The Value of Peering

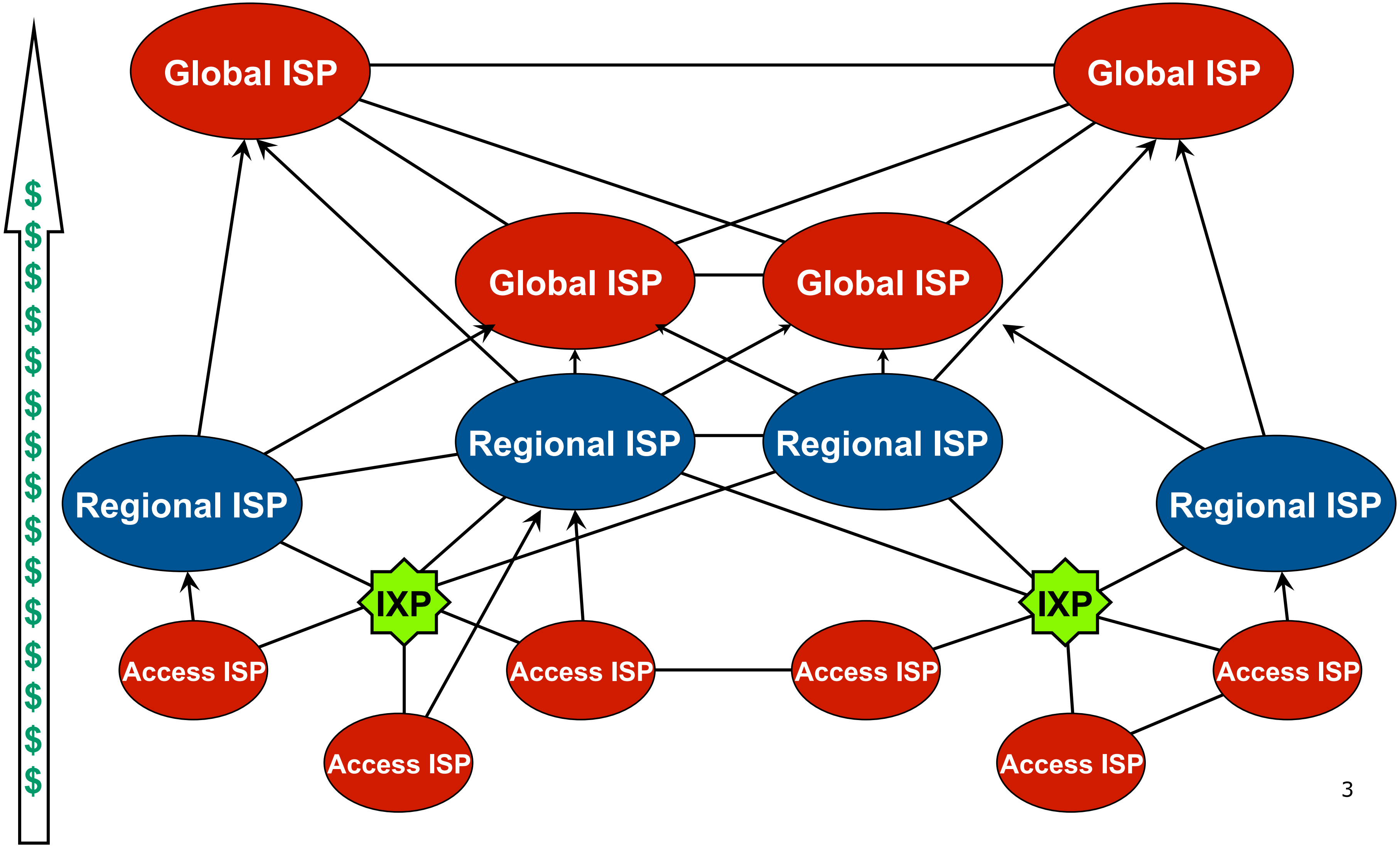
ISP Workshops

Last updated 21 May 2013

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 44000 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
  - Around 6000 autonomous networks provide transit

Categorising ISPs

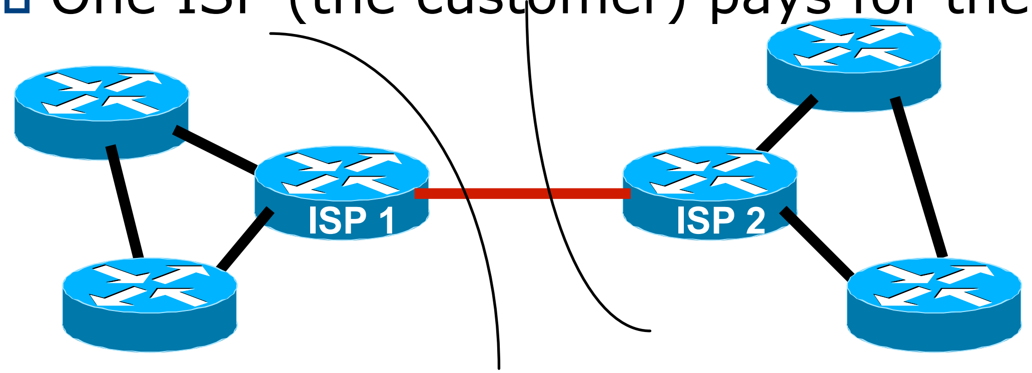


Peering and Transit

- 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

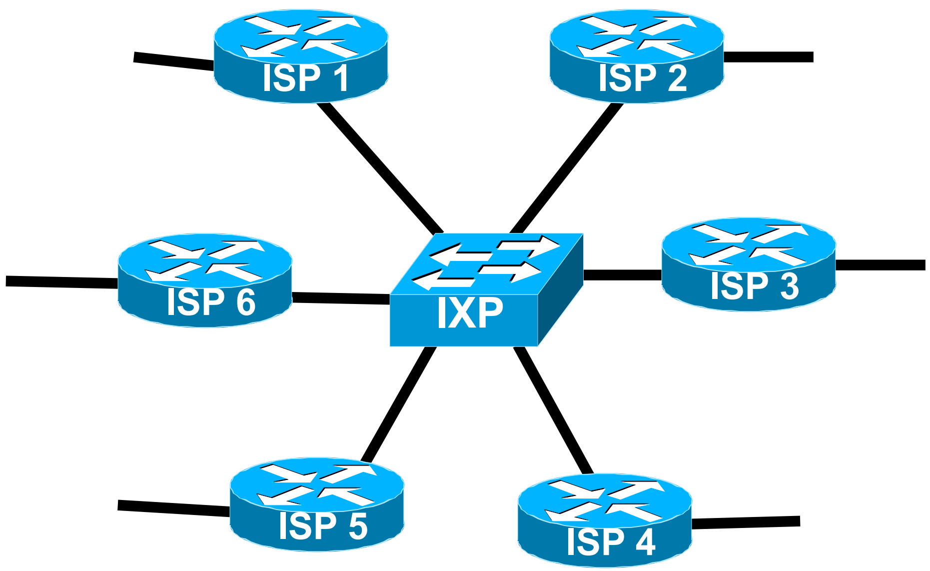
Private Interconnect

- 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



Types of Peering (1)

- Private Peering
  - Where two network operators agree to interconnect their networks, and exchange their respective routes, for the purpose of ensuring their customers can reach each other directly over the peering link
- Settlement Free Peering
  - No traffic charges
  - **The most common form of peering**
- Paid Peering
  - Where two operators agree to exchange traffic charges for a peering relationship

Types of Peering (2)

- Bi-lateral Peering
  - Very similar to Private Peering, but may take place at a public peering point (IXP)
- Multilateral Peering
  - Takes place at Internet Exchange Points, where operators all peer with each other via a Router Server
- Mandatory Multilateral Peering
  - Where operators are forced to peer with each other as condition of IXP membership
  - Strongly discouraged: Has no record of success

Types of Peering (3)

- Open Peering
  - Where an ISP publicly states that they will peer with all parties who approach them for peering
  - Commonly found at IXPs where ISP participates via the Route Server
- Selective Peering
  - Where an ISP's peering policy depends on the nature of the operator who requests peering with them
  - At IXPs, operator will not peer with RS but will only peer bilaterally
- Closed Peering
  - Where an ISP decides who its peering partners are, and is generally not approachable to creating peering opportunities

Types of Peering (4)

- The Peering Database documents ISPs peering policies
  - http://peeringdb.com
- All operators of ASNs should register in the peeringdb
  - All operators who are considering peering or are peering must be in the peeringdb to enhance their peering opportunities
- Participation in peering fora is encouraged too
  - Global Peering Forum (GPF)
  - Regional Peering Fora (European, Middle Eastern, Asian, Caribbean, Latin American)

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

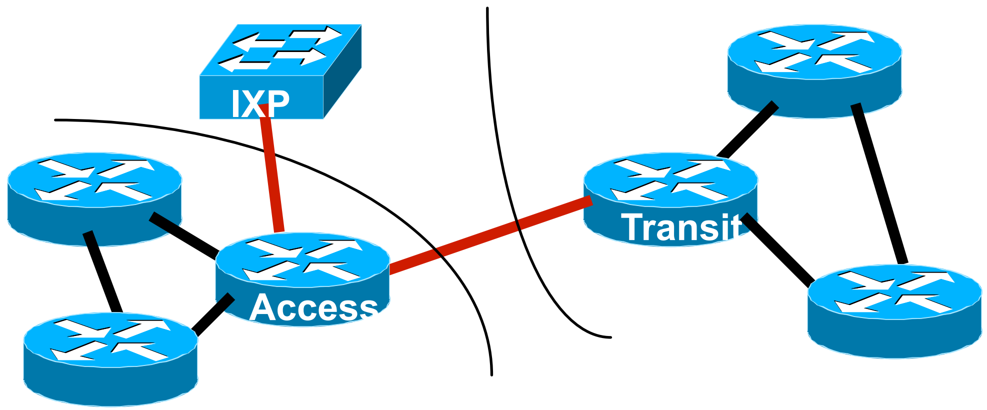
- Connecting to an IXP
  - ISP costs: one router port, one circuit, and one router to locate at the IXP
- Some IXPs charge annual "maintenance fees"
  - The maintenance fee has potential to significantly influence the cost balance for an ISP
- Generally connecting to an IXP and peering there becomes 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 and costs 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 and costs 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

1. Minimise number of transit providers
   - But maintain redundancy
   - 2 is ideal, 4 or more is hard
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

- Time: May 2013
- Data:
  - Route Server plus bilateral peering offers 70k prefixes
  - IXP traffic averages 247Mbps/45Mbps
  - Transit traffic averages 44Mbps/4Mbps
- Analysis:
  - 85% of inbound traffic comes from 70k prefixes available by peering
  - 15% of inbound traffic comes from remaining 380k prefixes from transit provider

Example: South Asian ISP @ HKIX

- Time: May 2013
- Data:
  - Route Server plus bilateral peering offers 67k prefixes
  - IXP traffic is 159Mbps/20Mbps
  - Transit traffic is 108Mbps/50Mbps
- Analysis:
  - 60% of inbound traffic comes from 67k prefixes available by peering
  - 40% of inbound traffic comes from remaining 383k prefixes from transit provider

Example: South Asian ISP

- Summary:
  - Traffic by Peering: 406Mbps/65Mbps
  - Traffic by Transit: 152Mbps/54Mbps

  - 73% of incoming traffic is by peering
  - 55% of outbound traffic is by peering

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

The Value of Peering

ISP Workshops