The Value of Peering

Philip Smith

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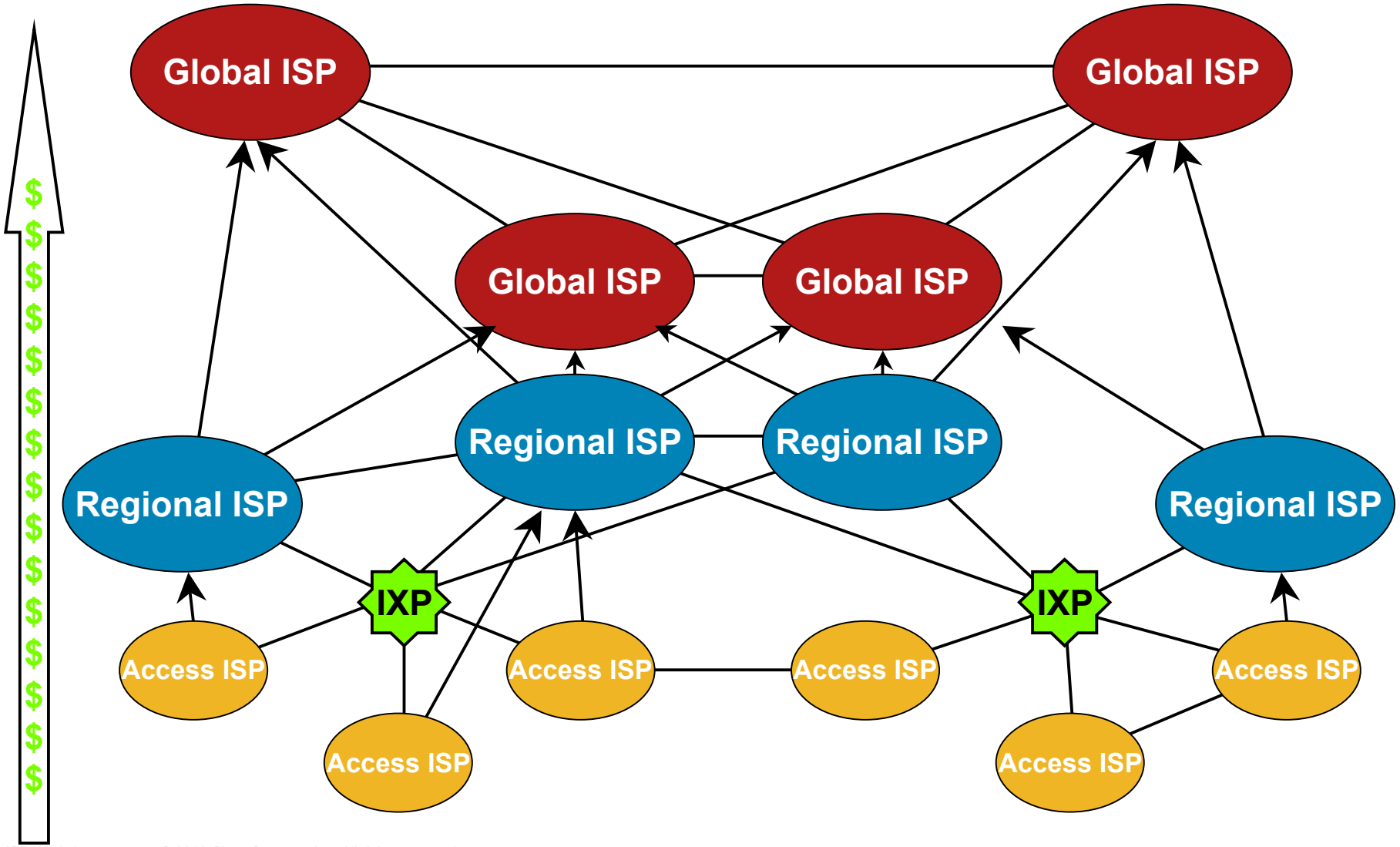
The Internet

- 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 35000 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

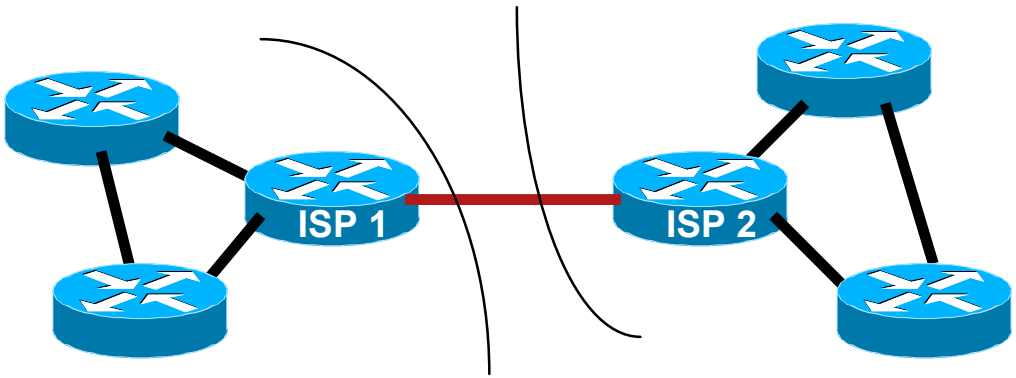
  Usually for no fee

  Sometimes called **settlement free peering**

  Example: Regional provider connects to another regional provider

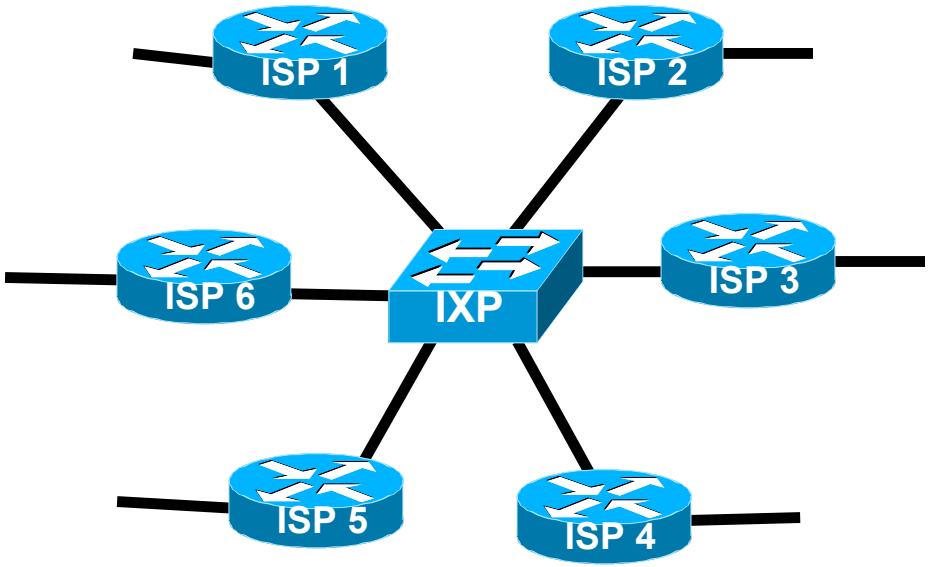
Private Interconnect

- 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

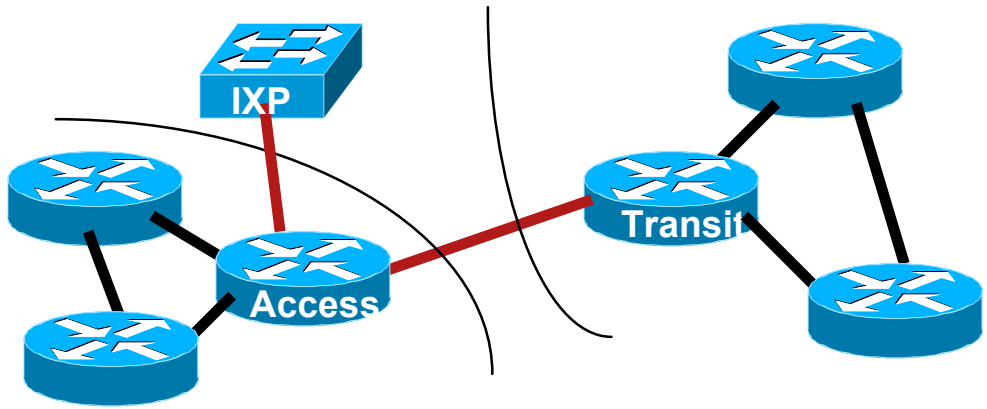
  The real $ amount varies from region to region, IXP to IXP

The IXP's role

- Who peers at an IXP?
- Access Providers
  - Don't have to pay their regional provider transit 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 then 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

- **Minimise number of transit providers**
  - But maintain redundancy
  - 2 is ideal, 4 or more is bad
- **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 number 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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