Global Crossing®

Some Perspectives on Internet Network Neutrality and Peering: Current Challenges & Future Hurdles

PLNOG 2009

Eur Ing Peter Lawson

Strategic Marketing
Worldwide Carrier Services

Agenda

Introduction on Global Crossing

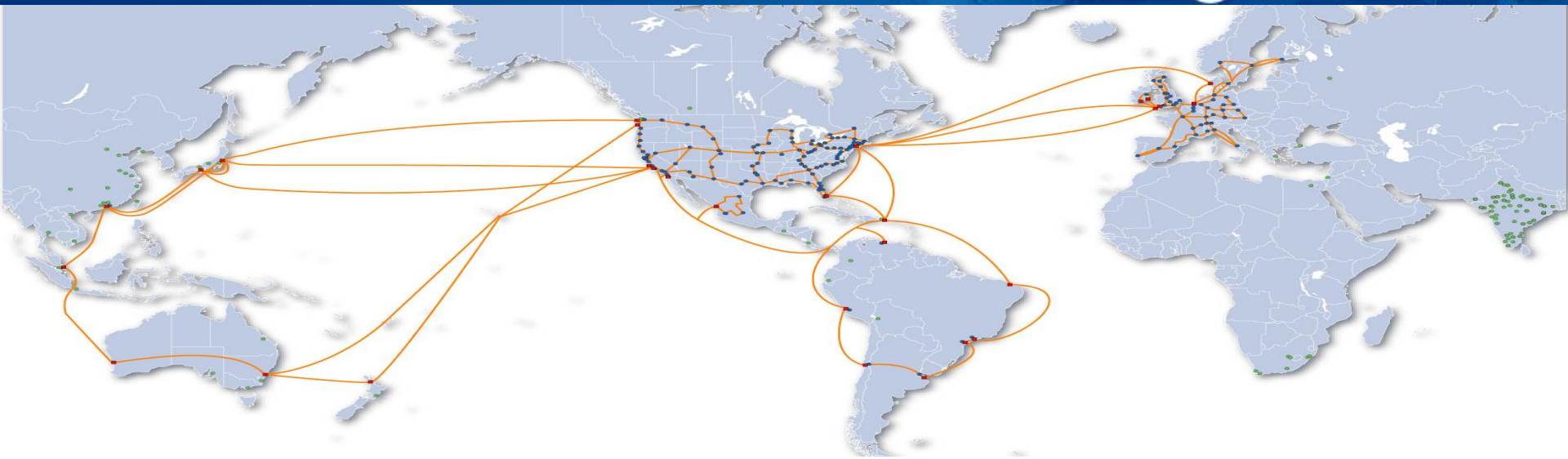
Some Historic Perspective

Current Challenges to the Peering Model

Future Hurdles

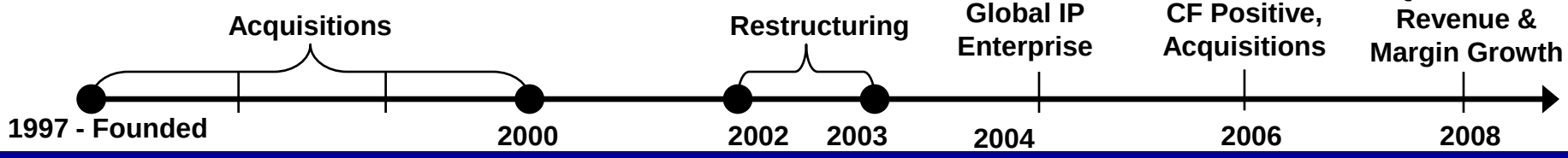
Net Neutrality and Peering

Who We Are



"Global Network with Local Relationships"

- *Sales and Customer Support in 46 countries*
- *Leading expertise and experience in IP based services*








Our solutions set

Global Crossing

Global Crossing IP Solutions

Global Crossing DataTransport Solutions

Global Crossing Voice Solutions

Global Crossing On Demand Solutions

Global Crossing Collaboration Solutions

Global Crossing Continuity Solutions

Global Crossing Consulting Services

Global Crossing Security Solutions

Global Leader in IP Based Services

Global Crossing

- First global deployment of MPLS
- First global MPLS-based IP VPN
- First global VoIP platform
- First to decommission legacy TDM switches
- First converged IP solution
- First global Multicast IP VPN Service
- First to deploy IPv6 globally

Converged IP
Pan-European Crossing® (PEC)

Global Crossing®

Additional PoPs

Acton	Grantham	Redhill
Ashford	Gravesend	Romford
Aston	GreenfordGuildford	Rotherham
Avonmouth	Hale	Salisbury
Aylesbury	Harlow	Shepherds Bush
Basildon	Hartford	Shipley
Battersea	Harringay	Slough
Beckenham	Harrow-on-the-Hill	St. Buryann
Bedford	Hatfield	Staines
Bexleyheath	Hayes & Harlington	Stevenage
Bicester	Heald Green	Stockport
Birkdale	Hemel Hempstead	Swindon
Bracknell	Hitchin	Tilbury
Bradford	Hendon	Trent
Brentwood	Holloway	Trowbridge
Brighton	Hounslow	Tunbridge Wells
Chelmsley	Huddersfield	Upton Park
Chesterfield	Ilford	Vauxhall
Chichester	Isleworth	Warrington
Colchester	Kettering	Warwick
Crawley	Leamington	Watford
Croydon	Leicester	Wembley
Dagenham	Leigh	Westbury
Dartford	Leyland	Wigan
Doncaster	Longton	Willesden
Ealing	Luton	Wilmslow
Eastleigh	Maidenhead	Winchester
Ellesmere	Maidstone	Woking
Elstree	Milton Keynes	Woolwich
Falconwood	Newbury	Wolverhampton
Feltham	Paddington	Yeovil
Folkestone	Poplar	York

- Landing Points
- Core Network Reach
- Metro Networks
- Data Centers
- Service Reach
- Global Crossing Operated Network
- Leased Capacity/IRU on Other Network

Converged IP

Ireland and the United Kingdom

Global Crossing®

Converged IP

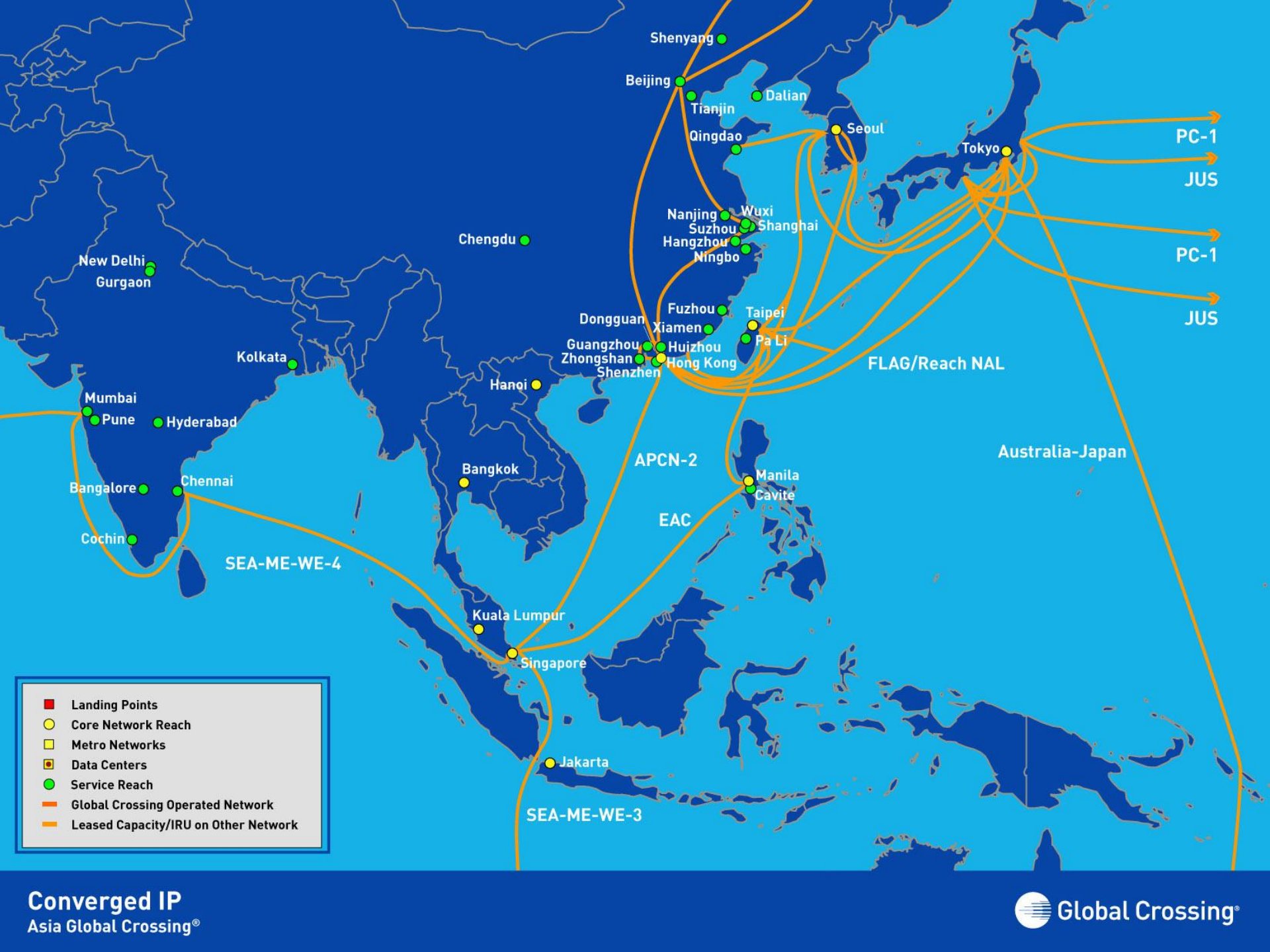
North American Crossing® and Mid-Atlantic Crossing®

Global Crossing®

Converged IP

South American Crossing® (SAC®)

Global Crossing®



Converged IP
Asia Global Crossing®

Global Crossing®

Converged IP
Oceania

Global Crossing®

Global Crossing®

Some perspectives on Internet Peering and Network Neutrality

Factors Contributing to Views

Global Crossing

What factors shape Global Crossing's perspective on peering and traffic trends?

GC is a global carrier (EU, US, LatAm, Asia-Pac)

Measured by announced BGP prefixes, we are world's 3rd largest Tier1

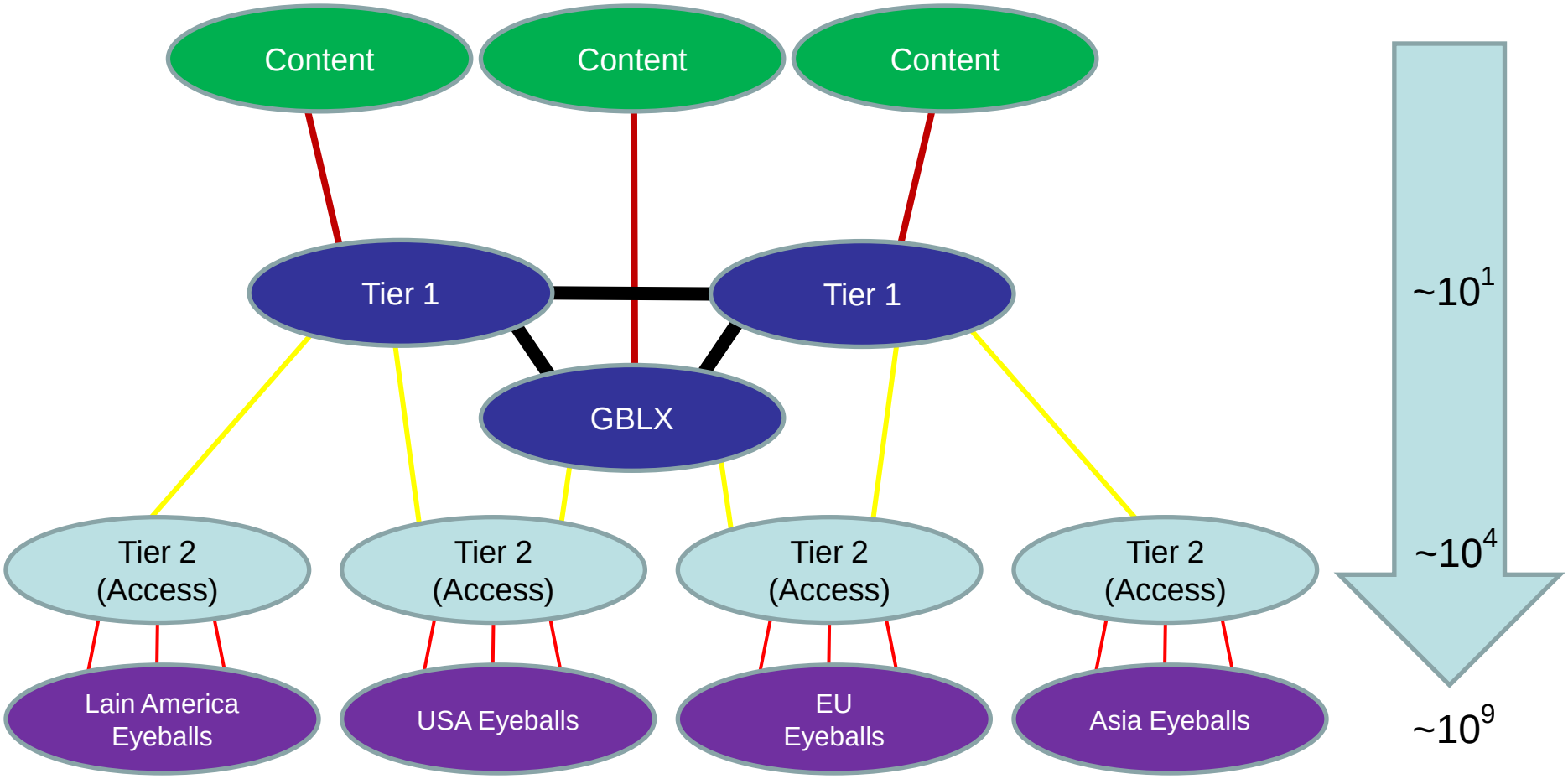
Provider of IP Transit to all types of customers—subrate to 10GE, content and eyeball—no one specific area of interest or dominance

Facilities-based in EU, US, LatAm including subsea systems in between regions

~1.5Tbps of one way peering capacity (a 10Ge=10Gbps, not 20)

Almost entirely peered through private peering, very little traffic over public exchanges

Simplified Internet Model



The Internet is a challenge of SCALE

Market roles & positions

Access providers

- Provide access to end-users.
- Cable availability varies highly per country
- Limited number of providers
- Loop unbundling gives theoretical freedom, still geographically defined

Content providers

- Information or applications
- Multitude of suppliers and supplier types
- Not geographic dependent

Tier 1 / Transit providers

- Limited number of Tier 1s
- Role of Aggregator
- Global investment

Business Models

- Most common is flat fee subscription, price dependent on (download) speed
- Mobile: per Meg or flat fee
- High investments to upgrade national networks

- Revenues are volume-based (advertising)
- Costs also volume-based
- Users: Free of charge or subscription
- Relatively low start up costs to address a global market

- Per MB per month, Rarely Volume
- High investments on global scale

15

The internet nowadays

In principle, every eyeball on the globe can access all content

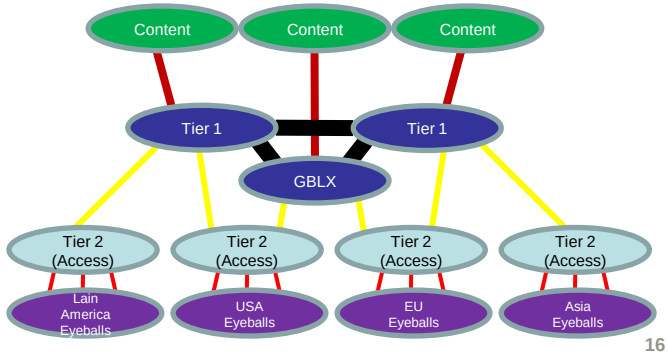
Freedom enables start-ups and is one of the underlying reasons for the success of the internet

New applications can be launched easily (Standardisation)

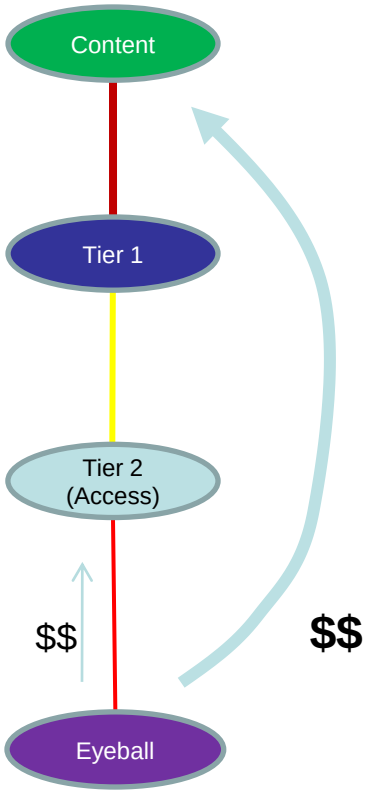
Successful applications can generate huge revenues with limited investments

Access networks need to invest heavily in their infrastructure, ARPU is difficult to grow. Growth in subscriptions is decreasing

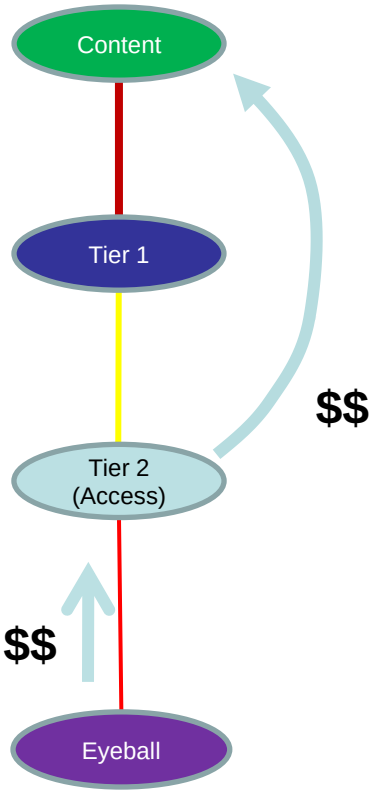
Transit providers invest in bigger pipes globally



But where is the money?



OR



Historic Perspective on Traffic Growth and the Interconnection Model

Global Crossing Network Traffic Growth

- ~200x Growth in since early 1999
- 2006 growth: +185% (2.85x)
- 2007 growth: +70% (1.70x)
- 2008 year to date: 116% (2.16x)

Old model, there were not very many types of relationships between carriers—it was either customer, peer, or provider.

Pre-2001 Interconnection model relied heavily on local loops at OC3/OC12/OC48

Little centralization of peering interconnect sites.

Port speed hierarchy existed, where there was a capacity increase from customer->peer->backbone interconnects. (oc3->oc12->oc48 for example)

For larger Tier-2's the idea was to attempt to obtain Tier1 status

The Former Internet

Global Crossing

Web 1.0

In light of current set of applications and usage patterns, the Web 1.0 Internet was very different from today's Internet.

Smaller BLOBs, less hubbing, less streaming, less Peer-Peer

YouTube, MySpace, Facebook, Wikipedia, Blogging, many Google Apps, Flickr, Pandora, iTunes Video, etc—all of these did not exist, or at least were not nearly as mainstream at the time.

Some Argue that these Applications are a success PURELY because of OPPORTUNITY SCALE

Current Traffic Trends and the Current Interconnection Model

Global Crossing

More variety in interconnect relationships

Much more grey area in relationships: Paid peering, Partial Transit, Peering included with wave purchases, regional peering, regional peering + transit, and others

(Larger number of more complex relationships, requires more resources (human and network) to negotiate, build, bill, maintain, and troubleshoot.)

Increased number and varied types of relationships between carriers create a more dense interconnection environment in the Internet as a whole (again, adding more complexity)

Interconnection Model has changed drastically

Heavy reliance on lit buildings (Telehouse, InterXion, Equinix, S&D etc) type facilities to exchange most peering traffic

Upgrades to new port speeds are often as simple as a hot cut, with no need to install new fiber, resulting in more resilient peering relationships and faster upgrade cycles (GE->10GE or STM16->10GE for example)

Current Traffic Trends and the current Interconnection Model, cont.

Port speed Hierarchy is flattening

Largest customers, larger Tier 2s, most peers, and most backbone links are all now at 10G or nx10G

Becoming “Tier 1” is not necessarily the goal anymore

Some networks are scaling back global peering efforts, in favour of more regional peering + transit…others no longer looking to eliminate their transit connections, but wish to keep them as “backup”

Continued IP Transit pricing erosion has enabled this as an option, as these largest Tier2’s can command single-digit / Mbps pricing

AND

avoid Cost of maintaining a global network (space, power, leased lines, peering, extra capital, etc.)

AND Peering “problems” become the responsibility of the upstream

Current Challenges to the Traditional Peering Model

Global Crossing

What challenges do these changes to the peering model in recent years present today?

Growing diversity of Web 2.0 content, and it's greater bandwidth needs, combined with the ability of the users to download data at higher speeds, has fueled significant traffic growth, as well as more divergent traffic ratios between content and access networks.

What's the big deal about traffic ratios?

Increased traffic ratios cause problems for content providers, and the ISP's that serve them, when searching for new or maintaining existing settlement-free peering relationships – upgrade policy/ dimensioning.

Pure content providers can rarely get true settlement free peering from any of the largest networks – the traffic ratio argument

Current Challenges to the Traditional Peering Model, cont.

Global Crossing

Flat port speed hierarchy

- Individual customers are often generating traffic levels that are often on par with the networks providing them transit
  - Individual customer turnups or traffic shifts can have significant impact on a carrier's peering links, uplinks, backbone, etc.
- Compounded by the fact that some of the larger customers only need to reach a few top-tier networks as they are heavily peered

Upgrade thresholds are still too high for many carriers

- GC peering upgrade strategy is to keep capacity at 3-5x actual usage to allow traffic to grow without congestion—other carriers will wait until 75% utilization or more before upgrading with peers. This practice constrains growth

Current Challenges to the Traditional Peering Model, cont.

In Access Markets having dominant (powerful) players some are taking actions that block competition from entering or competing in the “home” market, and slow traffic growth, thereby slowing need for their investment in infrastructure.

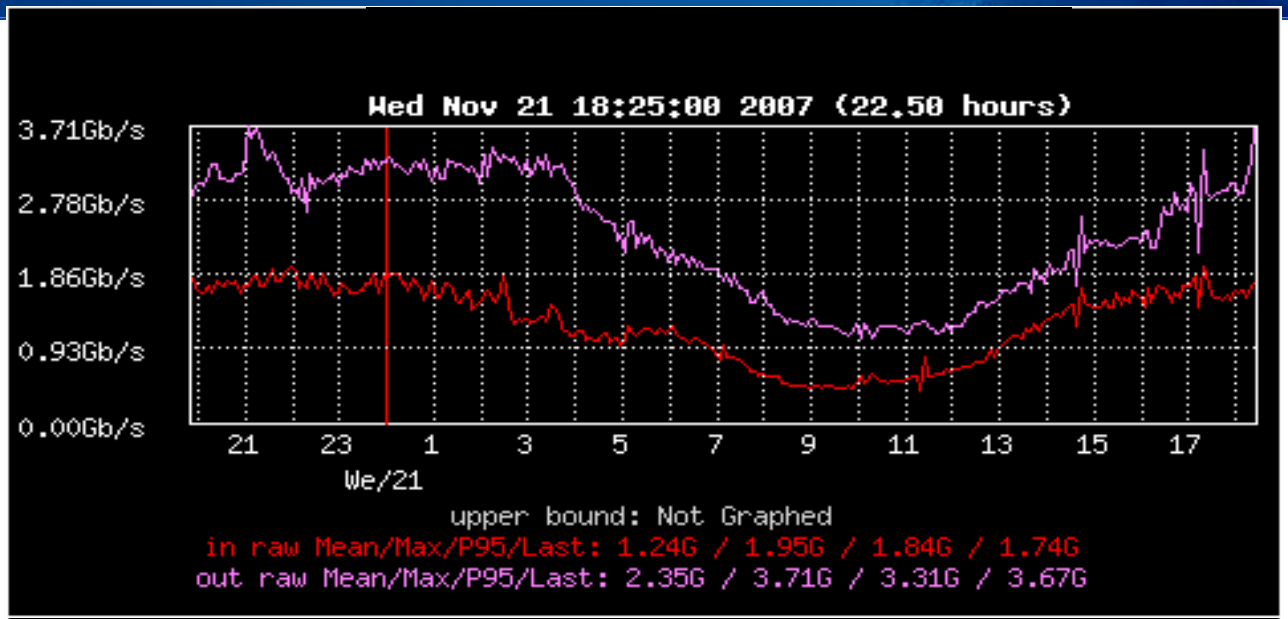
In Europe Incumbents control 82% broadband local loops*

Freeze on new peering, demands for payment from peers to subsidize network build, even rate-limiting existing or turning away new customers, and often very uncompetitive prices

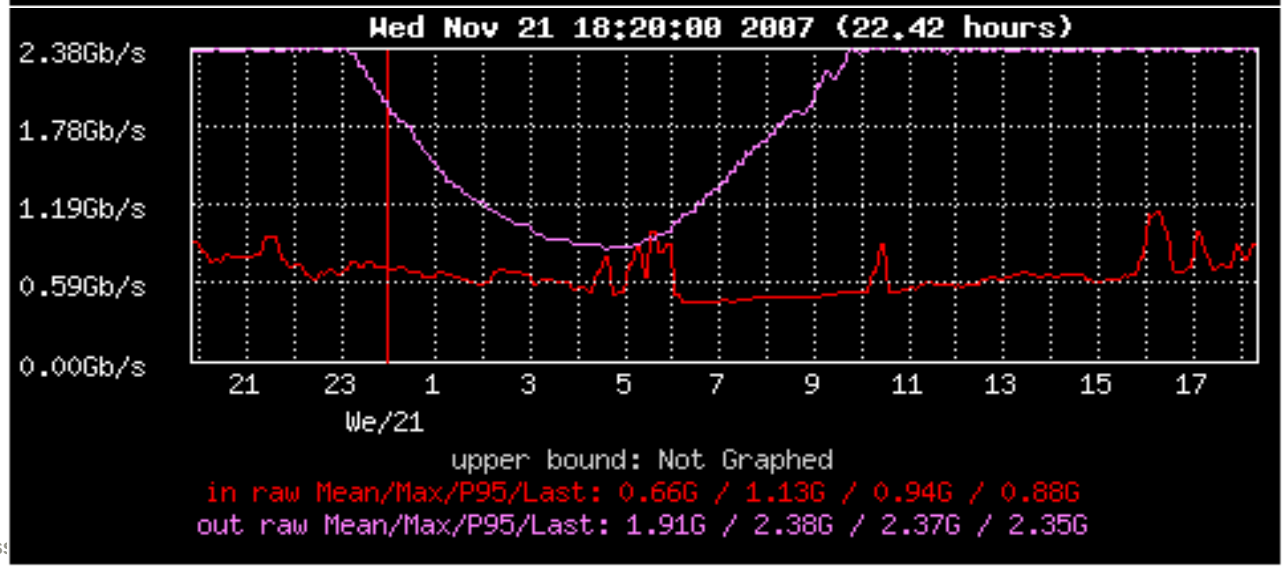
Key Point: We are seeing a huge disparity in the upgrade strategies of networks (as applied to customer, edge, and core) based on their primary source of revenue (flat vs per Meg based). As Internet becomes more bandwidth intensive, the problems caused by these conflicting strategies become more significant as well (read: the consumers will begin to notice and feel the pain)

* Source ECTA

What Problems Do Conflicting Upgrade Strategies Cause?



10GE interface with a peer operating on a usage-based revenue stream



STM16 interface with peer unwilling to upgrade due to protectionist strategies and avoidance of new traffic and network investment

Current Challenges to the Traditional Peering Model, cont.

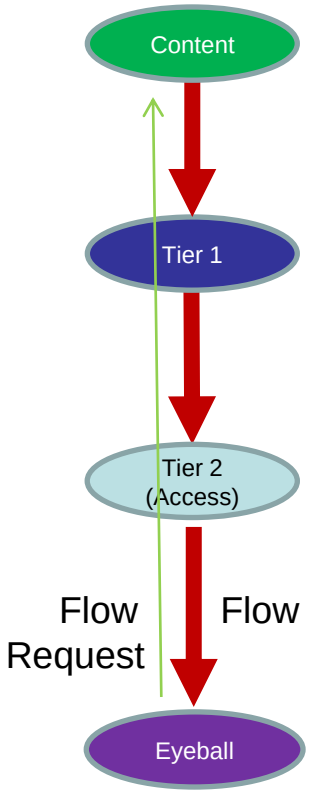
Some Access providers are beginning to take the position that the eyeballs are more Value than Content

Some claim their costs to maintain their network with high capillarity in a focused region are significant enough, that even in their "home market" they must seek compensation from networks delivering "**too much traffic"** to their users.

Traffic ratio argument often used, but is a mask for the true issue, as offers to haul traffic from the US to the country of destination are not enough to trigger an upgrade.

These same providers still expect settlement free peering in non-home markets with the same networks they are trying to charge

Without good access to users, content creators have no outlet for their work and no way to generate income from it



Global Crossing

Q. Is the access problem a) incoming content traffic?
b) peer-to-peer within his own AS?

2008 Internet Traffic by Application

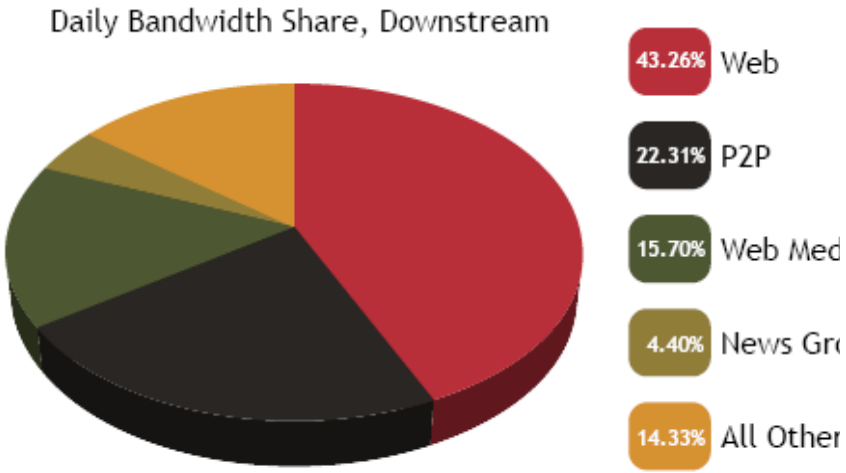


Figure 3 - Relative Bandwidth Share, Top Categories, Daily Average, Global Downstream

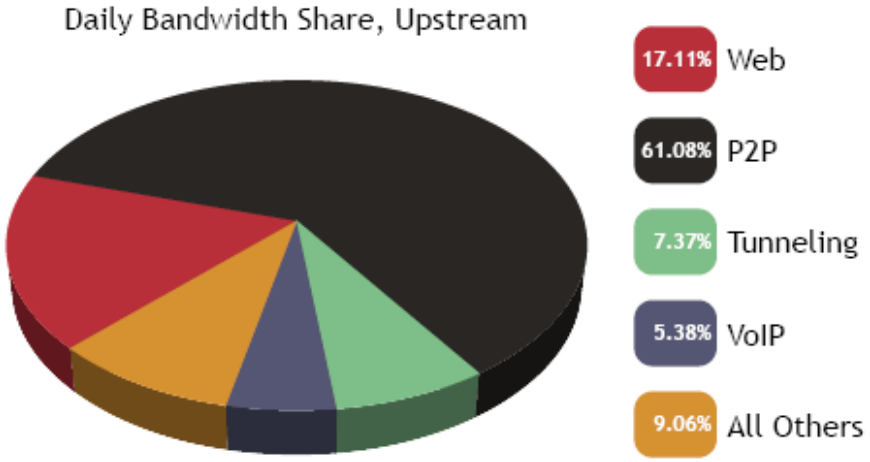


Figure 2 - Relative Bandwidth Share, Top Categories, Daily Average, Global Upstream

Source; Sandvine
2008 Global Broadband Phenomena report

Some possible solutions to current issues

Conflicting network upgrade strategies

Providers must work together to avoid incumbents freezing upgrades, or charging other networks for access to it's subscribers in-country.

Access providers who experience problems with increasing traffic load, must adjust their cost models and service offerings relating to *customers*--not peering partners

Work to block illegal p2p traffic, and limit excessive legal p2p if necessary

In 2007 Comcast began blocking some bittorrent traffic –now resolved

In 2008, numerous Tier 2 ISPs voiced their desire to charge Content providers for carriage

- Limit demand – cap 'unlimited', 'fair usage policies', PAYG
- Flat fee up to a point—then $ per GB billed after that
- Flat fee unlimited usage—but rate limited to 64kbps after reaching a certain threshold

Some possible solutions to current issues

Global Crossing

Flat port speed hierarchy

Web 2.0 is here to stay - bandwidths will grow rapidly

Peering coordinators in the top tier networks must work closely together to resolve disputes between their companies swiftly, involving executive level management if needed to resolve peering disputes, and not allowing freezes to drag on for months on end.

Backbone and Peering engineers will need to develop closer relationships with largest customers to manage traffic flow and exchange information.

Drive to maintain capacity levels at 3-5x current traffic loads ensuring ability to grow and to encourage development of new applications / uses of the Internet.

(Swift adoption and implementation of 100GE standards will open the door for carriers to support the next phase of growth in the Internet.)

Future Hurdles & Some Possible Solutions

Avoiding Government and / or Regulating Body Intervention

As the Internet becomes indispensible to everyday life, global economies, and financial transactions, then governments and regulators will become increasingly intolerant of any outages, disputes, or service degradations that negatively impacts the consumer.

Most of the Internet community wants to avoid regulatory attention

Due to the global nature of the Internet, regulatory intervention would have only localized impact, and would only complicate network management for global networks

The Internet's success as largely based on it's "free and open" status, where your connectivity to any particular network does not typically affect your ability to reach the rest of the Internet

Solution: Networks must work together to assure the overall quality and stability of the Internet (comprised of these relationships!)

Future Hurdles & Some Possible Solutions

Traffic Ratios will continue to get worse for content providers and the networks that serve them when peered with pure access/incumbent networks

Solutions:

Content providers and the networks serving them will need to:

- find ways of balancing traffic ratios (take on more transit from user networks)
- find ways of sourcing traffic closer to source of the request (may involve working with largest customers to develop local distribution networks)

Network Neutrality – Broader Issues

The Uniform and Ubiquitous Internet

A platform for innovation

A framework for economic growth

A force for social cohesion

A competitive necessity

A showcase for technology

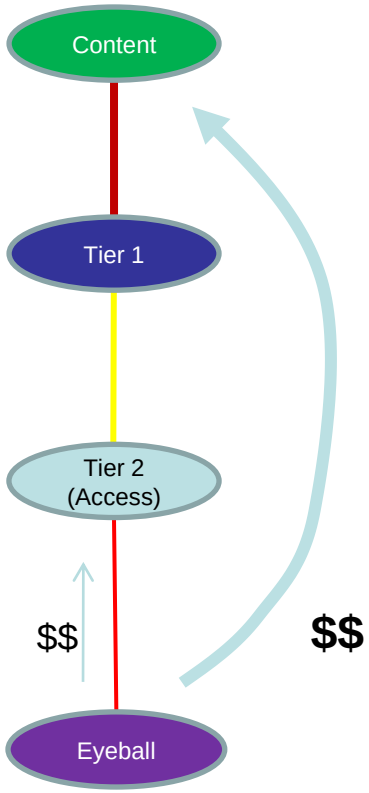
Challenge - Ensuring Demand funds Supply

Network Neutrality and Peering

Global Crossing

Broadly,

- Against Neutrality Regulation:
  - ATT, Verizon, most US Republicans, most Access Networks
    - No neutrality regulation means these networks can take discriminatory actions over what kinds of content are allowed over the “last mile”, and how that content is treated
- For Neutrality regulation:
  - Yahoo, Google, Ebay, Amazon, Microsoft, Cogent, Global Crossing, Moveon.org, most US Democrats.
    - i.e. Content creators, and networks that perform a significant amount of the workload in distributing that content globally
    - Many supporters of neutrality regulation are probably supporting it only in light of the alternative.—not because they crave government intervention.



Network Neutrality Risks & Possible Scenarios

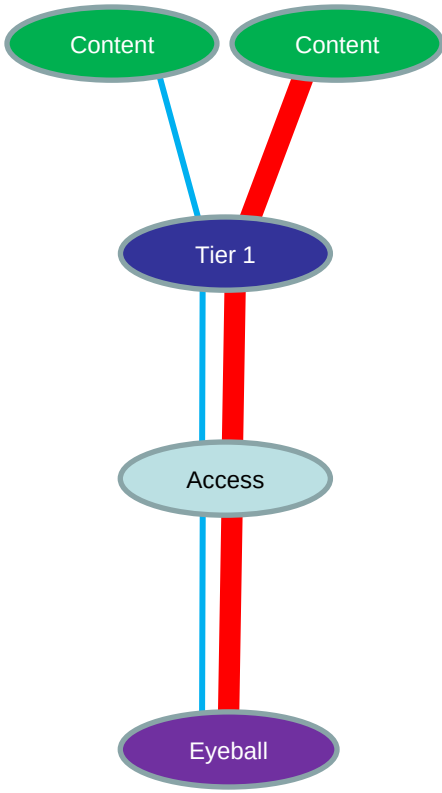
Incumbents still control most of the network infrastructure that links their customers with the outside world.

Might they favour their own over a third party's?

Example: xxx pays incumbent—they get traffic through untouched. yyy does not, so they get rate-limited.

XXX pays incumbent even more, and they become the "exclusive" content provider for our network, while YYY is filtered out completely.

- Creates a hostile environment to newer apps/companies that don't have big cash to pay up to the incumbents.
- Free and open premise of the Internet deteriorates rapidly
- Inconsistent user experience will hurt public perception of the Internet.



Conclusions

- The misguided idea that the content companies are causing the high bandwidth growth rates on access networks, resulting in cost incursion and the need for them to constantly increase network capacity, needs to be stopped. Users must be held accountable for the content they *choose* to view (quantity and legality), and for the bandwidth they consume, by allowing their node to be a P2P distributor for example.
- Increased communication, cooperation, and collaboration is needed among network peering coordinators, as well as at executive levels, to avoid unwanted government intervention and regulation.
- The success of the Internet is founded on it's "free and open" nature. A lack of net neutrality on access networks will lead to an Internet that is controlled by those who have the most cash to lay on the table at the feet of the broadband providers.
- Pricing models offered to users must begin to differentiate between grandma checking email and viewing a few pictures of the grandkids, and the user who "lives" online and sustains multiple high bitrate streams for hours at a time….OR-
- P2P must be dealt with, to provide some relief to the access networks that are supposedly struggling with the cost of maintaining their networks—either way, it's an issue to be dealt with directly with customers—not at the peering level.

Global Crossing®

Thank You

For more details, please contact
Roland.Vrijheid@GlobalCrossing.com, or
Bart.VanderSloot@GlobalCrossing.com