Peering Resiliency: Perspectives from a carrier-neutral IX and co-location provider

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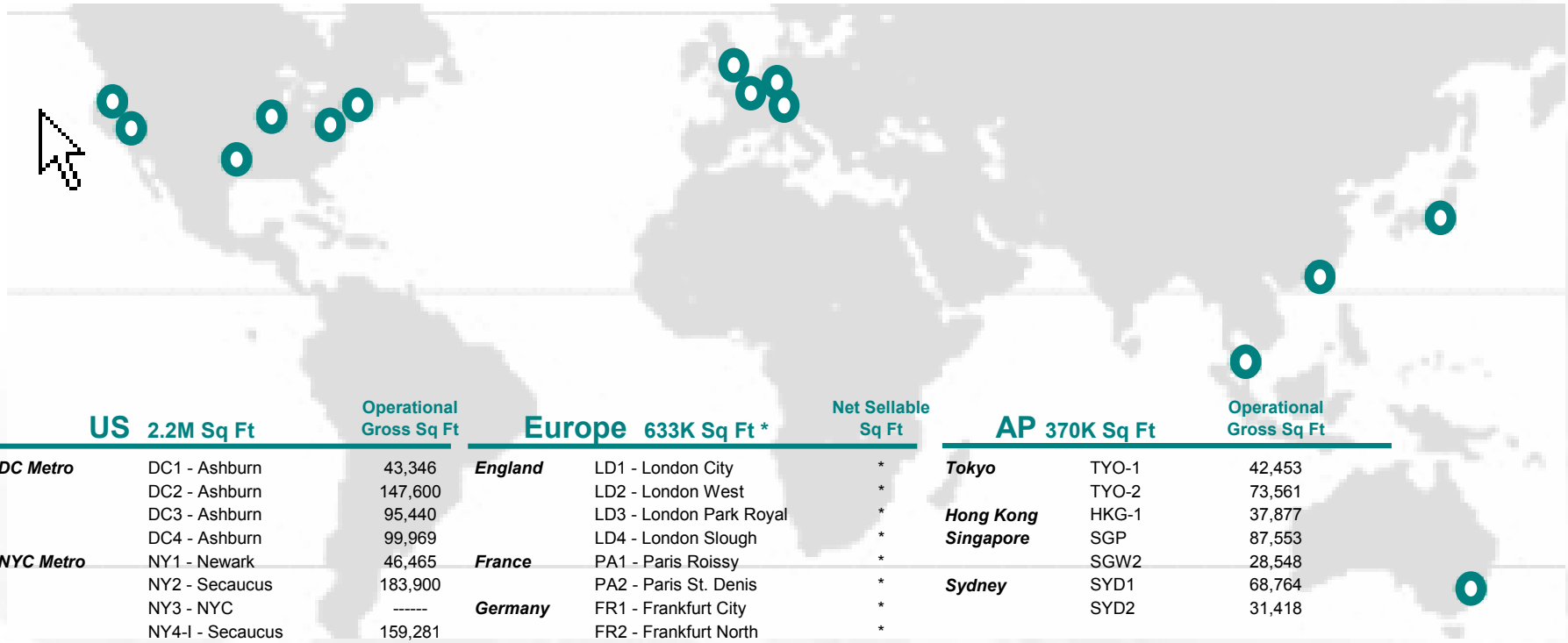
Overview

- About Equinix
- Impact of cable system outages on carriers & ISPs
- Aftermath: capacity growth & drive towards resiliency
- Evolving Internet traffic trends in Asia
- The drive towards more peering
- Conclusion

Global Footprint

3.01M Gross Operational Square Feet Worldwide*



US 2.2M Sq Ft		Operational Gross Sq Ft
DC Metro	DC1 - Ashburn	43,346
	DC2 - Ashburn	147,600
	DC3 - Ashburn	95,440
	DC4 - Ashburn	99,969
NYC Metro	NY1 - Newark	46,465
	NY2 - Secaucus	183,900
	NY3 - NYC	------
	NY4-I - Secaucus	159,281
Chicago	CH1 - Downtown	172,081
	CH2 - Downtown	120,523
	CH3-I - Elk Grove Village	212,727
Dallas	DA1 - Dallas	61,573
Los Angeles	LA1 - Los Angeles	67,000
	LA2 - Los Angeles	33,080
	LA3 - El Segundo	106,885
	LA4 - El Segundo	159,281
Silicon Valley	SV1 - San Jose	133,500
	SV2-I - Santa Clara	94,000
	SV2-II - Santa Clara	66,000
	SV3 - San Jose North	103,420
	SV4 - Sunnyvale	119,756

Europe 633K Sq Ft *		Net Sellable Sq Ft
England	LD1 - London City	*
	LD2 - London West	*
	LD3 - London Park Royal	*
	LD4 - London Slough	*
France	PA1 - Paris Roissy	*
	PA2 - Paris St. Denis	*
Germany	FR1 - Frankfurt City	*
	FR2 - Frankfurt North	*
	FR3 - Frankfurt Morfelden	*
	DU1 - Dusseldorf	*
	MU1 - Munchen 1	*
	MU2 - Muchen 2	*
Switzerland	ZH1 - Zurich 1	*
	ZH2 - Zurich 2	*
	ZH3 - Zurich 3	*
	GV1 - Geneva	*

AP 370K Sq Ft		Operational Gross Sq Ft
Tokyo	TYO-1	42,453
	TYO-2	73,561
Hong Kong	HKG-1	37,877
Singapore	SGP	87,553
	SGW2	28,548
Sydney	SYD1	68,764
	SYD2	31,418

- IXEurope Gross Operational sq ft estimated on 380K+ net sellable Sq Ft

Impact of cable system outages on carriers & ISPs

Disaster Strikes!

- Two major cable system outages in the past 18 months
  - Taiwan: Dec 2006
  - Mediterranean/Persian Gulf: Jan 2008

Taiwan Outage - APCN2

Map Source:
Telegeography

Taiwan Outage - C2C

Map Source:
Telegeography

Taiwan Outage - EAC

Map Source:
Telegeography

Taiwan Outage - FNAL

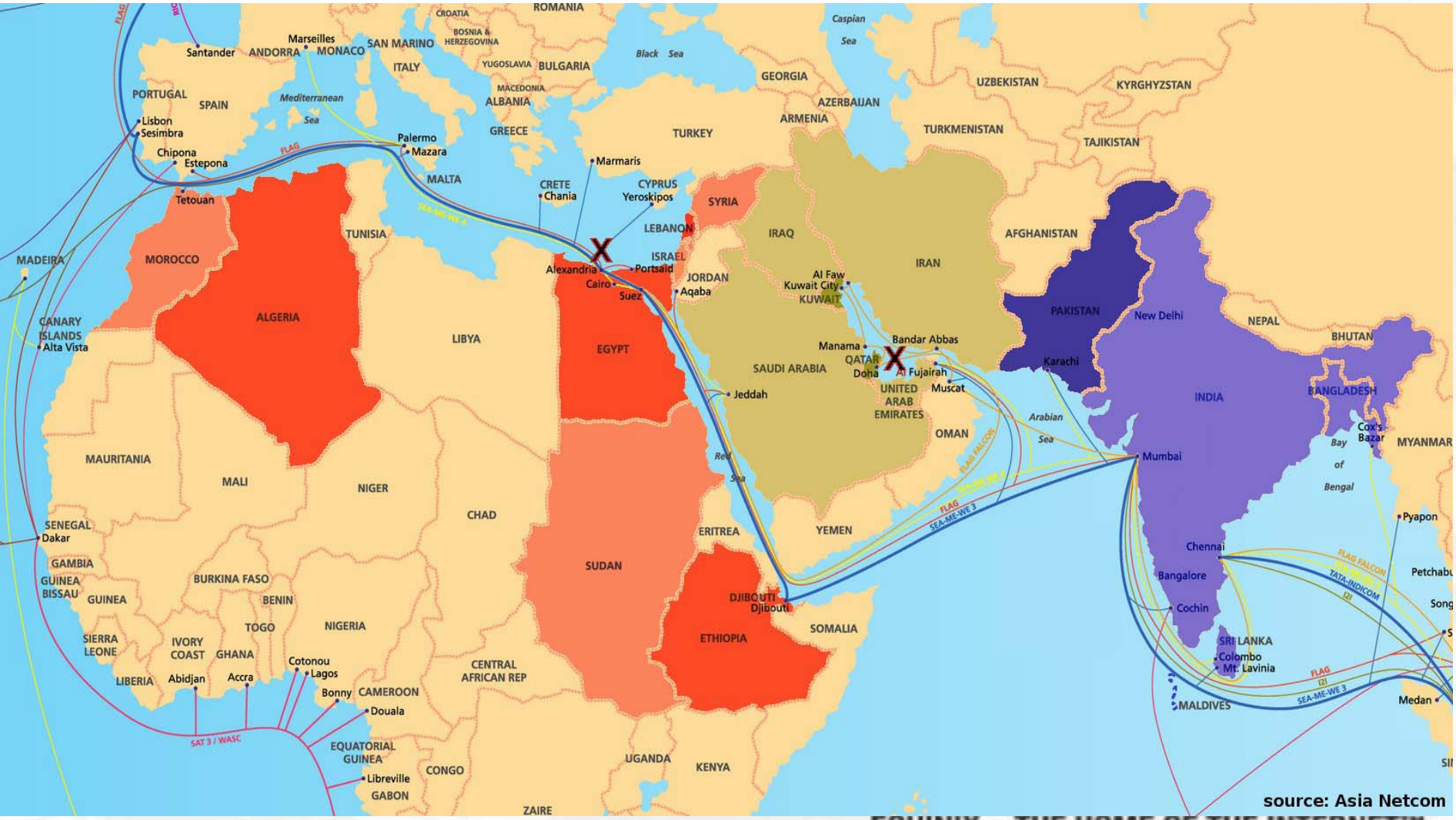
Map Source:
FLAG

Taiwan - Major ISPs Impacted

- Examined Asian prefixes outaged and/or unstable: 1667 ASNs impacted:
  - China Telecom: AS4134, AS4812 (CN)
  - Sify: AS9583 (IN)
  - VSNL: AS4755 (IN)
  - Bharti BT Internet: AS9498 (IN)
  - PT Telekomunikasi: AS17974 (ID)
  - CNC Group (AS4808, AS4837) (CN)
  - Smart Broadband: AS10139 (PH)
  - INDOSAT: AS4795 (ID)

Source: Renesys (APRICOT 2008)

Mediterranean/Persian Gulf Outage



source: Asia Netcom

Impact of Med/Persian Gulf Outage

- Several cables in the Mediterranean and the Persian Gulf were damaged around 30 January 2008
  - 3 cables severed
  - SEA-ME-WE 4 (30 January: 04:30 UTC)
  - Flag (30 January: 08:00 UTC)
  - Flag-Falcon (2 February: 05:59 UTC)
- Impacted regions include:
  - Middle East / North Africa (approx 65% outaged networks)
  - Persian Gulf (approx 45% outaged networks)
  - Indian Subcontinent (approx 32% outaged networks)
  - 6856 networks from 23 countries suffered outages

Source: Renesys

Impact of Outages

- Major transport and transit providers impacted
- As a result, major regional & domestic ISPs impacted
- Regional/domestic ISPs experienced major bandwidth degradation, loss of routes

What Followed

- Mad scramble for “substitute” transit
- Urgent connection requests in major interconnection and exchange points
- Regional ISPs who were overly reliant on 1 or 2 major transit providers were the worst affected
- As a result:
  - Drive to build better network resilience
  - New transit relationships
  - New peering relationships

Downstream Observations

- Transit providers with capacity in both directions won business
  - PCCW
  - Tata (VSNL/Teleglobe)
- ISPs with PoP diversity (in right locations) recovered fastest
- Regional ISPs - less dependency, more autonomy

Aftermath: capacity growth & drive towards resiliency

Carriers & Major Transit Providers

- Cable capacity upgrades
- Build-out PoPs for better network resilience
  - E.g. VSNL improve intra-Asia PoP-meshing (source: VSNL/Sylvie LaPerriere, NANOG 39)
  - New PoPs in Singapore for:
    - Telkom
    - Excelcomindo
    - CS Loxinfo
    - Bharti
    - Etisalat
    - Maxis
- New cables

New Cable Systems in Asia

Asia to US

- Unity
  - Consortium of 6 companies including Bharti, Pacnet, KDDI and Google
- Asia-America Gateway (AAG)
  - Consortium including AT&T, Starhub, Bharti, CAT, Indosat, Telstra, Telkom, Saigon Postel, Telekom Malaysia
- TGN Intra-Asia (Singapore-HK-Japan)
  - VSNL, Globe, PCCW, EVN

Asia to Europe

- TGN Eurasia (Mumbai, Egypt, London, Paris, Madrid)
- I-ME-WE
  - Includes VSNL, Telecom Italia, Telecom Egypt, Etisalat

And several more...NGN, TPE, etc.

Singapore Grows as Interconnection & Peering Hub

- End point for various major cable systems
  - SE-ME-WE4
  - TIC
  - Unity
  - TGN
- Uniquely positioned for traffic heading West (to Europe) and East (to North Asia and US)
- Conveniently located for content delivery to rapidly emerging markets, India and China
- De-regulated environment for interconnection and peering

Importance of Connecting to an IX/Major "Carrier Hotel"

- Availability of capacity for growth
- Availability of providers for network recovery & resilience
- Access to peering
  - Improve network/routing efficiency
  - Easy to make routing changes
  - Evolving traffic profiles
- Commercial considerations
  - Buying of services
  - Selling of services

Evolving Internet traffic trends in Asia

Traffic Trends

- Accelerated growth in broadband services in Asia
- Major content providers & CDN deployment in Asia: Yahoo, Google, Akamai, Limelight
- Localized content growth
- 10G exchange deployments
- Continued exponential growth in P2P Traffic
- HD streaming video and VoIP
- Mass market gaming

Traffic Trends

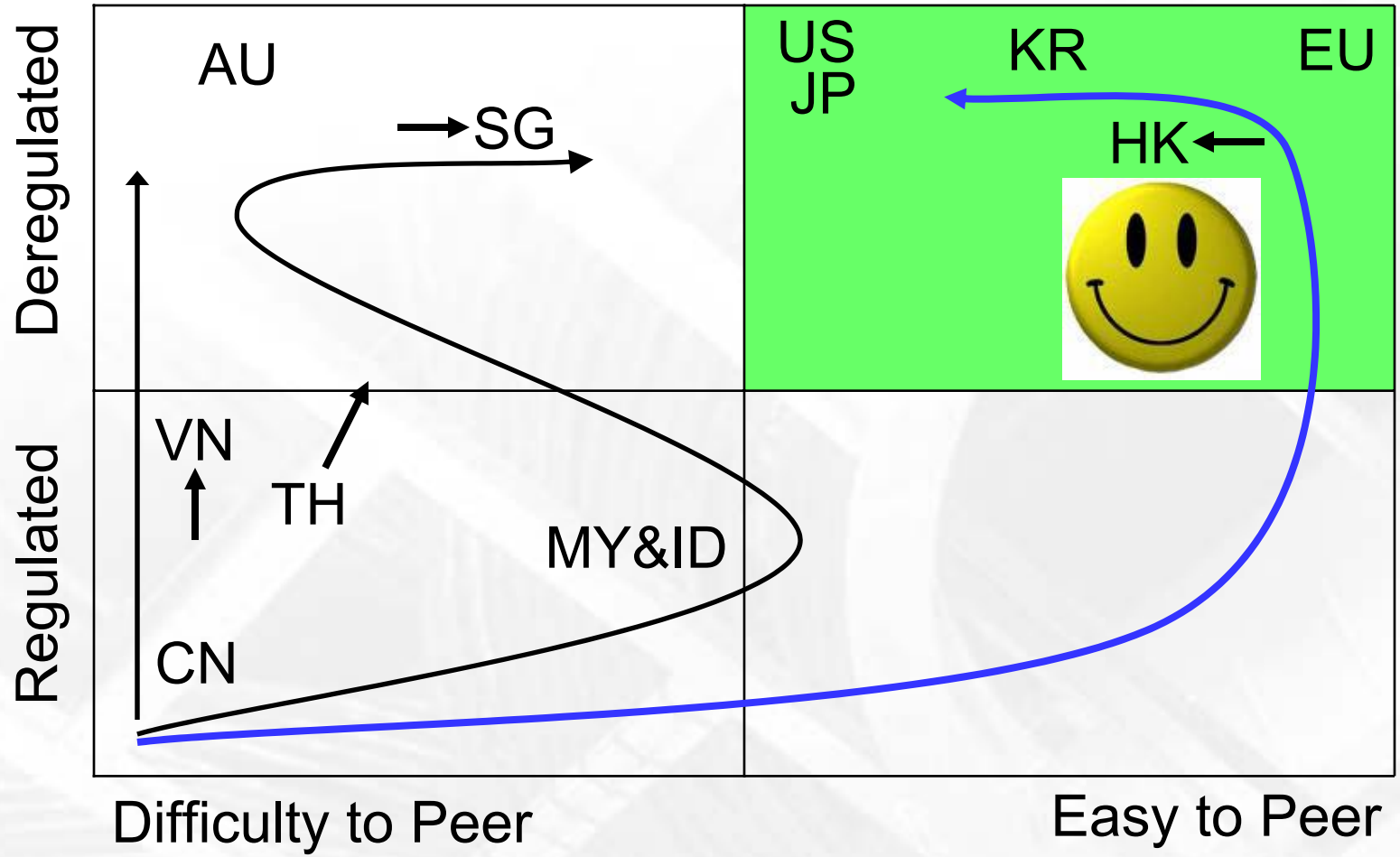
	1997	2007
Typical User Access Speed	28.8k Modem	10Mbps+ Broadband
Protocols	70% HTTP	70% P2P*
Tariff	US$30 monthly	US$30-50 monthly
Major Applications	Web Email	Video Web Games
Traffic Profile	Pull Content from US	Content pushed to the edge Localised Content

* Source: http://www.ipoque.com/media/internet_studies/internet_study_2007

Telecommunications Deregulation

- Additional competition across the board
  - Cheaper access to international capacity
- Some countries only partially deregulate to protect domestic interests
  - China, India, Thailand, Malaysia, Philippines
- Others still have a high barrier to entry
  - Vietnam, Indonesia - cost of licenses, access, capacity availability, etc
- Where there is full deregulation, dominant carriers try to protect their turf
  - Australia, Singapore, Taiwan
- Life is relatively easier in some places…
  - Japan, Hong Kong

The Road Ahead...



Cost of International Capacity

- Cost of international capacity falling dramatically over the past 10 years
  - US$10,000/month for 64k IPLC Asia-US in 1996
  - US$10,000/month for STM1 IPLC Asia-US in 2006
  - Over 2000x!
- IRU capacity essentially “free” for some incumbent operators (backhaul swaps)
- Availability in developing countries
  - Indonesia, Vietnam, Thailand, Philippines
- Local peering was critical back then, now merely a convenience

Cost of Domestic Capacity

- Cost of domestic capacity has fallen, but at a slower pace than the international capacity
  - Right-of-way difficult to obtain
  - Usually the last thing to be deregulated
- For retail IPLC, over 50% of the circuit price goes to domestic transmission
  - Local loops from customer premise to POP x2
  - Carrier backhaul from POP to Cable station x2
- Domestic capacity to peering point might be more expensive than buying international IP transit from the same carrier!
- Dark fiber not generally available (except Japan)

The drive towards more peering

Catalyst to Peering

- Need for better resilience
- More carrier-neutral facilities
- Capacity & cost
  - Capacity availability
  - Local dark fibre availability
- Find the right people
- Find a win-win business model
  - Value of Eyeballs vs. Content
    - ISP's infrastructure cost, incremental revenue
    - Content Provider's content, ISP saves on transit

The Internet vs Commercial Ethos

- The Internet Ethos
  - Sharing and collaboration
  - Efficiency
  - Elegant solutions
- The Commercial Ethos
  - Lower costs
  - Destroy the competition
  - Profit!

Finding the Right Balance

- Don’t peer. Sell only
- Settlement-based peering, pay for traffic “difference”?
  - Need change to billing mechanism
  - Value of eyeball/content; differing philosophies
- Exchange local-routes freely, buy/sell domestic & international transit?
  - Need changes to routing mechanism
- Exchange customer routes, buy/sell international transit
- Free Internet for all (not going to happen…)

Conclusion

Lessons to be Remembered

- Cable cuts illustrate fragility of today's Internet
  - Asia and Middle East are particularly vulnerable
- Solutions revolve around:
  - Educated Internet consumers
  - New business relationships
  - International & local peering (IXs)
  - Allows individual countries/regions can retain connectivity
  - New cable systems
  - Physical redundancy
  - Different submarine cables with different paths
  - Land-based systems where possible

Thank you

Comments?

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