



Jisc: Using perfSONAR

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**Building high-performing
campus infrastructures for research**

26 Sep 2018

» Our high-level goals:

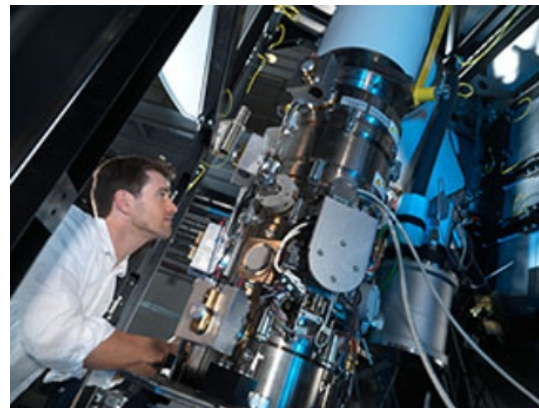
- » “Supporting user communities in making optimal use of the Janet network for high-performance network applications”
- » “We will identify, document and share best practices on high performance networking, to raise awareness amongst Janet network connected communities of the issues and factors affecting end-to-end network performance”



- » Growing interest in moving large volumes of research data
 - › Captured or generated data to remote computing facility
 - › Remote visualisation
 - › Data replication / distributed storage / backups
 - › To / from cloud

- » Data set volumes are increasing
 - › 100 TB is no longer 'very large'
 - › But moving 100 TB takes 10 Gbit/s of throughput for 24 hours

- » Examples:
 - › Astrophysics, genomics, environmental sciences, ...
 - › The new Titan Krios cryo-EM/ET microscope at Diamond
 - › The Square Kilometer Array (SKA) project



www.diamond.ac.uk



www.skatelescope.org

» An ongoing activity within Jisc:

- › Engaging with existing and data-intensive research communities and identifying emerging communities who need to move data around Janet (and beyond)
- › Creating dialogue between Jisc, computing services, and research communities
- › Holding workshops, facilitating discussion on e-mail lists, etc.
- › Helping researchers manage expectations
- › Sharing best practices in identifying and rectifying causes of poor performance
- › Promoting good practices in campus network engineering, esp. 'Science DMZ'
- › **Promoting deployment of performance measurement tools, esp. perfSONAR**

» More information:

- › <https://www.jisc.ac.uk/rd/projects/janet-end-to-end-performance-initiative>



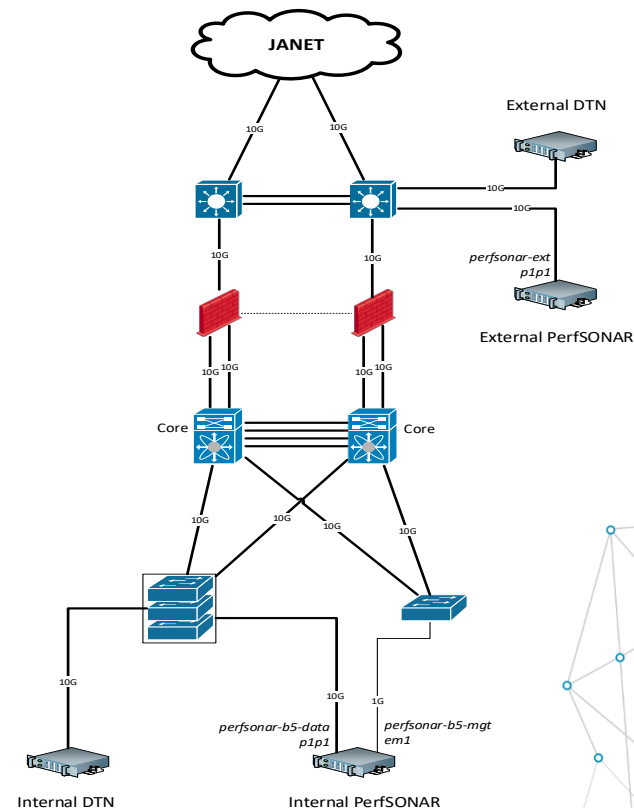
- » An example of data still being moved by physical media
 - › Southampton μ -VIS X-Ray Imaging Centre
 - › Has local facilities, but takes samples to Diamond Light Source ~6 times a year
 - › Might gather 10-40 TB of experimental result data per visit
 - › One data set typically a ~50 GB file, plus up to 5,000 8-25 MB files
 - › Tried using network and *rsync*; obtained ~30 MB/s (240 Mbit/s)
 - › Would take 4 days to copy 10 TB home over Janet, best case

- » We ought to be able to do better...
 - › Diamond end has already deployed Science DMZ
 - › Southampton has a 10 Gbit/s campus link to Janet
 - › A target of 2 Gbit/s would allow ~1 TB per hour

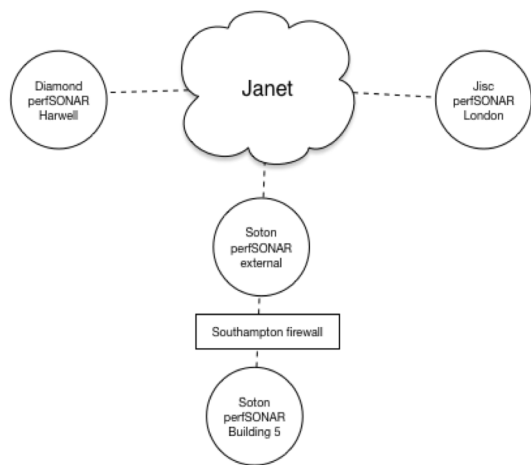


www.diamond.ac.uk

- » Met with Diamond and Soton IT & research staff
- » Agreed a phased plan of action:
 - › Change to using Globus software tools
 - › Deploy perfSONAR to measure network characteristics
 - › Engineer 10 Gbit/s link to research file store, internal to campus firewall
 - › Pilot a 10 Gbit/s DTN at the campus edge
- » Outcome:
 - › External data transfers achieving 2-4 Gbit/s
 - › Potential to transfer their most recent 12 TB data set in 6-12 hours (overnight)



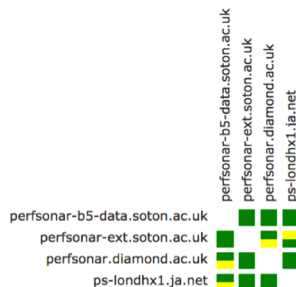
- » Jisc has deployed two perfSONAR servers – one at a London PoP, one at our Slough DC
- » We set up a perfSONAR mesh for the Southampton case study (on a Jisc VM mesh server)
- » Used measurement points at Diamond, Janet (London), and two at Southampton
- » See - <http://ps-dash.dev.ja.net/maddash-webui/index.cgi?dashboard=SES>



SES - Traceroute

Number of Paths is ≤ 1 Number of Paths is \geq

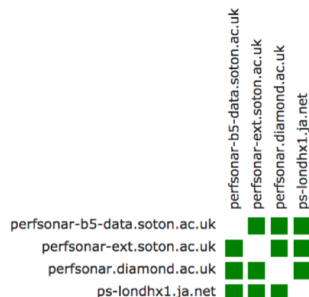
✓ No problems found in grid



SES - Throughput Testing

Throughput ≥ 900 Mbps Throughput < 900 Mb

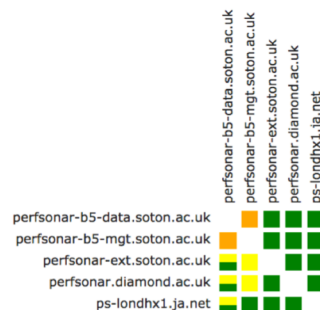
✓ No problems found in grid



SES - Latency Testing

Loss rate is ≤ 0 Loss rate is ≥ 0 Loss rate is \geq

✓ No problems found in grid



Source

ps-londhx1.ja.net
194.83.97.209,2001:630:3c:f800:0:0:0:209

[Host info](#) ▾

Destination

perfsonar-b5-data.soton.ac.uk
152.78.176.16

[Host info](#) ▾

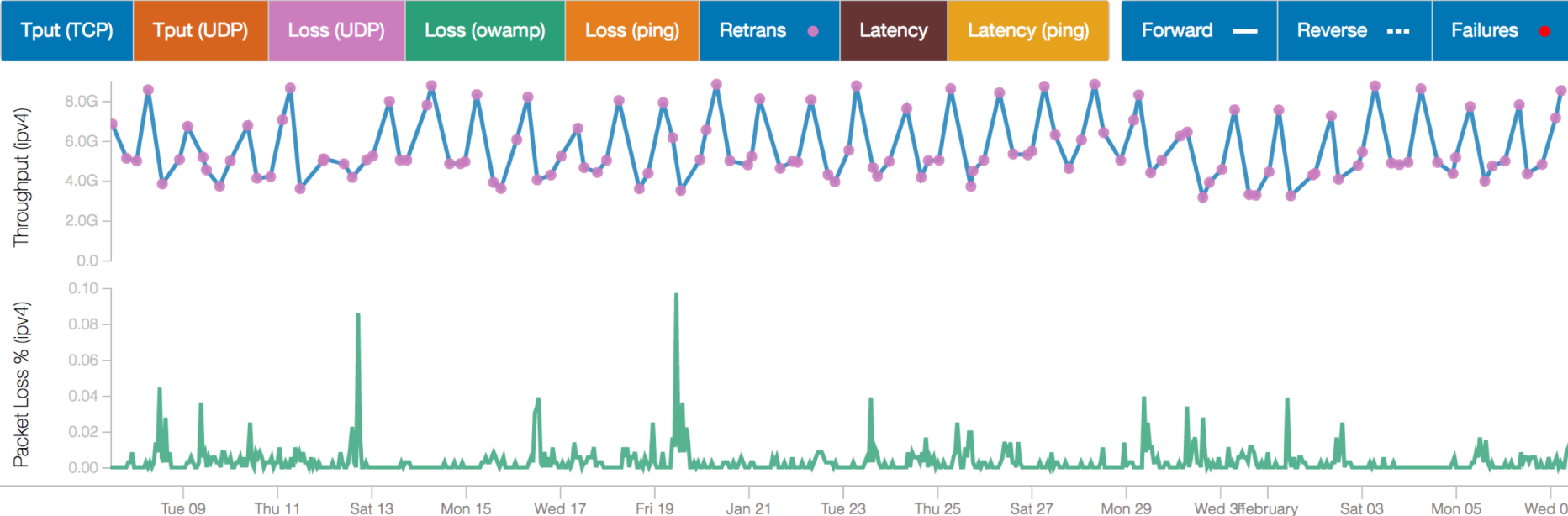
Report range

←

1 month ▾

→

Sun 01/07/2018 to Wed 02/07/2018
10:57:37 (GMT+0) 10:57:37 (GMT+0)



Janet London pS node to external pS node

Source

ps-londhx1.ja.net
194.83.97.209,2001:630:3c:f800:0:0:0:209
[Host info](#) ▾

Destination

perfsonar-ext.soton.ac.uk
152.78.1.2
[Host info](#) ▾

Report range

←

1 month ▾

→

Sun 01/07/2018 to Wed 02/07/2018
10:59:12 (GMT+0) 10:59:12 (GMT+0)

Tput (TCP)

Tput (UDP)

Loss (UDP)

Loss (owamp)

Loss (ping)

Retrans

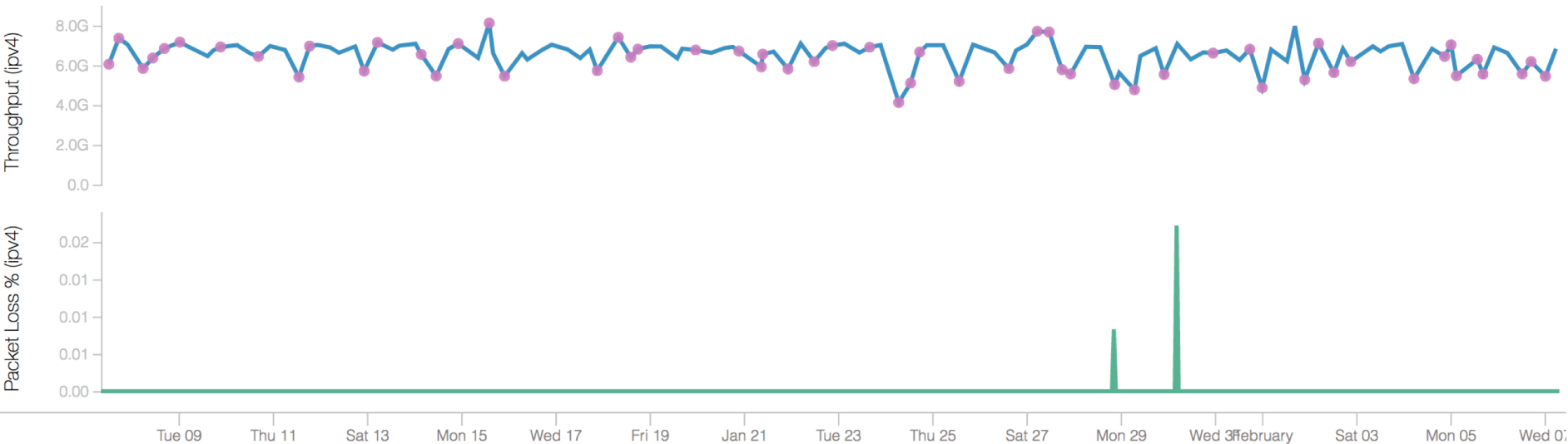
Latency

Latency (ping)

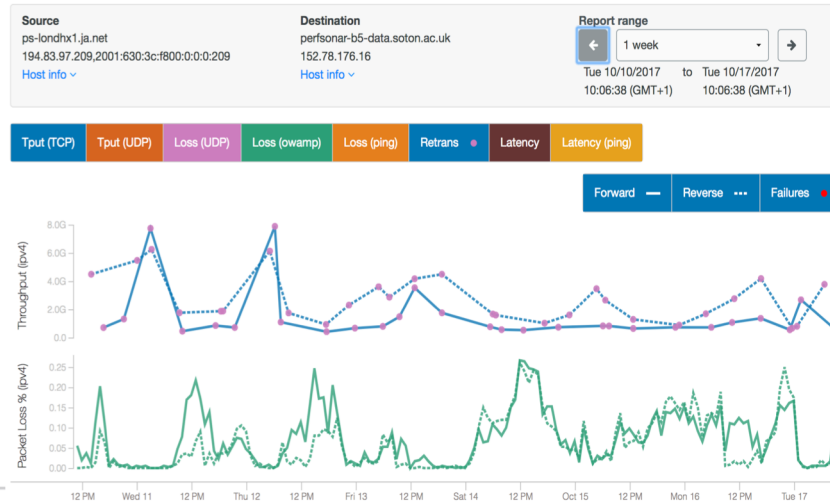
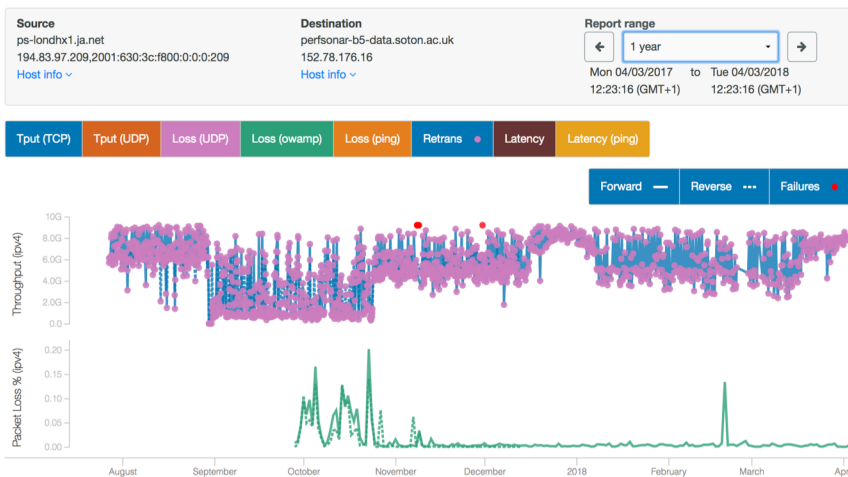
Forward —

Reverse ...

Failures ●



- » Slight persistent packet loss after a routine update of the Southampton firewall
- » Resulting throughput issues not reported by users, or observable with Jisc Netsight view
- » But highlighted by perfSONAR; clear drop in throughput, with higher loss (up to 0.3 %)
- » Also gives interesting insight into traffic characteristics over a year-long period



- » Working with Imperial College and SingAREN
- » New genomics project, needs to send/receive up to 200 TB of data between sites
- » perfSONAR highlighted one-way issue on Singapore -> Janet path; faulty hardware
- » Resolved with TEINCC/CERNET, now get 2.5 Gbit/s single stream, both ways

Source

bwctl-10g-ps.singaren.net.sg
203.30.39.13,2001:df0:21a:0:f6e9:d4ff:fea4:6432
[Host info](#) ▾

Destination

ps-londhx1.ja.net
194.83.97.209,2001:630:3c:f800:0:0:0:209
[Host info](#) ▾

Report range

← 1 month →
Sat 03/10/2018 11:25:07 (GMT+0) to Tue 04/10/2018 12:25:07 (GMT+1)

Tput (TCP)

Tput (UDP)

Loss (UDP)

Loss (owamp)

Loss (ping)

Retrans

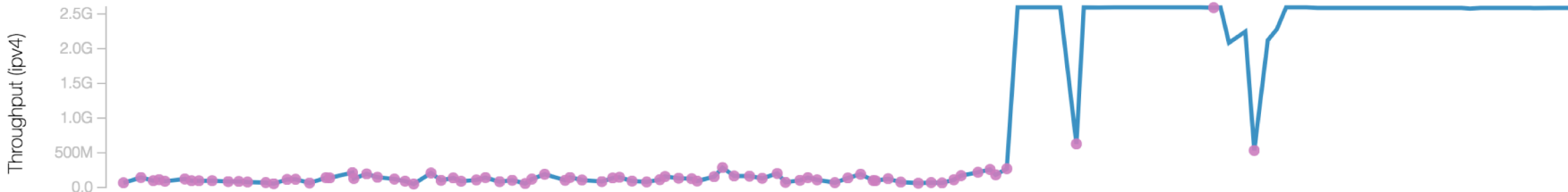
Latency

Latency (ping)

Forward

Reverse

Failures



```
$ pscheduler task --slip PT1H throughput --source=bwctl-10g-ps.singaren.net.sg --dest=ps-londhxl1.ja.net -t 30 --ip-version 4
```

```
* Stream ID 5
```

Interval	Throughput	Retransmits	Current Window
0.0 - 1.0	2.67 Mbps	0	81.40 KBytes
1.0 - 2.0	9.97 Mbps	0	333.74 KBytes
2.0 - 3.0	64.37 Mbps	0	2.27 MBytes
3.0 - 4.0	314.58 Mbps	0	9.68 MBytes
4.0 - 5.0	1.22 Gbps	0	25.23 MBytes
5.0 - 6.0	723.46 Mbps	1	12.58 MBytes
6.0 - 7.0	602.85 Mbps	2	6.59 MBytes
7.0 - 8.0	402.02 Mbps	0	6.40 MBytes
8.0 - 9.0	314.56 Mbps	0	6.65 MBytes
9.0 - 10.0	335.56 Mbps	1	3.63 MBytes
10.0 - 11.0	115.32 Mbps	2	1.20 MBytes
11.0 - 12.0	62.92 Mbps	0	976.80 KBytes
12.0 - 13.0	52.43 Mbps	0	1.21 MBytes
13.0 - 14.0	83.89 Mbps	0	1.89 MBytes
14.0 - 15.0	83.87 Mbps	1	1.22 MBytes
15.0 - 16.0	62.92 Mbps	0	1.27 MBytes
16.0 - 17.0	83.89 Mbps	0	1.69 MBytes
17.0 - 18.0	94.37 Mbps	0	2.58 MBytes
18.0 - 19.0	178.27 Mbps	0	4.18 MBytes
19.0 - 20.0	251.65 Mbps	0	6.39 MBytes
20.0 - 21.0	419.18 Mbps	0	9.95 MBytes
21.0 - 22.0	566.56 Mbps	0	13.96 MBytes
22.0 - 23.0	765.42 Mbps	0	18.87 MBytes
23.0 - 24.0	1.05 Gbps	1	11.84 MBytes
24.0 - 25.0	566.22 Mbps	0	11.90 MBytes
25.0 - 26.0	461.40 Mbps	1	6.00 MBytes
26.0 - 27.0	293.60 Mbps	0	6.17 MBytes
27.0 - 28.0	262.15 Mbps	1	3.26 MBytes
28.0 - 29.0	167.77 Mbps	0	3.35 MBytes
29.0 - 30.0	167.76 Mbps	0	4.01 MBytes

```
Summary
```

Interval	Throughput	Retransmits
0.0 - 30.0	325.88 Mbps	10



```
$ pscheduler task --slip PT1H throughput --source=bwctl-10g-ps.singaren.net.sg --dest=ps-londhx1.ja.net -t 30 --ip-version 4
```

```
| * Stream ID 5
```

Interval	Throughput	Retransmits	Current Window
0.0 – 1.0	2.15 Mbps	0	81.40 KBytes
1.0 – 2.0	8.34 Mbps	0	260.48 KBytes
2.0 – 3.0	45.42 Mbps	0	1.14 MBytes
3.0 – 4.0	145.17 Mbps	0	4.89 MBytes
4.0 – 5.0	995.93 Mbps	0	33.80 MBytes
5.0 – 6.0	2.58 Gbps	0	50.40 MBytes
6.0 – 7.0	2.42 Gbps	0	50.40 MBytes
7.0 – 8.0	2.80 Gbps	0	50.40 MBytes
8.0 – 9.0	2.42 Gbps	0	50.40 MBytes
9.0 – 10.0	2.62 Gbps	0	50.40 MBytes
10.0 – 11.0	2.61 Gbps	0	50.40 MBytes
11.0 – 12.0	2.41 Gbps	0	50.40 MBytes
12.0 – 13.0	2.81 Gbps	0	50.40 MBytes
13.0 – 14.0	2.42 Gbps	0	50.40 MBytes
14.0 – 15.0	2.69 Gbps	0	50.40 MBytes
15.0 – 16.0	2.53 Gbps	0	50.40 MBytes
16.0 – 17.0	2.46 Gbps	0	50.40 MBytes
17.0 – 18.0	2.76 Gbps	0	50.40 MBytes
18.0 – 19.0	2.42 Gbps	0	50.40 MBytes
19.0 – 20.0	2.80 Gbps	0	50.40 MBytes
20.0 – 21.0	2.43 Gbps	0	50.40 MBytes
21.0 – 22.0	2.56 Gbps	0	50.40 MBytes
22.0 – 23.0	2.66 Gbps	0	50.40 MBytes
23.0 – 24.0	2.42 Gbps	0	50.40 MBytes
24.0 – 25.0	2.80 Gbps	0	50.40 MBytes
25.0 – 26.0	2.42 Gbps	0	50.40 MBytes
26.0 – 27.0	2.65 Gbps	0	50.40 MBytes
27.0 – 28.0	2.58 Gbps	0	50.40 MBytes
28.0 – 29.0	2.41 Gbps	0	50.40 MBytes
29.0 – 30.0	2.81 Gbps	0	50.40 MBytes

Summary Interval	Throughput	Retransmits	Receiver Throughput
0.0 – 30.0	2.19 Gbps	0	2.17 Gbps

- » Janet E2EPI project page
 - › <https://www.jisc.ac.uk/rd/projects/janet-end-to-end-performance-initiative>
- » JiscMail E2EPI list (approx 100 subscribers)
 - › <https://www.jiscmail.ac.uk/cgi-bin/webadmin?Ao=E2EPI>
- » Campus Network Engineering for Data-Intensive Science workshop slides
 - › <https://www.jisc.ac.uk/events/campus-network-engineering-for-data-intensive-science-workshop-19-oct-2016>
- » Fasterdata knowledge base
 - › <http://fasterdata.es.net/>
- » eduPERT knowledge base
 - › <http://kb.pert.geant.net/PERTKB/WebHome>



A close-up photograph of a person's hand holding a white business card. The hand is positioned with the thumb and index finger gripping the top edge of the card, and the other fingers supporting it from underneath. The background is a plain, light color.

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