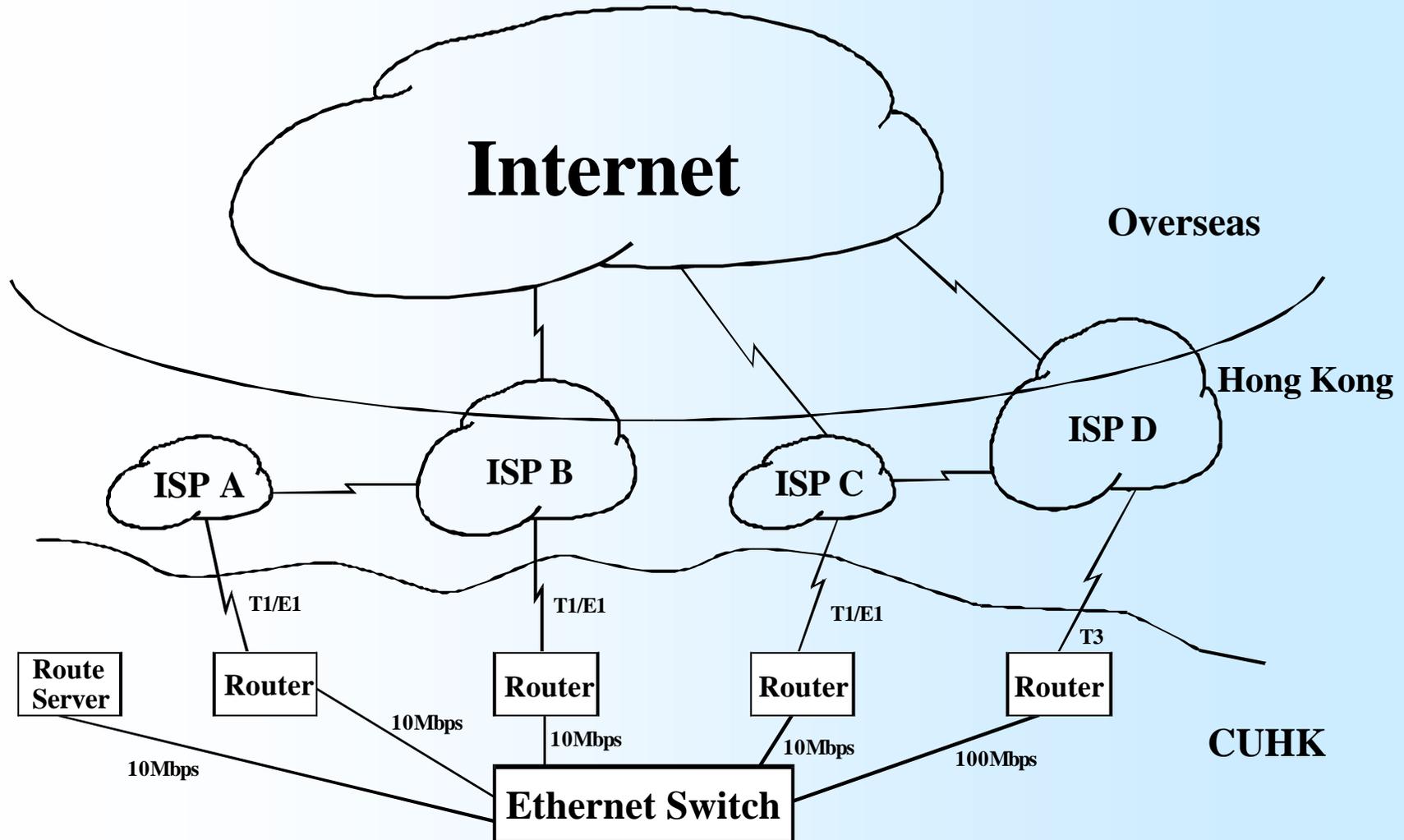
Schematic Diagram of HKIX (Phase I)

Apr. 95



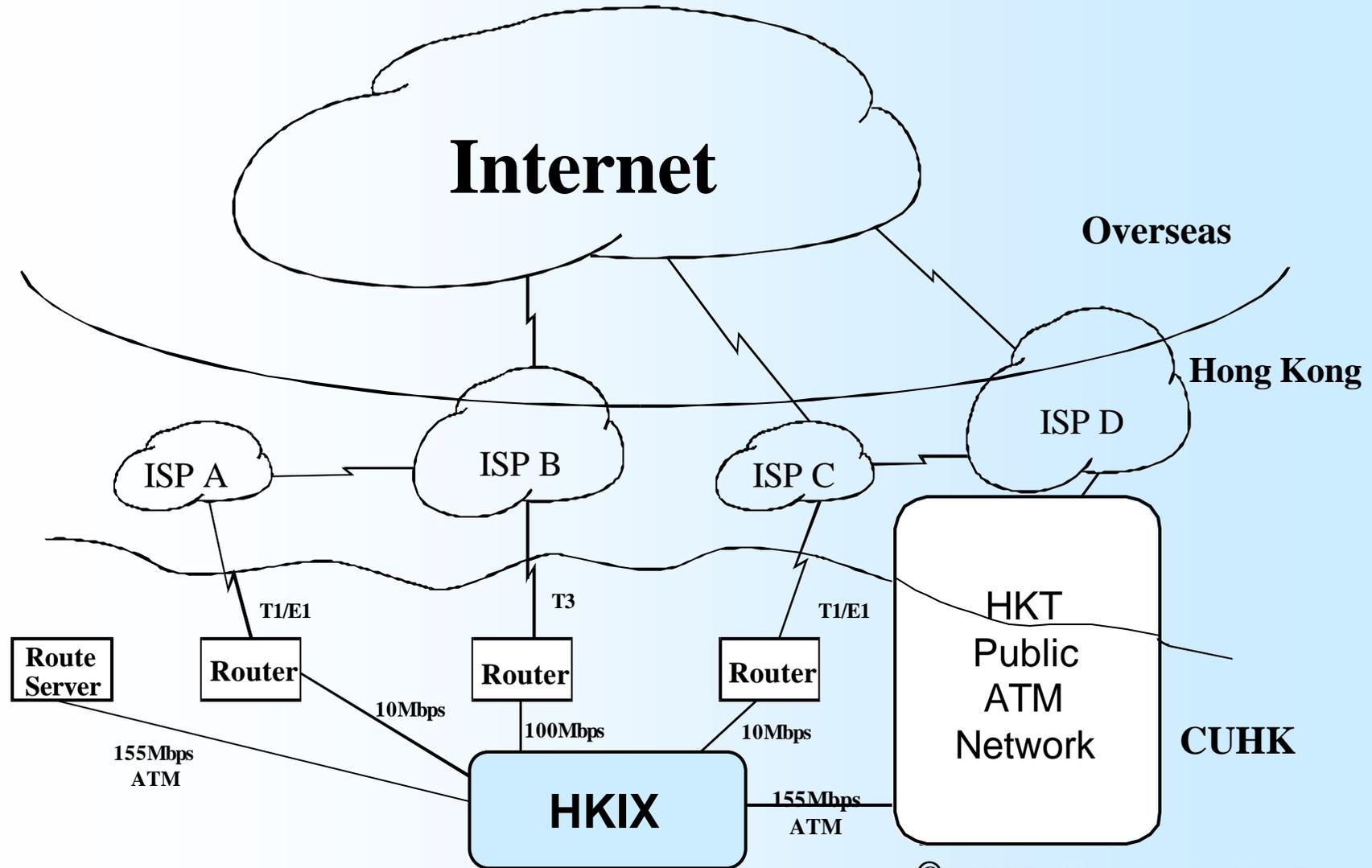
Schematic Diagram of HKIX (Phase II)

Jun 96



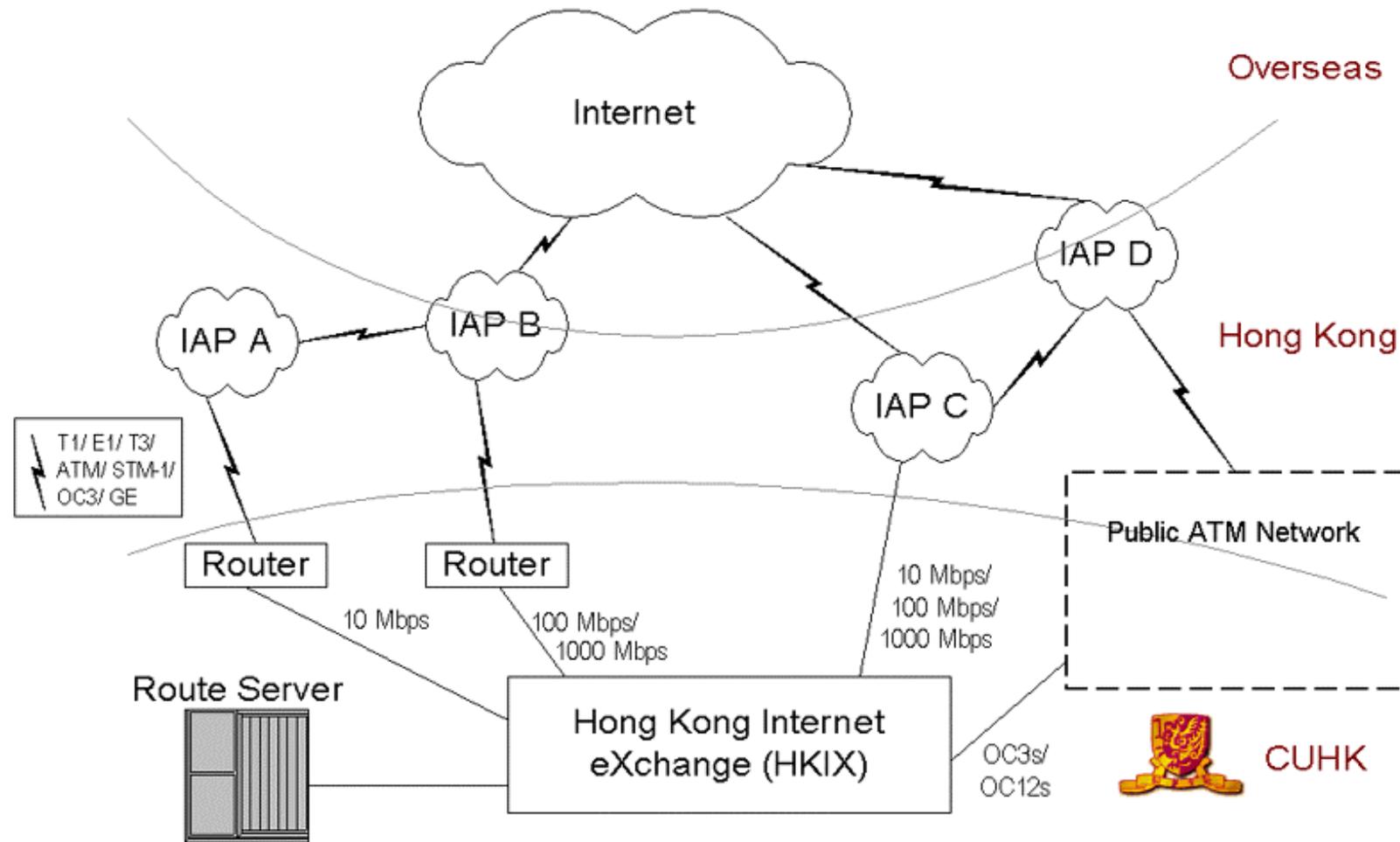
Schematic Diagram of HKIX (Phase III)

Jan 97

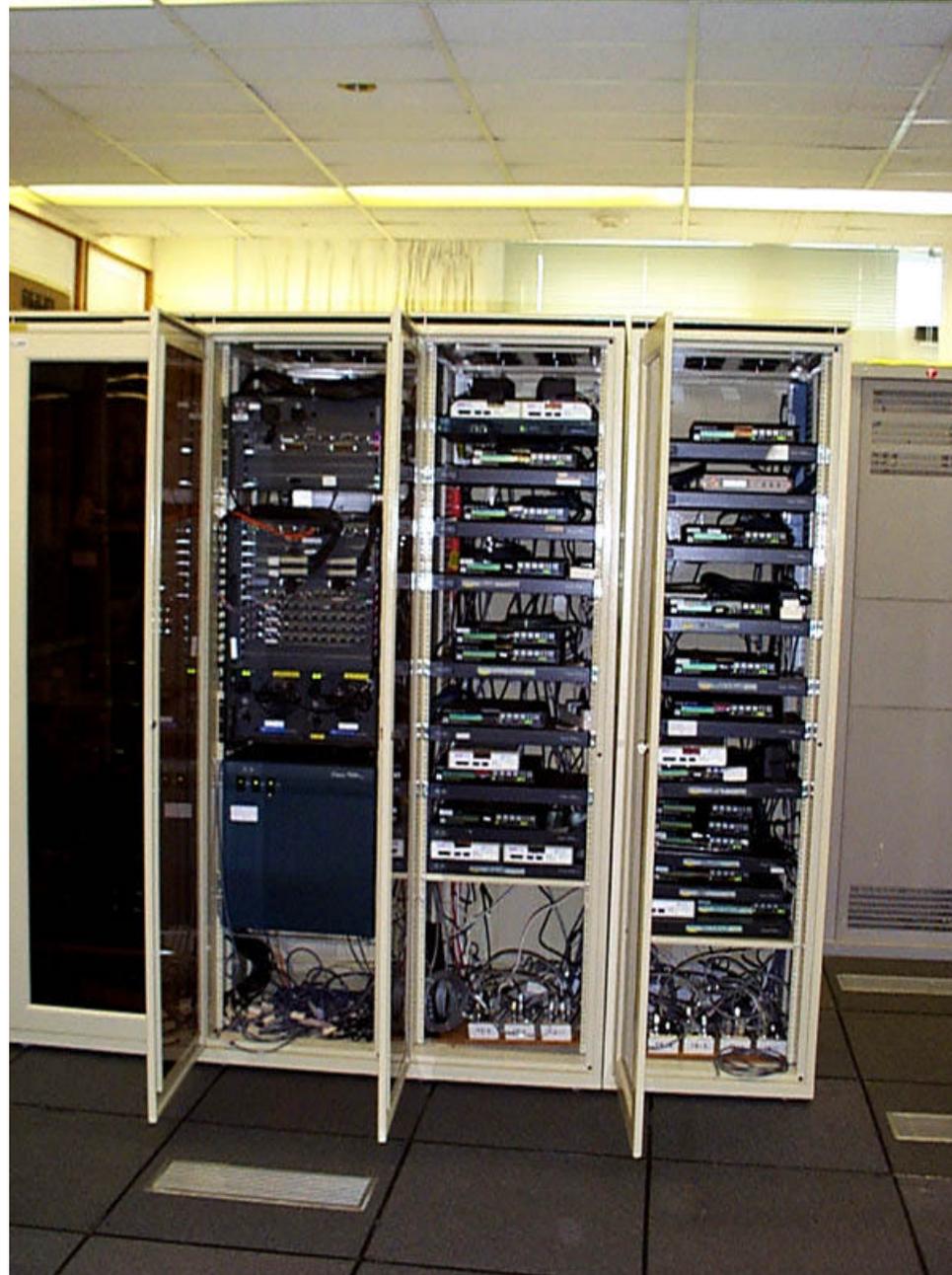


Schematic Diagram of HKIX (Phase IV)

November 2000







HKIX Policies for Participants

- **Internet Service Providers with proper licenses (PNETS)**
- Have global Internet connectivity independent of HKIX facilities
- Use BGP4 to exchange routing information
- Have globally-unique autonomous system (AS) number
- Have IP address block of at least /24 (class C equivalent)
- T1 or above to HKIX
- Provide necessary router and circuit

HKIX Policies for Participants

- Allow backdoor connections between co-located routers
- Allow Bilateral Peering/Transit Agreements
- Allow offering of transit services over HKIX

HKIX: Connections Supported

- Coaxial segment changed to Ethernet switch in Dec 95
- Dedicated Ethernet switch port for each participant now (10BaseT, 100BaseTX or 1000BaseSX/LX/LH)
- For higher speed connections, ATM-155 / T3 / FE / STM-1 / GE can be used
- Support ATM-PVC / FE / GE direct connections without co-located routers now

HKIX: Some Updates

- All major HK ISPs are connected - CWHKT IMS, HKNet, CTI, Hutchison, PSINet, UUNET....
- More than 40% of HK ISPs are connected
 - 69 ISP directly connect participants (Max – 87)
 - 12 indirectly connect participants
- > 2,000 routes
- 17 GE, 3 STM-1, 13 FE, 19 dedicated ATM-155, 3 T3 and 37 ATM-PVC connections
- Total connection Bandwidth > 20Gbps
- Peak 5-min average traffic : > 3.3Gbps

HKIX Services

- Current Services
 - News exchange
 - Stratum 1 Time Server
 - Multiple carriers: 3 now, more to come
 - HKIX Looking Glass
- Planned Services
 - IPv6 Address Assignment and Routing
 - Time Stamping
 - IP Multicast Support

IPv6 Tentative Planning

- Native IPv6 Peering Service
- IPv6 Addresses Assignment
- Looking Glass
- IPv6 Over IPv4 Tunneled Access
- BGP Route Server
- 6to4 Gateway
- Extend Current IPv4 Service to IPv6

Success of HKIX

- **Neutral**
- **Not for Profit**
- Low set-up cost and simple configuration
- Mandatory multi-Lateral Peering Agreement (MLPA)
- No settlement for routing of local traffic
- Non-discriminatory operating on equal basis
- Highly efficient network infrastructure required by ISPs
- Dedication and enthusiasm of **ITSC** staff

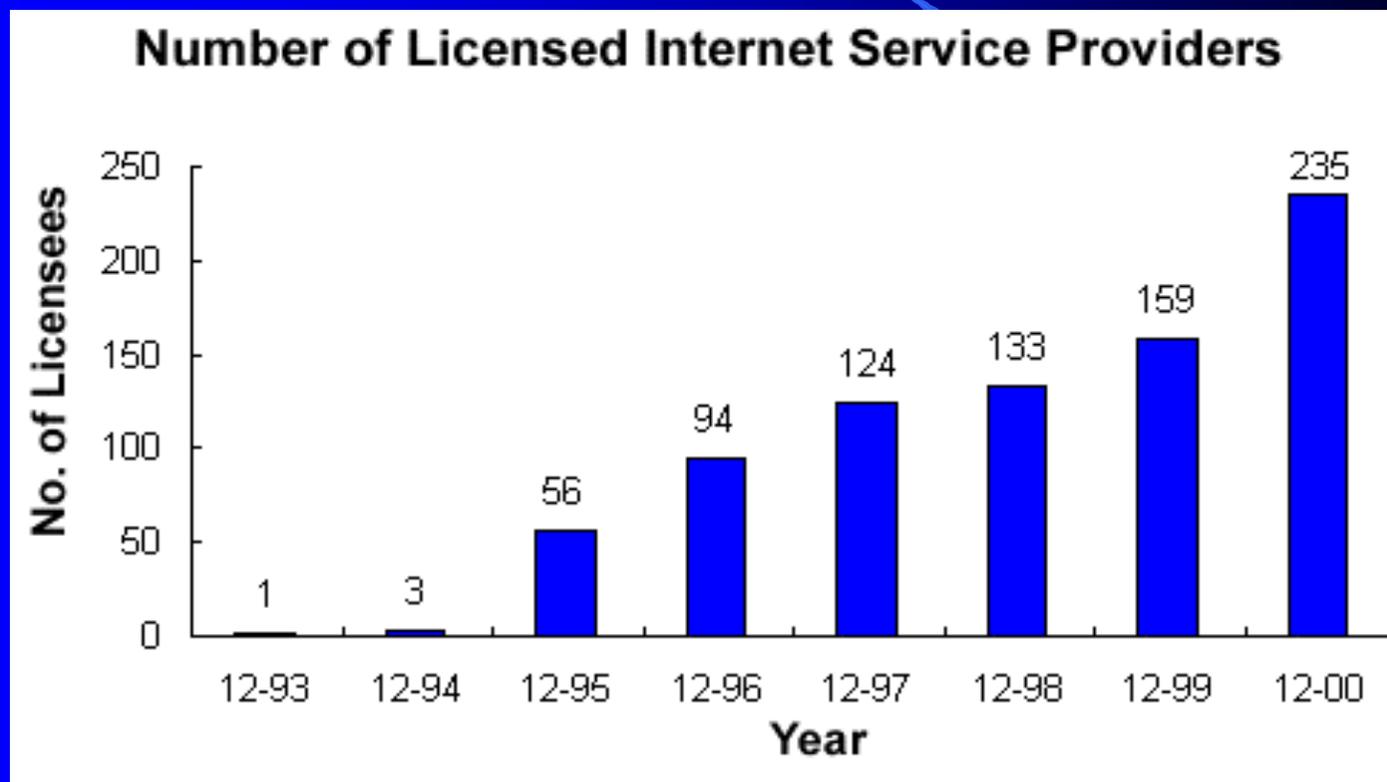
Trends Observed – Impact to HKIX

- Declining number of Dial-up users, and increasing number of Broadband users, sources from OFTA.
- More and more multimedia applications put onto the Web, such as NOW.
- More and more local e-Banking activities
- Impact to HKIX
 - More and more traffic will be switching through HKIX
 - Volume of Traffic doubled each year starting from 2000
 - More and more colocation requests...

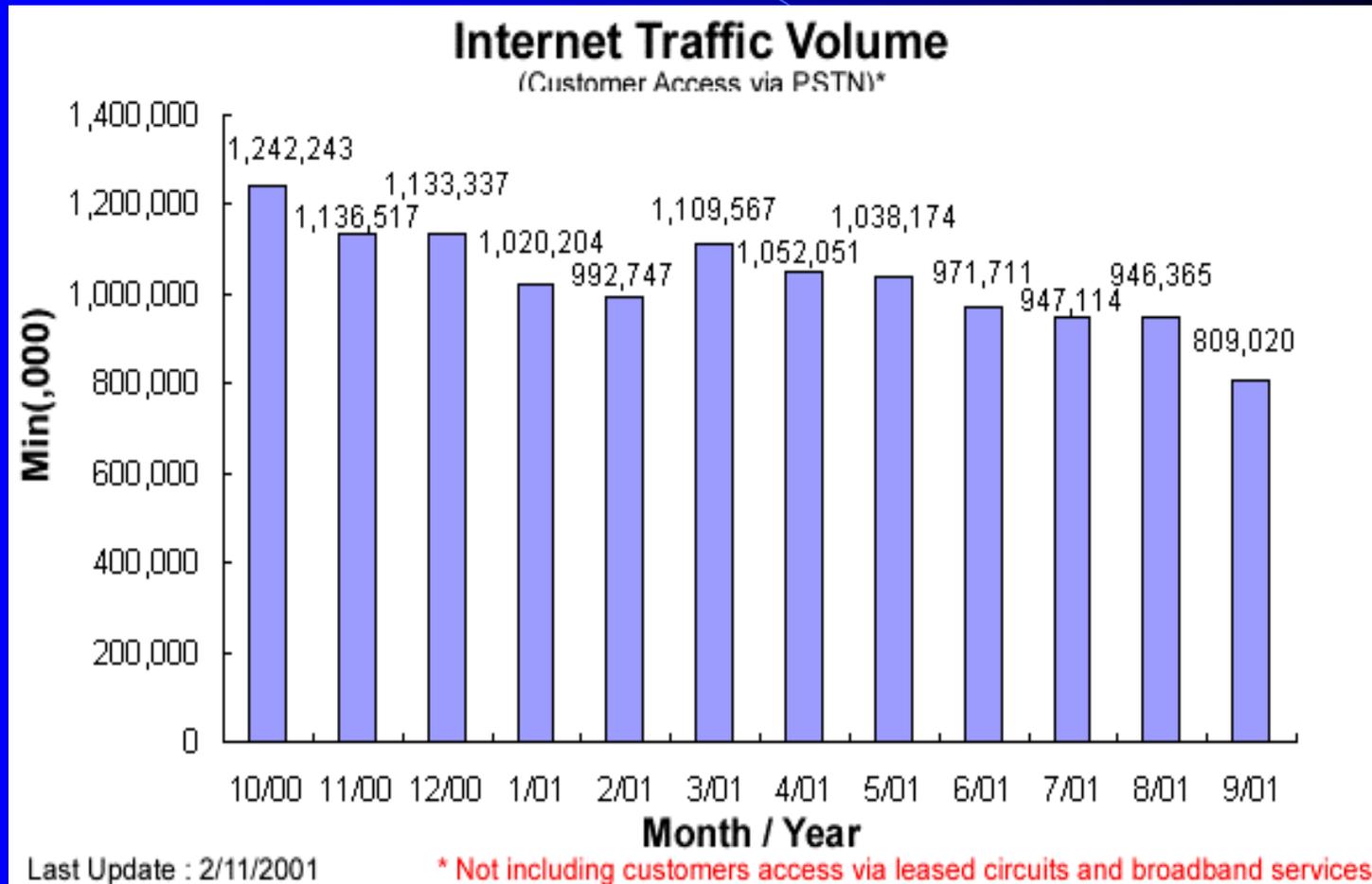
ISP Customers Stat — Sources from OFTA

End of Month	Estimated no. of <i>registered customer accounts with dial-up access</i> (narrowband Internet access up to 1 Mbps) (excluding Internet pre-paid calling cards) (see Notes (b) and (c))	Estimated no. of <i>Internet pre-paid calling cards for dial-up access</i>	Estimated no. of <i>registered customer accounts with leased line access</i> (see Notes (b) and (c))	Estimated no. of <i>registered broadband Internet access customer accounts</i> (see Note (e))
Dec-00	2,283,047	38,708	11,527	392,118
Jan-01	2,199,820	38,744	10,759	406,882
Feb-01	2,179,720	35,903	10,850	417,266
Mar-01	2,175,186	36,552	10,200	444,450
Apr-01	2,111,807	36,795	9,821	385,392 *
May-01	2,120,186	37,253	9,640	403,592
Jun-01	2,093,474	37,192	8,896	415,369
Jul-01	1,996,118	41,069	8,453	442,176
Aug-01	2,085,041	17,426	8,032	470,964
Sep-01	2,078,668	17,604	7,683	501,859
* The drop in the number of broadband Internet access customer accounts in April 2001 was due to downward adjustment of the reported data from some operators.				

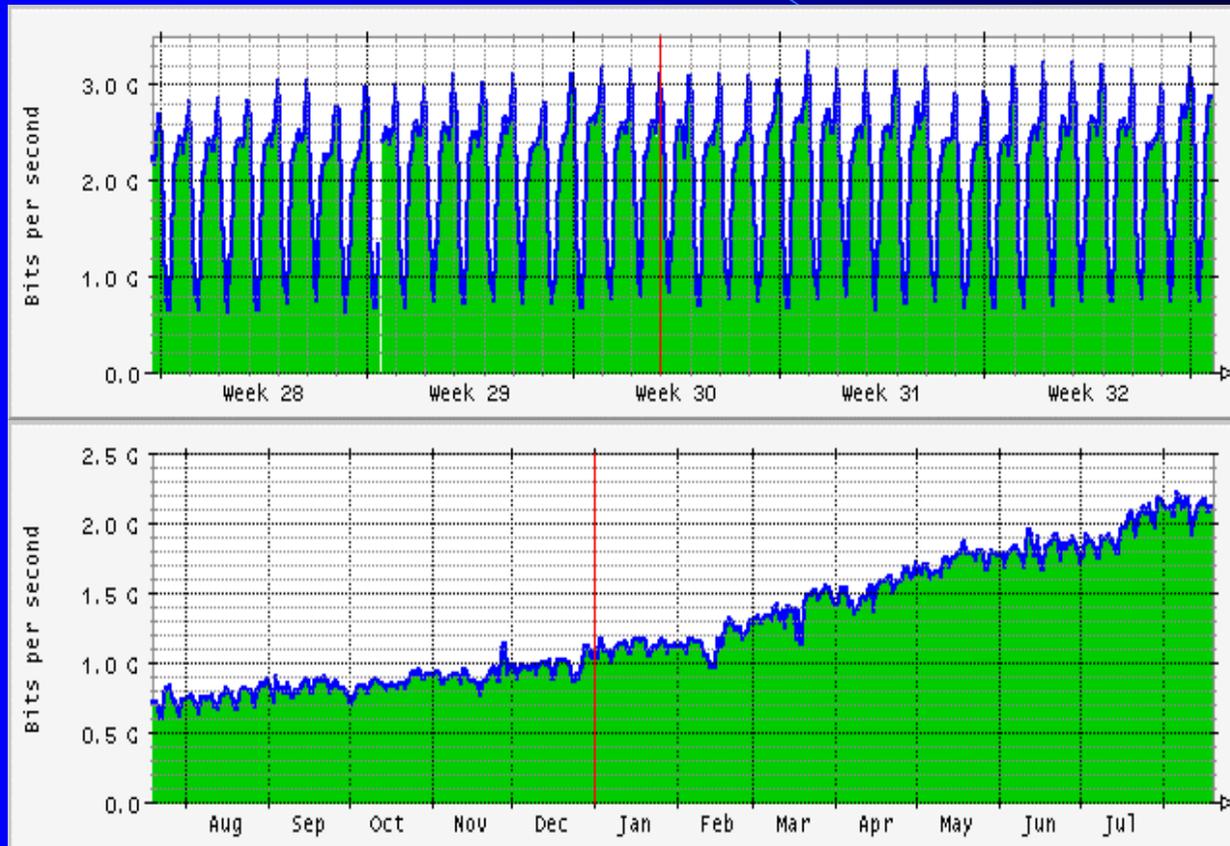
No. of ISPs in HK — Sources from OFTA



HK Internet Traffic Volume — Sources from OFTA



HKIX: Switching Traffic Trend



Other Issues

- HK Cyber Maps
 - By IDG
 - By HK Economic Times
 - Shows ISP links within and outside HK only
- 3G, GPRS, SMS
 - No. of license holders far less than the no. of ISPs
- HKIX reliability, load balancing, disaster recovery.
 - No major outage in the past 6 years
 - ISPs all have their International links as requested
 - There are other Internet Exchanges in HK...

Thank You

19-Aug-2002

ITSC, CUHK

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