

The Value of Peering

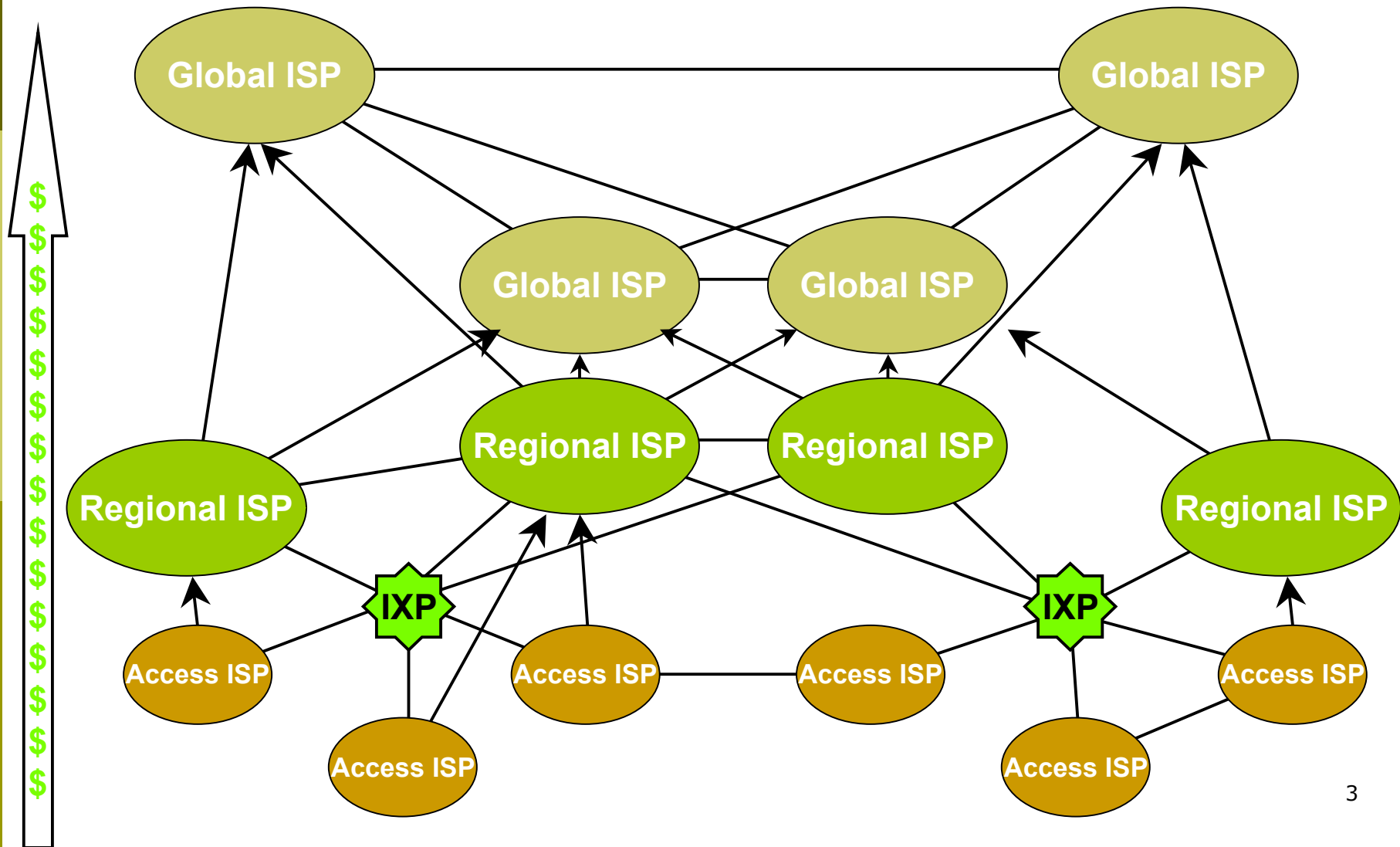


ISP Training Workshops

The Internet

- ❑ Internet is made up of ISPs of all shapes and sizes
 - Some have local coverage (access providers)
 - Others can provide regional or per country coverage
 - And others are global in scale
- ❑ These ISPs interconnect their businesses
 - They don't interconnect with every other ISP (over 37000 distinct autonomous networks) – won't scale
 - They interconnect according to practical and business needs
- ❑ Some ISPs provide transit to others
 - They interconnect other ISP networks

Categorising ISPs



Peering and Transit

□ Transit

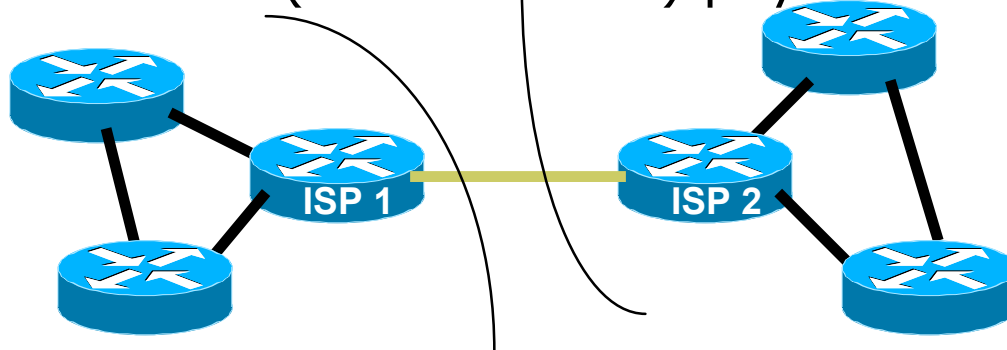
- Carrying traffic across a network
- Usually for a fee
- Example: Access provider connects to a regional provider

□ Peering

- Exchanging routing information and traffic
- Usually for no fee
- Sometimes called settlement free peering
- Example: Regional provider connects to another regional provider

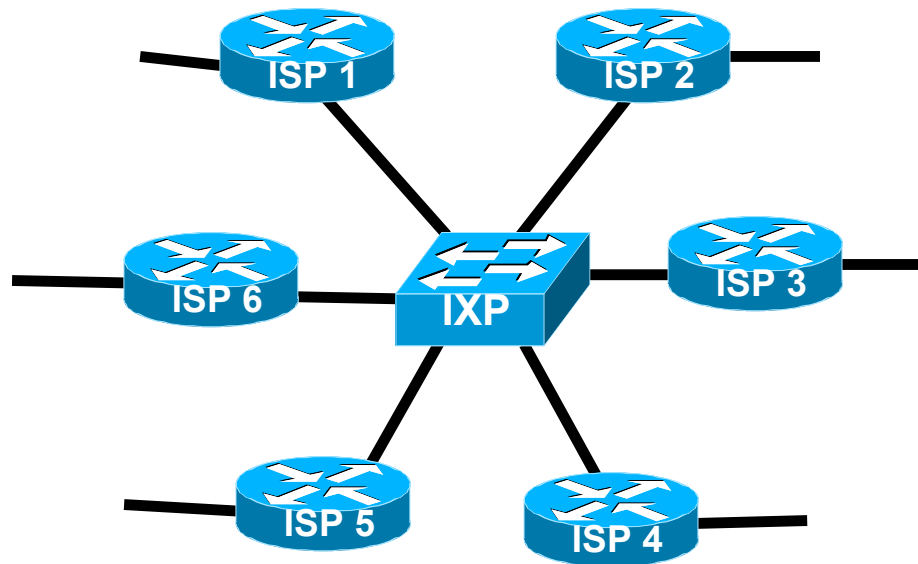
Private Interconnect

- ❑ Two ISPs connect their networks over a **private link**
 - Can be peering arrangement
 - ❑ No charge for traffic
 - ❑ Share cost of the link
 - Can be transit arrangement
 - ❑ One ISP charges the other for traffic
 - ❑ One ISP (the customer) pays for the link



Public Interconnect

- ❑ Several ISPs meeting in a common neutral location and interconnect their networks
 - Usually is a peering arrangement between their networks



ISP Goals

- ❑ **Minimise** the **cost** of operating the business
- ❑ Transit
 - ISP has to pay for circuit (international or domestic)
 - ISP has to pay for data (usually per Mbps)
 - Repeat for each transit provider
 - Significant cost of being a service provider
- ❑ Peering
 - ISP shares circuit cost with peer (private) or runs circuit to public peering point (one off cost)
 - No need to pay for data
 - Reduces transit data volume, therefore reducing cost

Transit – How it works

- ❑ Small access provider provides Internet access for a city's population
 - Mixture of dial up, wireless and fixed broadband
 - Possibly some business customers
 - Possibly also some Internet cafes
- ❑ How do their customers get access to the rest of the Internet?
- ❑ ISP buys access from one, two or more larger ISPs who already have visibility of the rest of the Internet
 - This is transit – they pay for the physical connection to the upstream and for the traffic volume on the link

Peering – How it works

- ❑ If two ISPs are of equivalent sizes, they have:
 - Equivalent network infrastructure coverage
 - Equivalent customer size
 - Similar content volumes to be shared with the Internet
 - Potentially similar traffic flows to each other's networks
- ❑ This makes them good peering partners
- ❑ If they don't peer
 - They both have to pay an upstream provider for access to each other's network/customers/content
 - Upstream benefits from this arrangement, the two ISPs both have to fund the transit costs

The IXP's role

- Private peering makes sense when there are very few equivalent players
 - Connecting to one other ISP costs X
 - Connecting to two other ISPs costs 2 times X
 - Connecting to three other ISPs costs 3 times X
 - Etc... (where X is half the circuit cost plus a port cost)
- The more private peers, the greater the cost
- IXP is a more scalable solution to this problem

The IXP's role

- ❑ Connecting to an IXP
 - ISP costs: one router port, one circuit, and one router to locate at the IXP
- ❑ Some IXPs charge annual “maintenance fees”
 - The maintenance fee has potential to significantly influence the cost balance for an ISP
- ❑ Generally connecting to an IXP and peering there becomes cost effective when there are at least three other peers
 - The real \$ amount varies from region to region, IXP to IXP

Who peers at an IXP?

□ Access Providers

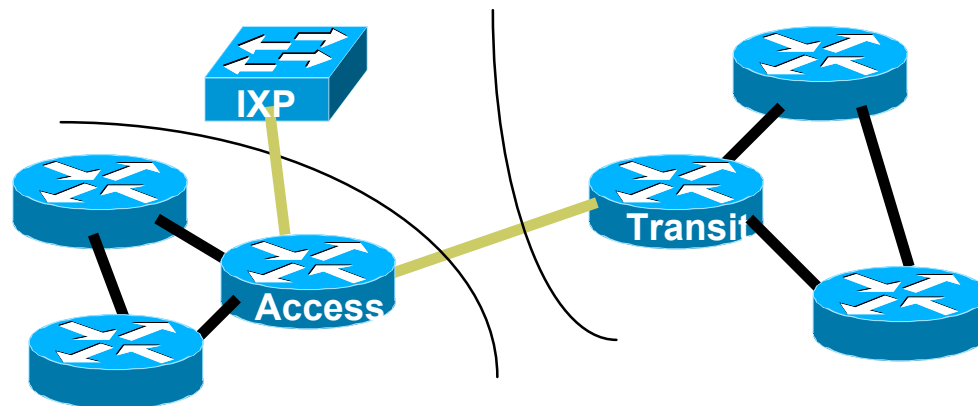
- Don't have to pay their regional provider transit fees for local traffic
- Keeps latency for local traffic low
- 'Unlimited' bandwidth through the IXP (compared with costly and limited bandwidth through transit provider)

□ Regional Providers

- Don't have to pay their global provider transit for local and regional traffic
- Keeps latency for local and regional traffic low
- 'Unlimited' bandwidth through the IXP (compared with costly and limited bandwidth through global provider)

The IXP's role

- ❑ Global Providers can be located close to IXPs
 - Attracted by the potential transit business available
- ❑ Advantageous for access & regional providers
 - They can peer with other similar providers at the IXP
 - And in the same facility pay for transit to their regional or global provider
 - (Not across the IXP fabric, but a separate connection)



Connectivity Decisions

□ Transit

- Almost every ISP needs transit to reach rest of Internet
- One provider = no redundancy
- Two providers: ideal for traffic engineering as well as redundancy
- Three providers = better redundancy, traffic engineering gets harder
- More than three = diminishing returns, rapidly escalating costs and complexity

□ Peering

- Means low (or zero) cost access to another network
- Private or Public Peering (or both)

Transit Goals

1. **Minimise number of transit providers**
 - But maintain redundancy
 - 2 is ideal, 4 or more is bad
2. **Aggregate capacity to transit providers**
 - More aggregated capacity means better value
 - Lower cost per Mbps
 - 4x 45Mbps circuits to 4 different ISPs will almost always cost more than 2x 155Mbps circuits to 2 different ISPs
 - Yet bandwidth of latter (310Mbps) is greater than that of former (180Mbps) and is much easier to operate

Peering or Transit?

- How to choose?
- Or do both?
- It comes down to cost of going to an IXP
 - Free peering
 - Paying for transit from an ISP co-located in same facility, or perhaps close by
- Or not going to an IXP and paying for the cost of transit directly to an upstream provider
 - There is no right or wrong answer, someone has to do the arithmetic

Private or Public Peering

- Private peering
 - Scaling issue, with costs, number of providers, and infrastructure provisioning
- Public peering
 - Makes sense the more potential peers there are (more is usually greater than “two”)
- Which public peering point?
 - Local Internet Exchange Point: great for local traffic and local peers
 - Regional Internet Exchange Point: great for meeting peers outside the locality, might be cheaper than paying transit to reach the same consumer base

Local Internet Exchange Point

- Defined as a public peering point serving the local Internet industry
- Local means where it becomes cheaper to interconnect with other ISPs at a common location than it is to pay transit to another ISP to reach the same consumer base
 - Local can mean different things in different regions!

Regional Internet Exchange Point

- ❑ These are also “local” Internet Exchange Points
- ❑ But also attract regional ISPs and ISPs from outside the locality
 - Regional ISPs peer with each other
 - And show up at several of these Regional IXPs
- ❑ Local ISPs peer with ISPs from outside the locality
 - They don’t compete in each other’s markets
 - Local ISPs don’t have to pay transit costs
 - ISPs from outside the locality don’t have to pay transit costs
 - Quite often ISPs of disparate sizes and influences will happily peer – to defray transit costs

Which IXP?

- ❑ How many routes are available?
 - What is traffic to & from these destinations, and by how much will it reduce cost of transit?
- ❑ What is the cost of co-lo space?
 - If prohibitive or space not available, pointless choosing this IXP
- ❑ What is the cost of running a circuit to the location?
 - If prohibitive or competitive with transit costs, pointless choosing this IXP
- ❑ What is the cost of remote hands/assistance?
 - If no remote hands, doing maintenance is challenging and potentially costly with a serious outage

Example: South Asian ISP @ LINX

- Date: October 2010
- Facts:
 - Route Server plus bilateral peering offers 62k prefixes
 - IXP traffic averages 95Mbps/26Mbps
 - Transit traffic is 50Mbps/3Mbps
- Analysis:
 - 66% of inbound traffic comes from 62k prefixes available by peering
 - 34% of inbound traffic comes from remaining 270k prefixes from transit provider

Example: South Asian ISP @ HKIX

- Date: October 2010
- Facts:
 - Route Server plus bilateral peering offers 34k prefixes
 - IXP traffic is 34Mbps/2Mbps
 - Transit traffic is 54Mbps/29Mbps
- Analysis:
 - 39% of inbound traffic comes from 34k prefixes available by peering
 - 61% of inbound traffic comes from remaining 300k prefixes from transit provider

Example: South Asian ISP

- Router at remote co-lo
 - Benefits: can select peers, easy to swap transit providers
 - Costs: co-lo space and remote hands
- Servers at remote co-lo
 - Benefits: mail filtering, content caching, etc
 - Costs: co-lo space and remote hands
- Overall advantage:
 - Can control what goes on the expensive connectivity “back to home”

Value propositions

- Peering at a local IXP
 - Reduces latency & transit costs for local traffic
 - Improves Internet quality perception
- Participating at a Regional IXP
 - A means of offsetting transit costs
- Managing connection back to home network
- Improving Internet Quality perception for customers

Summary

- Benefits of peering
 - Private
 - Internet Exchange Points
- Local versus Regional IXPs
 - Local services local traffic
 - Regional helps defray transit costs

Worked Example



Single International Transit
Versus
Local IXP + Regional IXP + Transit

Worked Example

- ISP A is local access provider
 - Some business customers (around 200 fixed links)
 - Some co-located content provision (datacentre with 100 servers)
 - Some consumers on broadband (5000 DSL/Cable/Wireless)
 - Some consumers on dial (1000 on V.34 type speeds)
- They have a single transit provider
 - Connect with a 16Mbps international leased link to their transit's PoP
 - Transit link is highly congested

Worked Example (2)

- There are two other ISPs serving the same locality
 - There is no interconnection between any of the three ISPs
 - Local traffic (between all 3 ISPs) is traversing International connections
- Course of action for our ISP:
 - Work to establish local IXP
 - Establish presence at overseas co-location
- First Step
 - Assess local versus international traffic ratio
 - Use NetFlow on border router connecting to transit provider

Worked Example (3)

- Local/Non-local traffic ratio
 - Local = traffic going to other two ISPs
 - Non-local = traffic going elsewhere
- Example: balance is 30:70
 - Of 16Mbps, that means 5Mbps could stay in country and not congest International circuit
 - 16Mbps transit costs \$50 per Mbps per month traffic charges = \$250 per month, or \$3000 per year for local traffic
 - Circuit costs \$100k per year: \$30k is spent on local traffic
- Total is \$33k per year for local traffic

Worked Example (4)

□ IXP cost:

- Simple 8 port 10/100 managed switch plus co-lo space over 3 years could be around US\$30k total; or \$3k per year per ISP
- One router to handle 5Mbps (e.g. 2801) would be around \$3k (good for 3 years)
- One local 10Mbps circuit from ISP location to IXP location would be around \$5k per year, no traffic charges
- Per ISP total: \$9k
- Somewhat cheaper than \$33k
- Business case for local peering is straightforward - \$24k saving per annum

Worked Example (5)

- After IXP establishment
 - 5Mbps removed from International link
 - Leaving 5Mbps for more International traffic – and that fills the link within weeks of the local traffic being removed
- Next step is to assess transit charges and optimise costs
 - ISPs visits several major regional IXPs
 - Assess routes available
 - Compares routes available with traffic generated by those routes from its Netflow data
 - Discovers that 30% of traffic would transfer to one IXP via peering

Worked Example (6)

□ Costs:

- Router for Regional IXP (e.g. 2801) at \$3k over three years
- Co-lo space at Regional IXP venue at \$3k per year
- Best price for transit at the Regional IXP venue by competitive tender is \$30 per Mbps per month, plus \$1k port charge
- 30% of traffic offloads to IXP, leaving 70% of 16Mbps to transit provider = \$330 per month, or \$5k per annum
- Total with this model is \$9k per year, plus the cost of the circuit (still \$100k)
- Compare this with paying \$50 per Mbps per month to the transit provider = \$10k per annum (plus cost of the circuit)

Worked Example (7)

□ Result:

- ISP co-locates at Regional IXP
- Pays reduced transit charges to transit provider (competitive tender)
- Pays no charges for traffic across Regional IXP

□ Bonuses:

- Rate limits on router at Regional IXP Co-lo
 - Can prioritise congestion dependent on customer demands
- Install servers at Regional IXP co-lo facility
 - Filters e-mail (spam and viruses) – relieves some capacity on link
 - Caches content – relieves a little more capacity on link

Conclusion

- Within the original costs of having one international transit provider:
 - ISP has turned up at the local IXP and offloaded local traffic for free
 - ISP has turned up at a major regional IXP and offloaded traffic, avoiding paying transit charges to transit provider
 - ISP has reduced remaining transit charges by competitive tender at the regional IXP co-location facility
- Caveat
 - These numbers are typical of the Internet today
 - As ever, your mileage may vary – but do the financial calculations first and in the context of potential technical advantages too

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