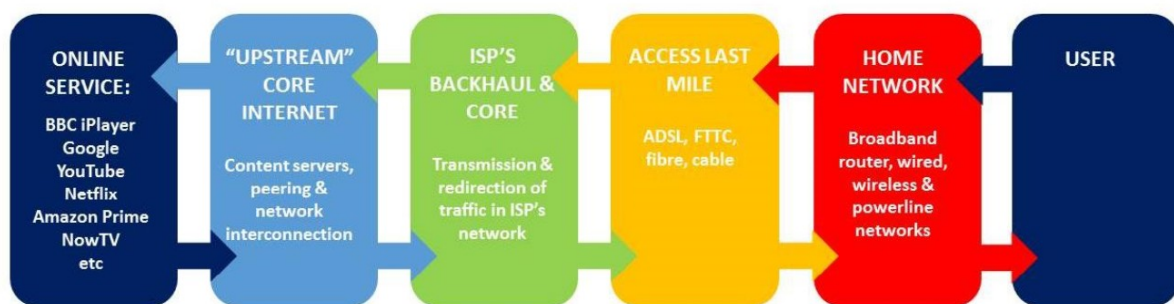# NEN – The Education Network

NEN peering & interconnection benefits

What is peering?

Peering refers to the interconnection of broadband networks to facilitate direct access to online content and services. It is an important step in the broadband delivery chain. The following diagram shows the steps in the delivery chain for a residential broadband service:


- The red link shoes the home network environment, consisting of the router or other connectivity device supplied by broadband service provider, together with WiFi or wired local area network (LAN) infrastructure and access devices (desktops, laptops, tablets, smartphones, set top boxes, smart TVs etc), from which users can connect to the internet.

- The orange link is the broadband service provider's local infrastructure – physically connecting the premise to the provider's network, typically via a local street cabinet or telephone exchange, often along with many others in that geographic area.

- The green link comprises the broadband service provider's national network, upstream of the local infrastructure that comprises the orange access segment.

- The blue link incorporates interconnections with the many other network provider and content provider infrastructures that form the part of the digital supply chain between the broadband service provider and the content itself, as well as onward connectivity to the global internet.

Interconnections between broadband content and service providers' networks are called peerings: connections between networks that facilitate the direct exchange of traffic. A peering relationship between two service providers benefits both: the content or service provider has a higher guarantee that their service (such as a streaming video service) will reach a broadband ISP's customers without being subject to performance issues, while the ISP benefits because peerings reduce the amount of traffic that must traverse paid-for commercial Internet transit arrangements.

What does peering mean in relation to the NEN?

The following diagram shows the steps in the delivery chain for a school broadband service provided via a local authority or Regional Broadband Consortium (RBC) network, interconnected via the national Janet network:
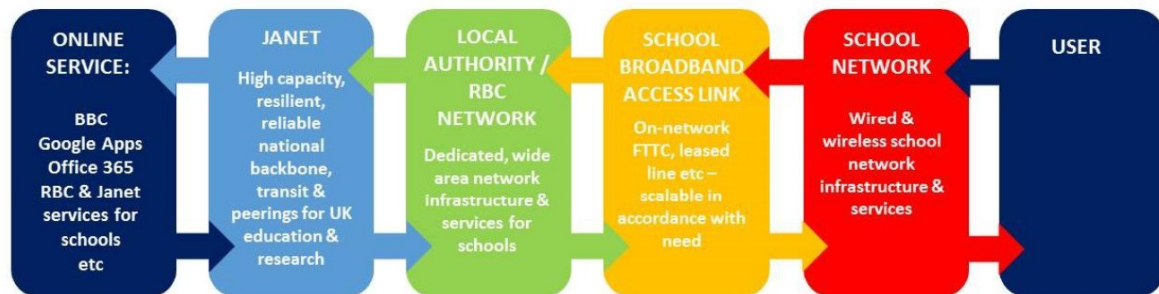
The delivery chain incorporates the same steps, but with some important differences. The orange link is provided by the RBC or local authority, connecting schools into the green link which comprises the RBC's or local authority's wide area network. The blue link is provided by the national Janet network, which facilitates direct access to the many content and service providers that peer with the Janet network, high capacity access to the global internet and access between RBC and local authority networks.

The Janet network was established to provide direct connectivity and related services to approximately 1,000 higher education, further education and research establishments and currently serves over 18 million users. The network covers the whole of the UK with over 5,000 km of optical fibre. The Janet backbone runs at 200Gbit/s (with a total interconnection capacity of around 1Tbit/s) and the network is regarded as mission critical to the UK's knowledge economy.

What does this mean for schools?

End-to-end managed networks guarantee availability and performance; all parts of the broadband delivery chain need to be provisioned and maintained appropriately to ensure that the needs of end users are met.

Janet, RBC and local authority networks provide a private, bespoke architecture designed and built specifically to support the education and research sectors. Janet, RBC and local authority networks are designed to scale to meet changing (and growing) demands for bandwidth and services across the education and research networks.

Jisc constantly reviews the traffic traversing Janet's global internet transit arrangements to identify new opportunities to peer with content and service providers for the benefit of the education and research community. Jisc maintains many private peerings[1] between Janet and the owners and providers of much of the content and services widely used in schools, including the BBC, Google and Microsoft (see diagram below). This ensures that the majority of internet traffic to and from schools flows across a series of managed, highly

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1 https://community.jisc.ac.uk/groups/janet-peering-policy

resilient and highly available private networks, rather than over the public internet where performance and availability cannot always be guaranteed, especially during periods of high demand.

Similarly, local authorities and RBCs monitor and review the connections that make up their wide area networks and backhaul arrangements, upgrading individual links as necessary to maintain performance and avoid congestion. The interconnection of RBC and local authority networks via Janet also provides high-quality access to NEN resources hosted within RBC and local authority networks[2] across the Janet backbone.

Janet external peers: 25-06-2019 (jas) - Telia 100G x 2 added = 2.33Tbit/s
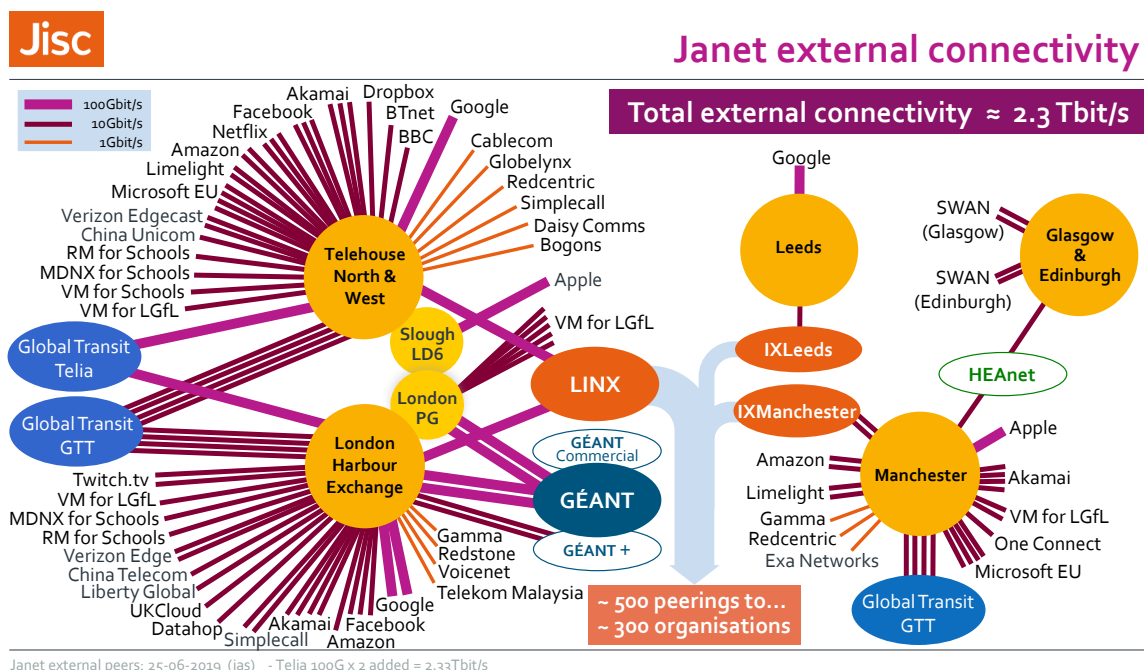
Don't all ISPs have peering arrangements in place? How are the NEN's peering arrangements different?

While the two delivery chains shown previously appear similar and include the same steps, a key difference is that broadband service providers' networks are provisioned for a wide range of customers, rather than the needs of a specific sector

In addition, customers do not generally enjoy the same degree of transparency, visibility and end- to-end control of the complete delivery chain afforded by Janet, RBC and local authority networks. All parts of the chain must be provisioned and maintained appropriately to ensure a good end user online experience, with no or minimal issues such as buffering of streaming video, slow loading of web pages or poor access to cloud-based services.

For example, both the upstream interconnection arrangements between ISPs and online services at one end of the chain and the performance of local area networks (LANs) and WiFi at the other can have a significant

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2https://www.nen.gov.uk/resource/

impact on the quality of end users' experience. Having visibility of and being able to manage, maintain and scale each link in the delivery chain in accordance with changing customer requirements is key to ensuring the best possible end user experience.

An individual school purchasing a broadband service has very little leverage with its service provider outside of the general terms and conditions of its contract, particularly in relation to the links higher up the delivery chain.

How important are the links higher up the chain anyway?

Ofcom analysis undertaken in relation to its 2015 Connected Nations Report[3] shows that the rollout of higher speed connections in the last mile (the yellow link shown in the previous diagrams) is now starting to make access link speeds less of a constraint. This is in turn placing greater emphasis on other potential bottlenecks higher up the delivery chain, such as ISPs' upstream and interconnection arrangements. Ofcom's analysis found the links higher up the delivery chain to be particularly important in relation to the performance of applications and services such as thin client, cloud services and videoconferencing.

Again, this underlines the benefits that access to the Janet network brings to the schools sector, in that Jisc constantly reviews and refreshes Janet's internet transit and peering arrangements to keep pace with changing needs, just as RBCs and local authorities review and refresh their wide areas networks (WANs). Ofcom is currently investigating the impact of all the links in the broadband internet delivery chain on the broadband end user experience.

Janet – some key peerings for schools:

- **Google** (search, Gmail, Google Apps)

- **BBC**

- **Microsoft** (Office365, software updates & patches)

- **Content delivery network (CDN)**[4] providers such as **Akamai**[5] and **Limelight**[6] carry a wide range of internet content, including software, video and music, serving content to end-users with high

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3 Ofcom Connected Nations Report 2015 pages 51-55
http://stakeholders.ofcom.org.uk/binaries/research/infrastructure/2015/downloads/connected_nations2015.pdf & Measurement of Internet Quality of Service – UK Analysis pages 38-32
http://stakeholders.ofcom.org.uk/binaries/research/infrastructure/2015/downloads/qoe_uk-analysis.pdf

4 https://en.wikipedia.org/wiki/Content_delivery_network

5 http://www.bbc.co.uk/news/business-your-money-26829431

6 http://www.bbc.co.uk/news/business-your-money-26829431

availability and high performance. A large proportion of internet content now reaches end-users via global CDNs; Akamai's CDN alone serves 15-30% of all internet traffic.

In addition, a wide and growing range of NEN resources are available via the interconnection of local authority and RBC networks via the Janet network – see https://www.nen.gov.uk/resource/ for more details.

NEN Guidance Notes explain concisely a particular aspect of the broadband services required by schools to deliver education. The Education Network cannot accept responsibility for the application of these ideas to individual schools and local expert advice should be sought.
Audience: Bursars, Network Managers, Technical Support Staff.

Schools may re-use this material, providing that The Education Network is acknowledged.
For further information and updates, see http://www.nen.gov.uk

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