The Internet Eco-System

The global Internet is made up of all types of network infrastructure operators. They might be categorised as follows:

- Access Providers
- Regional Providers
- Global Providers
- "Tier-1s"
- Content Providers
- Content Distribution Networks
- Internet Exchange Points

All these network infrastructure operators interconnect with each other in a variety of ways.

Access Providers

The vast majority of network operators participating in the Internet today are Access Providers.

Access Providers provide consumer access (fixed broadband, WiFi, mobile 3G/4G/5G). National research and education networks are also Access Providers, connecting universities, research institutions, schools, colleges, and tertiary education institutions.

They buy transit from upstream providers and participate at Internet Exchange Points.

Some Access Providers may also provide transit to other (smaller) Access Providers.

Regional Providers

Have a presence in many economies. They provide transit to Access Providers, and may be Access Providers themselves (either directly or through specific local subsidiaries).

They buy transit from their upstream providers and usually participate at Internet Exchange Points.

Global Providers

Global providers normally have a presence in two or more continents (for example, North America and Europe, or Europe and Asia, or Africa and Europe).

They provide transit to Access and Regional Providers, but are unlikely to be Access Providers themselves (or they may own subsidiaries in several countries who operate access networks).

They might participate at Internet Exchange Points (either directly or through those specific local subsidiaries).

"Tier-1s"

A Tier-1 is a specific type of Global Provider that does not need to pay for transit. Tier-1s only peer with each other.

They do not participate at Internet Exchange Points, although subsidiaries of theirs may well do so.

Tier-1s have multiple high bandwidth links for their global backbones, and also have multiple high bandwidth interconnects with their peers in most continents.

There is no published list of Tier-1s - very few operators of this size publicly disclose their interconnect agreements.

It is estimated that the number of Tier-1s in the modern Internet is somewhat reduced compared with the turn of the century. This is due to consolidation and because the content providers and content distribution networks have built their own infrastructure out to the Access part of the Internet, including major Access Providers and most of the Internet Exchange Points on the Internet today.

Content Providers

(UPDATED)

Content Providers are responsible for generating content that end-users are interested in accessing. These providers connect to the global Internet infrastructure (“Tier-1s”, Regional Providers, or Access Providers) for transit like any other entity.

Some Content Providers operate their own global infrastructure and transit networks (called Content Distribution Networks), and participate actively at Internet Exchange Points. For them Internet Exchange Points are the easiest and most scalable way of accessing “eye-balls”, the end-users of the IXP members who will be consuming their content.

Once a Content Provider's traffic to any particular IXP member exceeds a pre-determined level, the Content Provider will quite often request a Private Network Interconnect (PNI) or private peering with the IXP member, separate from the IXP fabric.

Content Distribution Networks

(UPDATED)

Content Distribution Networks (CDNs) use their own global infrastructure and transit networks to deliver content for their customers either by private peering or by peering at Internet Exchange Points to the Access Providers whose end users consume it.

CDNs participate actively at Internet Exchange Points and often will provide servers/caches to be hosted either at the IXP or embedded within the network operator infrastructure itself.

For CDNs, Internet Exchange Points are the easiest and most scalable way of accessing “eye-balls”, the end-users of the IXP members who will be consuming the content being distributed on behalf of their customers.

Content Providers who operate their own CDN use the same approach but the content distributed by their CDN is specific to just the Content Provider itself.

In the diagram, one Access Provider at IXP A hosts an embedded cache from CDN 1, and an Access Provider at IXP B hosts an embedded cache from CDN 3. Two other Access Providers only have a PNI with CDNs at the IXPs (no embedded cache server), and the other two Access Providers simply peer across the IX fabric (no PNI and no embedded cache server).

Internet Exchange Points

The Internet Exchange Point is the foundation on which the entire Internet is built.

Most network operators want to peer as much as possible (because traffic across the IXP attracts no charges).

IXPs facilitate large volumes of peering and traffic exchange between the different types of network infrastructure operators listed above.

How does it fit together?

This diagram shows (approximately) how the Internet fits together. The lines with arrows represent transit links, and the lines without arrows are peering links. CDNs and Content Providers congregate around Internet Exchange Points so they are closest to their customers, the end-users.

Back to "Interconnections" page