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Peering Models for Localising Internet Traffic

Internet Exchange Points (IXPs)

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Two parts to this presentation:

- The Value of Peering
  - From Philip Smith's fantastic ISP Workshop materials
- A closer look at IXPs

The Value of Peering

ISP/IXP Workshops

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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 32000 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

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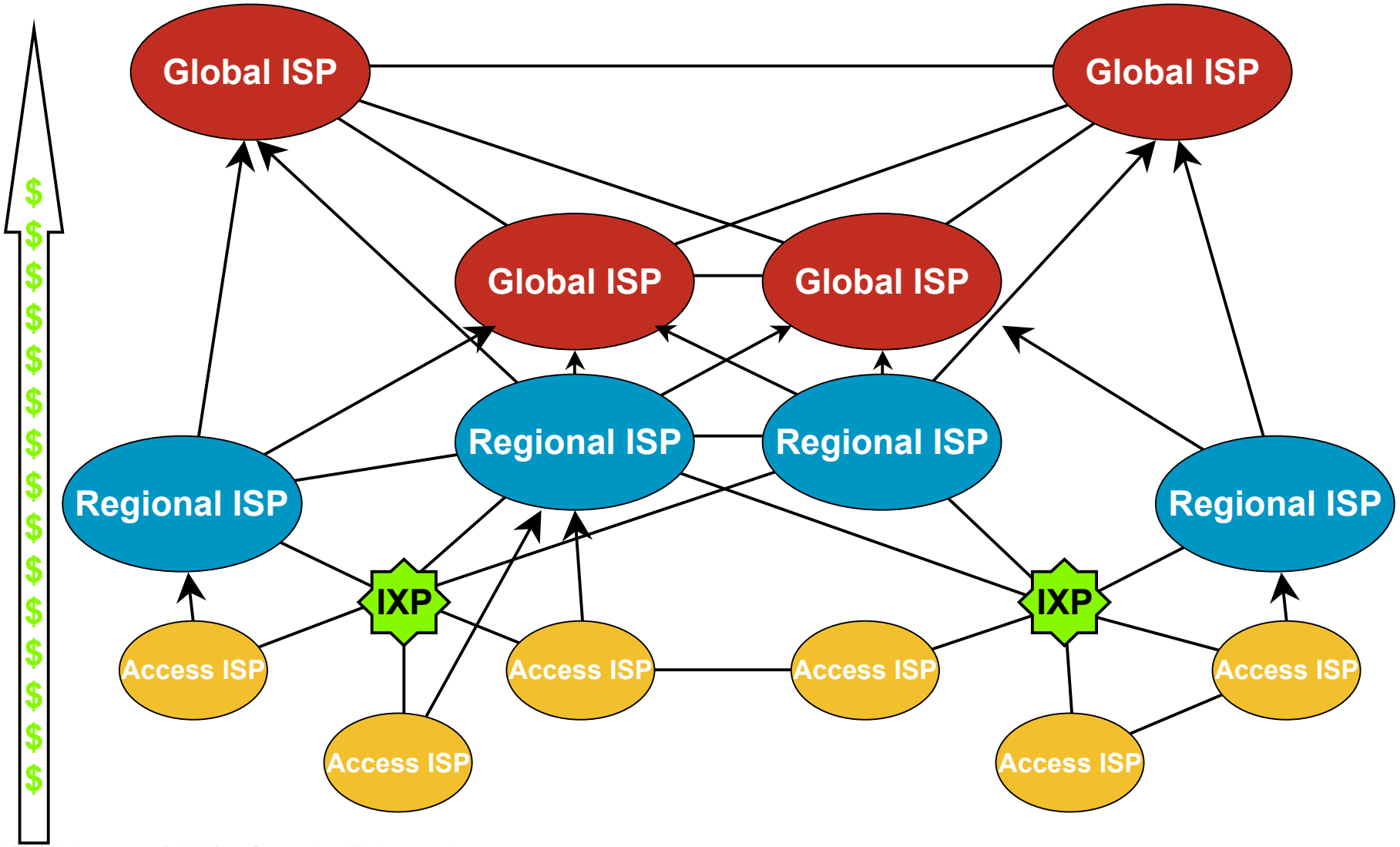
Categorising ISPs



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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

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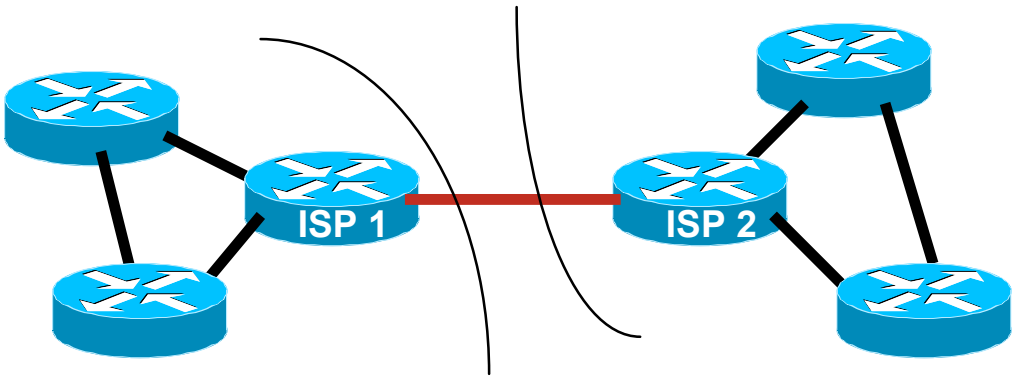
Private Interconnect

- 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



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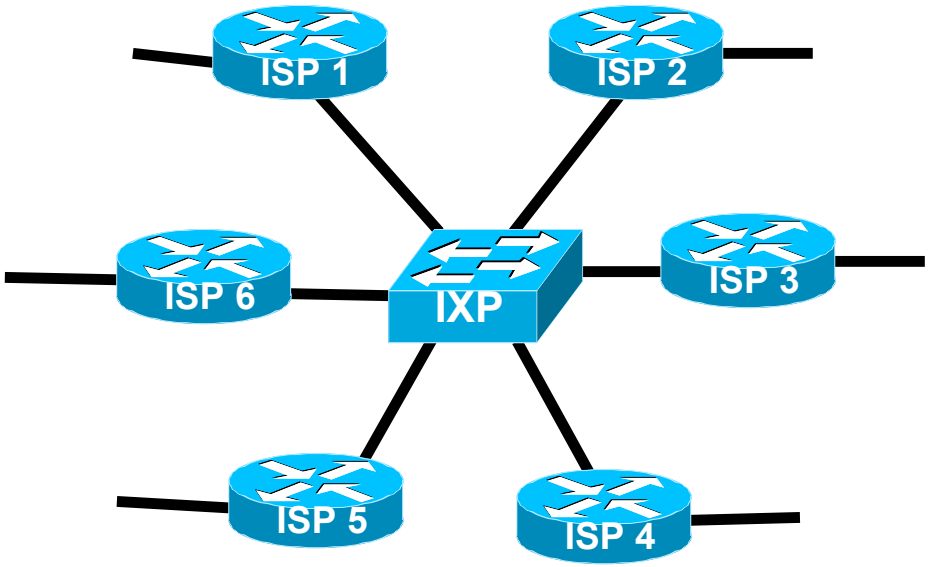
Public Interconnect

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



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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**

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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

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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

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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

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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

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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)

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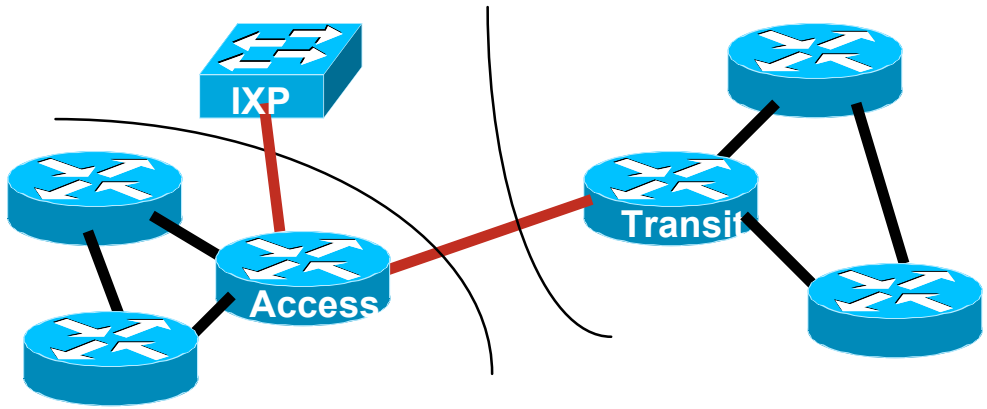
The IXP's role

- 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)



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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)

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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

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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

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What's the best location to build to?

- How long is a piece of string?
- It depends...

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Service Provider Goal

- Minimise the ***cost*** of operating the business
- Luckily most ISPs need to provide a “good” quality service
  - Often a *cost* associated with bad performance

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An IXP is more than just a switch

- A common meet-me point
- A hub for innovative and new businesses
- Focus point for connectivity
- In or surrounded by co-location facilities
- A community and people hub

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In brief: “Building” an IXP

- Determing Need
  - Sufficient users? How much local traffic?
  - Existing facilities?
- Geographic Location
  - Fibre or other facilities ‘near’ participants
- Density
  - Centralized in one room? Campus style?

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In brief: “Building” an IXP

- Building Management
  - Telco hotel? University or City facility?
- In-building Facilities
  - Pathways, power, cooling, access/security
- Services
  - Switch fabric, cross connects?
  - Route-server? DNS and other servers?

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In brief: “Building” an IXP

- Business Structure
  - Incorporated? Staffed / volunteer?
  - Non / for-profit? Ownership?
  - Cost recovery?
- Policies
  - Bilateral / Multilateral / Mandatory Multilateral peering?
  - Extensible switch fabric? Privacy policy?

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What makes an IXP attractive?

- Lots of routes
- Lots of participants
  - On switch fabric, or co-located in facility
- Networks of interest
  - Local content and ISPs
  - Content - DNS servers, Google, CDNs
- Suitable co-location

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Benefits of being at an IXP

- Ideally, reduced cost per Mbit/s
- Higher performance
  - Lower latency
  - “More” bandwidth
  - Increased resiliency
- Stop exporting capital offshore
  - Keep local content local, and help with *creation* of local content
- Marketing: “We support local industry”

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But... there are costs involved

- Cost of:
  - getting to the IXP
  - being at the IXP
  - connecting to the IXP
  - additional network management
- All of this is relative to your existing cost structure

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From a pure *cost* perspective:

- If the cost of peering <= cost of that peered traffic via transit

  Then Peer!

- *Generally* it will make sense to peer at a local IXP even for relatively small traffic volumes

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Taking a wider view

- Cost alone isn't everything
- Higher performance might be worth it, even if transit is cheaper than peering
- Benefits of increased peering apparent as the local Internet industry grows
- IXPs foster a sense of community
  - Increased contact and cooperation between participants

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Evaluating “value” of an IXP

- IXP operators and their websites
- PeeringDB
  - Who is there?
  - What are their policies?
- IXP directories
  - www.pch.net/ixpdir
  - Convenient view of many IXPs

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www.pch.net/documents