IPv6 in UK R&E Networks

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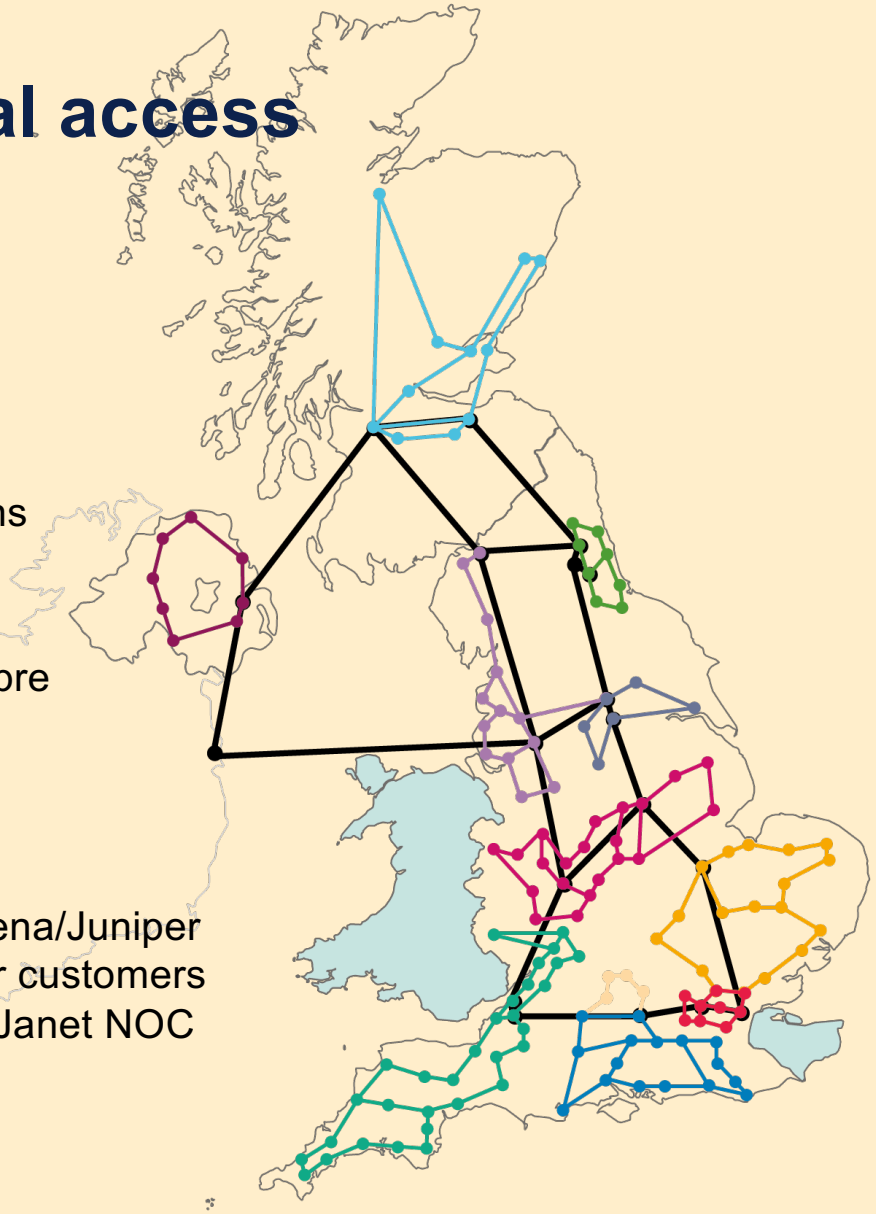
Janet backbone and regional access infrastructure

- Janet backbone
- Scotland
- North West
- Yorkshire
- Northern Ireland
- North East
- Midlands
- East
- South West
- Thames
- South
- London
- Public sector networks

Jisc is the ISP for UK HE/FE, and many research organisations

800G in main core
Around 9,000km of fibre
~1,000 customers
~1,500 connections

Network is largely Ciena/Juniper
~430 managed router customers
~700 devices run by Janet NOC



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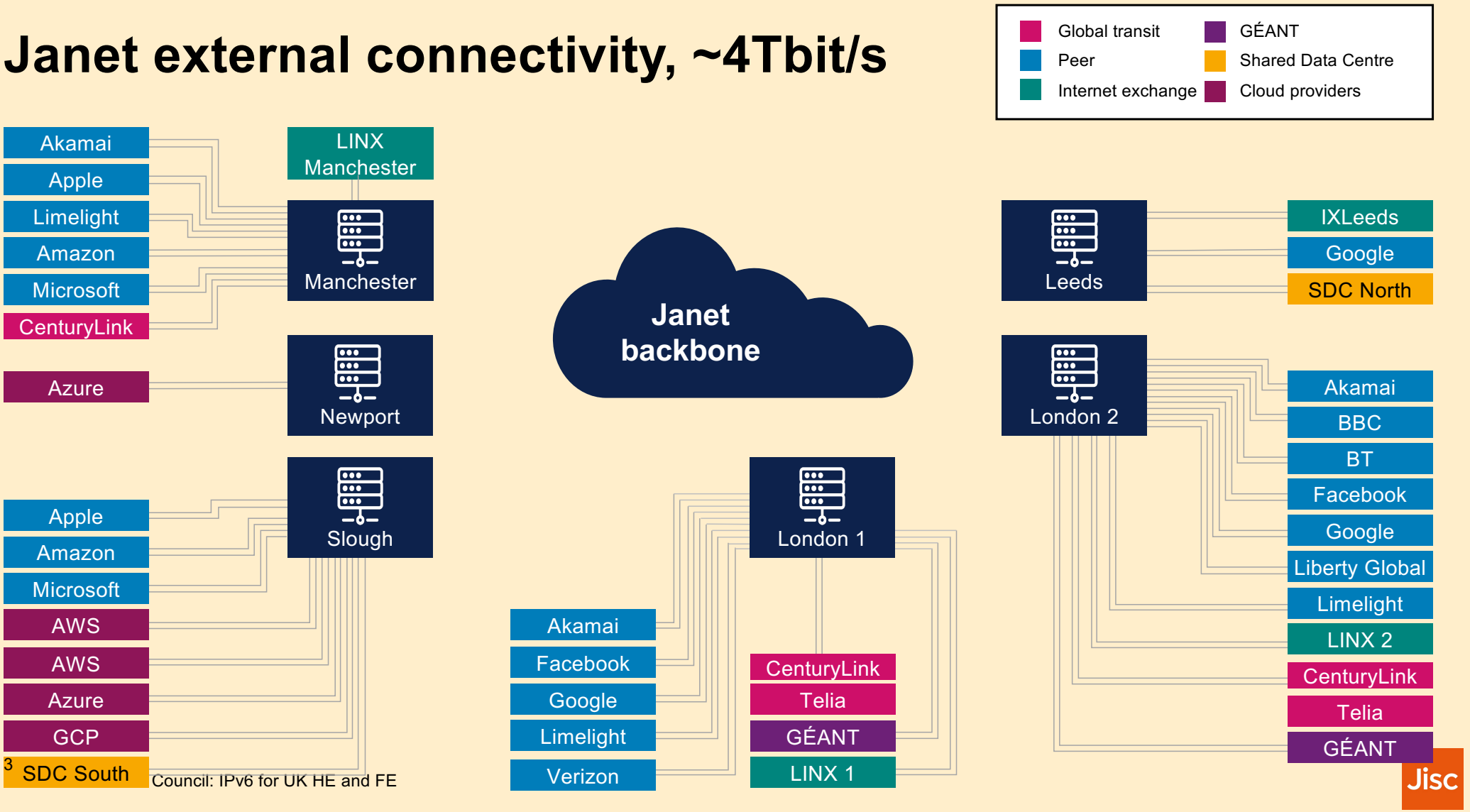
Janet external connectivity, ~4Tbit/s



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IPv6 on Janet

A good news story from a backbone perspective

- We deployed IPv6 dual-stack on our Janet network around 20 years ago
- The vast majority of worldwide NRENs like Janet are now running IPv6
- IPv6 connectivity is provided to all our members as part of their standard Janet IP Connection

- A default /48 to all sites (a few members have taken the LIR path, and we route that)
- Our network services all support IPv6
- DNS, NTP, eduroam peerings, etc
- Our Jisc web presence is IPv6-enabled via a CDN

- In principle, there should be nothing stopping our members deploying and using IPv6

But how is IPv6 adoption at Janet sites?

Not a happy tale

- Over 160 universities in the UK
- Just over 100 have an IPv6 assignment
- But only 28 have IPv6 address space that has been “seen”
- Of the Times Top 20 universities, all have an assignment, 14 have traffic seen, 10 have IPv6 DNS, 5 have IPv6-enabled their web presence but only 3 mention IPv6 on their CS syllabus

(with thanks to Graeme Bragg and content from his Networkshop 50 talk)

- UK GridPP (CERN experiment) sites are a much better story – see Dave’s talk later
- At least 15 of 19 UK Tier 2 sites have IPv6-enabled their GridPP systems and storage
- Imperial has seen 100Gbps of aggregate IPv6 traffic coming in

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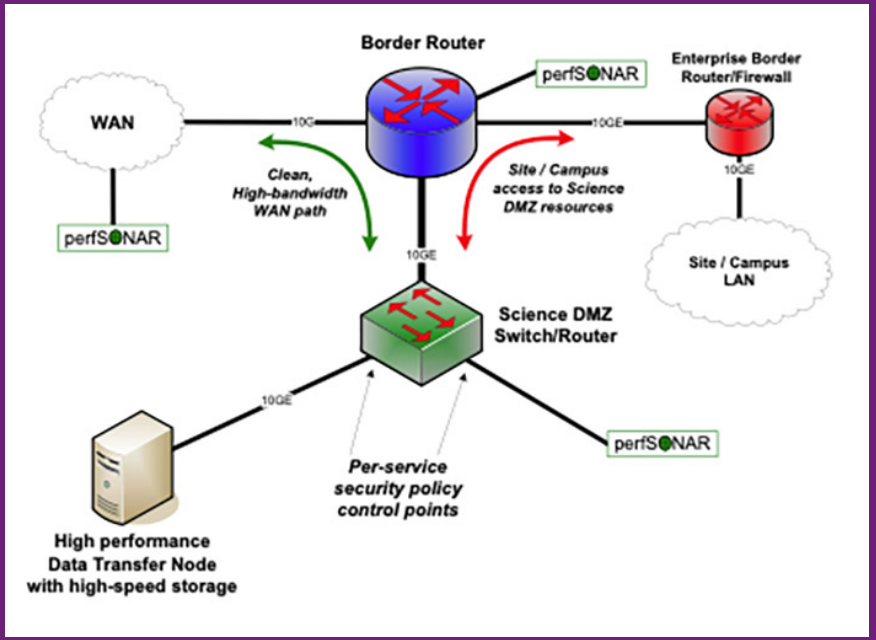
Aside: Science DMZ

Handling science and business traffic

- ESnet documented “Science DMZ” principles ~10 years ago
  - https://fasterdata.es.net/science-dmz/
- Key design elements:
  - Local network architecture to differentiate large science flows
  - Well-tuned data transfer nodes (DTNs)
  - Performant data transfer tools (Globus, etc)
  - Persistent monitoring of network characteristics (perfSONAR)
- Avoid the large flows traversing the main campus firewall
  - Apply security policy efficiently, save costs on the stateful DPI firewall capacity



- **Key point – our members don’t need to IPv6-enable their whole campuses from day 1**
  - They might “just” do public-facing services, their WiFi, or perhaps a Science DMZ

More on the IPv6 usage stats for Janet

What do the numbers say?

- UK as a whole is around 40% user traffic being IPv6
- On our peering with GÉANT (international R&E traffic):
  - 17% of exported traffic is IPv6, and 8% of imported traffic is IPv6
- On general commodity external traffic:
  - 2.5% of exported traffic is IPv6 and 1.6% of imported traffic
- The APNIC stats show Janet at around “2.9% capable” for IPv6 user traffic
  - So while GridPP experiments are using IPv6, user (WiFi / lab) networks generally are not
  - https://stats.labs.apnic.net/ipv6/GB

- These figures are disappointing compared to the UK overall position
- Shouldn’t R&E networks be leading the way?

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Rationale for IPv6

Why should our HE/FE members deploy IPv6?

- **Supporting teaching and research**
- Around 40% of user traffic on the Internet is IPv6 – it will be 50% in 2024 at current rates
- Robustness; ensuring the best performance to your services for IPv6-only client devices
- Minimising dependency on an ever-more fragile IPv4 network (witness CGN, etc)
- Security – all common platforms support IPv6, and it's usually enabled by default
- Scalability for campuses of the future; IoT is increasingly using IPv6
- Facilitating network innovation
- Example of big science working towards IPv6-only – CERN are not far off this goal

- **Are there other drivers / rationales we are missing?**

What is Jisc doing?

We're very keen to both use and promote member use of IPv6

- While our network position is good, not all Jisc systems and services support IPv6
- We have a new IPv6 Programme to drive change
- For Jisc:
  - Ensuring what is meant by "IPv6 support" is well-defined (inc. in absence of IPv4)
  - IPv6 now a requirement in **all new** procurements (not just network tenders)
  - All projects must support IPv6 to pass their service transition PLM gate for production use
  - Ensuring IPv6 is considered in all security-related activities and services
- For our members, we provide:
  - Advice and guidance, especially for decision makers, and a Janet IPv6 Technical Guide
  - Minimum recommendation – include in tenders, enable public-facing services
  - Training, community support, and inclusion of IPv6 content at our flagship events

Summary

UK research and education has fallen behind on IPv6

- All Janet-connected organisations have IPv6 to their doorsteps
- But adoption and usage as yet is minimal, certainly compared to commercial networks
- Graeme's "rough" investigation of publicly available information showed a lack of IPv6 in graduate teaching and in labs supporting that teaching
- This surely has an effect on UK industry, despite some interest from the top universities
- There are encouraging exceptions, particularly the GridPP CERN experiment sites

- There's plenty of room to do more
- **All input from the UK IPv6 Council community is welcome**

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