



ESnet

ENERGY SCIENCES NETWORK

LHCONE Operations Update

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Energy Sciences Network
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LHCOPN-LHCONE Meeting
Taipei Taiwan
March 13, 2016



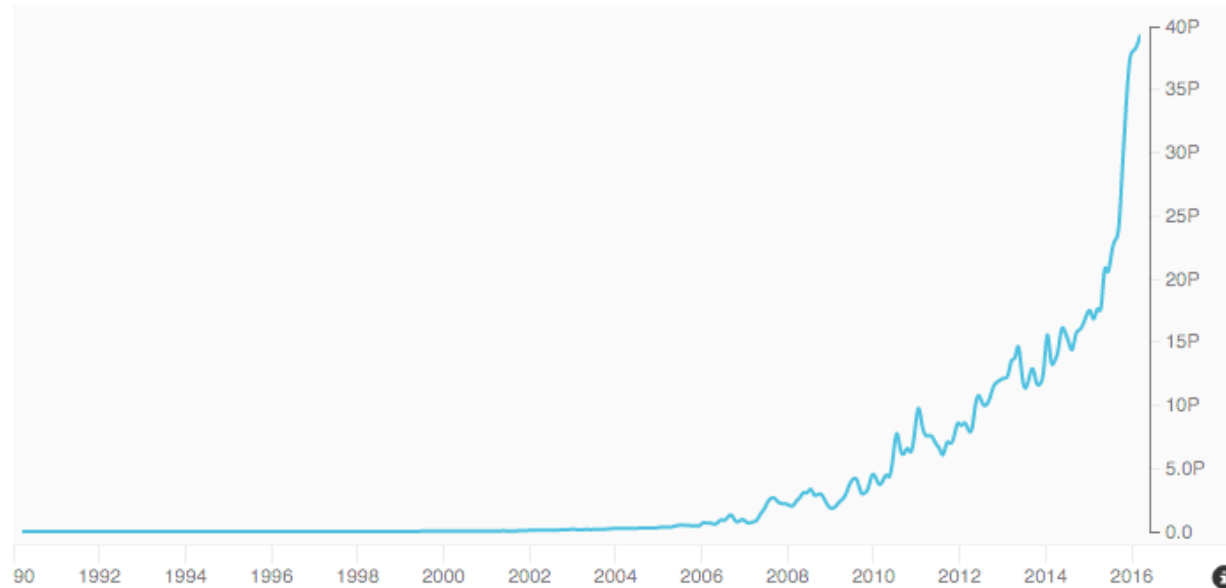
U.S. DEPARTMENT OF
ENERGY
Office of Science



ESnet Traffic Volumes

LHCONE represents more than 27% of ESnet accepted traffic

Traffic Volume

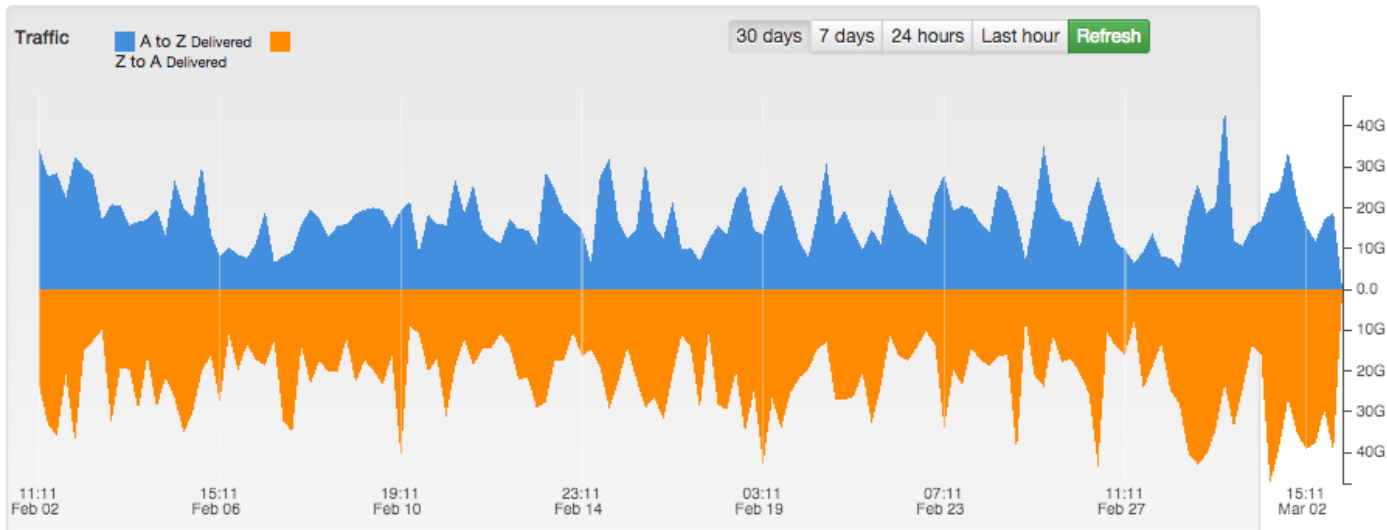
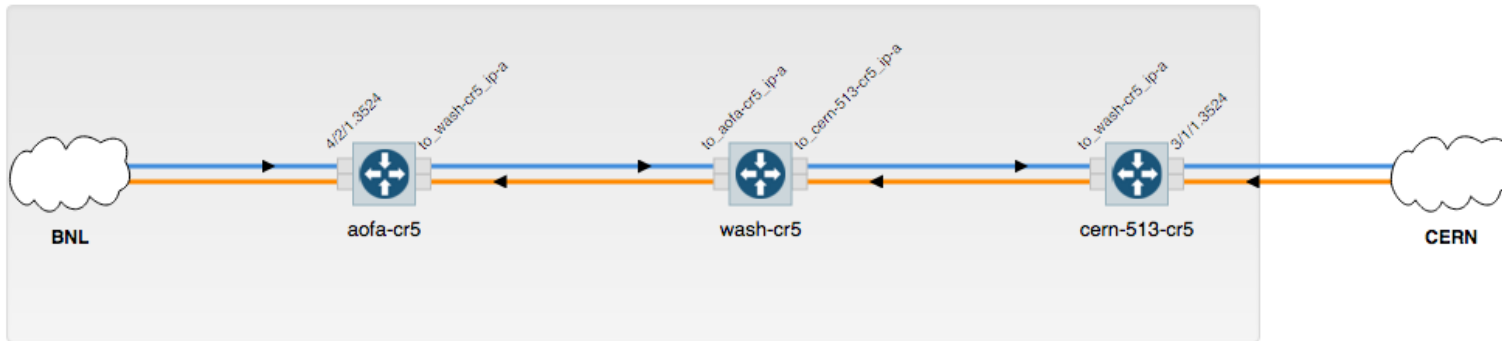


◀ January 2016 ▶

	Bytes	Percent of Total	One Month Change	One Year Change
OSCARS	10.46 PB	26.6%	-15.2%	+8.47%
LHCONE	10.79 PB	27.4%	+9.86%	+84.3%
Normal traffic	18.1 PB	46.0%	+10.0%	+61.6%
Total	39.35 PB		+2.54%	+53.7%

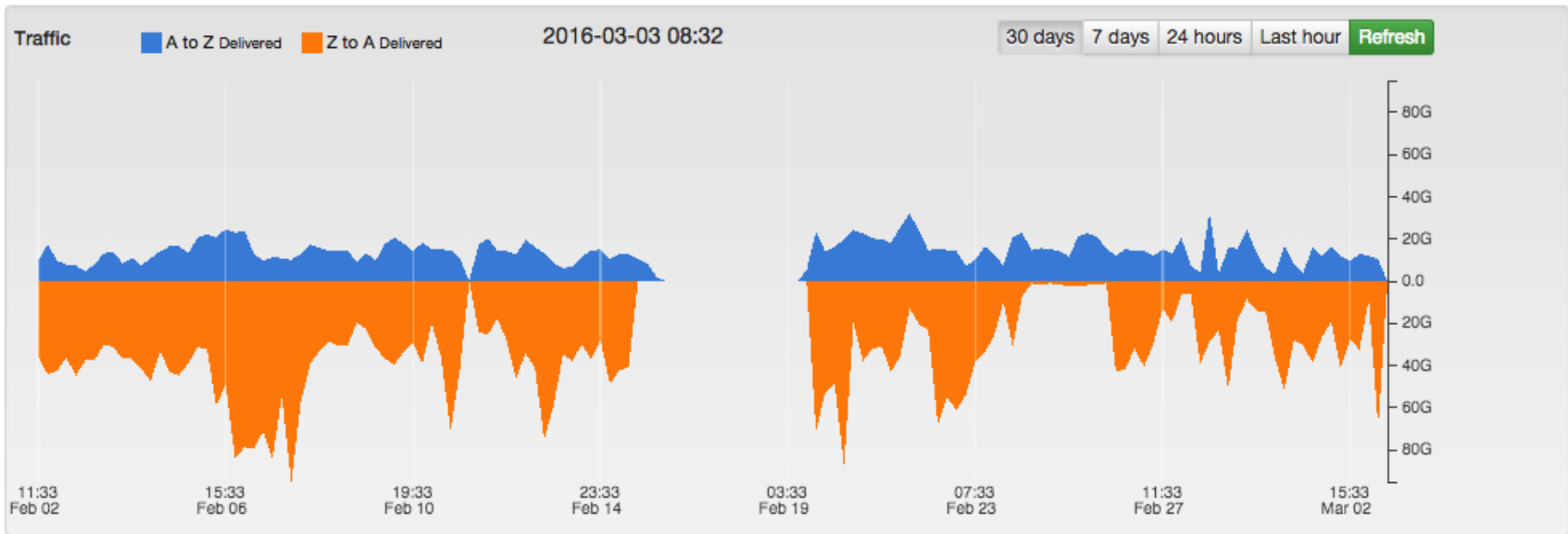
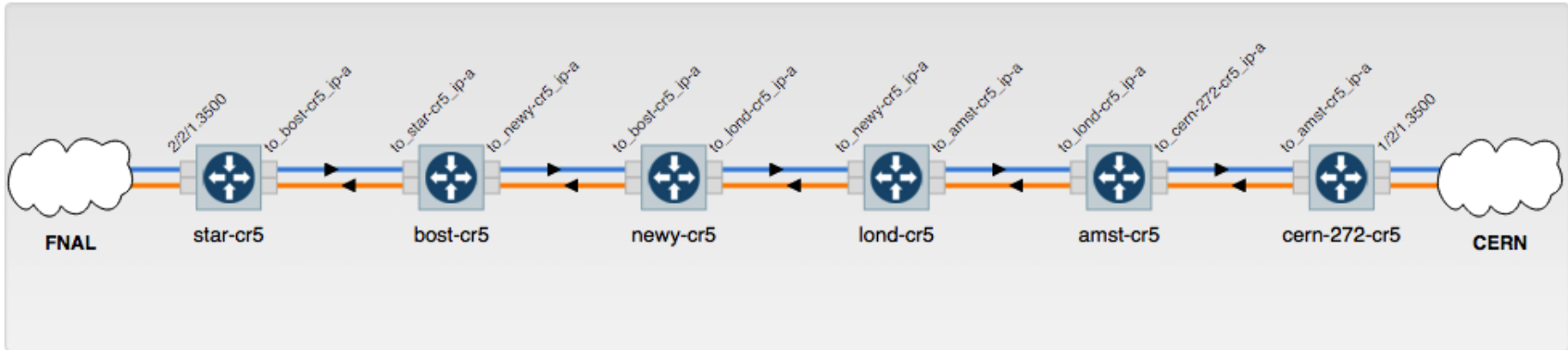
LHCOPN US ATLAS Tier1 BNL

Last 30 Days



LHCOPN US CMS Tier1 Fermilab

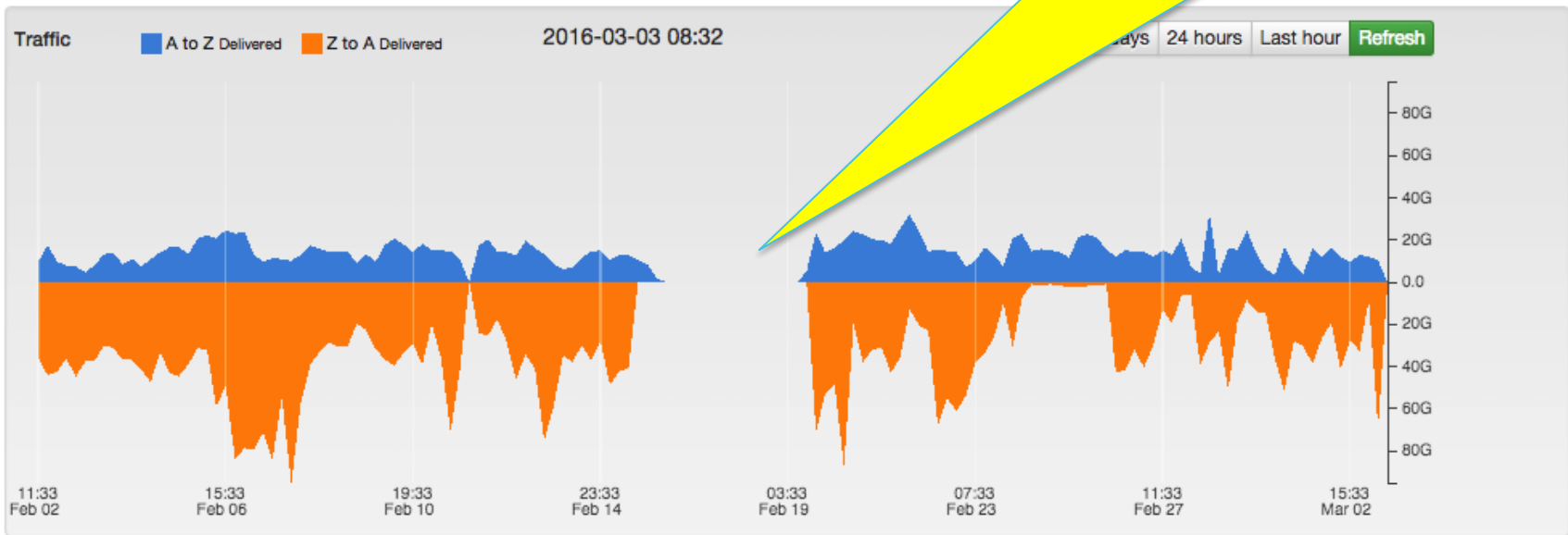
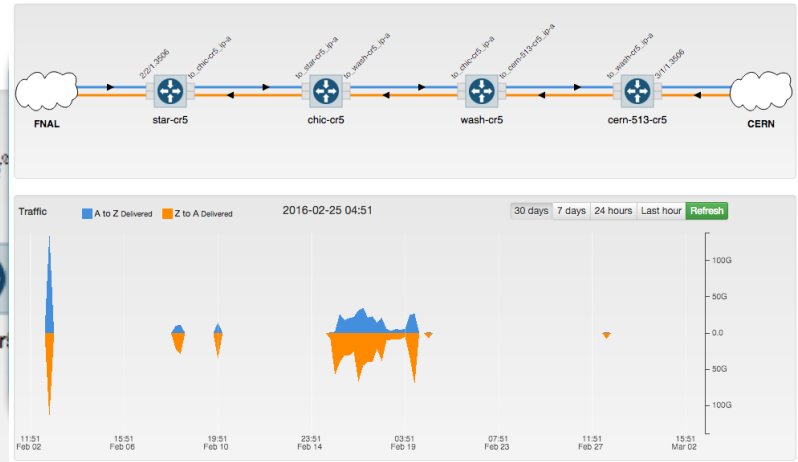
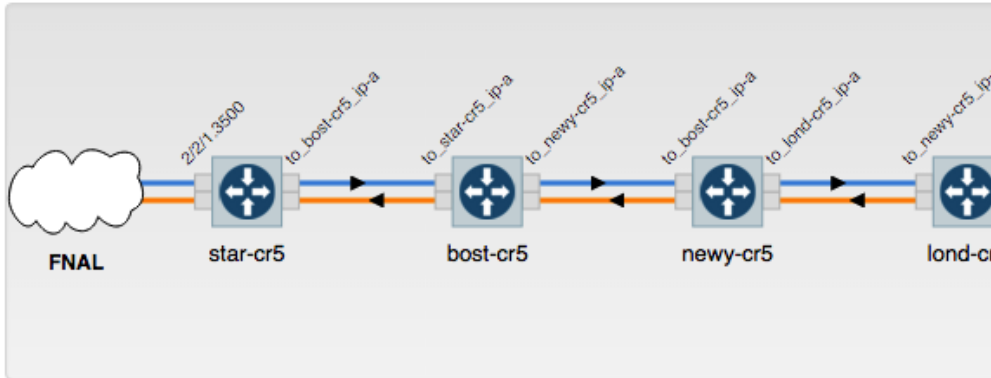
Last 30 Days



Why is there a large gap in this data?

LHCOPN US CMS Tier1 Fermilab

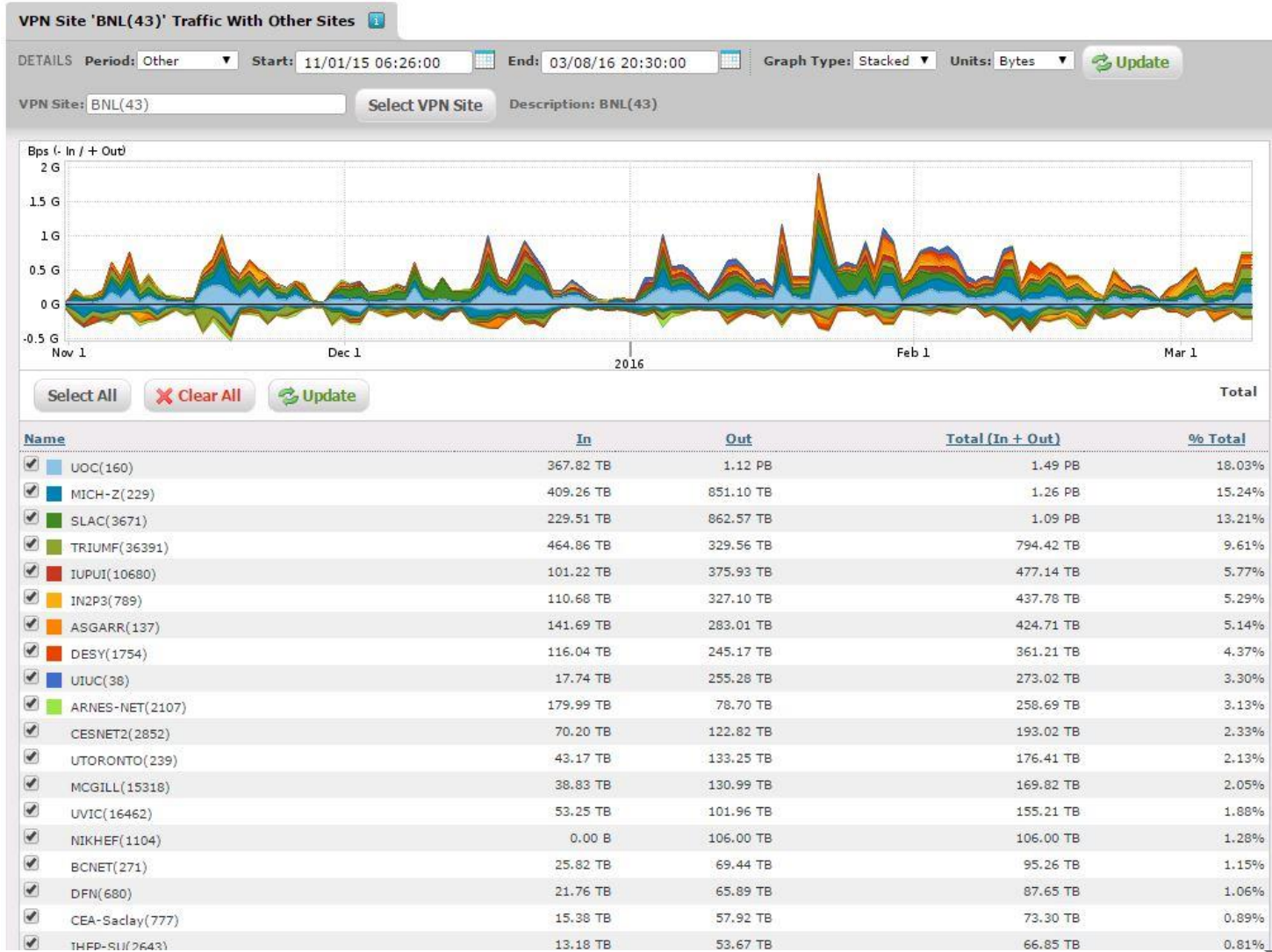
Last 30 Days



Fermilab shifted their traffic to their secondary during a period of TA link instability in Feb.

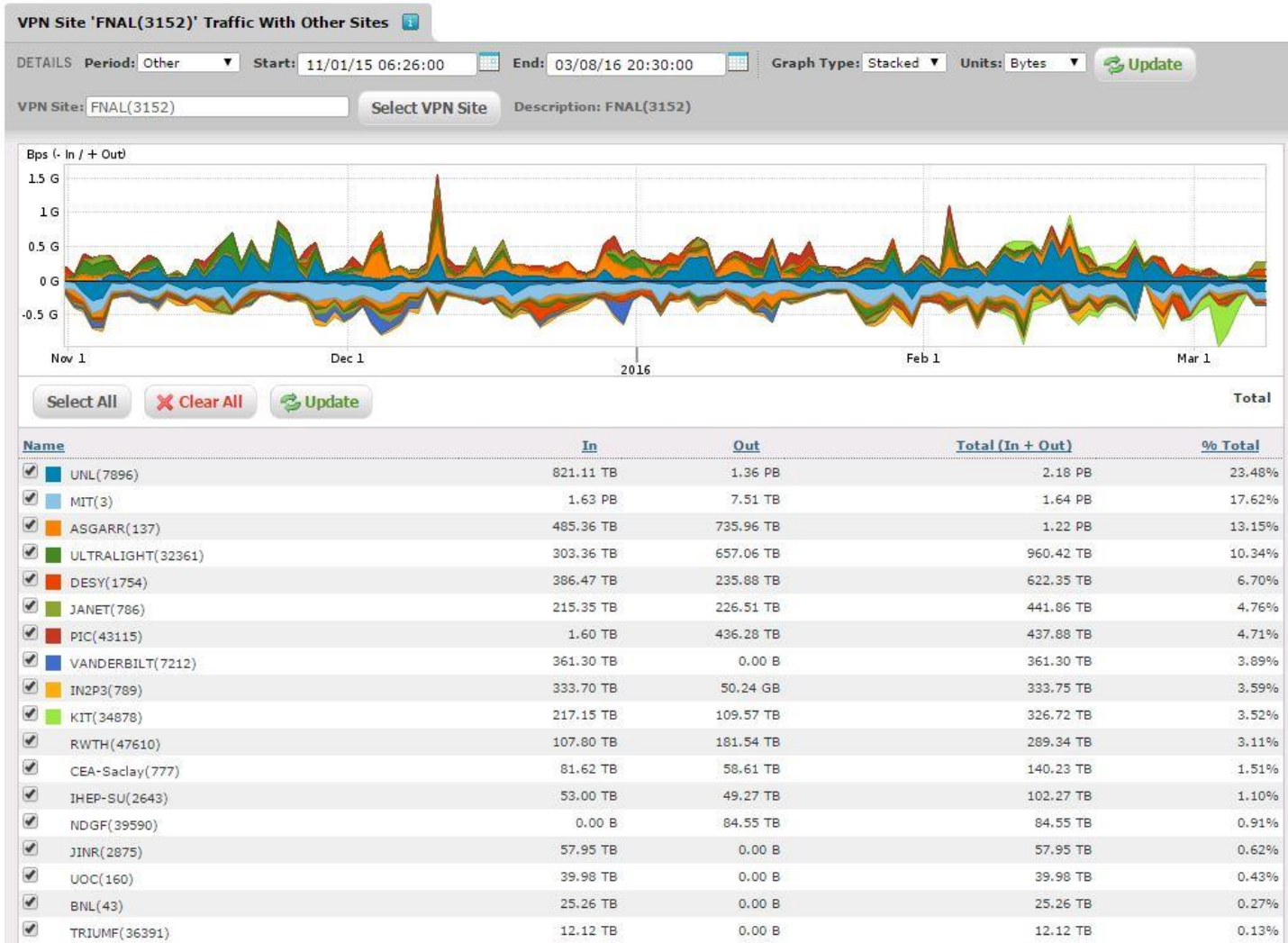
LHCONE BNL Top Sites

By Octets Transferred



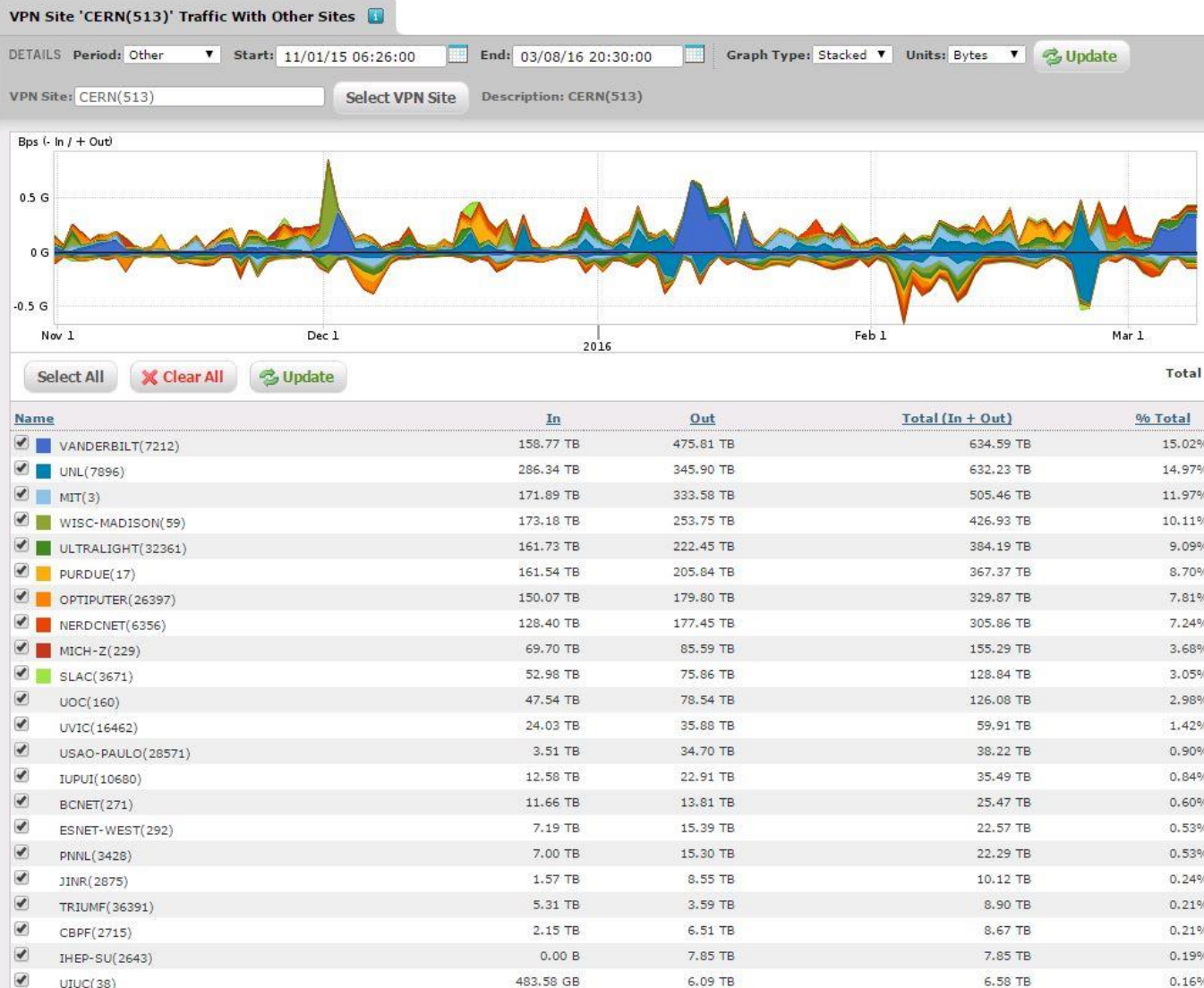
LHCONE Fermilab Top Sites

By Octets Transferred



LHCONE ESnet/CERN Top Sites

By Octets Transferred

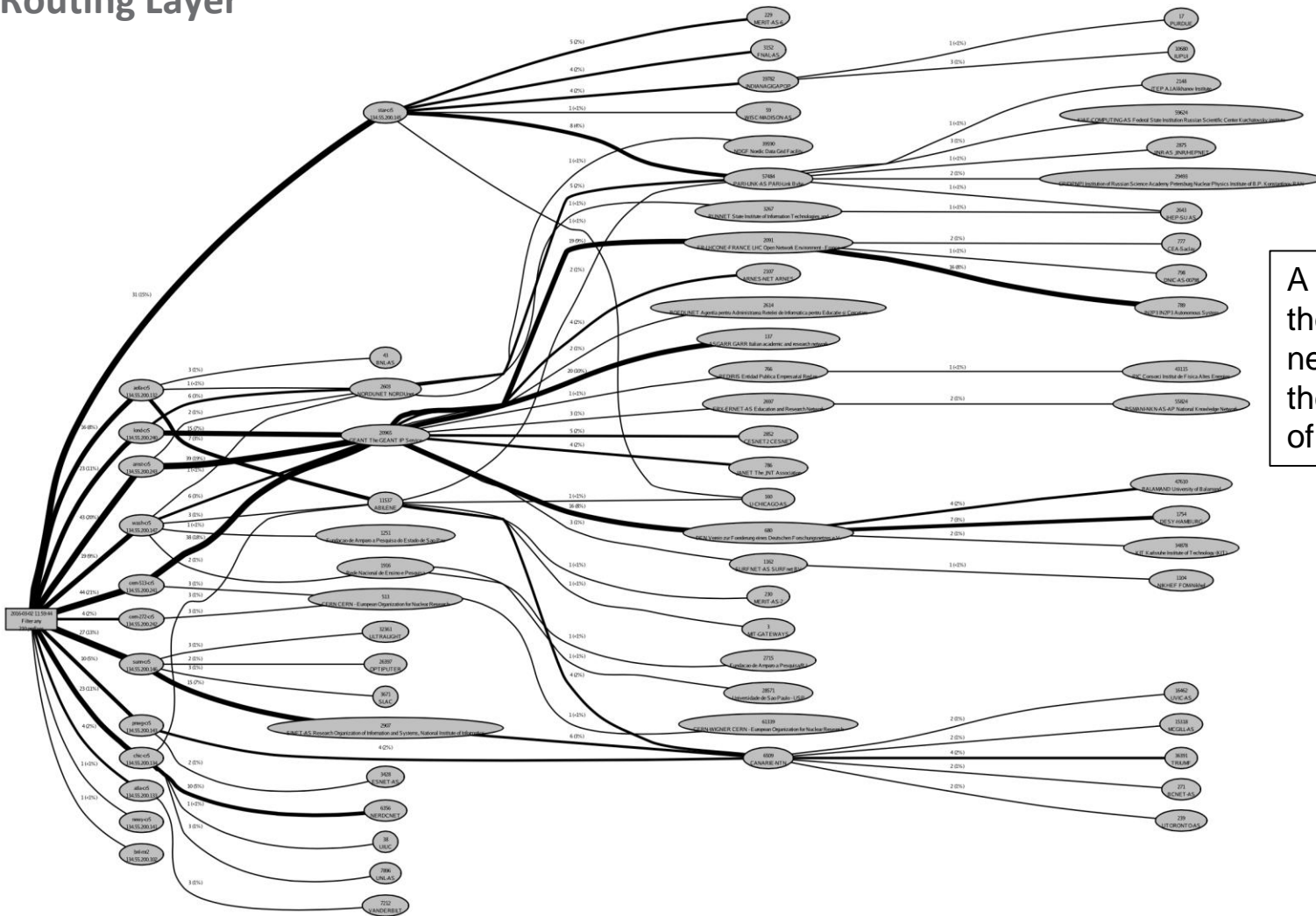


CERN also connects to GEANT/LHCONE. Not represented here.



ESnet LHCONE Reachability Graph

Routing Layer



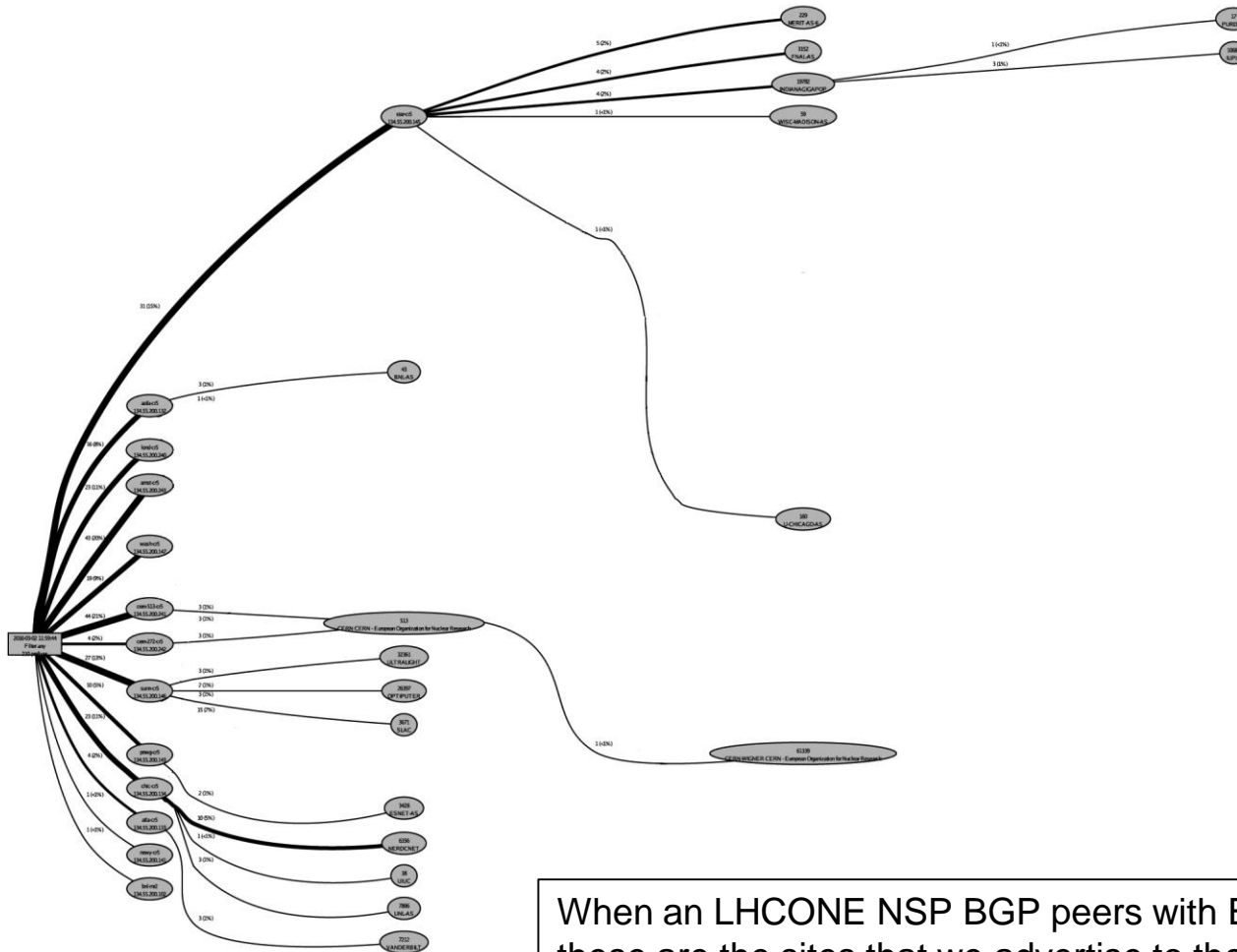
A routed view of the LHCONE network from the perspective of ESnet

<https://twiki.cern.ch/twiki/pub/LHCONE/LhcOneVRF/LHCONE-RoutingVis.svg>



ESnet LHCONE Site Routes

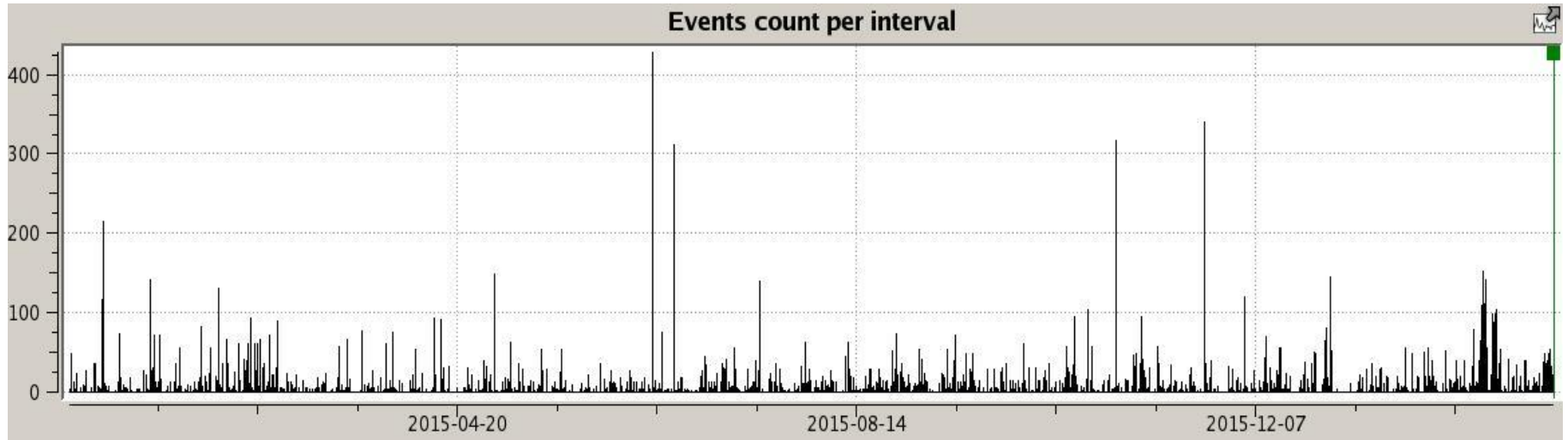
Exported to Peers



When an LHCONE NSP BGP peers with ESnet, these are the sites that we advertise to them.

ESnet LHCONE BGP Events

Past 14 Months

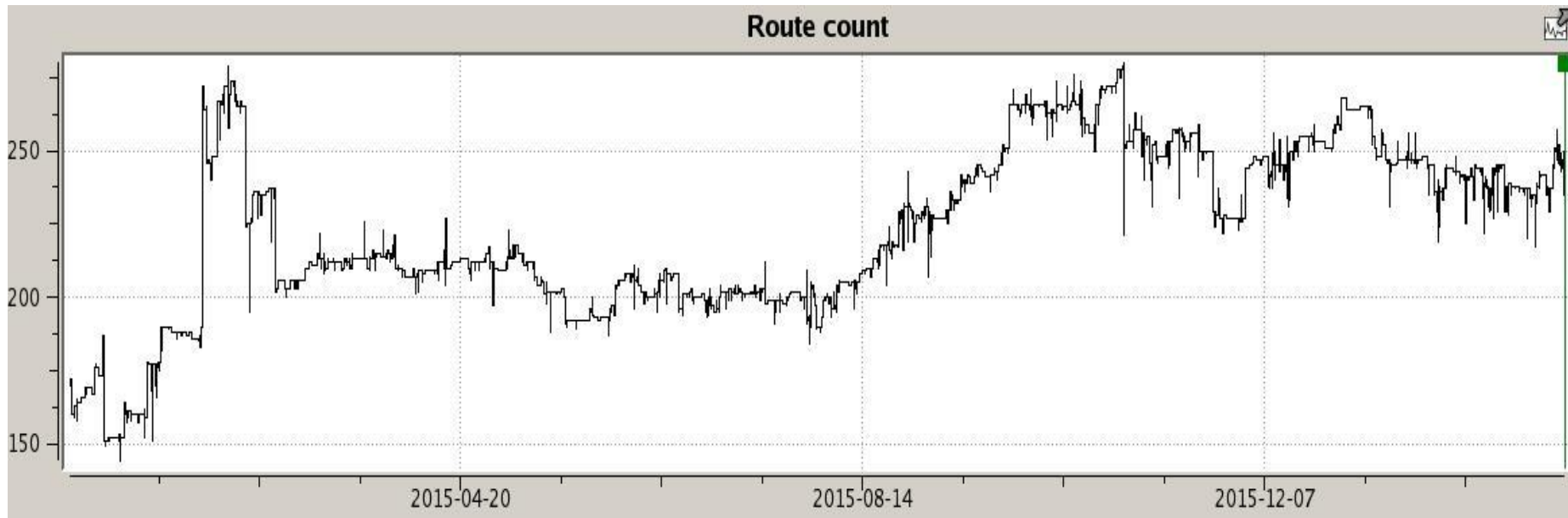


BGP Events:

- Routes added
- Routes withdrawn
- Neighbor State Transitions

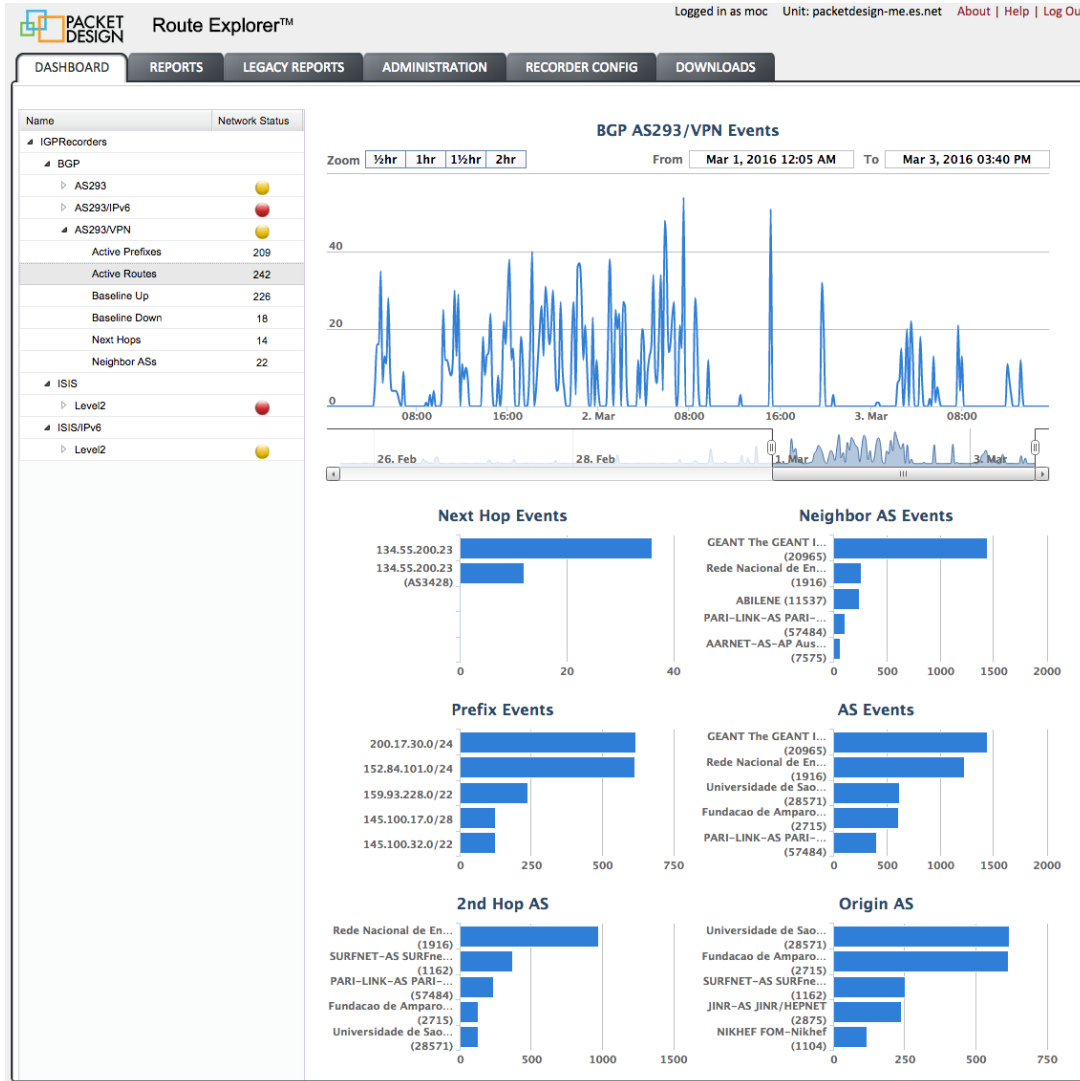
ESnet LHCONE BGP Table Size

Past 14 Months



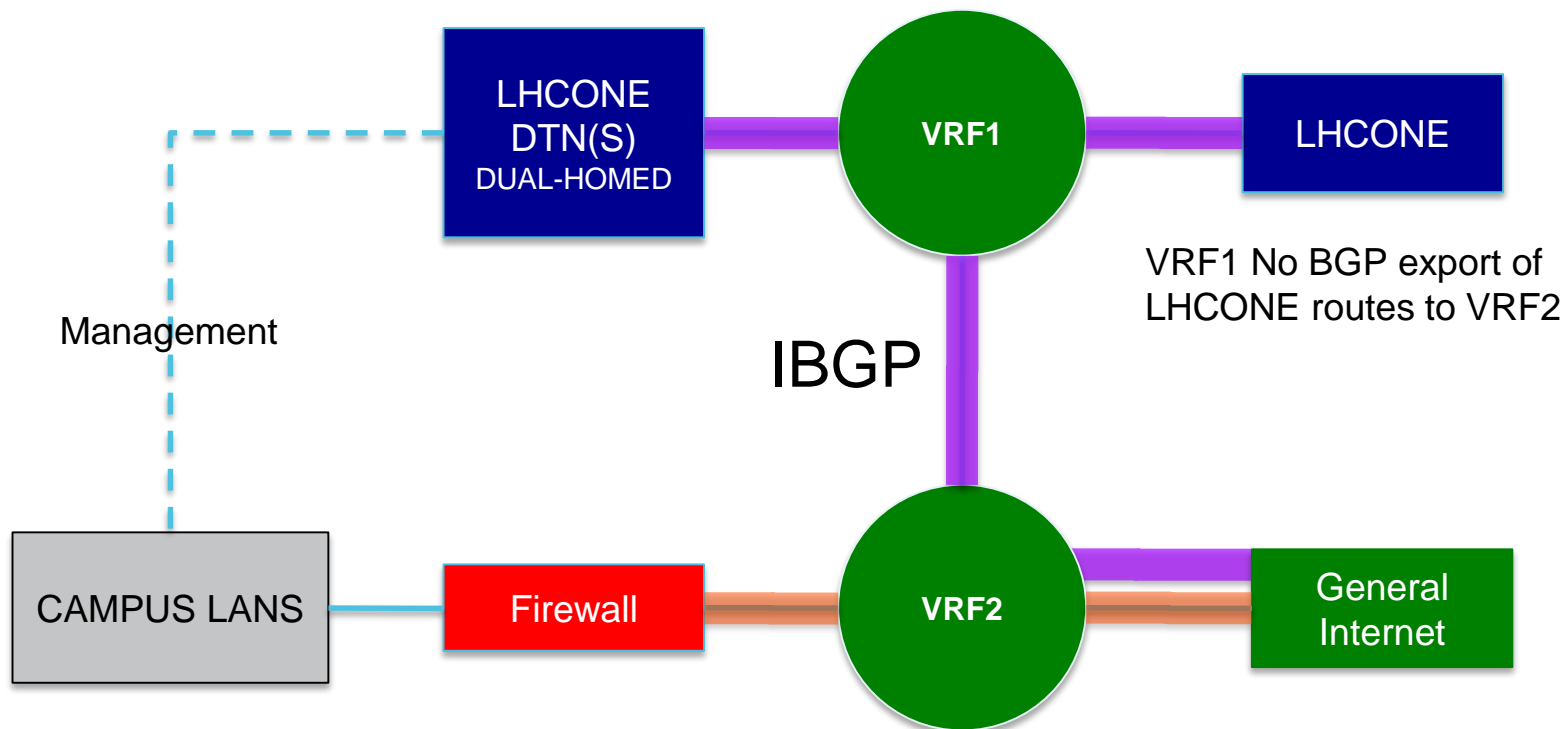
BGP Table size has varied between 150 to 275 routes received on all peers

LHCONE ESnet BGP Highlight Report



LHCONE Site Example

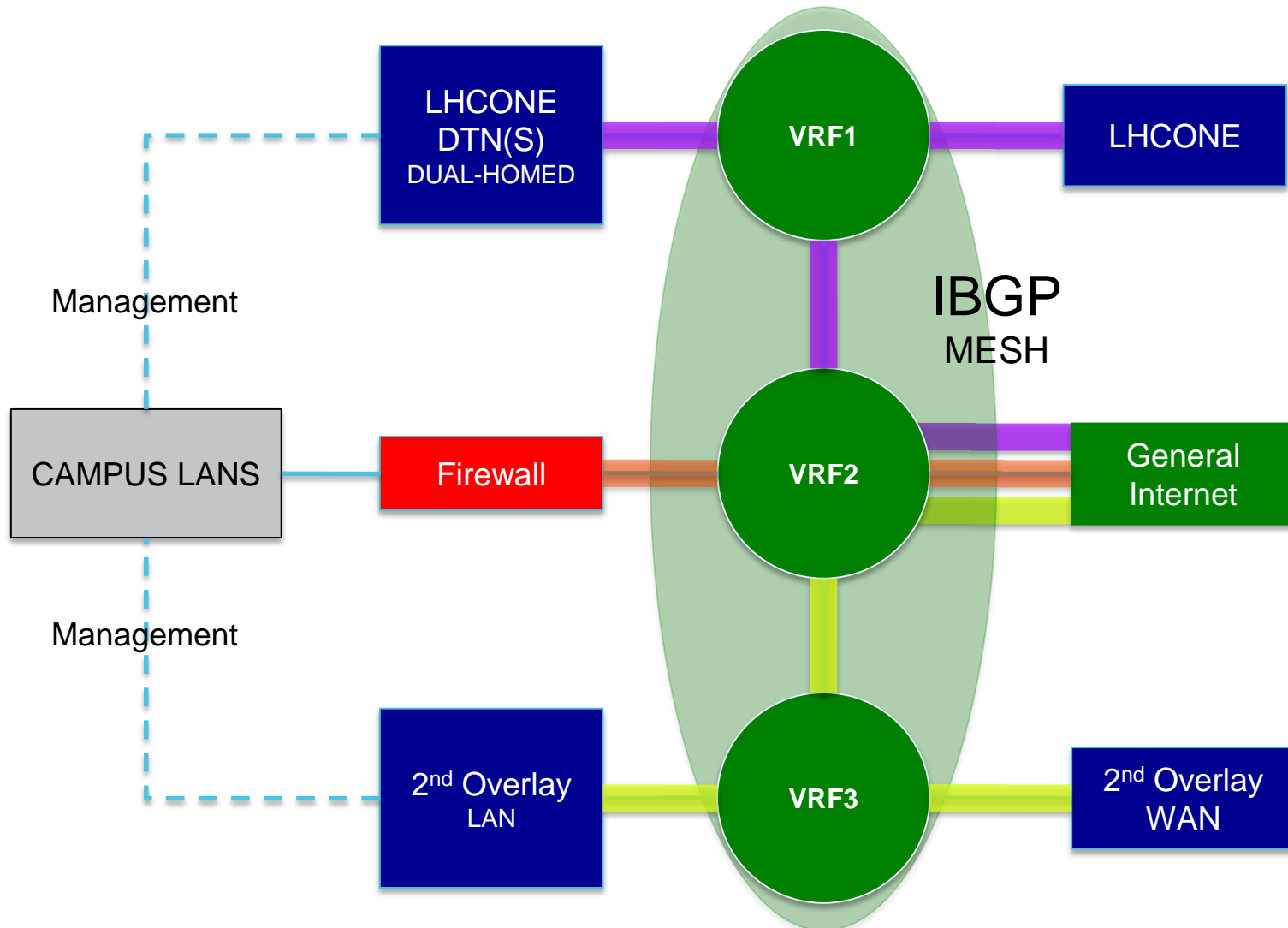
Destination Routing



If the LHCONE can be separated into a VR or VRF then standard destination based routing can be used

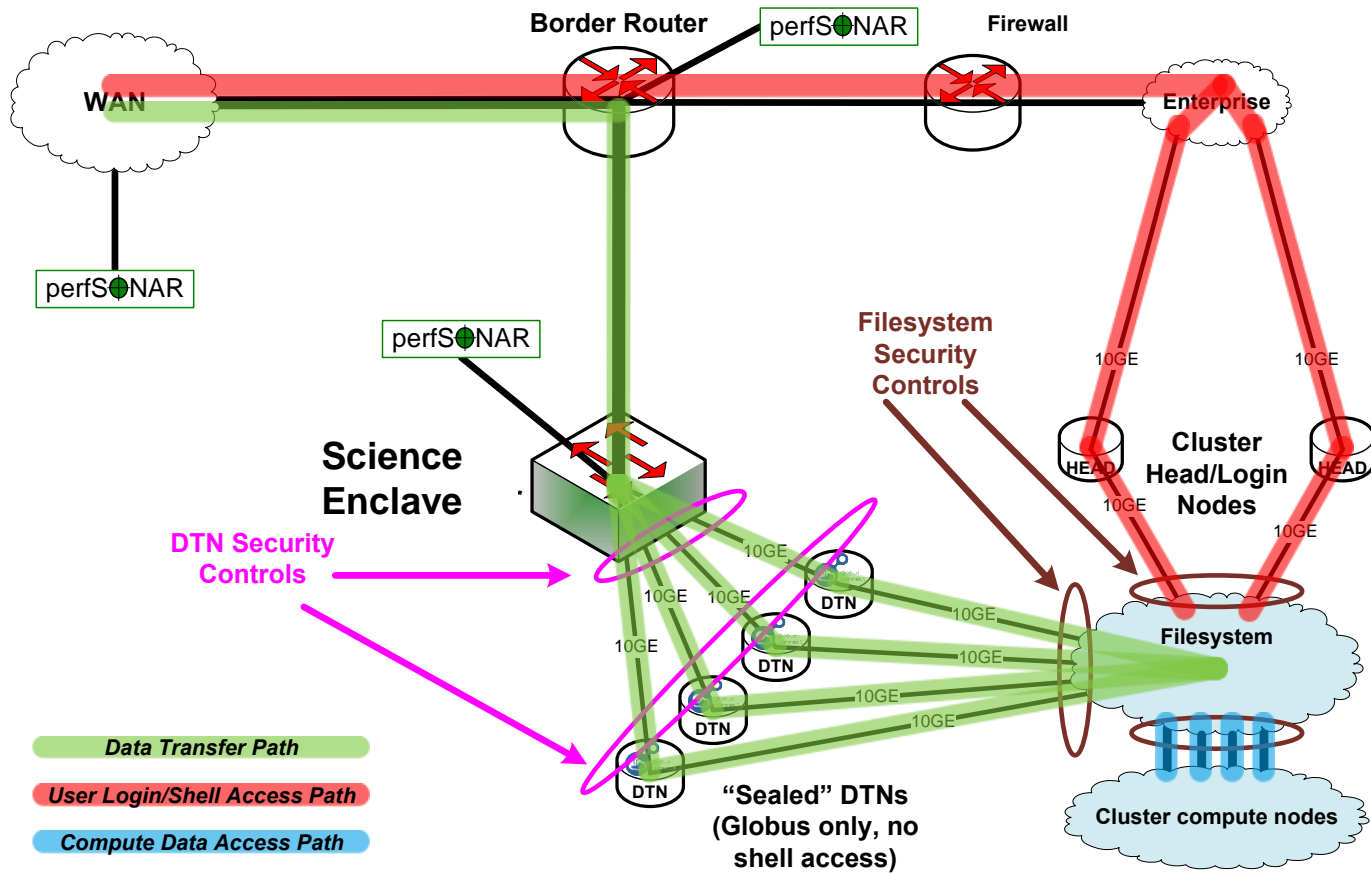
Multiple Overlay Networks

Scaling For Additional Overlay Networks



The additional overhead of protocol configuration pays back in scalability and powerful routing policy control.

Science Enclave DTNs



LHCONE BGP Filtering State Reporting

twiki.cern.ch/twiki/bin/view/LHCONE/WebHome

TWiki > [LHCONE Web](#) > [WebHome \(2015-10-24, MichaelOConnorExternal\)](#)



LHCONE

Large Hadron Collider Open Network Environment

Monitoring

- [perfSONAR](#)
- [MaDDash LHCONE](#)
- [MaDDash WLCG](#)
- [LHCONE BGP Filtering State](#)
- [ESnet LHCONE prefixes \(JSON\)](#)
- [ESnet LHCONE IPv6 prefixes \(JSON\)](#)

A report containing LHCONE BGP filtering community tags in use. (updated hourly)

Community	Meaning
65001:ASN	Prepend Local ASN 1X to Export to Peer ASN
65002:ASN	Prepend Local ASN 2X to Export to Peer ASN
65003:ASN	Prepend Local ASN 3X to Export to Peer ASN
65010:ASN	Do not Export to Peer ASN

LHCONE BGP Filtering State Analysis

GMT: Wed Mar 9 20:45:00 2016

CERN(513)

128.142.0.0/16 PREPEND 2X(65002) to KIAE(59624)

128.142.0.0/16 DO NOT ANNOUNCE(65010) to CERN(513)

CERN Testing

188.184.128.0/17 PREPEND 2X(65002) to KIAE(59624)

188.184.128.0/17 DO NOT ANNOUNCE(65010) to CERN(513)

KIAE-TRANSIT(57484)

144.206.255.128/26 PREPEND 2X(65002) to CERN(513)

CERN-WIGNER(61339)

188.185.128.0/17 PREPEND 2X(65002) to KIAE(59624)

188.185.128.0/17 DO NOT ANNOUNCE(65010) to CERN(513)

ESnet Service: <http://calendar.es.net/lhccone/lhconedata/lhccone-filter.txt>

LHCONE BGP Filtering Guidelines

Service Definition document V1.0

The BGP filtering service is intended to be used by an LHCONE end site to prevent the distribution of **their** BGP route prefixes to another LHCONE end-site.

1. An individual BGP community tag will be used for each and every remote end site that is filtered.
2. A site will tag ALL of the route prefixes it exports into LHCONE uniformly.
3. NSP ASNs are NOT valid for use in LHCONE BGP Filtering communities.
4. NSPs will only provision this service at their customer edge and will NOT provision it on internal LHCONE NSP/NSP BGP peerings.
5. NSPs only filter prefixes for their directly attached customers on export to those customers. Otherwise they pass LHCONE BGP Filtering communities along without modification.

<https://twiki.cern.ch/twiki/pub/LHCONE/LhcOneVRF/LHCO NEBGPFilteringServiceDefinition.pdf>



LHCONE BGP Filtering State Reporting

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A new report containing LHCONE BGP Ipv4 and Ipv6 route prefixes.

LHCONE IPv6

Connected Sites

March 2016

Site List:

ARNES-NET(2107)
ASGARR(137)
CEA-Saclay(777)
CERN(513)
DESY(1754)
FNAL(3152)
GEANT(20965)
IN2P3(789)
KIT(34878)
AGLT2(229)
NDGF(39590)
PIC(43115)
PURDUE(17)
THAIREN(24475)
THAISARN(3836)
UNINET-TH(836)
WISC-MADISON(59)

LHCONE Ipv6 Table

October 2015

32

2001:3c8::/32

GEANT(20965) TEIN2(24490) THAIREN(24475) UNINET-TH(836)

2001:f00::/32

GEANT(20965) TEIN2(24490) THAIREN(24475) THAISARN(3836)

42

2001:948:40::/42

NORDUNET(2603) NDGF(39590)

46

2a00:1398:104::/46

GEANT(20965) DFN(680) KIT(34878)

48

2001:1458:301::/48

GEANT(20965) CERN(513)

2001:18e8:804::/48

UINDIANA(19782) PURDUE(17)

2001:3c8:1012::/48

GEANT(20965) TEIN2(24490) THAIREN(24475)

2001:48a8:68f7::/48

MICH-Z(229)

2001:660:5009::/48

GEANT(20965) LHC1-RENATER(2091) IN2P3(789)

2001:760:4205::/48

GEANT(20965) ASGARR(137)

2001:760:4224::/48

GEANT(20965) ASGARR(137)

2001:948:30::/48

NORDUNET(2603) NDGF(39590)

50

2001:48a8:68f7:4000::/50

AGLT2(229)

2001:48a8:68f7:8000::/50

AGLT2(229)

2001:48a8:68f7::/50

AGLT2(229)

2001:48a8:68f7:c000::/50

AGLT2(229)

64

2001:1470:8000:403::/64

GEANT(20965) ARNES-NET(2107)

2001:1470:ff80:6d::/64

GEANT(20965) ARNES-NET(2107)

2001:638:700:1062::/64

GEANT(20965) DFN(680) DESY(1754)

2001:638:700:10a0::/64

GEANT(20965) DFN(680) DESY(1754)

2001:638:700:10bf::/64

GEANT(20965) DFN(680) DESY(1754)

2001:638:700:10c0::/64

GEANT(20965) DFN(680) DESY(1754)

22 IPv6 End Site Route Prefixes

IPv6 network advertisements are very large, standards need to be drafted





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Thank You

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