

Status of LHCONE IP Service

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LHCONE Meeting Caltech 3rd – 4th Dec 2013

Agenda

- LHCONE in Europe
 - LHCONE in France, Italy, Germany, Romania, Slovenia, Spain and Czech Republic
 - LHCONE in NORDUnet, CERNLight and GEANT
- LHCONE in North America
 - LHCONE In CANARIE, ESnet and Internet2
- LHCONE in Asia
- LHCONE in Open Exchanges

LHCONE in Europe RENATER (French NREN)



- All French LCG sites are now connected to LHCONE

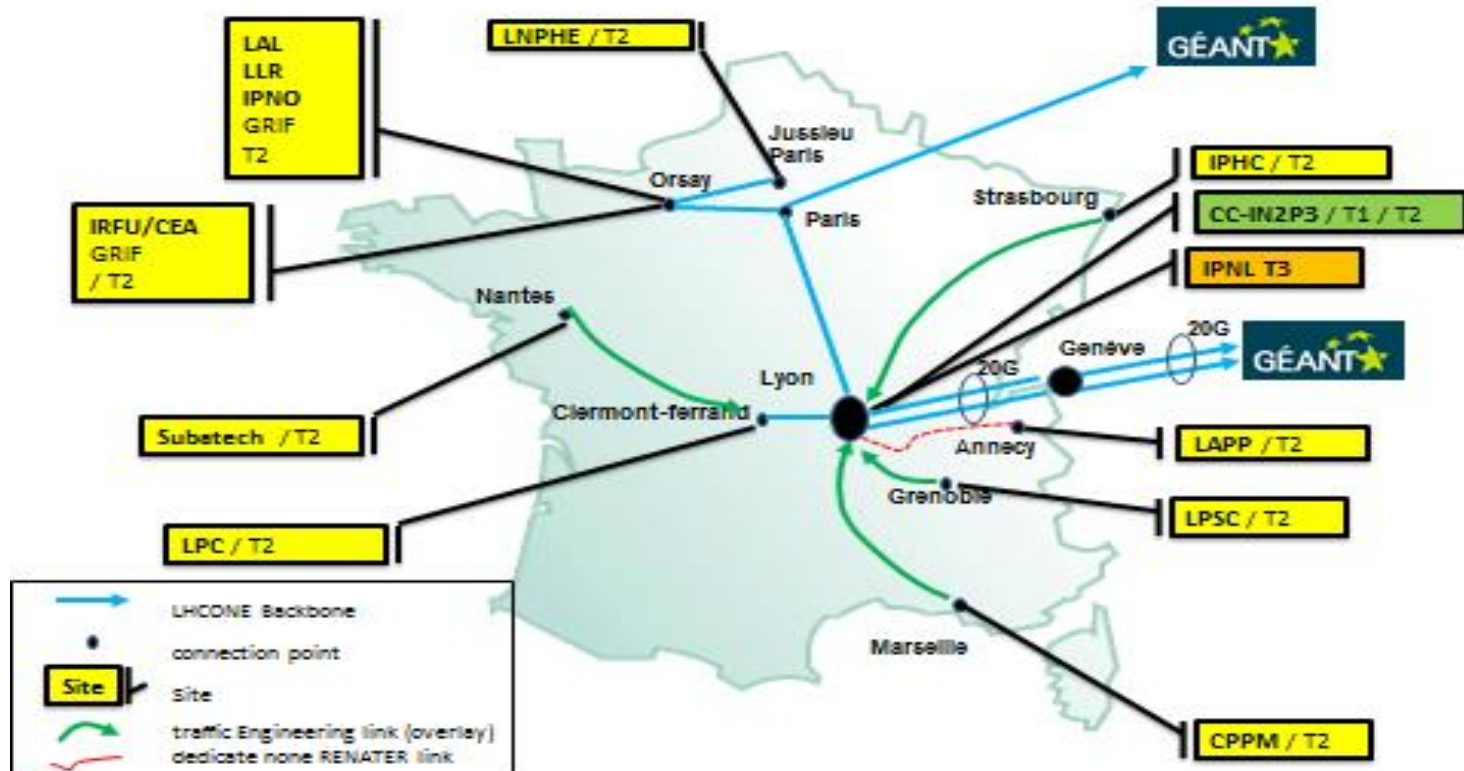
laboratories	NR RENATER	Connection Type
SUBATECH	Nantes	L2VPN-PW
LAL - LLR - IPNO (GRIF)	Orsay	Backbone LHCONE
IRFU-CEA (GRIF)	Orsay	Backbone LHCONE
LPNHE	Jussieu	Backbone LHCONE
IPHC	Strasbourg	L2VPN-PW
CC-IN2P3	Lyon1	Backbone LHCONE
LPSC	Grenoble	L2VPN-PW
IPNL - LAPP	Connection via CC-IN2P3	Backbone LHCONE
LPC	Clermont-Ferrand	Backbone LHCONE
CPPM	Marseille1	L2VPN-PW

- All Tier 2s are connected at 10Gbps and Tier 1 at 2 x10Gbps

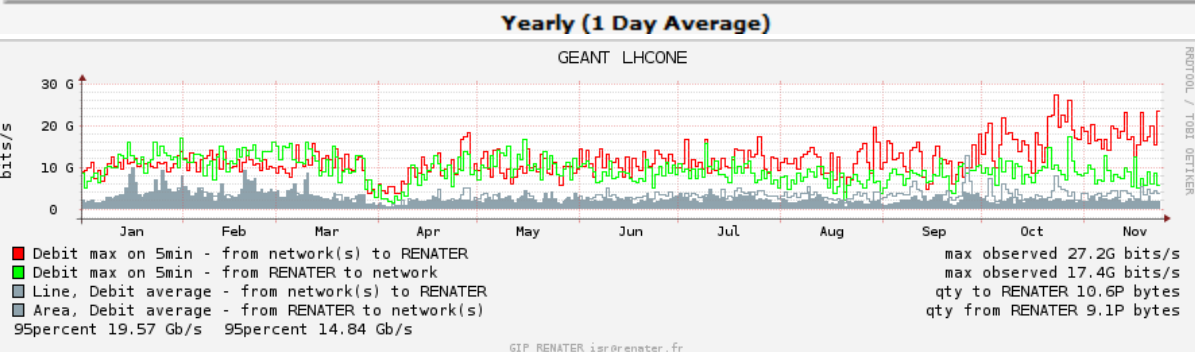
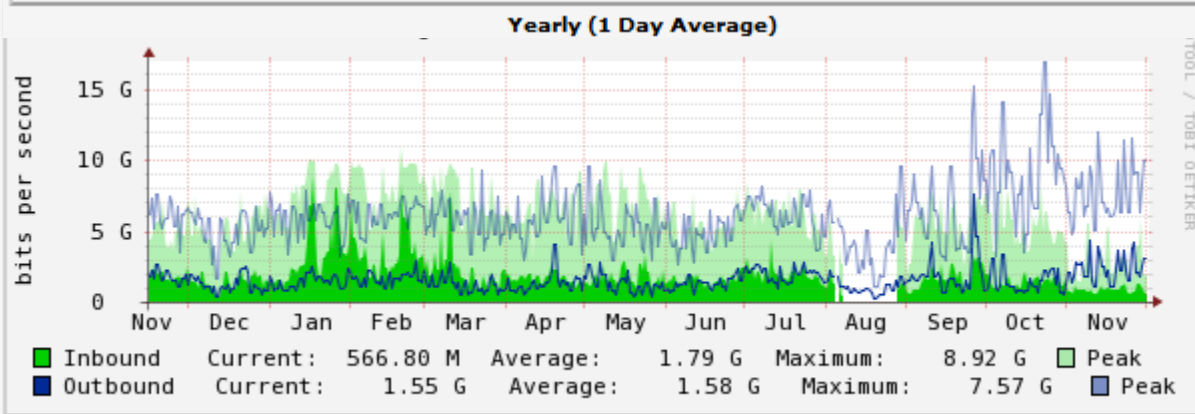
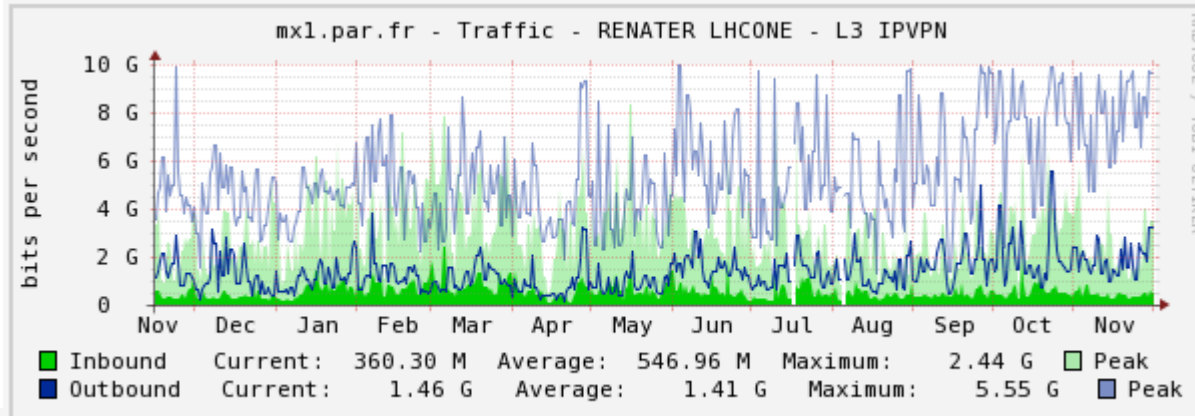
LHCONE in Europe RENATER (French NREN)



LHCONE nov. 2013



LHCONE in Europe RENATER (French NREN)



communicate • collaborate

LHCONE in Europe

GARR (Italian NREN)



- Connects:
 - Italian T1 and
 - Eight T2 sites

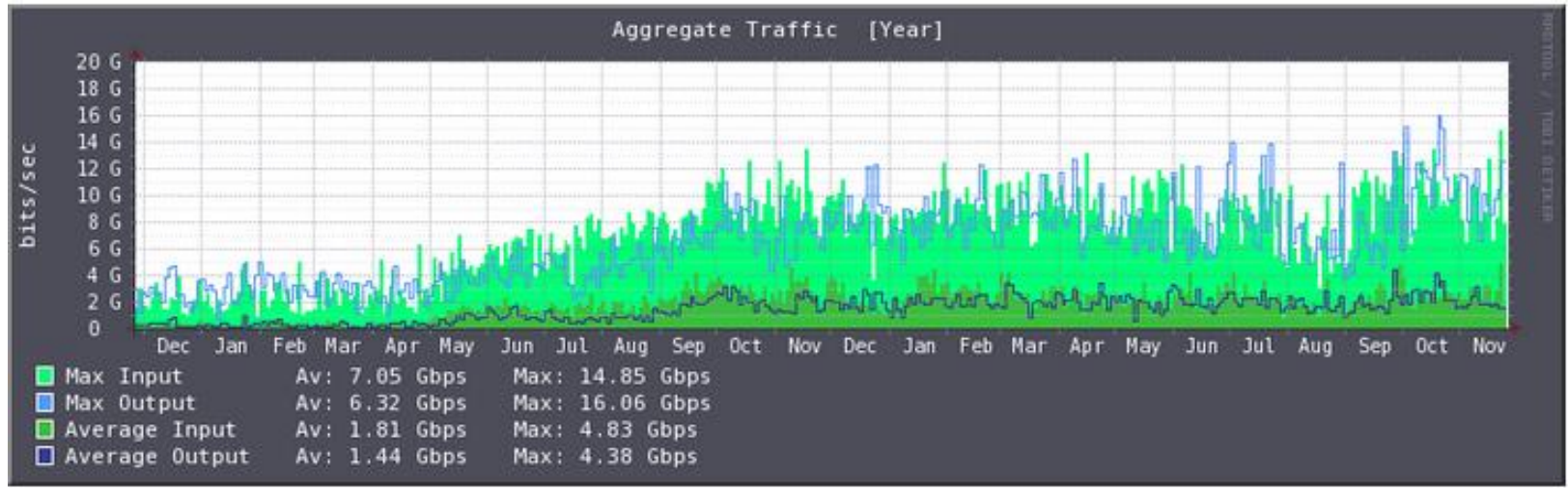
- Peers with:
 - GEANT and
 - ARNES VRF

INFN Bari (T2)	90.147.66.0/24 212.189.205.0/24	GARR, Italy (Bari)	10G
INFN Catania (T2)	90.147.16.0/23 193.206.208.0/24 193.206.219.0/24 212.189.144.0/23	GARR, Italy (Catania)	10G
INFN CNAF (T1)	131.154.128.0/17	GARR, Italy (Bologna)	20G
INFN Frascati (T2)	192.84.128.0/24	GARR, Italy (Frascati, Roma)	4G
INFN Legnaro (T2)	193.206.93.0/24	GARR, Italy (Legnaro, Padova)	10G
INFN Milano (T2)	192.135.14.0/24	GARR, Italy (Milano)	10G
INFN Napoli (T2)	90.147.67.0/24	GARR, Italy (Naples)	10G
INFN Pisa (T2)	192.135.9.0/24 193.205.76.0/23	GARR, Italy (Pisa)	10G
INFN Roma1 (T2)	141.108.35.0/24 141.108.36.0/22	GARR, Italy (Rome)	10G

LHCONE in Europe GARR (Italian NREN)



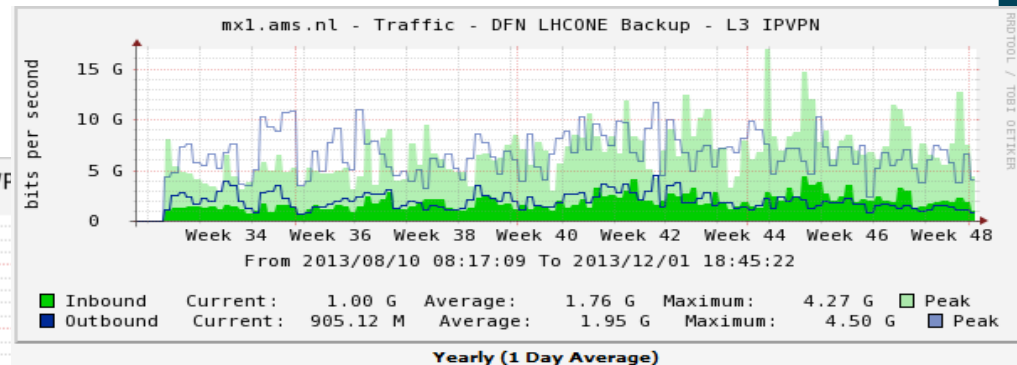
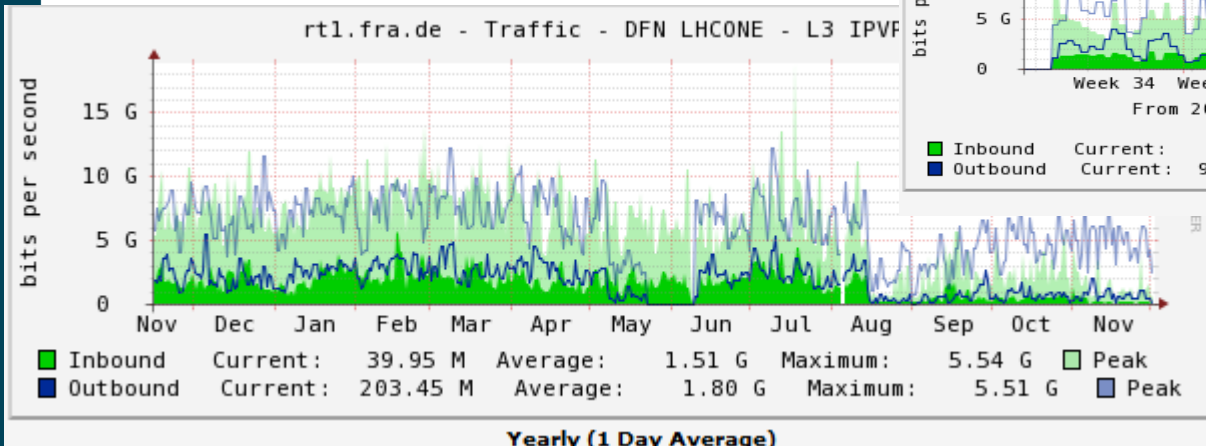
- Link to GEANT 100G primary and 100G backup (Shared)
- CNAF T1 soon to be upgraded to 40G (4x10G)
- The T2s might be upgraded to 2x10G in 2014
- Traffic to/from GEANT and ARNES VRF average traffic ~7Gbps, peak traffic over 20Gbps



LHCONE in Europe DFN (German NREN)



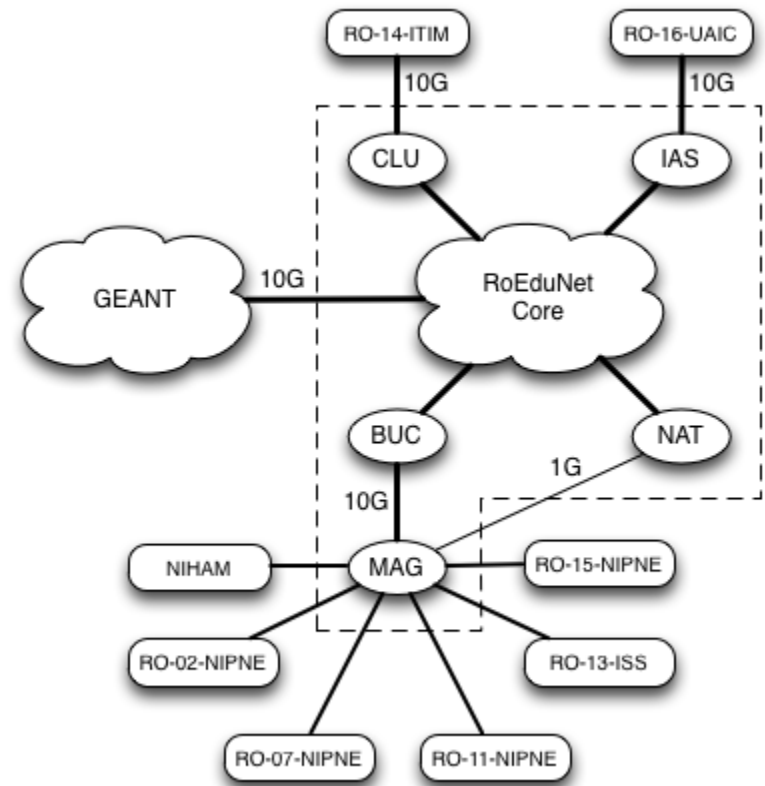
- Connects KIT, DESY, GSI, RWTH Aachen and Frankfurt
- Peer with GEANT VRF in Amsterdam and Frankfurt at 100GE(Shared)
- Estimated LHCONE traffic
 - 10G peak per end site access
 - 20G peak on the GEANT



LHCONE in Europe RoEduNet (Romainian NREN)



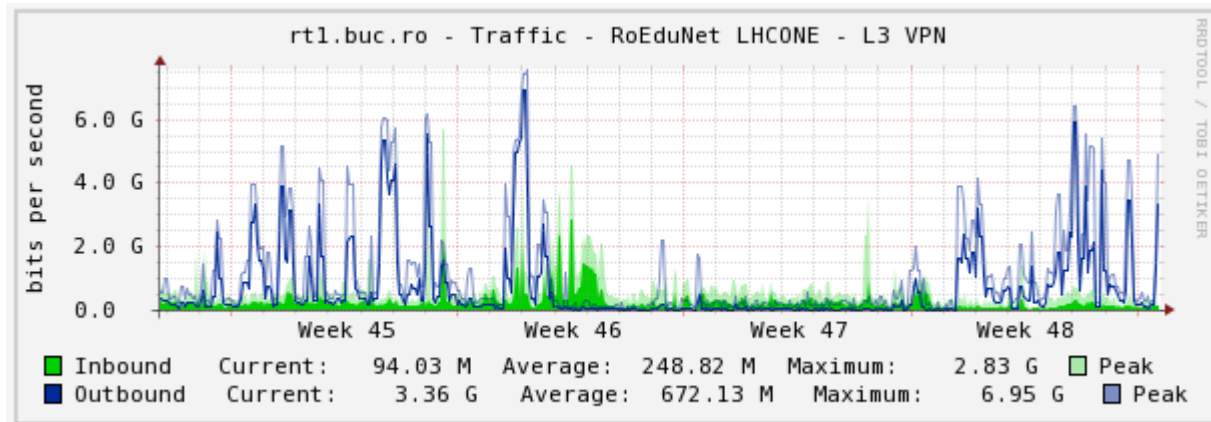
- Configured as separate VRF on RoEduNet
- All Seven T2s in Romania connected:
 - 1. RO-02-NIPNE
 - 2. RO-07-NIPNE
 - 3. RO-11-NIPNE
 - 4. RO-13-ISS
 - 5. RO-15-NIPNE
 - 6. RO-14-ITIM
 - 7. RO-16-UAIC
- Peers with GEANT LHCONE VRF



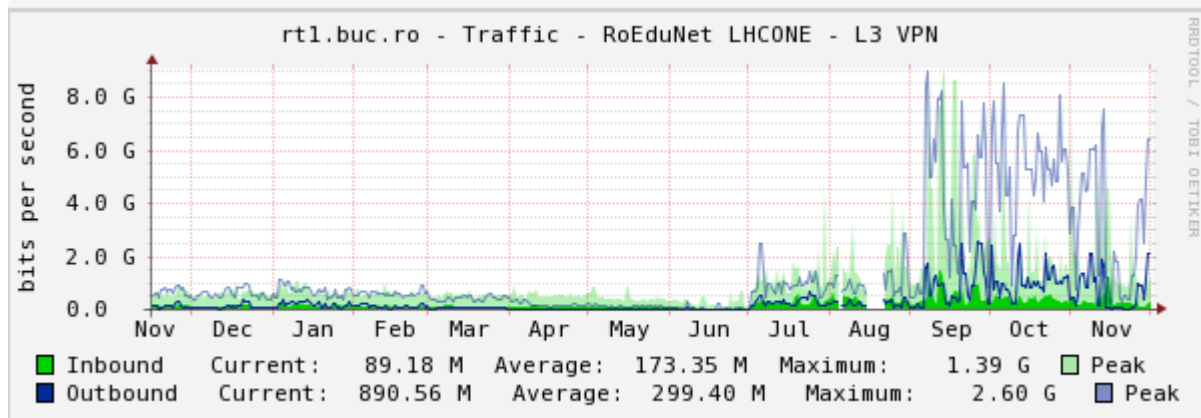
LHCONE in Europe RoEduNet (Romainian NREN)



- Sustained peaks of over 6 Gbps



Monthly (2 Hour Average)



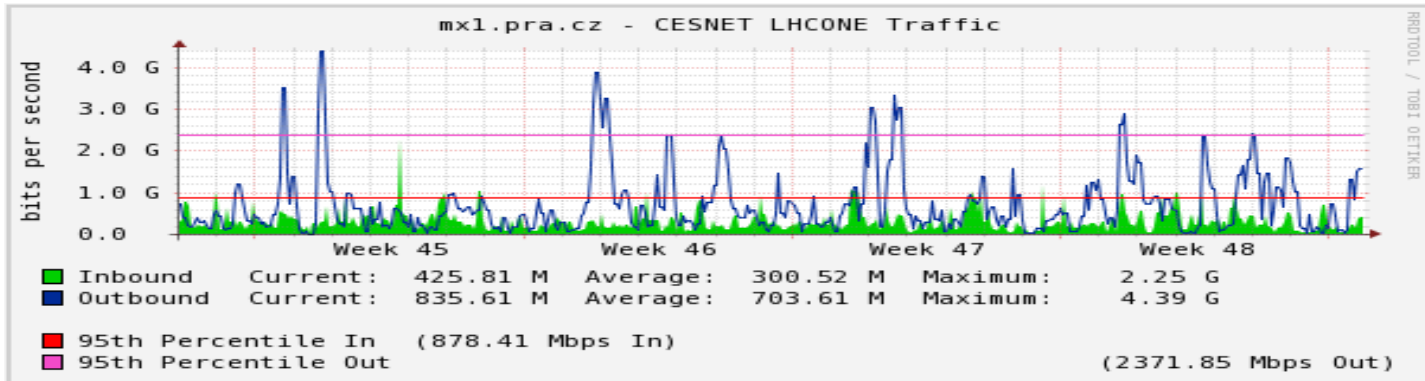
Yearly (1 Day Average)

LHCONE in Europe

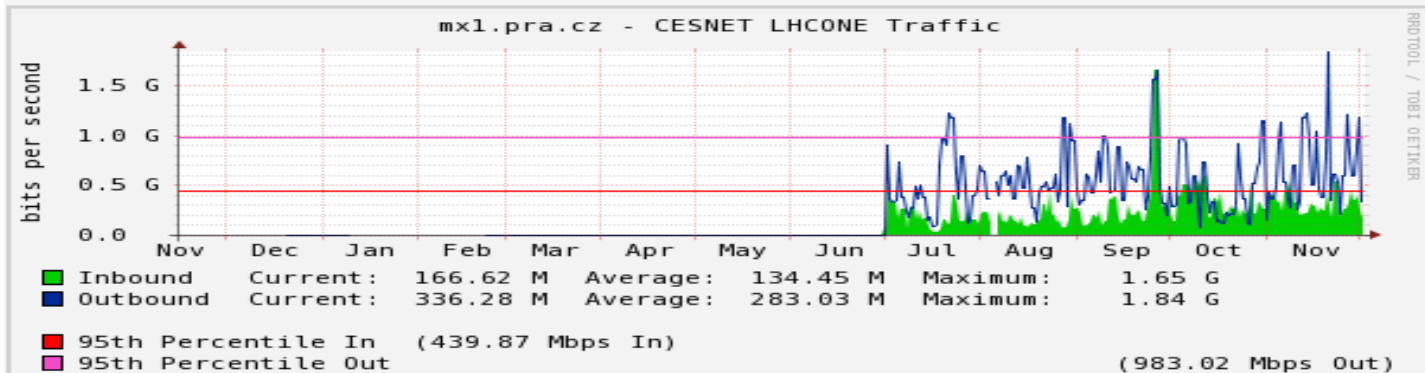
RedIRIS (Spain), CESNet (Czech Republic)



- RedIRIS connects to PIC Spanish T1 and IFAE Spanish T2 site
 - Peering with GEANT still not operational – Migration work on-going
- Link between CESNet and GEANT now active and exchanging traffic



Monthly (2 Hour Average)

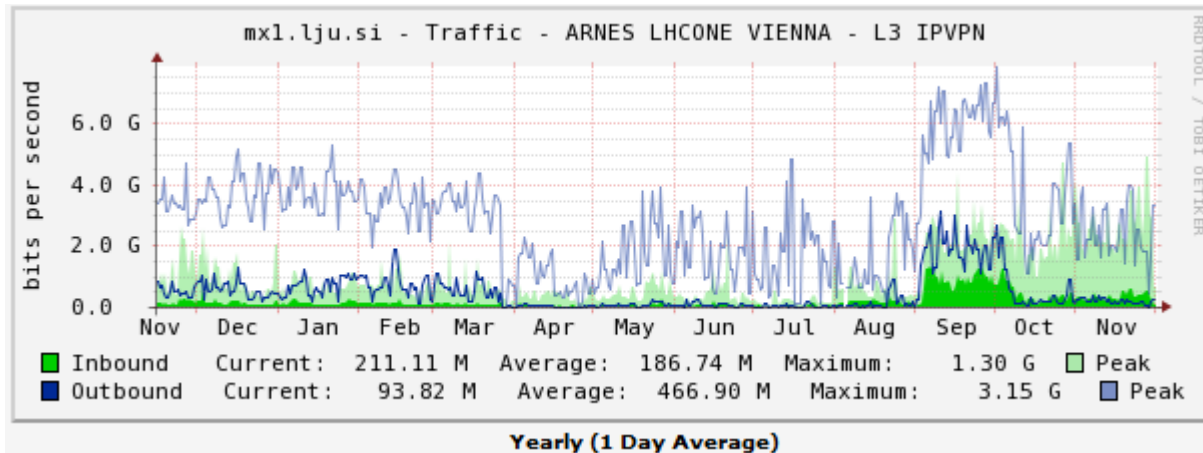


Yearly (1 Day Average)

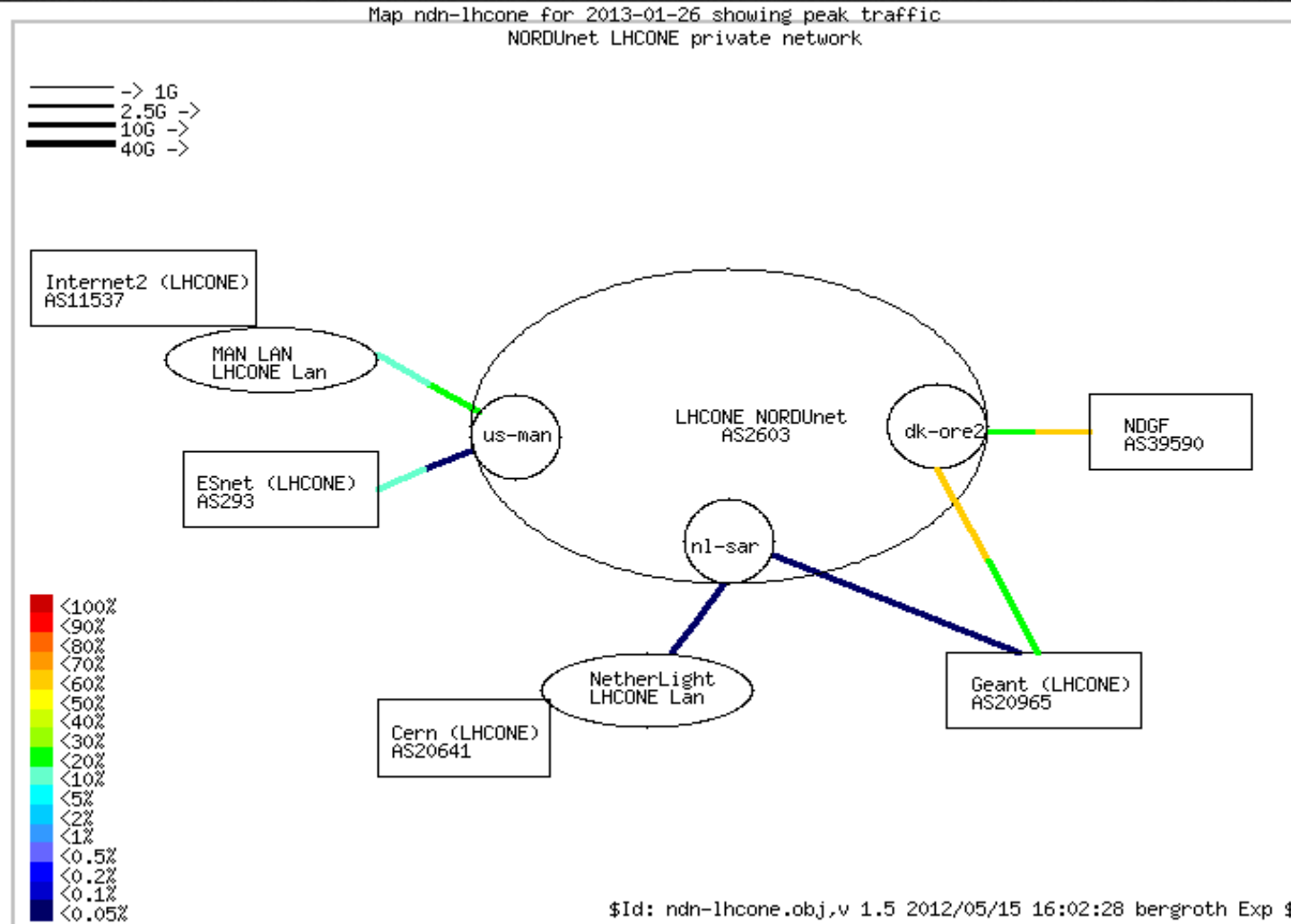
LHCONE in Europe ARNES (Slovenian NREN)



- Configured as separate VRF on ARNES network and peers with GEANT and GARR (Italian) VRF
- Connects Slovenian T2
- Traffic to/from GEANT VRF average ~2.5Gbps and peaks at ~7Gbps



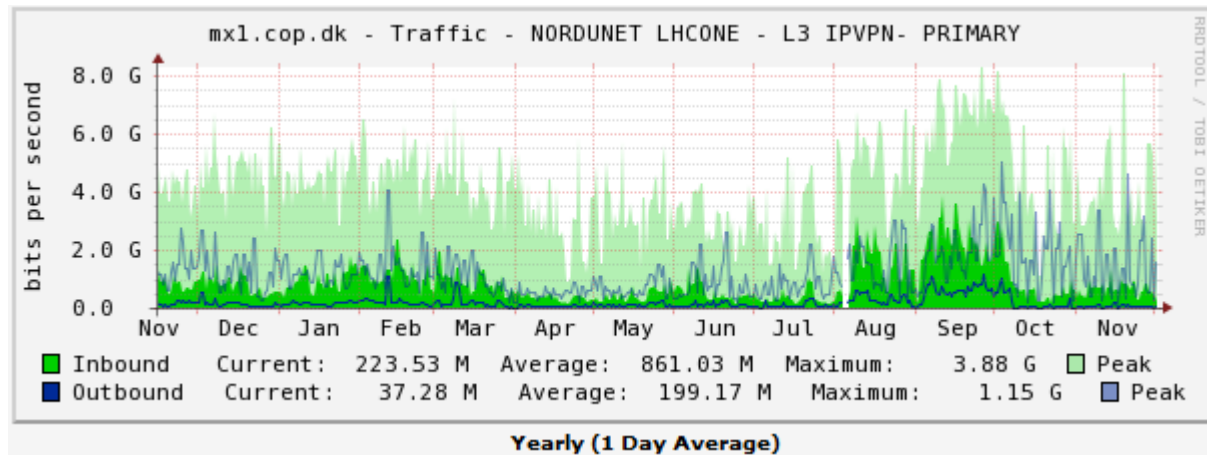
LHCONE in Europe NORDUNet



LHCONE in Europe NORDUNet



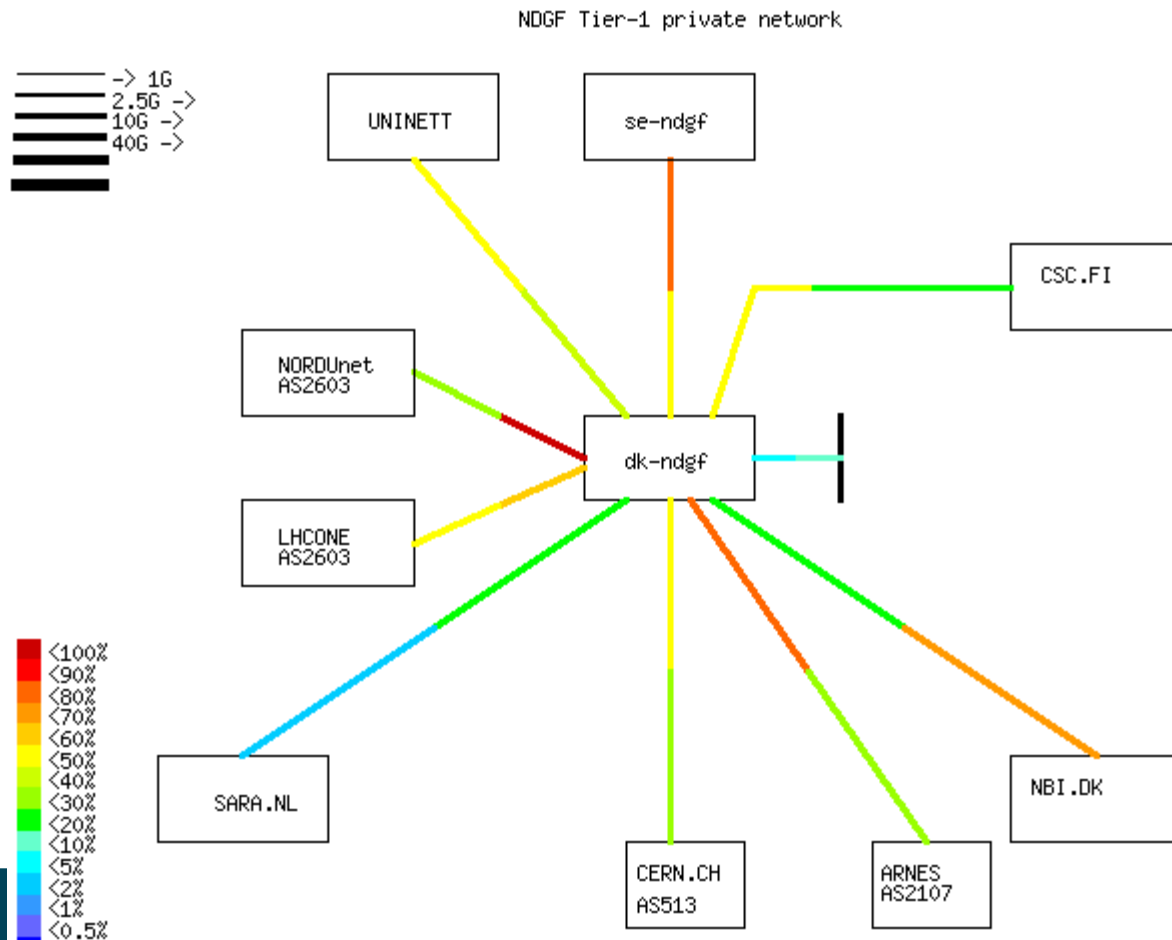
- Configured as VRF on NORDUNet backbone network
- NORDUNet VRF peers with GEANT, CERNLight, ESNet and Internet2 VRF
- NORDUNet present at MANLAN and NetherLight



LHCONE in Europe NORDUNet



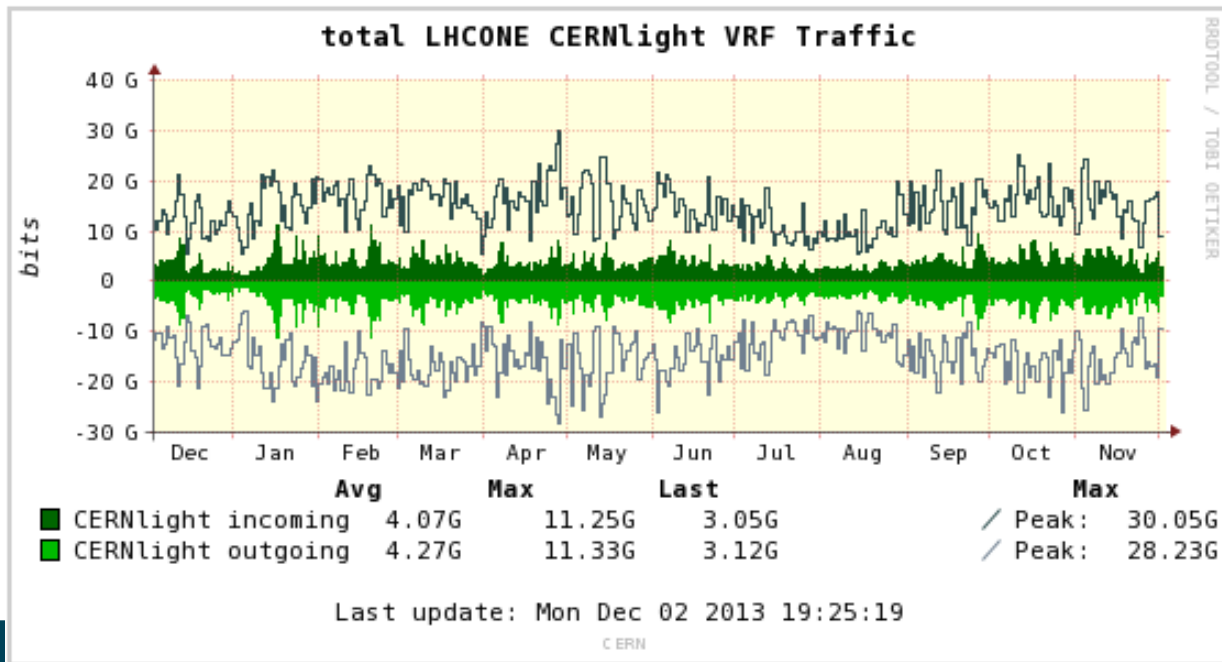
- Lambda from NDGF to ARNES (Slovenian T2)
- Traffic Peaks at ~7Gbps



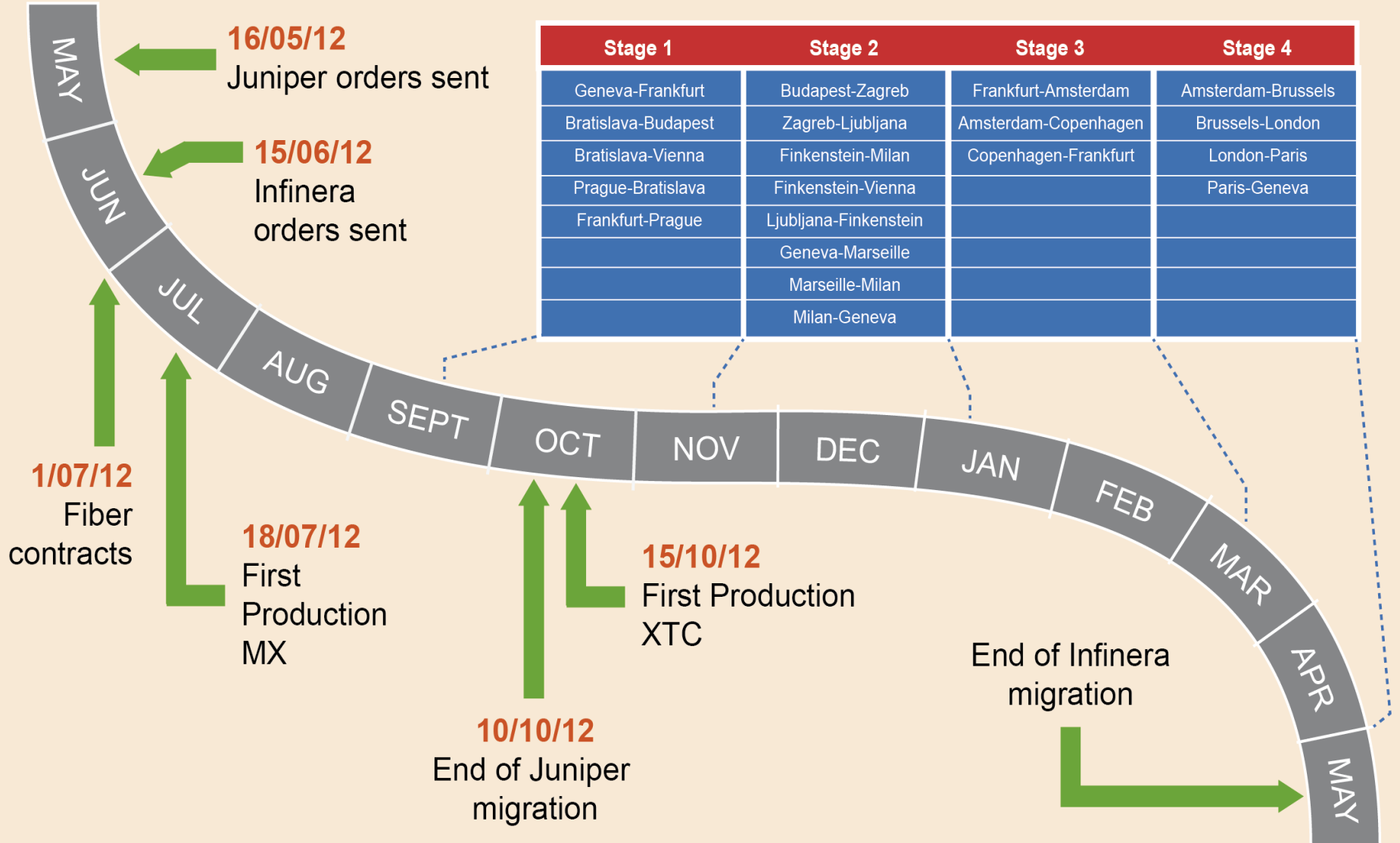
LHCONE in Europe CERNLight



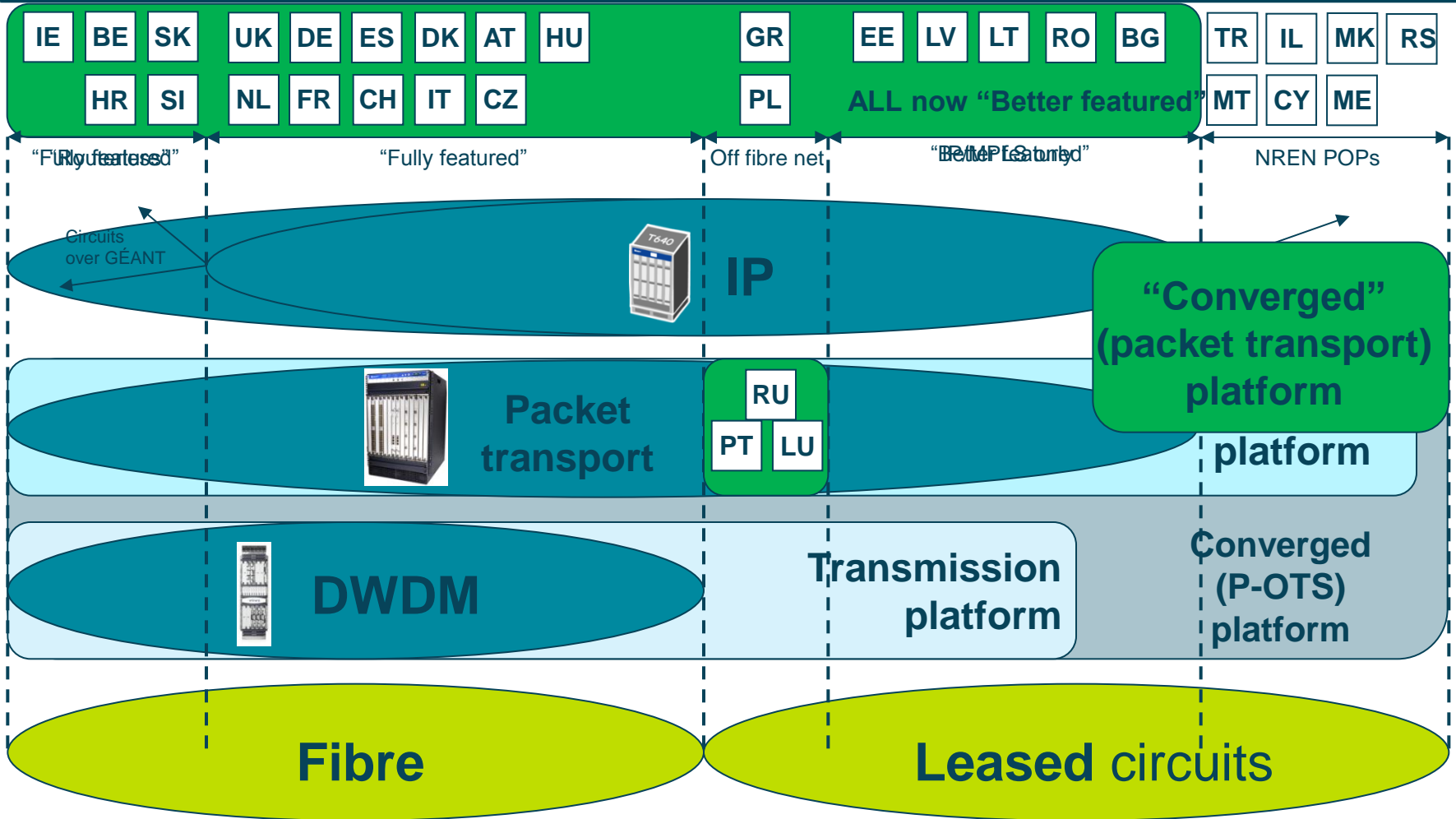
- Configured as L3VPN VRF on CERN Brocade MLXe
- CERNLight VRF peers with GEANT, NORDUNet, ESNet and Internet2 VRF
- Connects CERN T1 and TIFR (Indian T2)



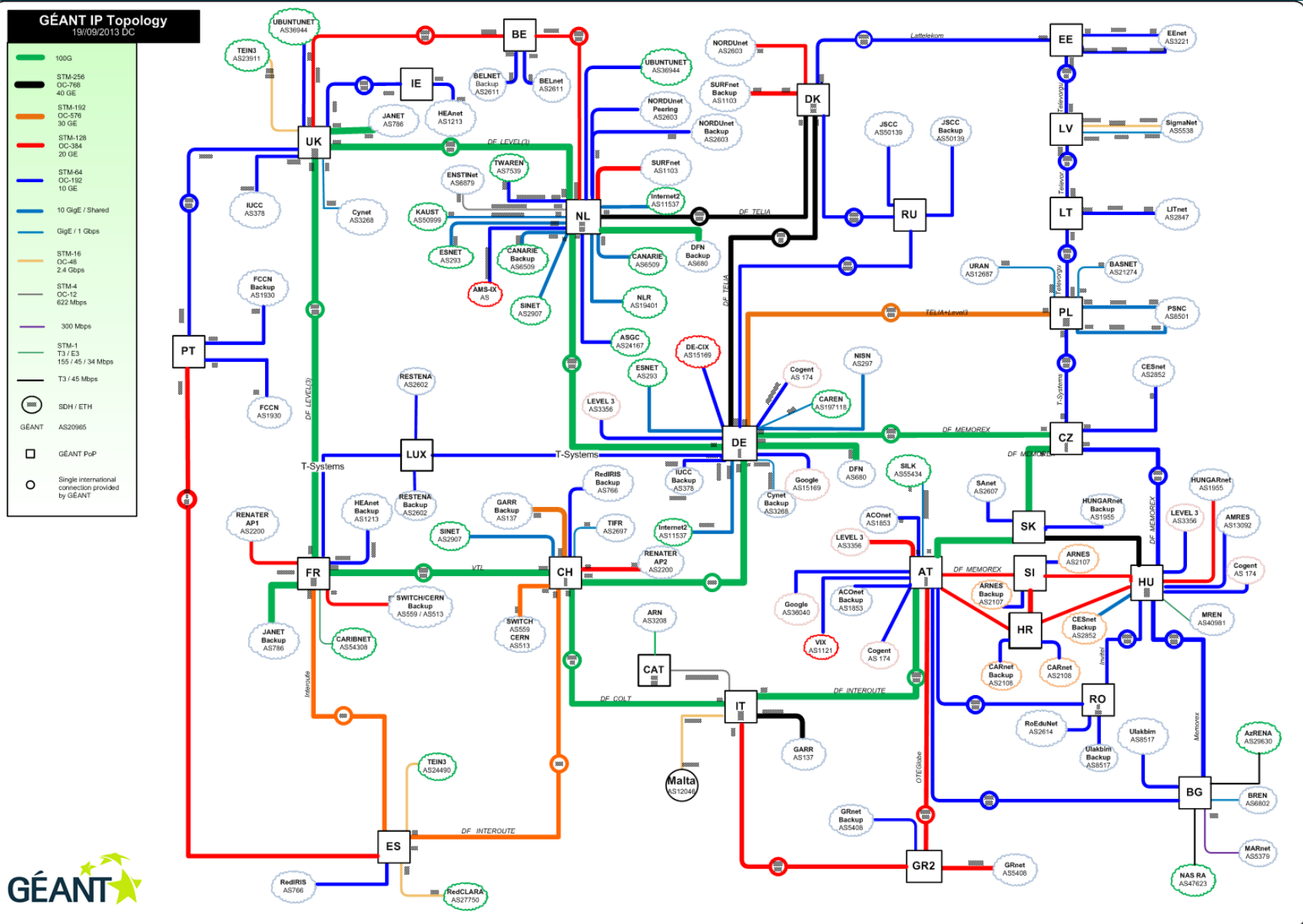
GEANT Migration



GEANT Network Convergence



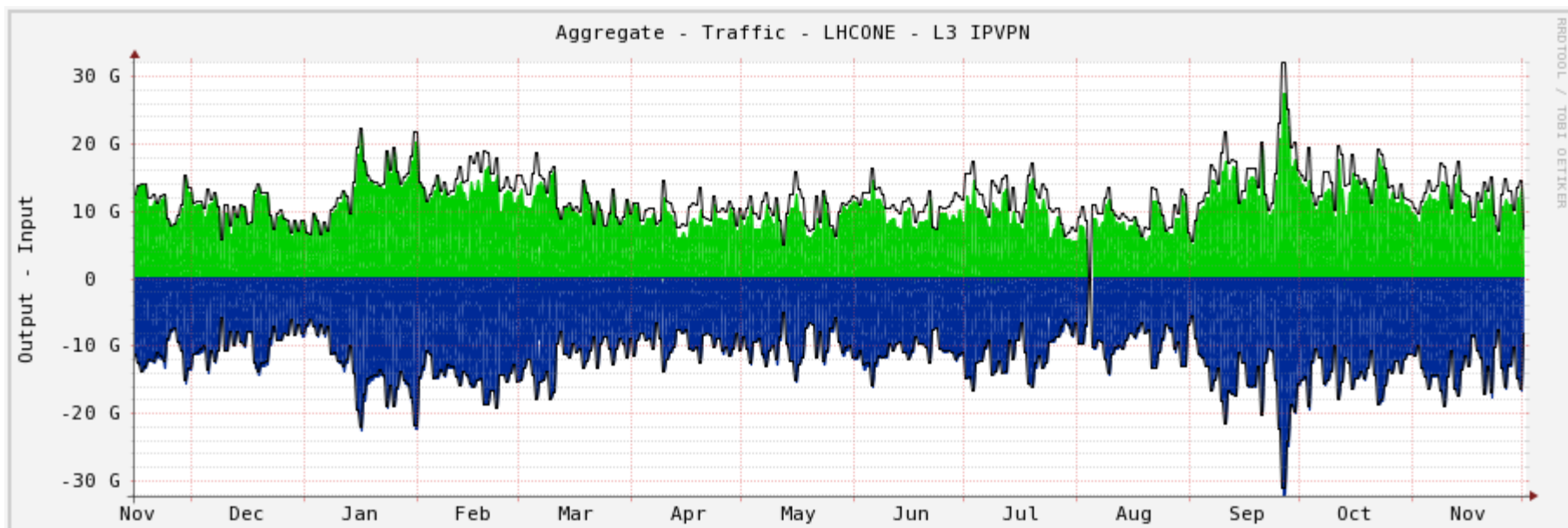
LHCONE in Europe GEANT



LHCONE in Europe GEANT



- Aggregate LHCONE traffic from all the NRENs and Peers
 - Average traffic ~18Gbps
 - Sustained Peaks of ~25Gbps



LHCONE in North America CANARIE

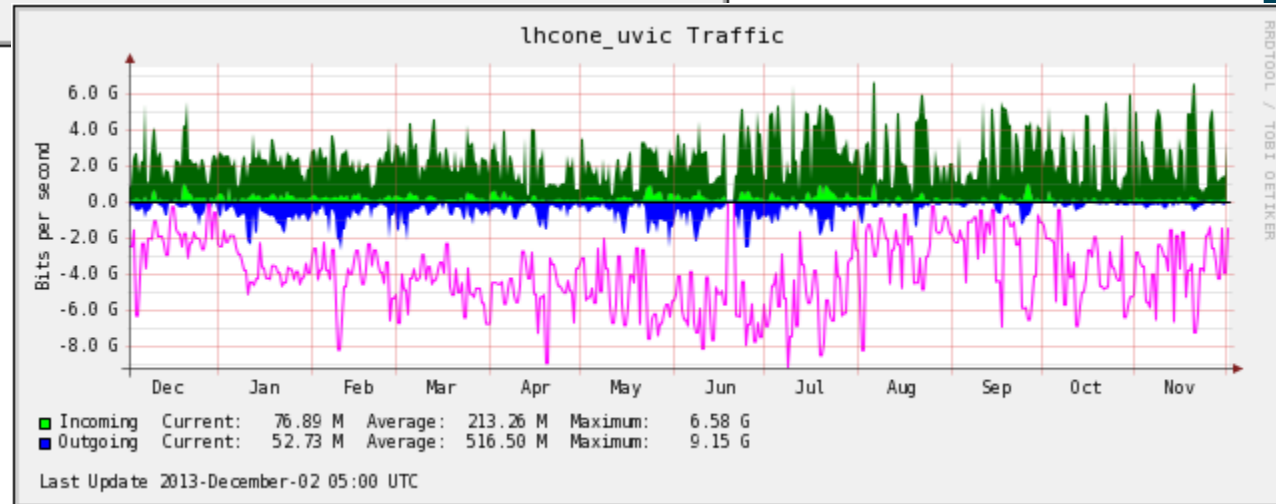
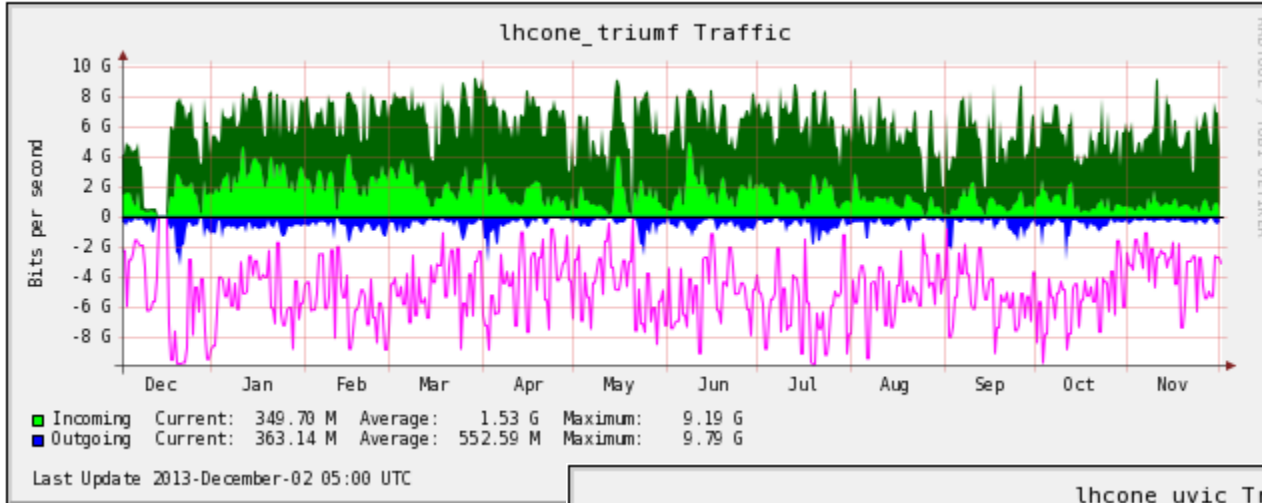


- Configured as L3VPN VRF and following sites connected:
 - T2s - Universities (5) - McGill, UofT, UofA, SFU, UVIC
 - T1 - Triumf - Canada's National Laboratory for Particle and Nuclear Physics
- CANARIE LHCONE VRF peers with ESNNet, GEANT and Internet2 LHCONE VRF
- CANARIE is present at StarLight, MANLAN and Pacific Wave
- Peak traffic from T1 is around 10Gbps most other sites have average 3-6Gbps traffic

LHCONE in North America CANARIE



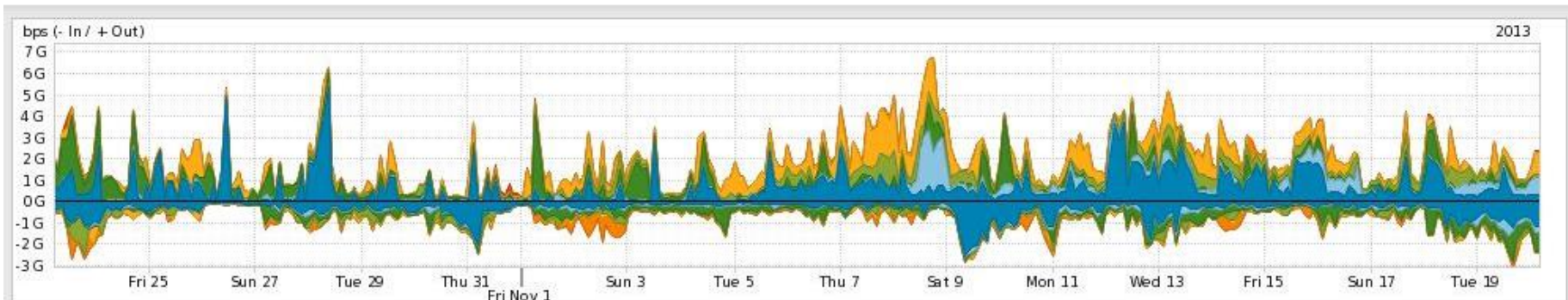
Yearly



LHCONE in North America ESNet



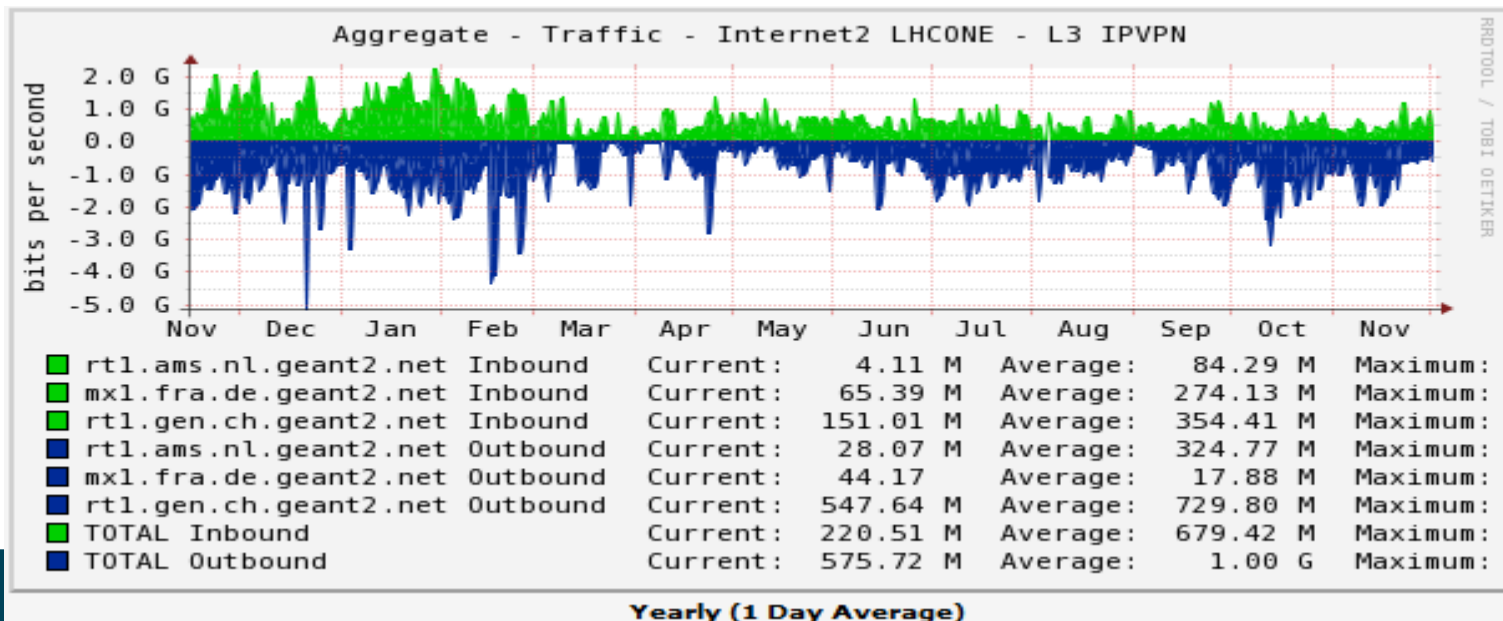
- Configured as L3VPN VRF and connects following sites:
 - BNL (Atlas T1) FNAL (CMS T1) SLAC (ATLAS T2)
- ESNet LHCONE VRF peers with Internet2, GEANT, NORDUNET, CERNLight and CANARIE LHCONE VRF
- ESNET is present at StarLight, MANLAN, WIX and PNWG
- Aggregate peak traffic in ESNET LHCONE VRF ~10Gbps



LHCONE in North America Internet2



- Configured as L3VPN VRF and connects several sites to LHCONE
- Internet2 LHCONE VRF peers with ESNNet, GEANT, NORDUNET, CERNLight and CANARIE LHCONE VRF
- Internet2 is present at StarLight, MANLAN, WIX and several other exchange points



LHCONE in Asia Taiwan and Japan

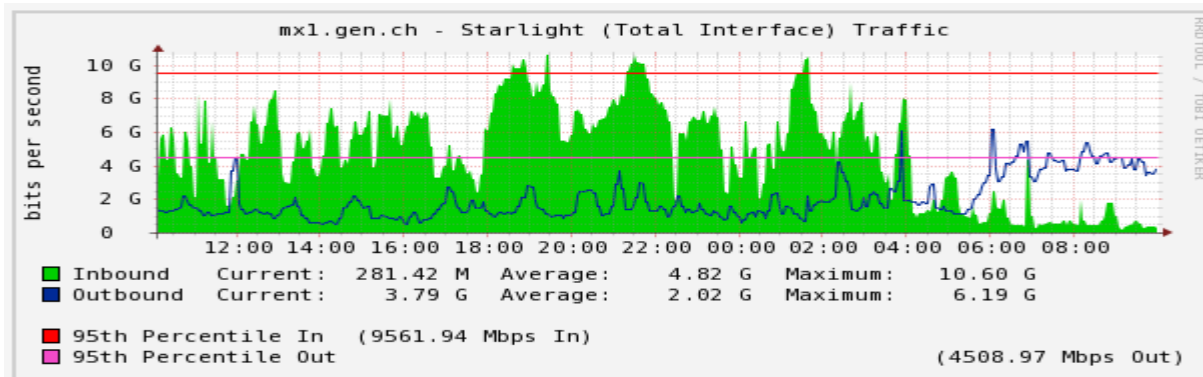


- ASGC connected to NetherLight and StarLight and peers with GEANT LHCONE VRF in Amsterdam
- Connects following sites:
 - ASGC-T1+T2: 117.103.96.0/20, 202.169.168.0/22, 202.140.160.0/19
 - ASGC-2: 140.109.102.0/24
 - TWAREN (Tiawan)
 - NCU-T2: 140.115.32.0/24
 - NTU-T2: 140.112.101.0/24, 140.112.102.0/24, 140.112.104.0/24
 - Kyungpook National University Daegu, Korea
- SINET (Japanese NREN) peers with GEANT at WIX and MANLAN

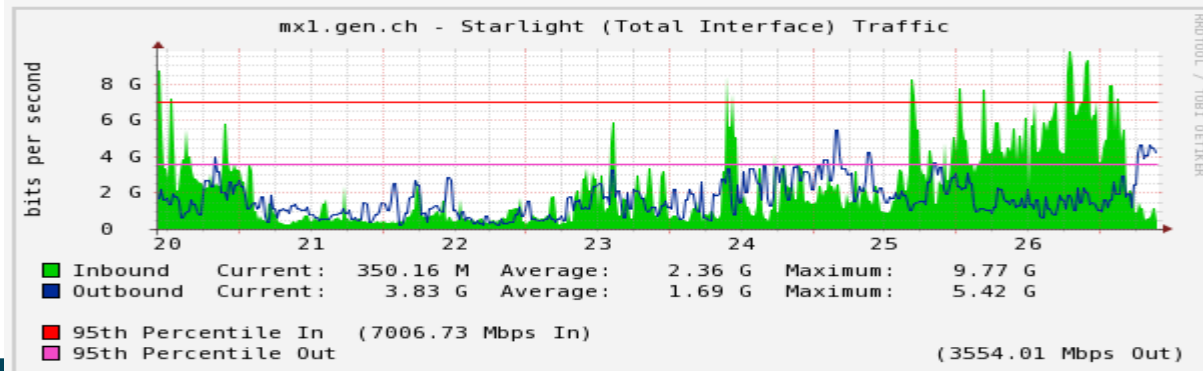
Trans-Atlantic Links



- NORDUNET ~ 1.5Gbps peaks
- NREN funded LHCONe dedicated links ~12Gbps peaks
- ACE and GEANT funded shared links ~8Gbps
- USLHCNET LHCONe dedicated link ~



Daily (5 Minute Average)



Weekly (30 Minute Average)

LHCONE in Open Exchanges



	MANLAN	StarLight	WIX	NetherLight	CERNLight
GEANT	★	★	★	★	★
NORDUnet	★			★	
Internet2	★	★	★		
ESnet	★	★	★		
CANARIE	★	★			
ASGC		★		★	



- Backbone networks 100Gbps (Shared)
- Interconnect upgrades
 - DFN - GEANT 100G (Shared)
 - GARR – GEANT 100G (Shared)
 - CERN – GEANT 2 x 10G dedicated
 - RENATER – GEANT Geneva 2 x 10G dedicated
 - RENATER – GEANT Paris 10G dedicated
 - CESNet – GEANT 10G dedicated

- LHCONE backbone supported by
 - Over 15 national and international RENs
 - Several Open Exchange Points including NetherLight, StarLight, MANLAN and others
 - Trans-Atlantic connectivity provided by ACE, GEANT, NORDUNET and USLHCNET
- Over 50 end sites connected to LHCONE
 - 40+ Tier 2s
 - 8 Tier 1

https://twiki.cern.ch/twiki/bin/view/LHCONE/LhcOneVRF#Connected_sites

- Site Survey

Questions?

- Questions?