

L3VPN LHCONE status update

Virtual edition!

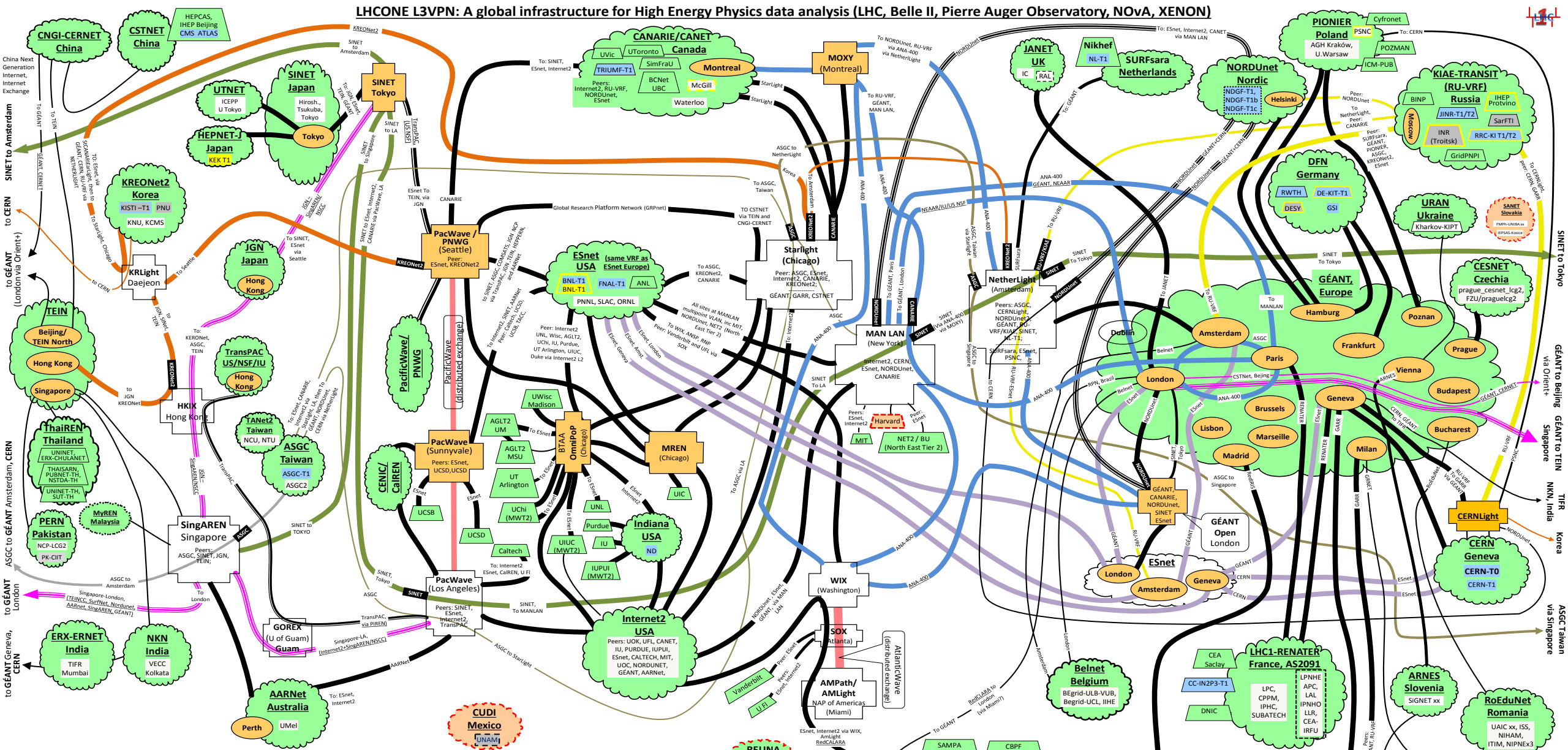
Enzo Capone

Head of Research Engagement and Support

LHCONE-OPN Virtual Meeting

13th May 2020

LHCONE L3VPN: A global infrastructure for High Energy Physics data analysis (LHC, Belle II, Pierre Auger Observatory, NOVA, XENON)



LHCONE Map Ver. 5.1, May 30, 2019 – WEJohnston, ESnet, wej@es.net

LHCONE VRF domain/aggregator
 - A provider network

Connector network – provides, e.g., an L2 path between VRFs.

Provider network PoP router

Not currently connected to LHCONE

Exchange point

Legend:
 - **Color/Line Style:** GARR (green), ANSP (orange), London (yellow), CUDI (red), Exchange point (black square)
 - **Line Style:** Dotted outline indicates distributed site, Dashed outline indicating a WLCG federation site not currently on LHCONE

International infrastructure by provider/collaboration

various
 GEANT
 SINET, Japan
 ASGC, Taiwan
 ESnet transatlantic, USA
 JGN, SingAREN (+ TIENCC, SurfNet, NORDUnet, GEANT on the London link)
 IJN, SingAREN (+ TIENCC, SurfNet, NORDUnet, GEANT on the London link)
 Dotted outline indicates distributed site

Legend:
 - **Color/Line Style:** NREN/site router at exchange point (black), Communication links: 1/10, 20/30/40, and 100Gb/s or N x 100G (various colors), Underlined link information indicates link provider, not use (underlined), Dotted outline indicates distributed site (dotted), Dashed outline indicating a WLCG federation site not currently on LHCONE (dashed)

LHC sites:
 PNU LHC ALICE or LHCb site
 CNAF-T1 LHC Tier 1 ATLAS and CMS
 Uchi LHC Tier 2/3 ATLAS and CMS
 KEK Belle II Tier 1/2
 Yellow outline indicates LHC+Belle II site

Legend:
 - **Color/Line Style:** PNU (blue), CNAF-T1 (green), Uchi (orange), KEK (red), Yellow outline (yellow)

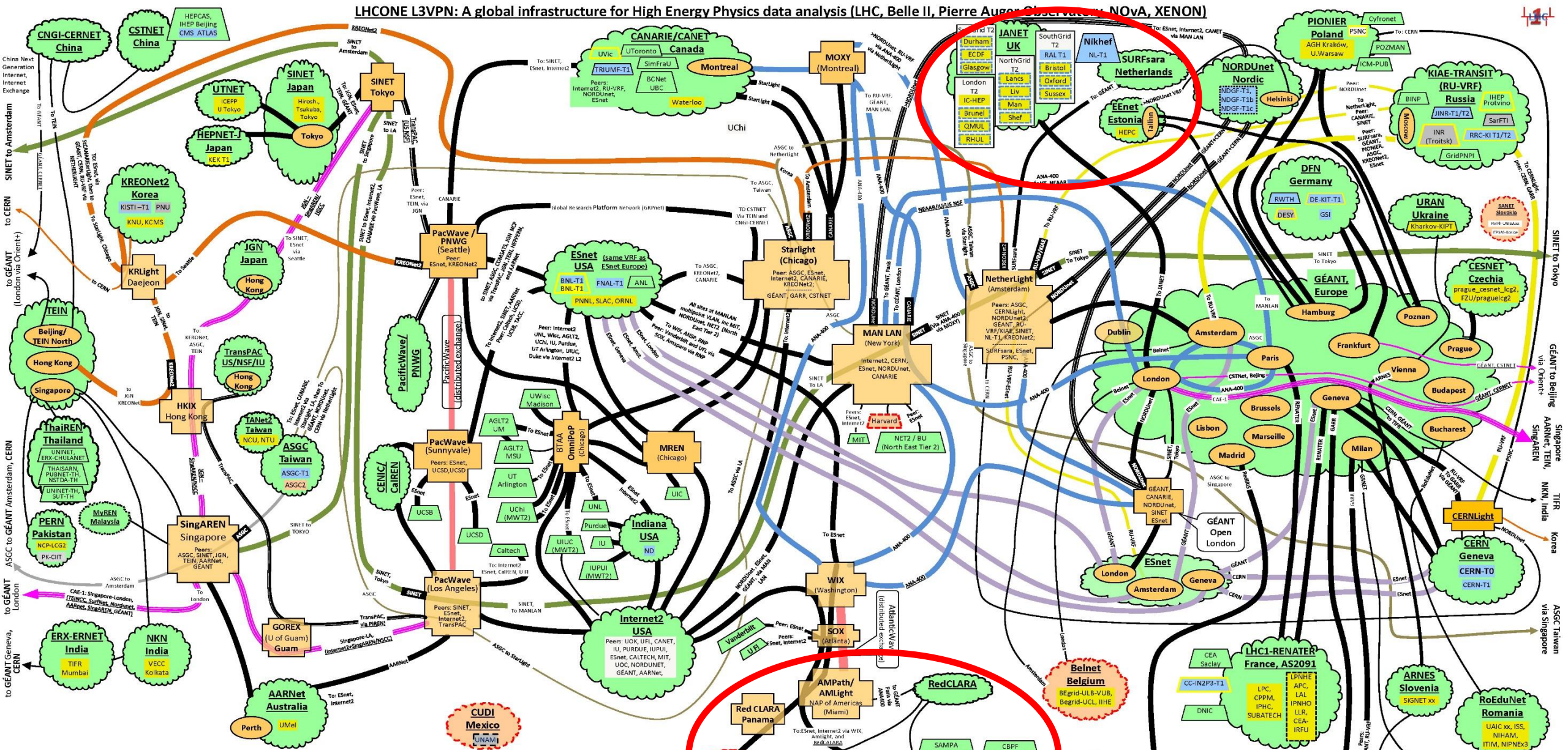
Notes:
 1) ONLY links involved in LHCONE are shown
 2) LHCOPN links are not shown on this diagram
 3) For map explanation see "Rationale Behind the LHCONE Map" at <https://www.dropbox.com/sh/pdxfo58j017az/AAD5B5K8TSH9FHCjA4eC7ea7d0>

Legend:
 - **Color/Line Style:** Various colors and line styles representing different providers and links.

Legend:
 - **Color/Line Style:** Various colors and line styles representing different providers and links.



LHCONE L3VPN: A global infrastructure for High Energy Physics data analysis (LHC, Belle II, Pierre Auger Observations, NOvA, XENON)



LHCONE Map Ver. 5.3, January 2020 – WEJohnston, ESnet, wej@es.net

LHCONE VRF domain/aggregator
 - A provider network
 - Connector network – provides, e.g., an L2 path between VRFs.
 - Provider network PoP router
 - Not currently connected to LHCONE
 - Exchange point

International infrastructure by provider/collaboration

Legend:
 - Various links provided by CANARIE, ESnet, GEANT, Internet2, NORDUnet, SURFnet, SINET, IU/NSF
 - Dotted outline indicates distributed site
 - Blue dashed outline indicating a WLCG federation site not currently on LHCONE

International infrastructure by provider/collaboration

Legend:
 - Various links provided by CANARIE, ESnet, GEANT, Internet2, NORDUnet, SURFnet, SINET, IU/NSF
 - Dotted outline indicates distributed site
 - Blue dashed outline indicating a WLCG federation site not currently on LHCONE

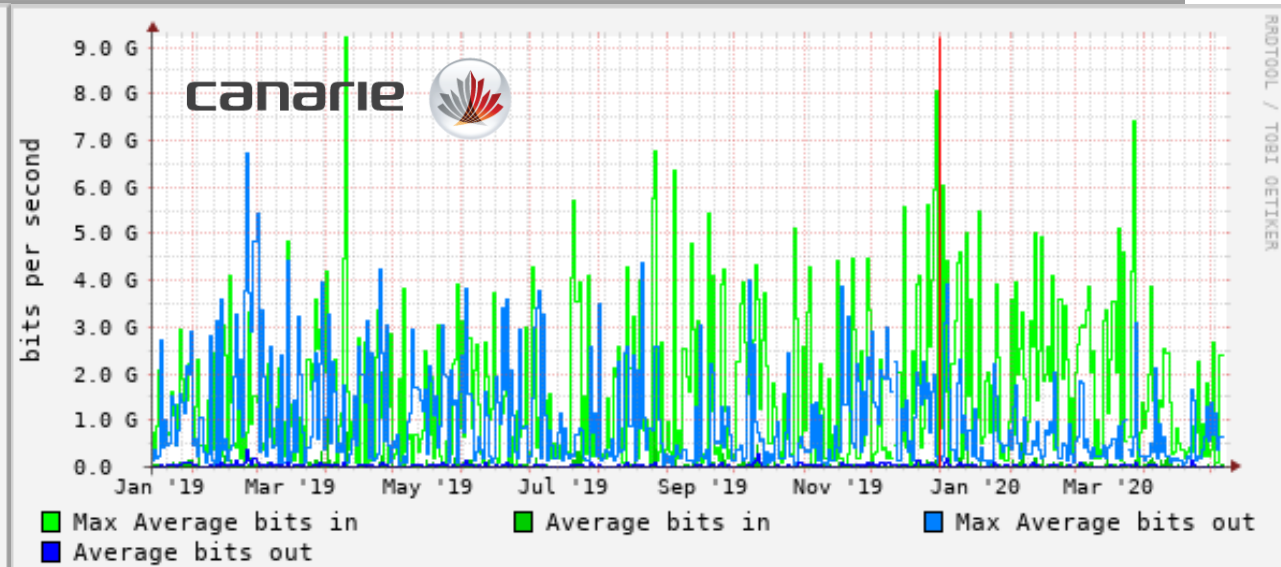
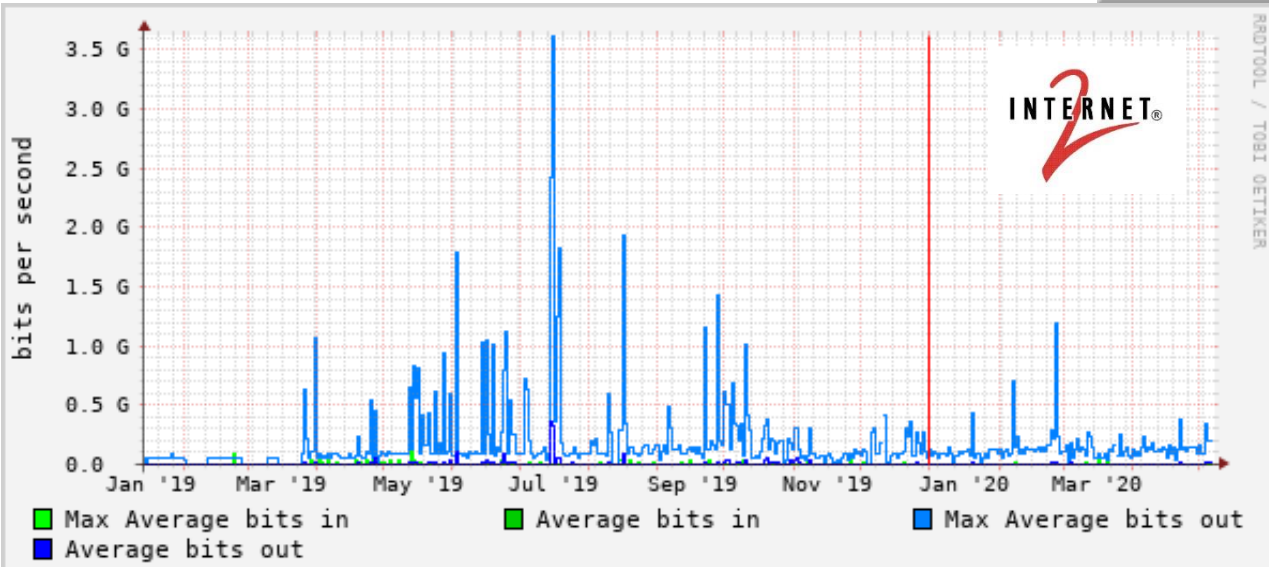
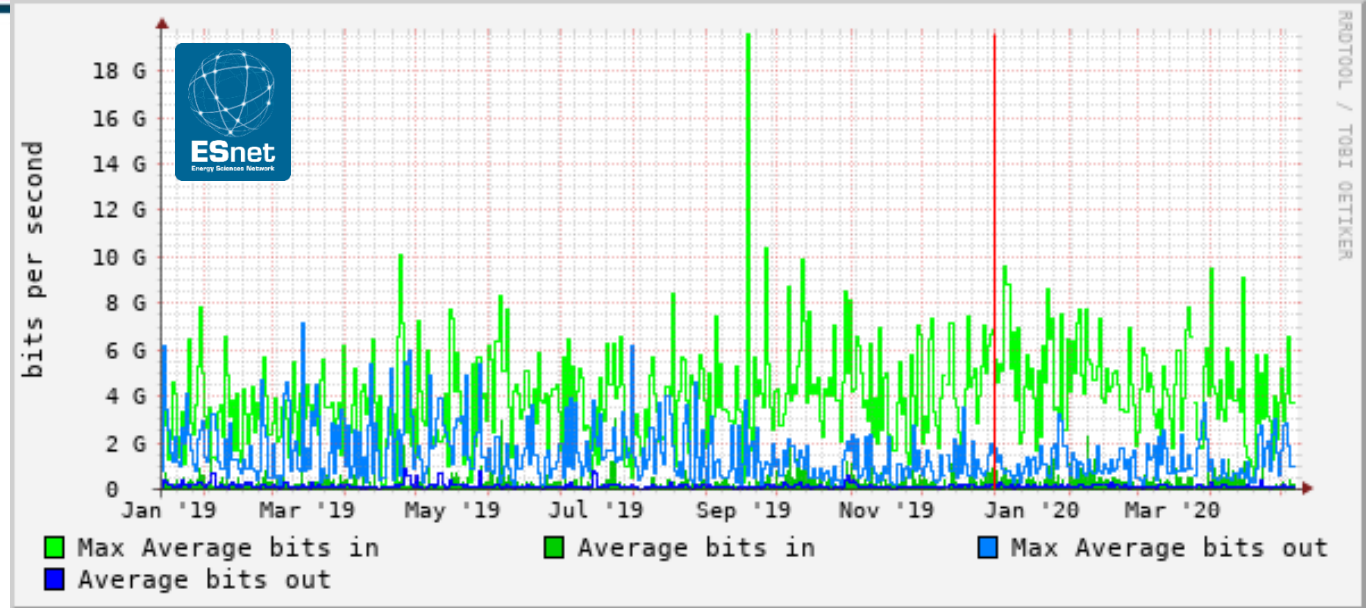
Legend:
 - Various links provided by CANARIE, ESnet, GEANT, Internet2, NORDUnet, SURFnet, SINET, IU/NSF
 - Dotted outline indicates distributed site
 - Blue dashed outline indicating a WLCG federation site not currently on LHCONE

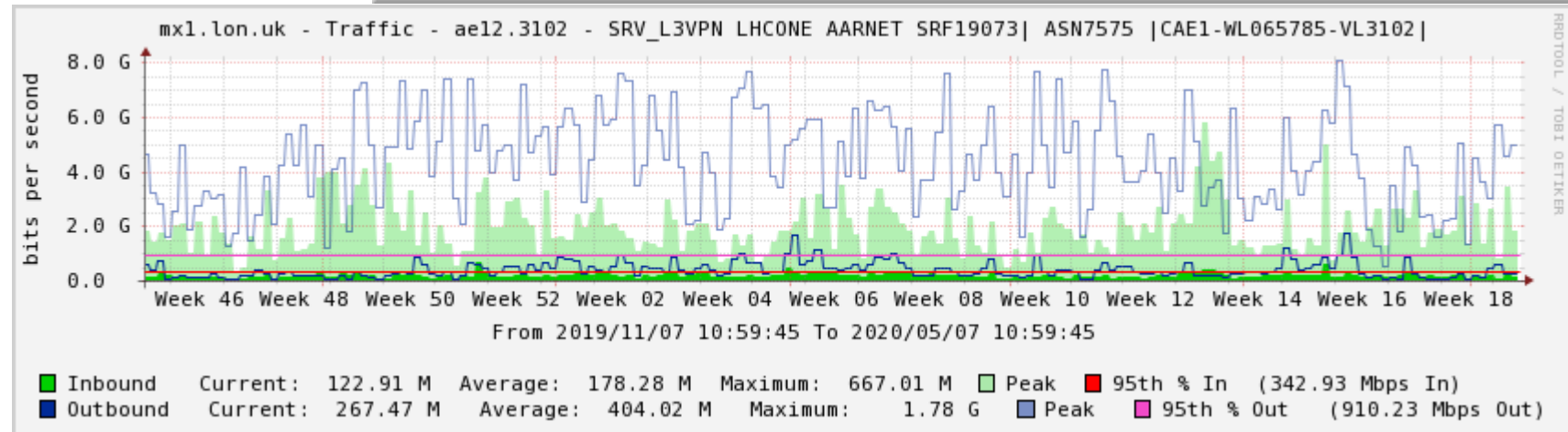
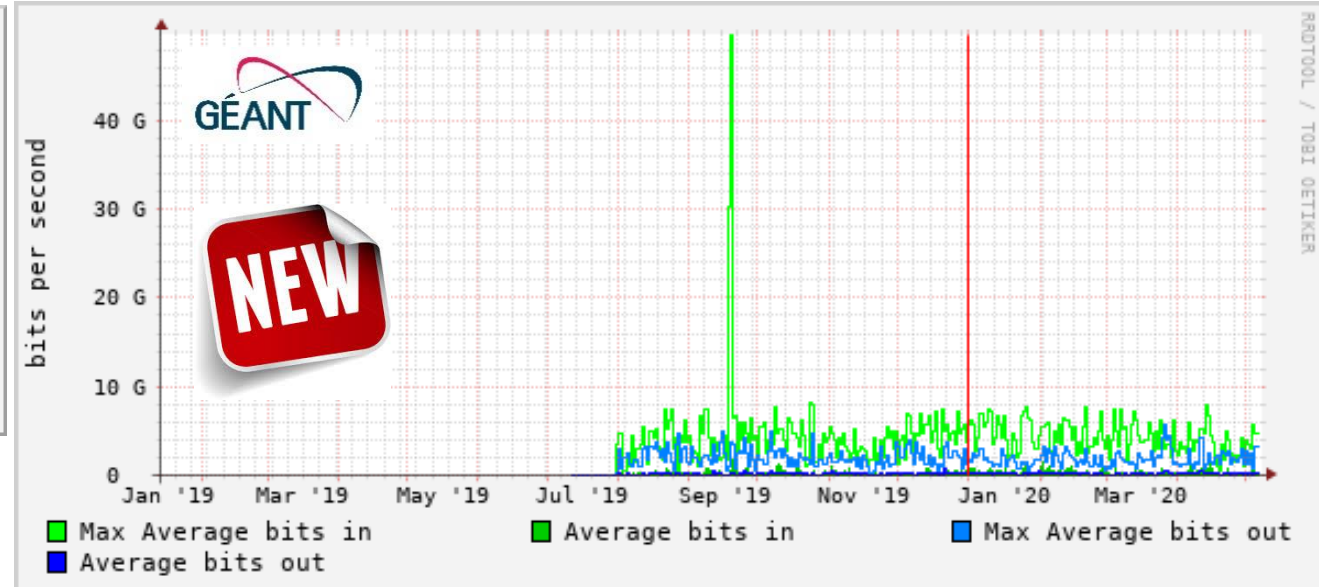
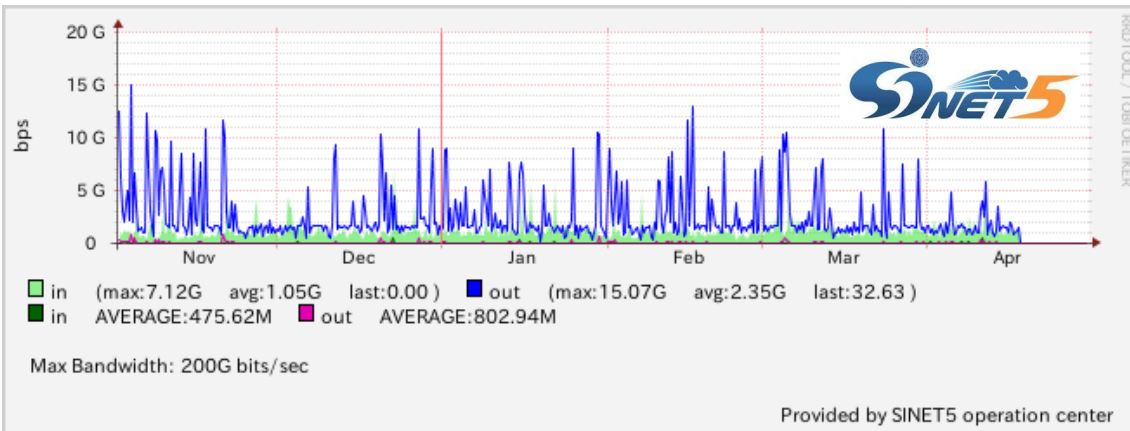
Legend:
 - Various links provided by CANARIE, ESnet, GEANT, Internet2, NORDUnet, SURFnet, SINET, IU/NSF
 - Dotted outline indicates distributed site
 - Blue dashed outline indicating a WLCG federation site not currently on LHCONE

Legend:
 - Various links provided by CANARIE, ESnet, GEANT, Internet2, NORDUnet, SURFnet, SINET, IU/NSF
 - Dotted outline indicates distributed site
 - Blue dashed outline indicating a WLCG federation site not currently on LHCONE

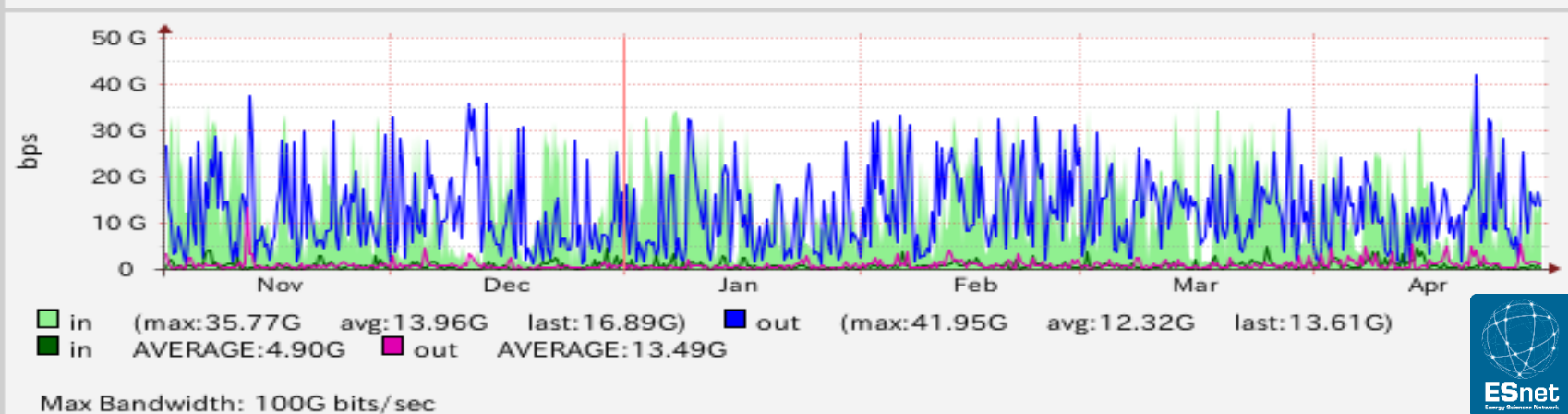
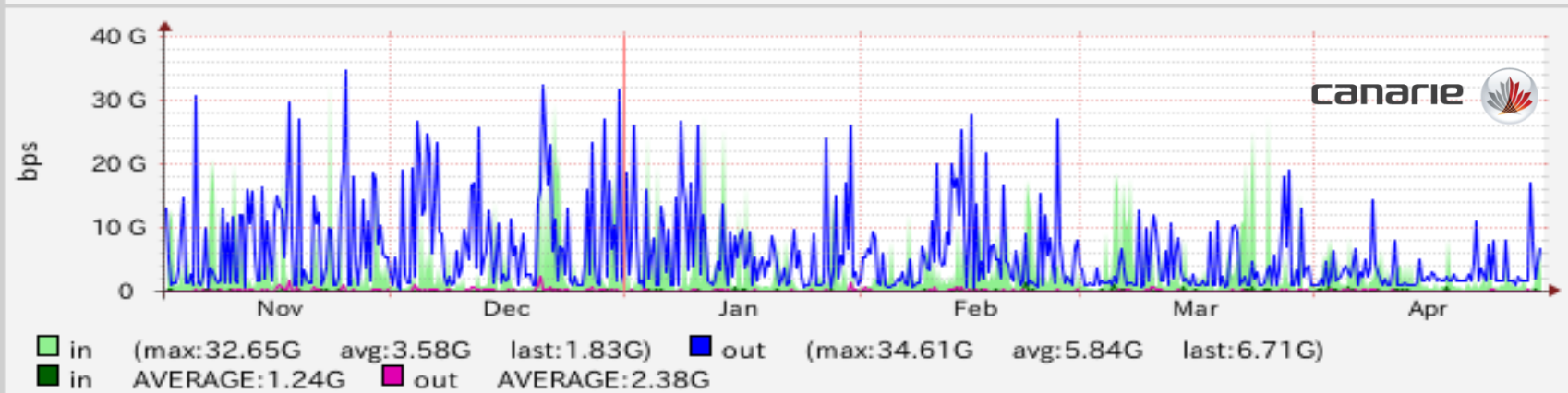
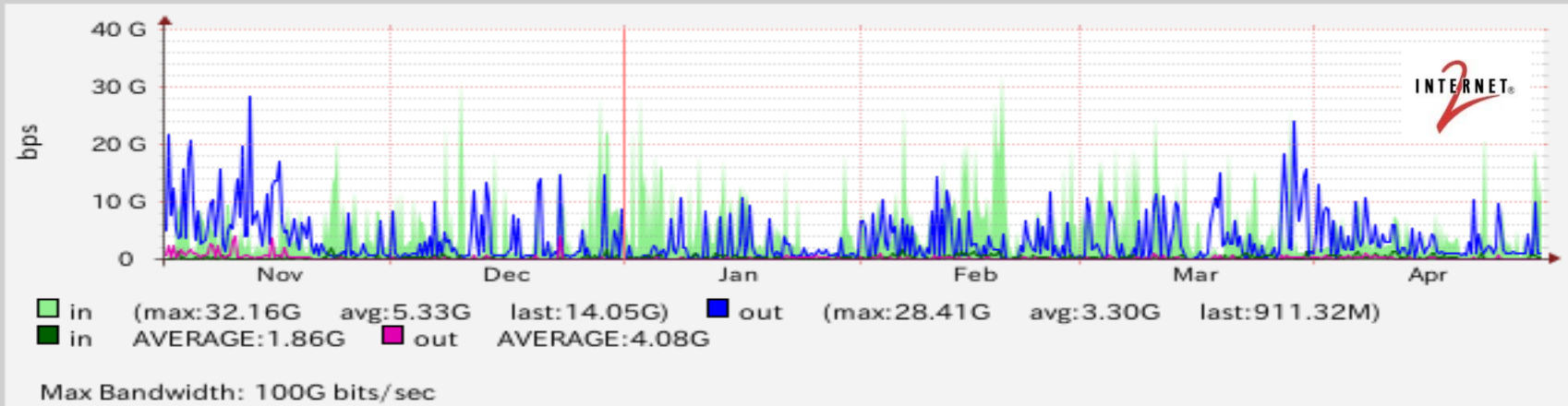
Legend:
 - Various links provided by CANARIE, ESnet, GEANT, Internet2, NORDUnet, SURFnet, SINET, IU/NSF
 - Dotted outline indicates distributed site
 - Blue dashed outline indicating a WLCG federation site not currently on LHCONE

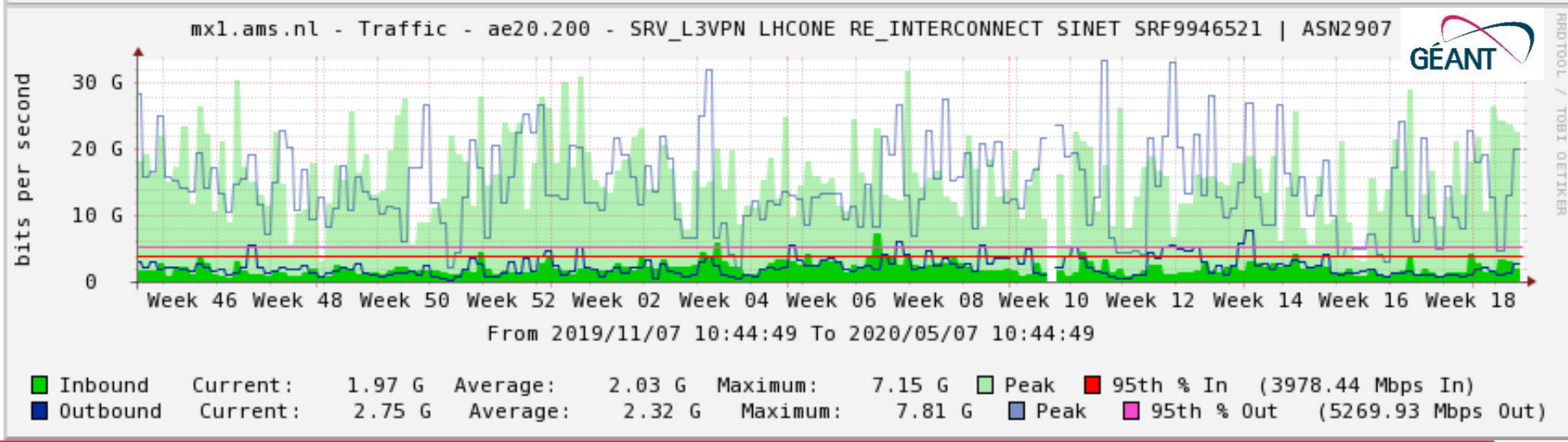
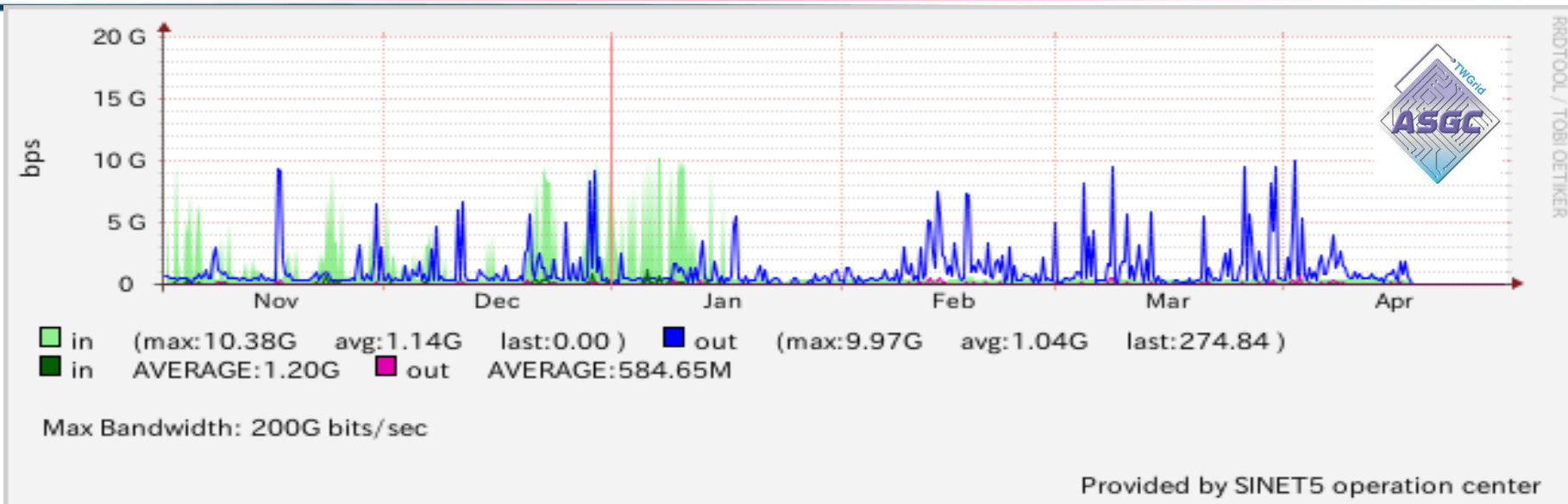
- Asia-Pacific
- Europe
- North America
- Latin America

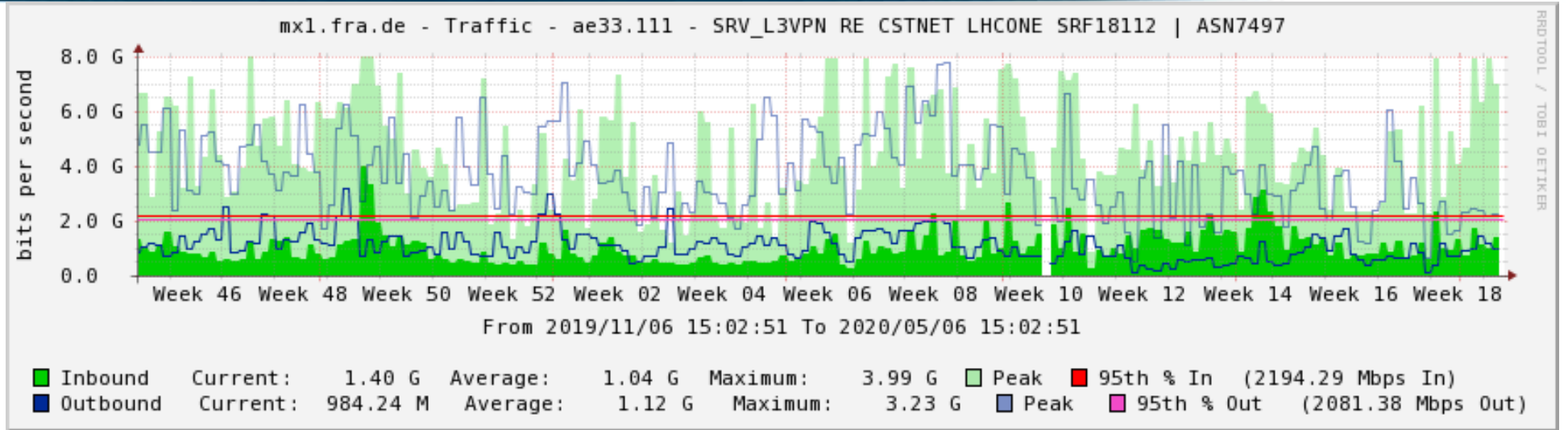




SINET

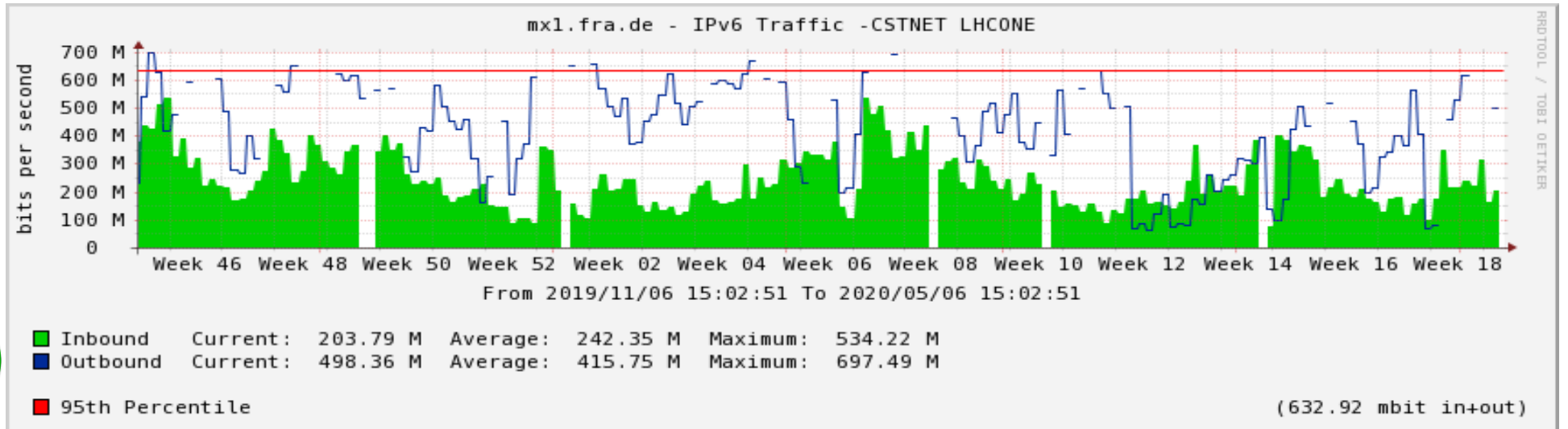


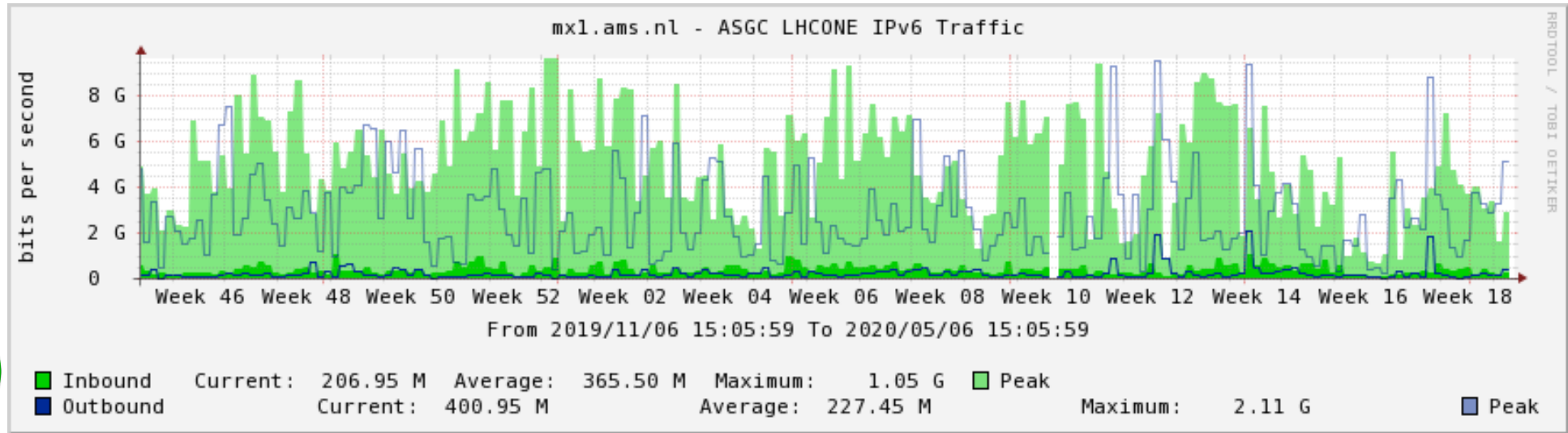
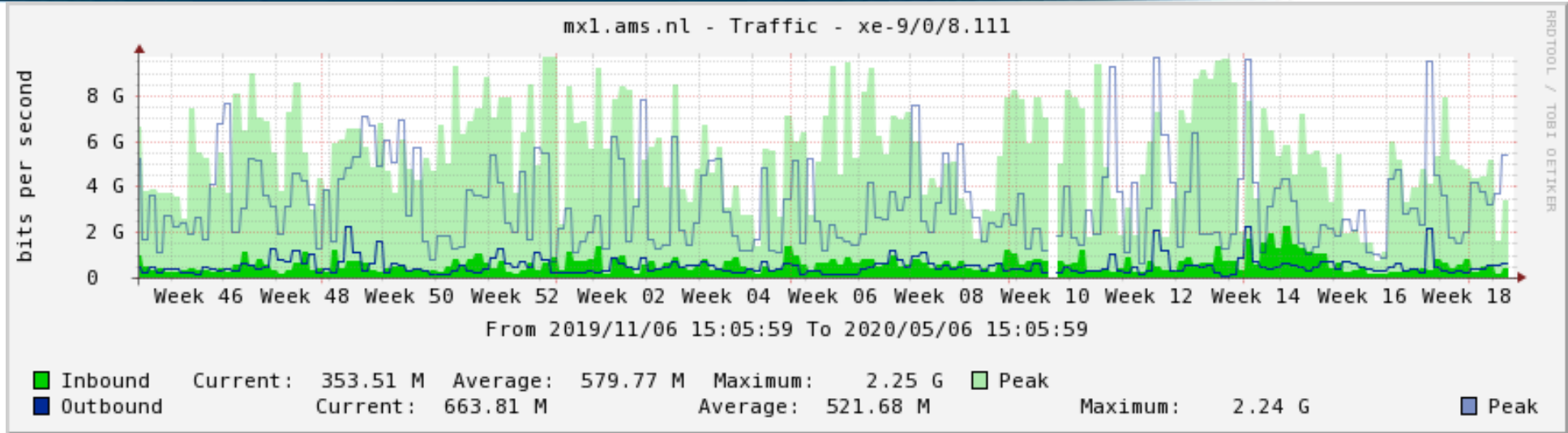




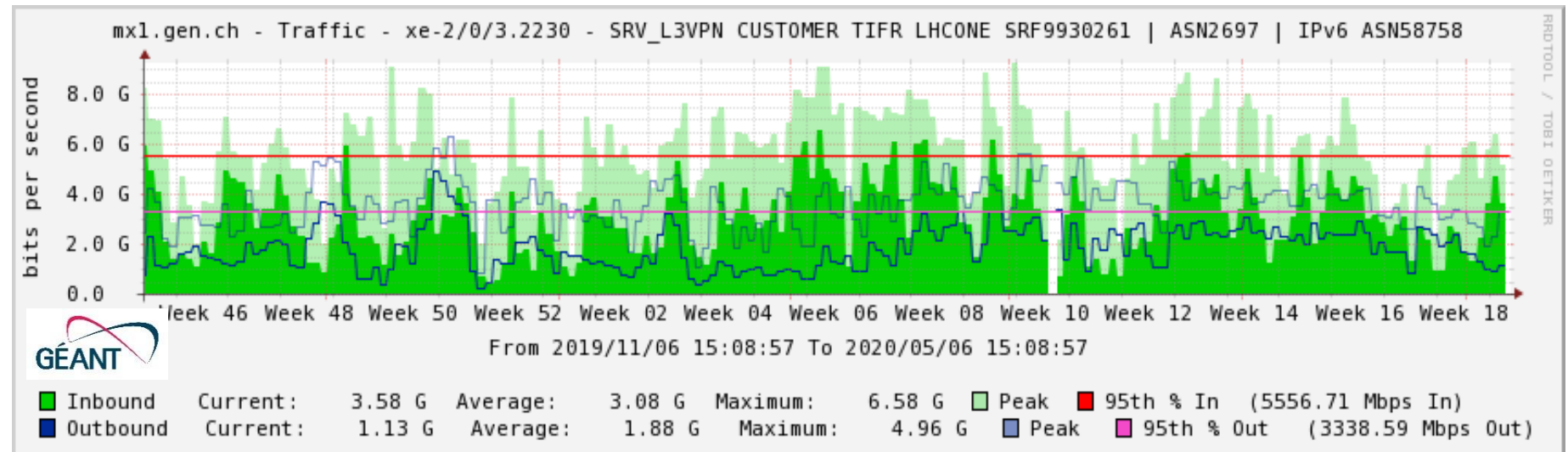
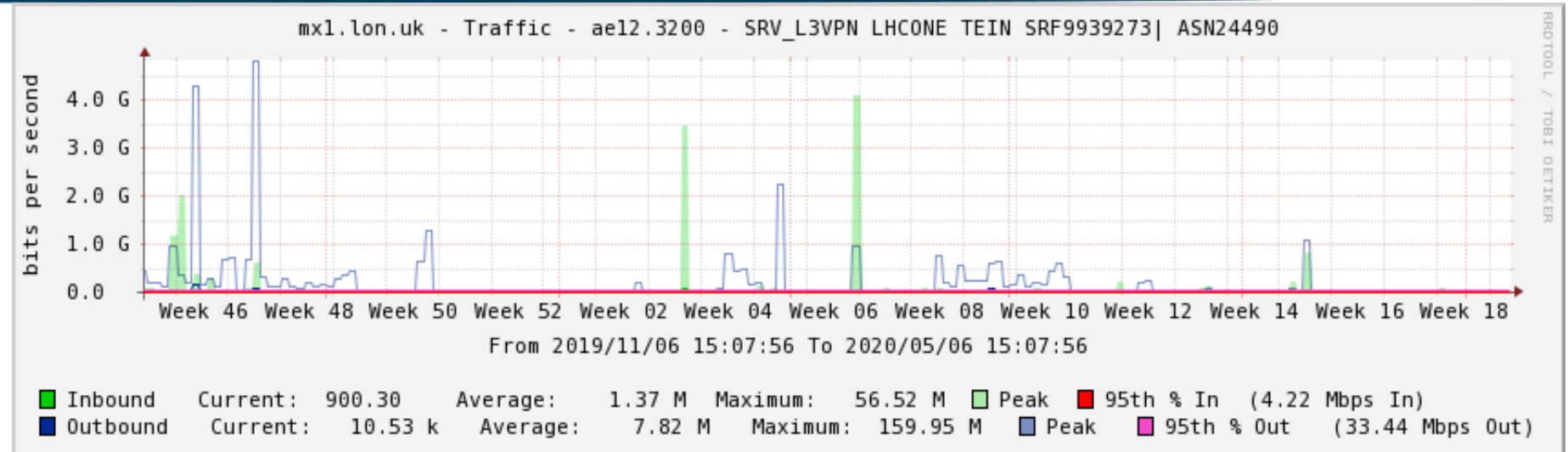
中国科技网

China Science & Technology Network





TEIN – TIFR (NKN)



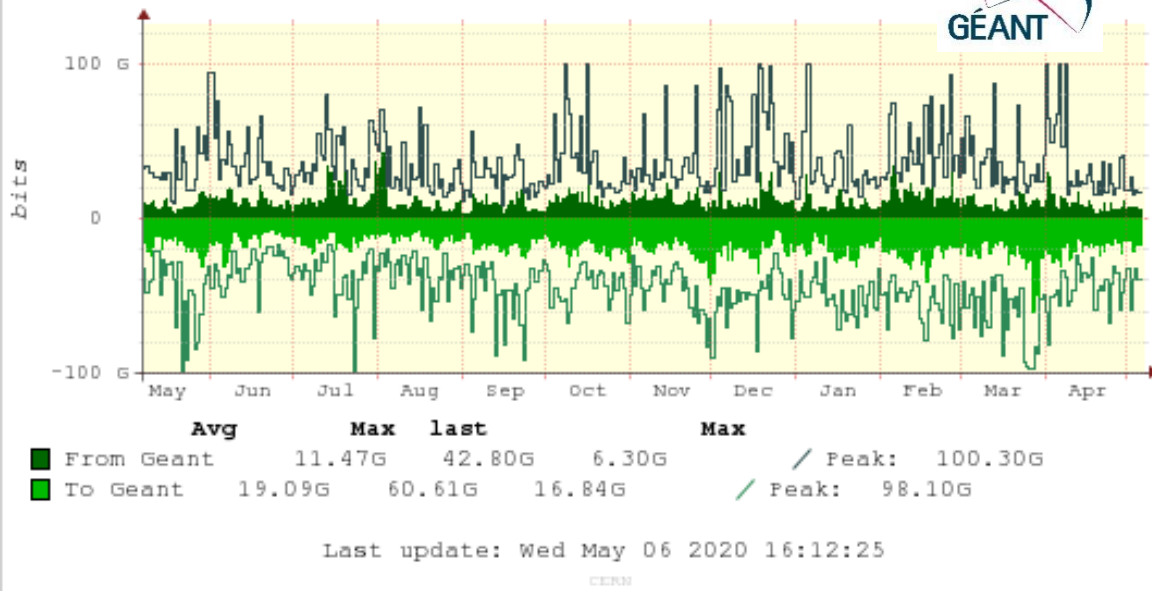


- RENs in these countries connect:

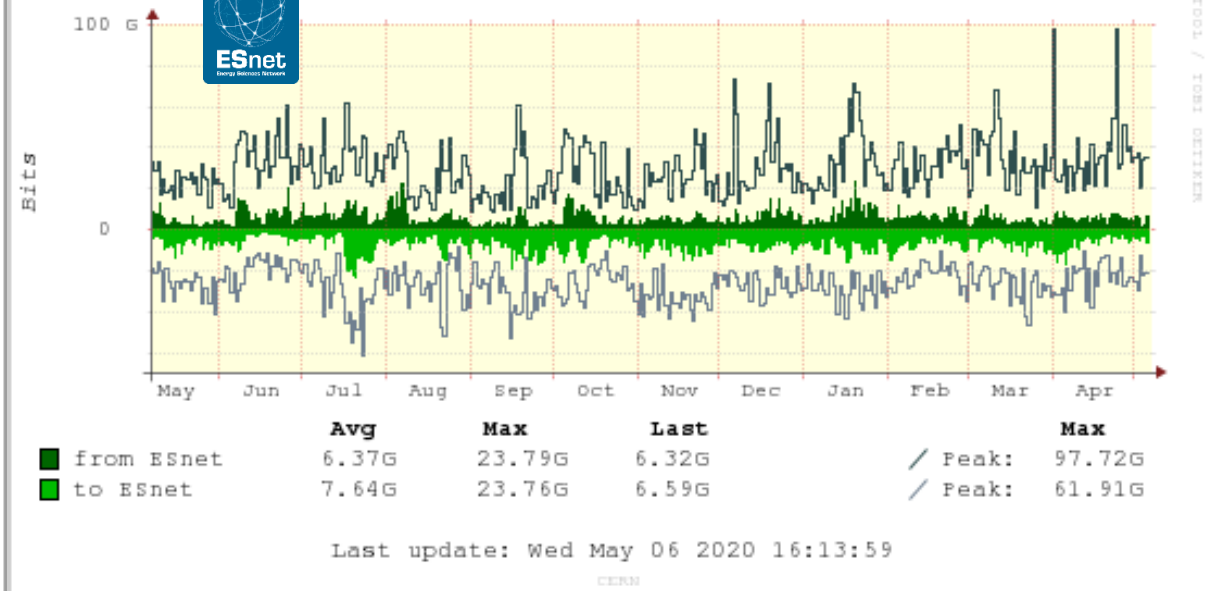
- 7 Tier 1s
- 36 Tier 2s
- Russian T1s and T2s (direct peering with GÉANT, NORDUnet, GARR, SURFnet and PIONIER)



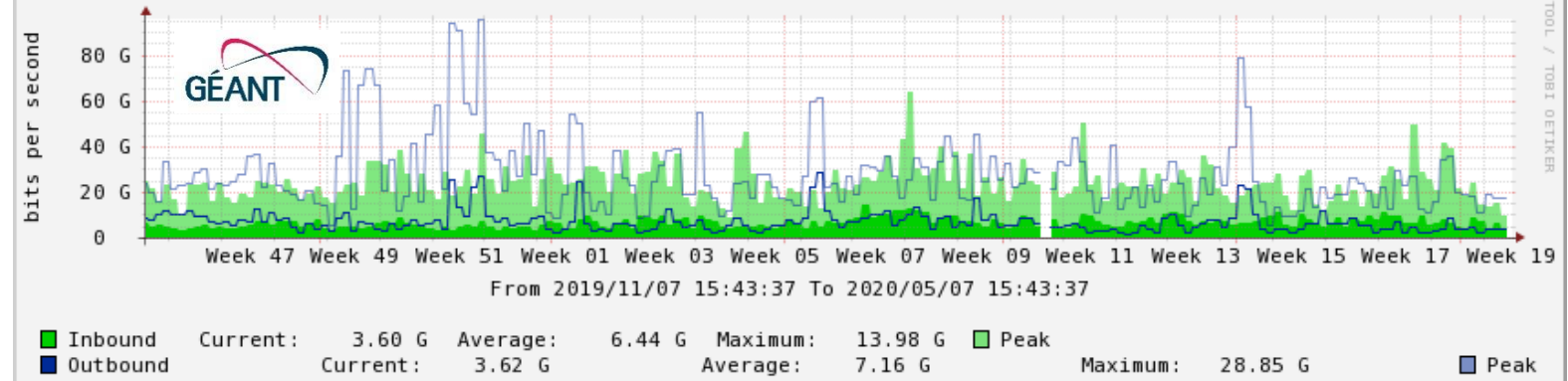
GEANT LHCONE access

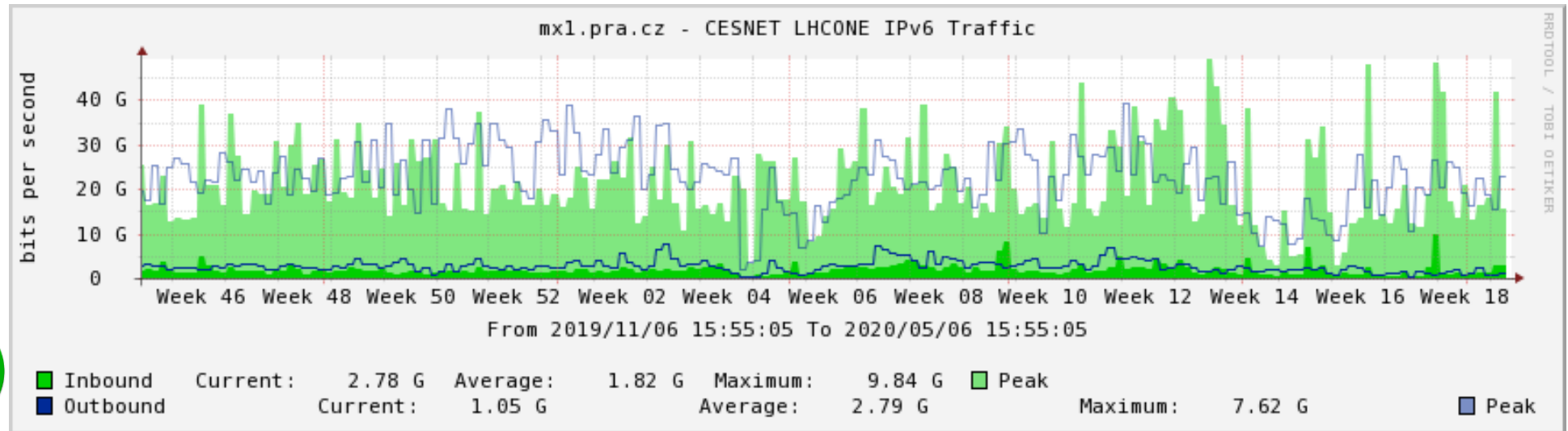
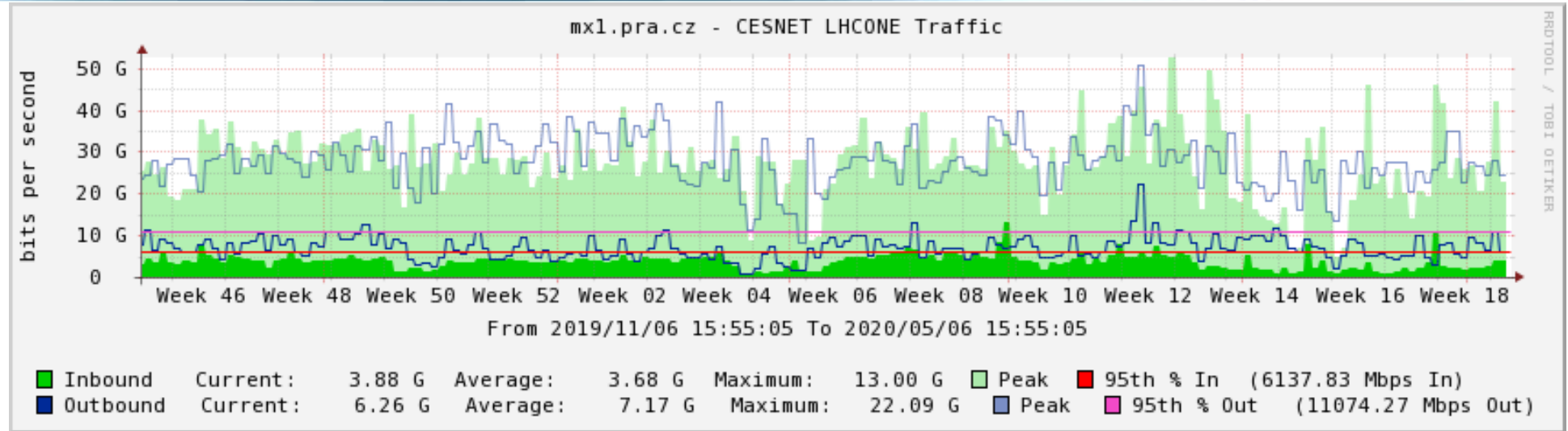


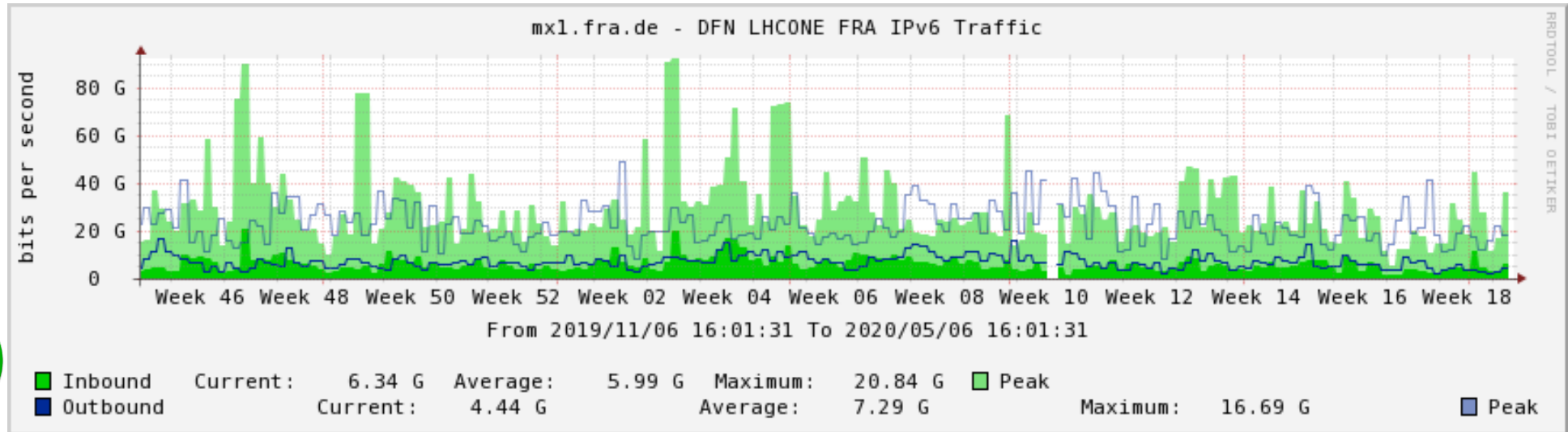
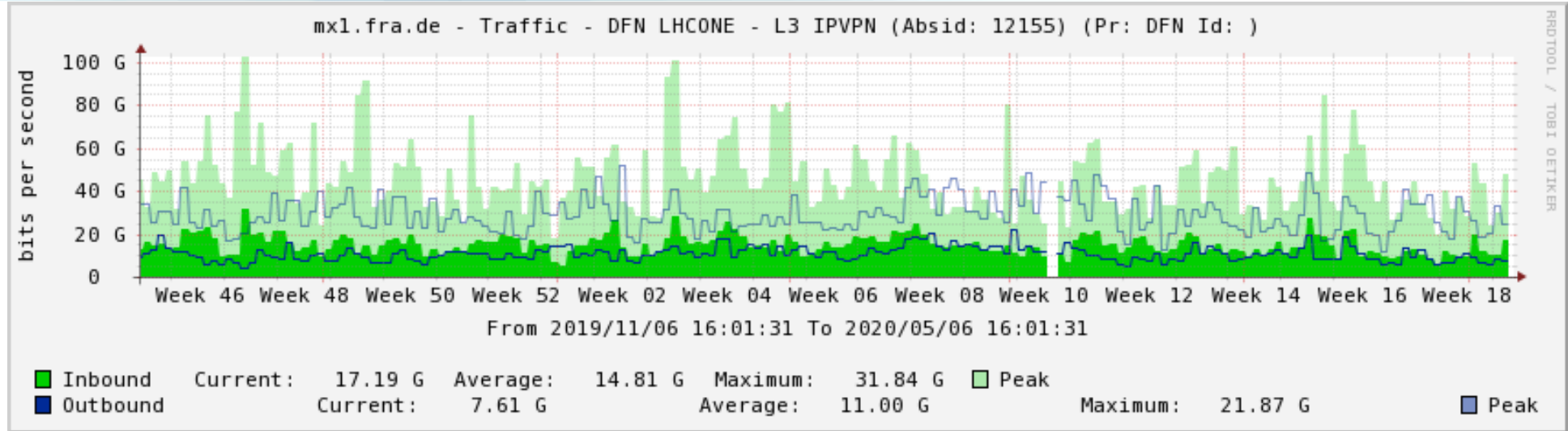
ESnet LHCONE total

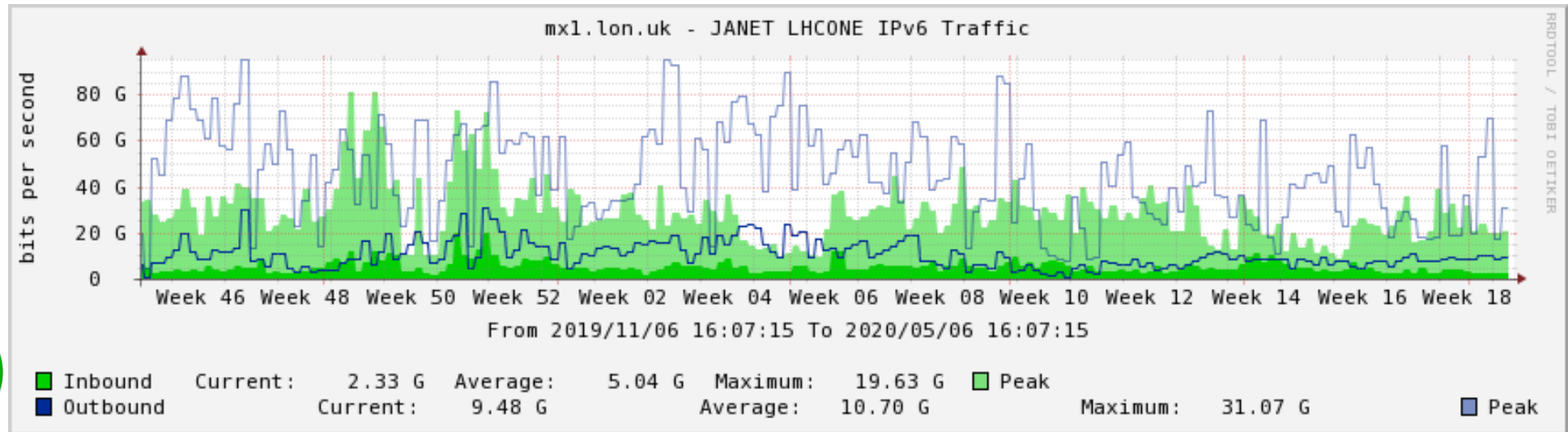
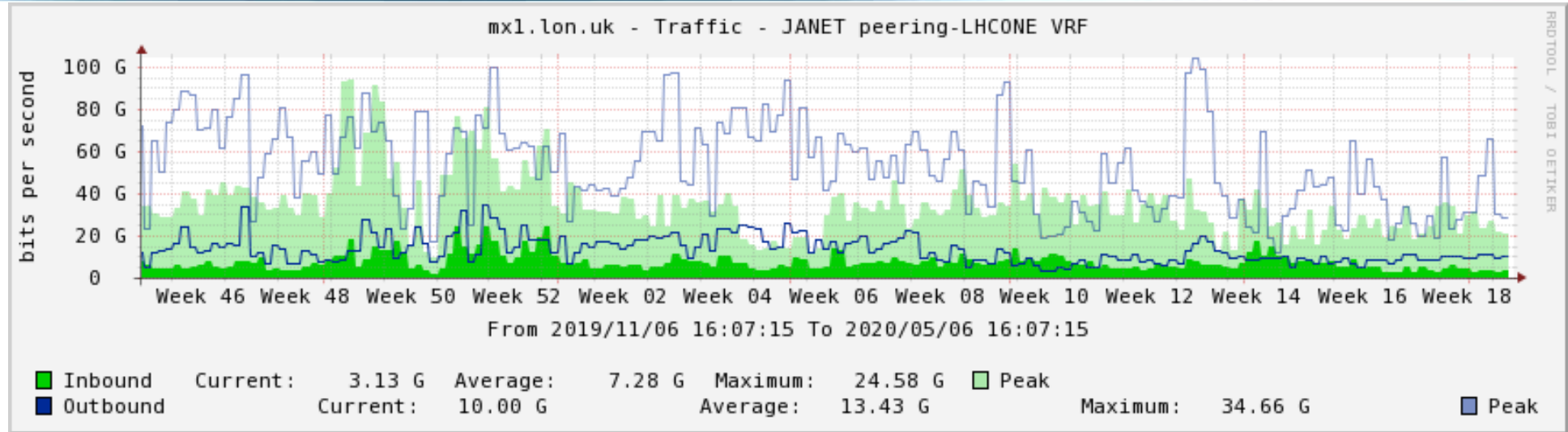


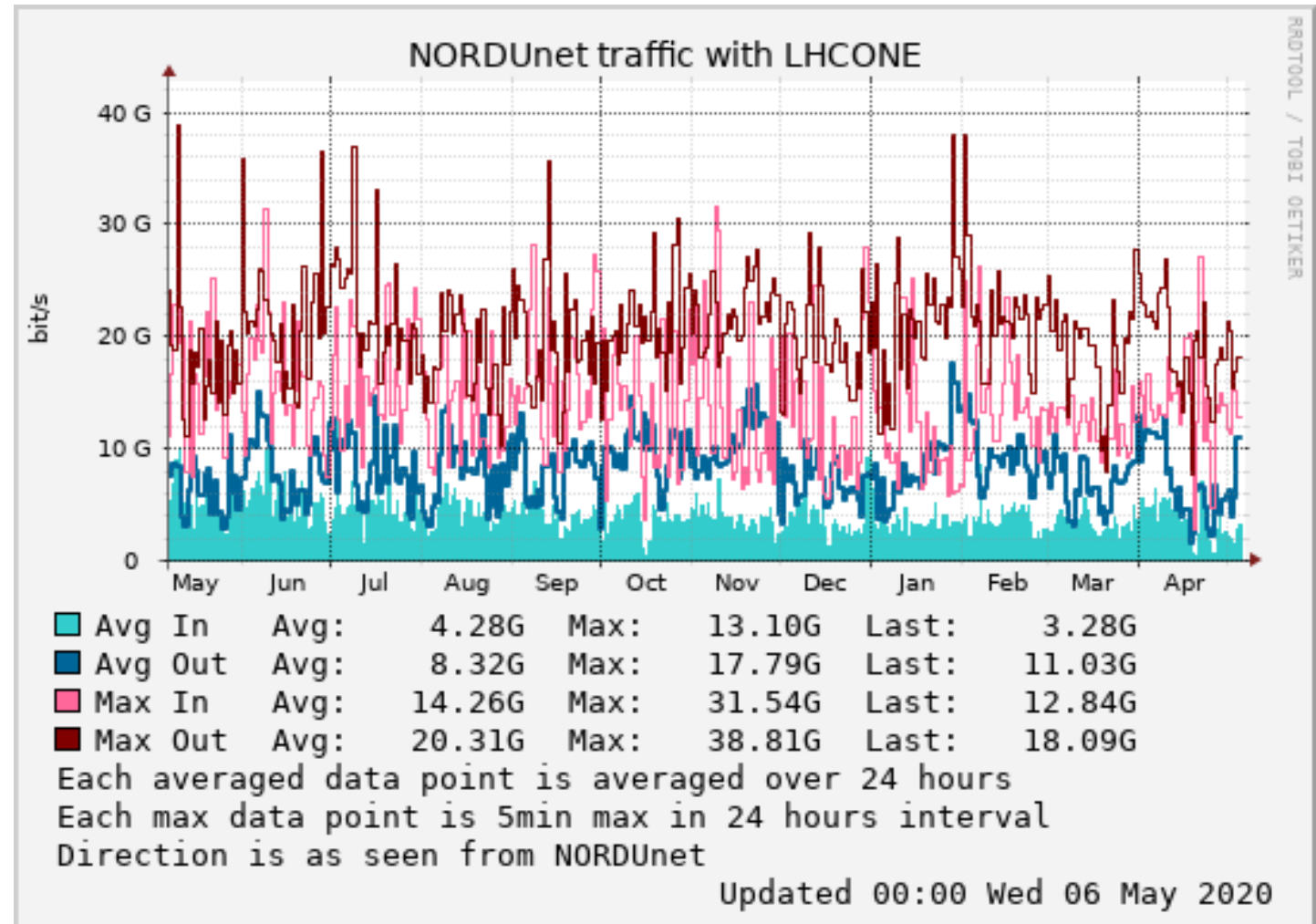
mx1.gen.ch - CERNLIGHT LHCONE GEN IPv6 Traffic

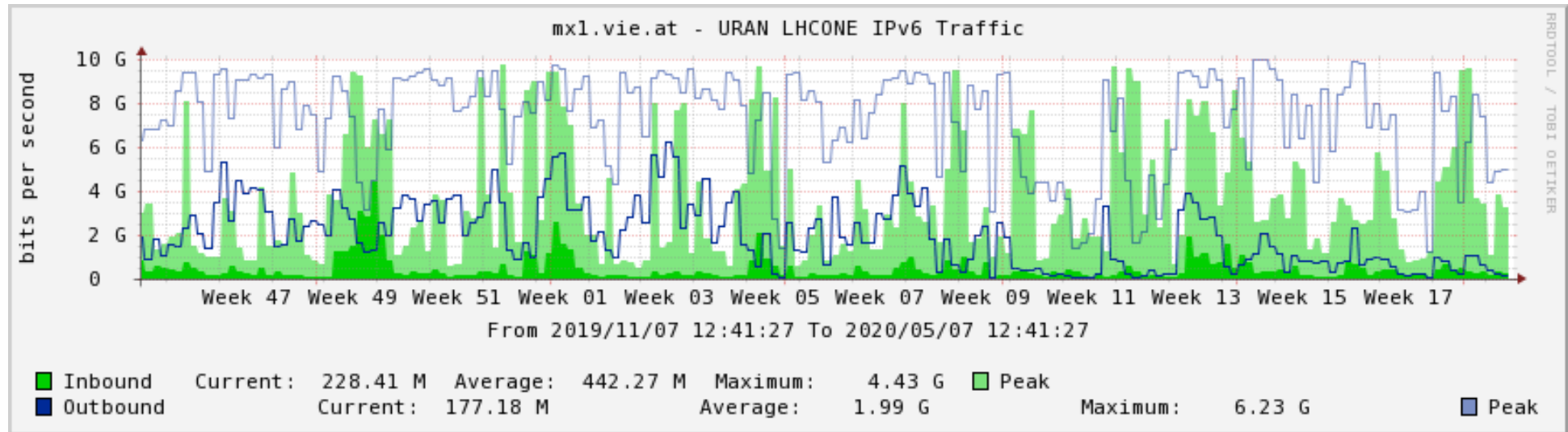
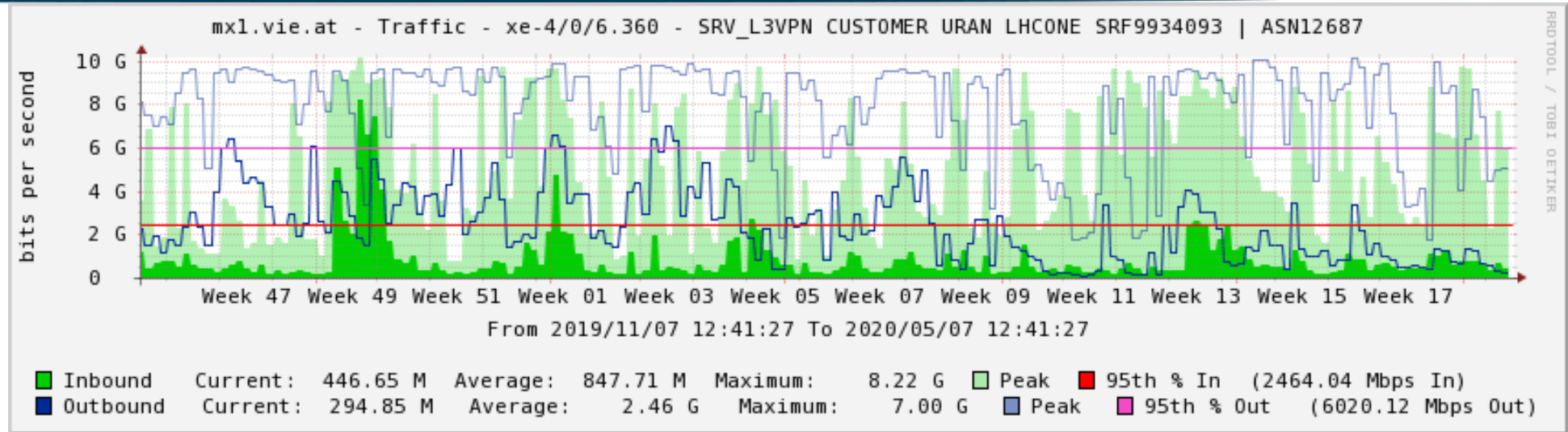


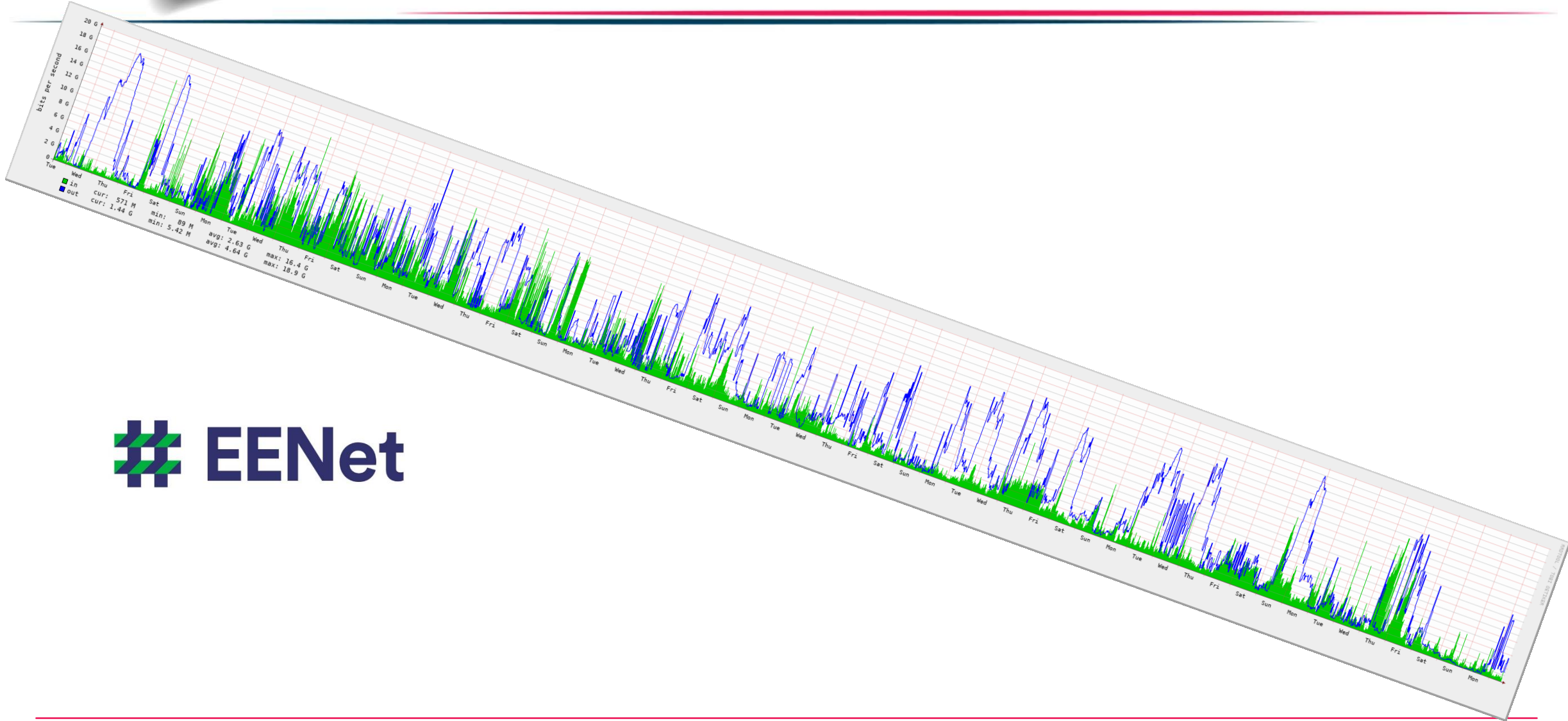


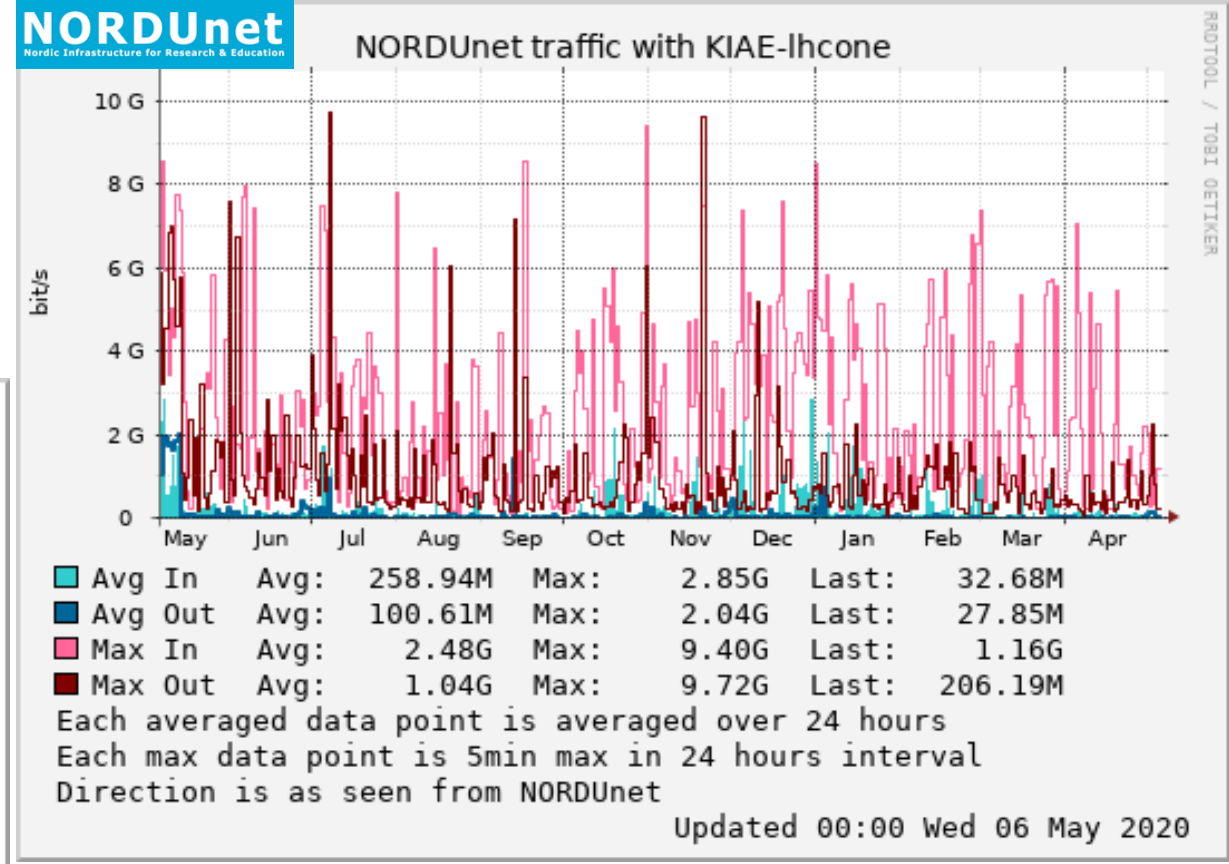
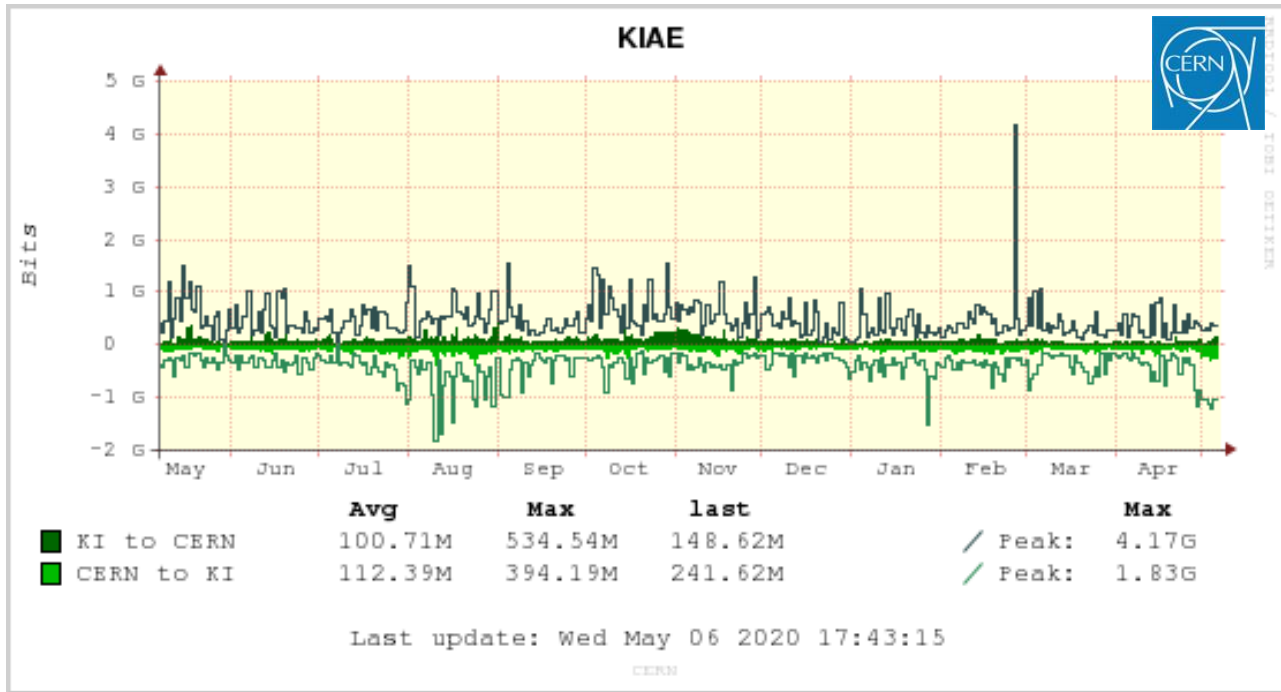
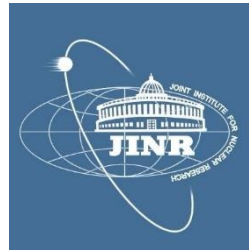


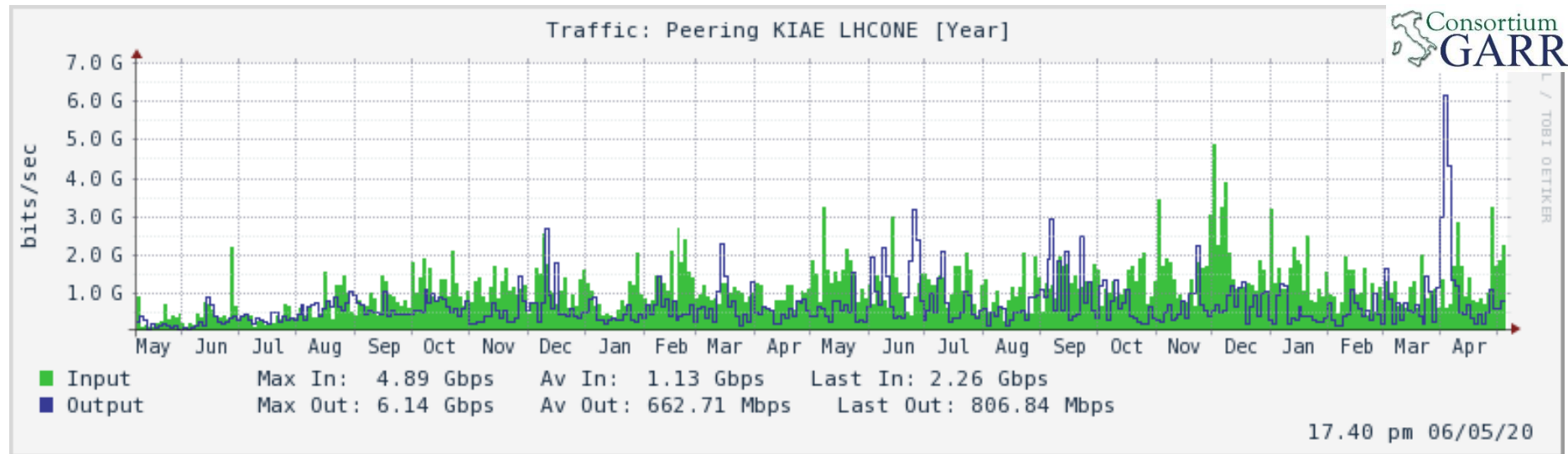
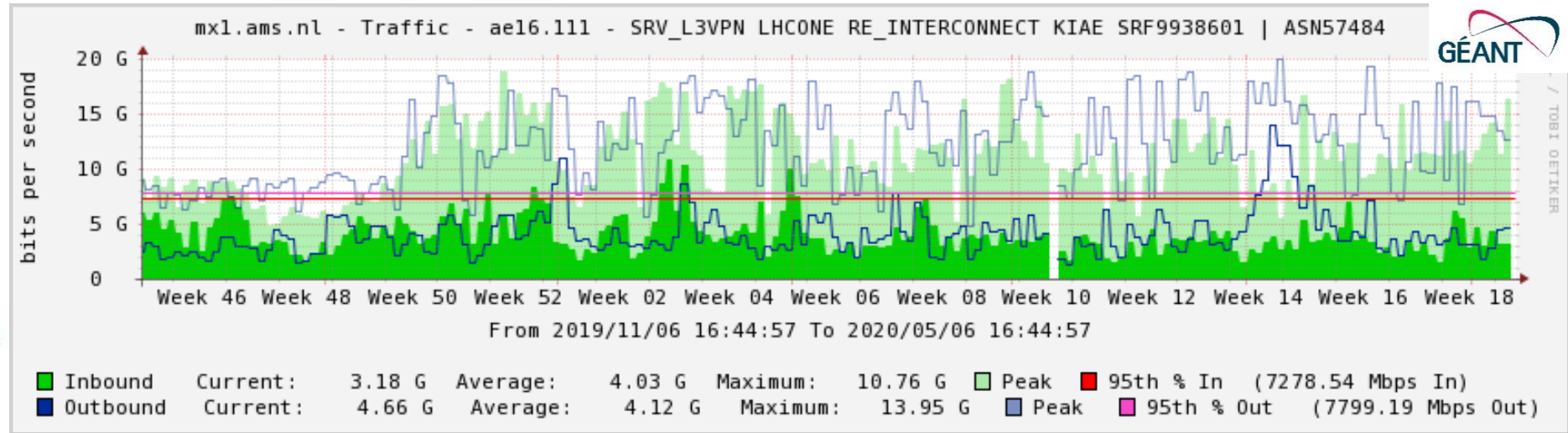




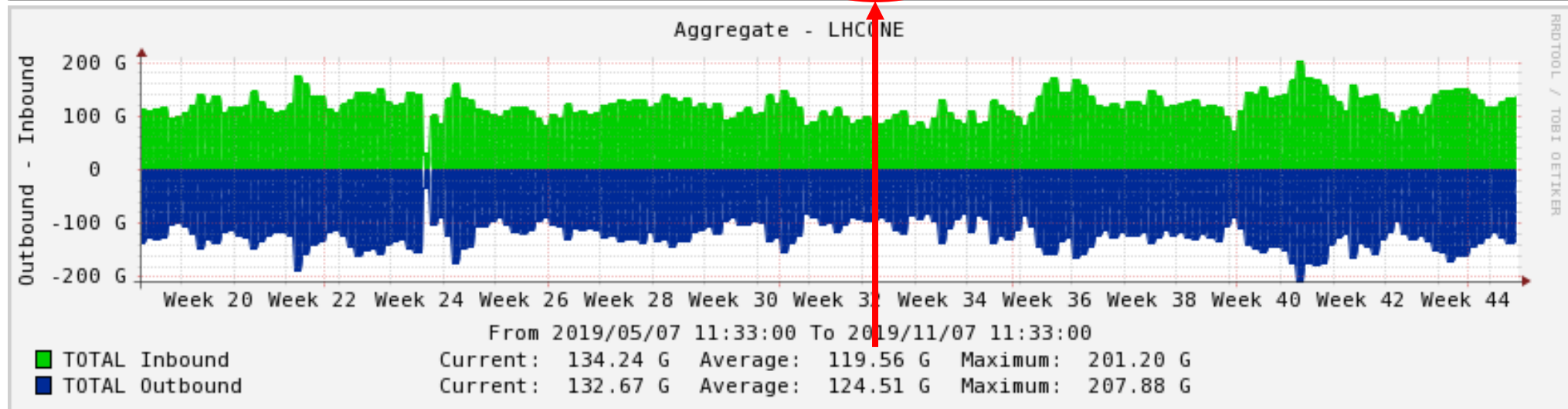
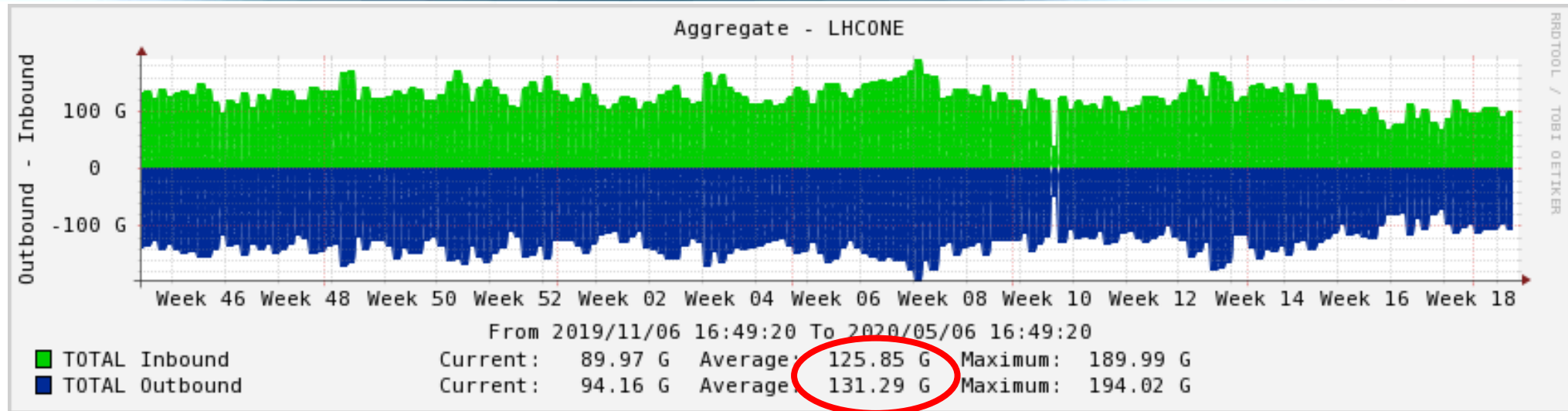




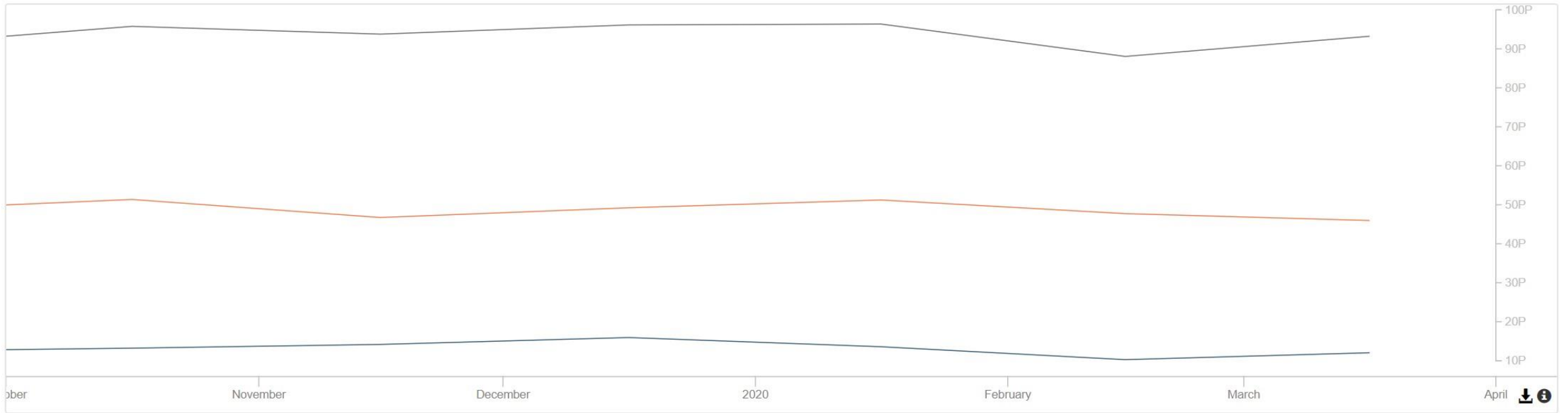




GÉANT overall

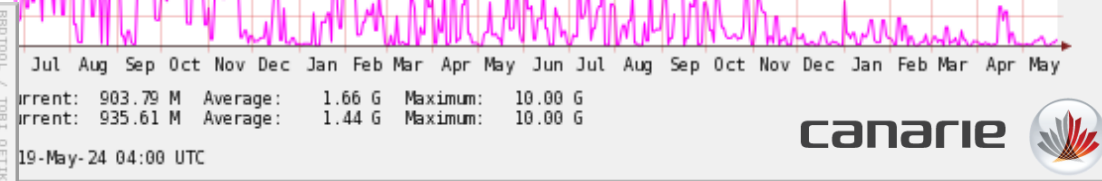
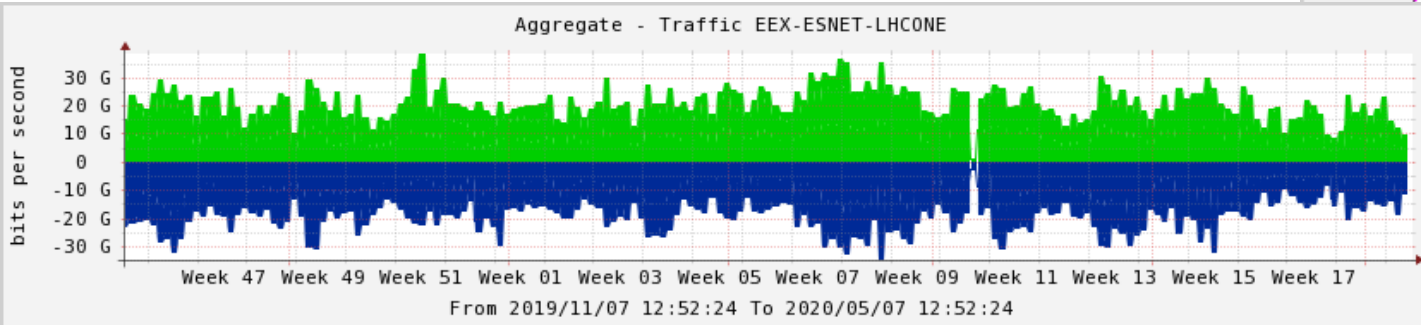
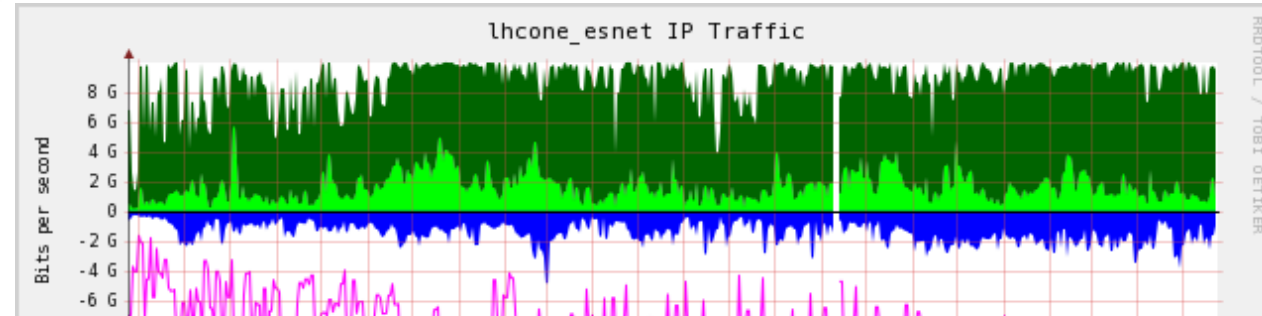


— Total — OSCARS — LHCONE

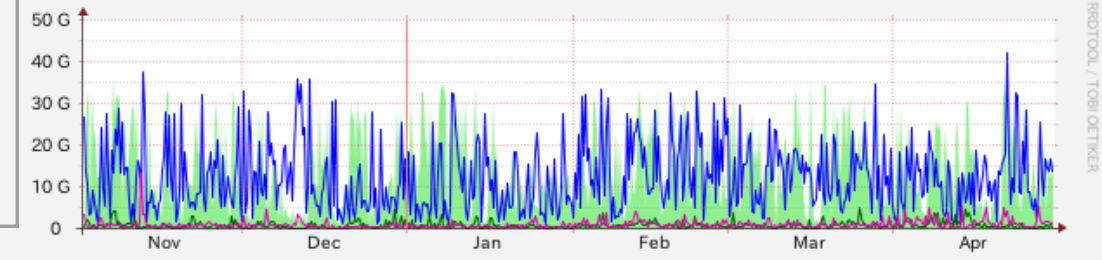


◀ April 2020 ▶

	Bytes	Percent of Total	One Month Change	One Year Change
OSCARS	10.68PB	13.3%	-10.4%	-5.46%
LHCONE	39.56PB	49.4%	-13.7%	-21.7%
Normal traffic	29.86PB	37.3%	-15.5%	-5.06%
Total	80.10PB		-14.0%	-14.1%



mx1.ams.nl Inbound	Current: 3.94 G	Average: 8.84 G	Maximum: 15.35 G
mx1.gen.ch Inbound	Current: 3.94 G	Average: 8.84 G	Maximum: 15.35 G
mx1.lon.uk Inbound	Current: 1.91 G	Average: 3.46 G	Maximum: 14.55 G
mx1.ams.nl Outbound	Current: 7.09 G	Average: 9.93 G	Maximum: 19.64 G
mx1.gen.ch Outbound	Current: 3.94 G	Average: 8.84 G	Maximum: 15.35 G
mx1.lon.uk Outbound	Current: 731.87 M	Average: 1.58 G	Maximum: 10.99 G
TOTAL Inbound	Current: 5.86 G	Average: 12.25 G	Maximum: 26.50 G
TOTAL Outbound	Current: 7.83 G	Average: 11.45 G	Maximum: 22.06 G



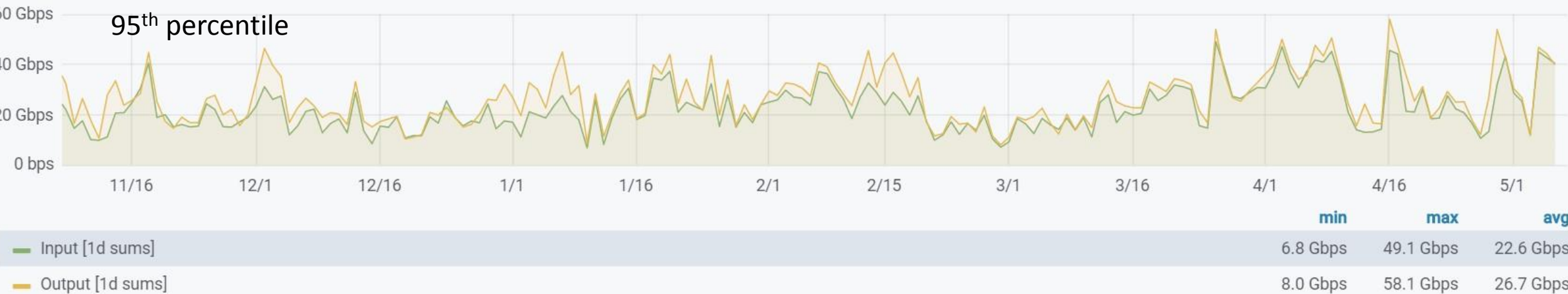
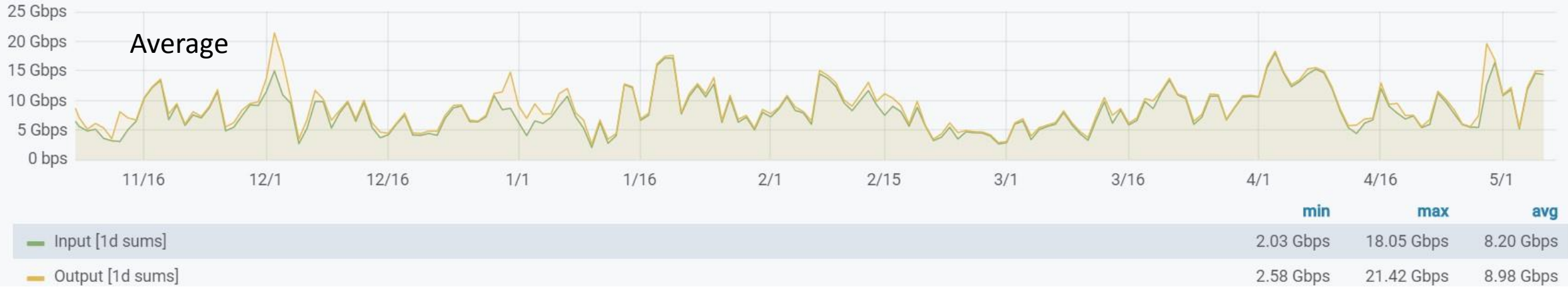
in (max:35.77G avg:13.96G last:16.89G) out (max:41.95G avg:12.32G last:13.61G)

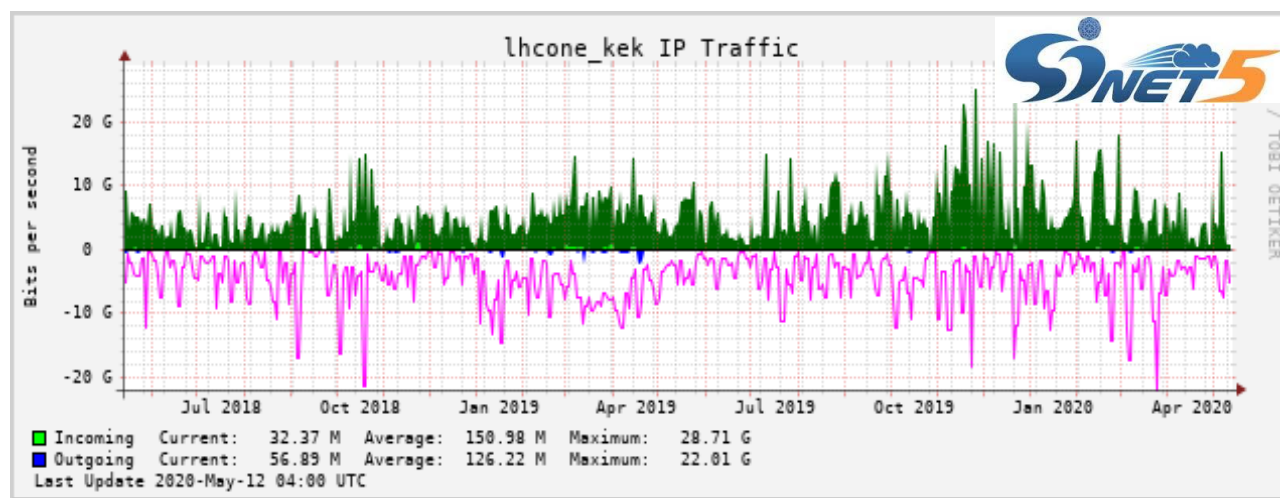
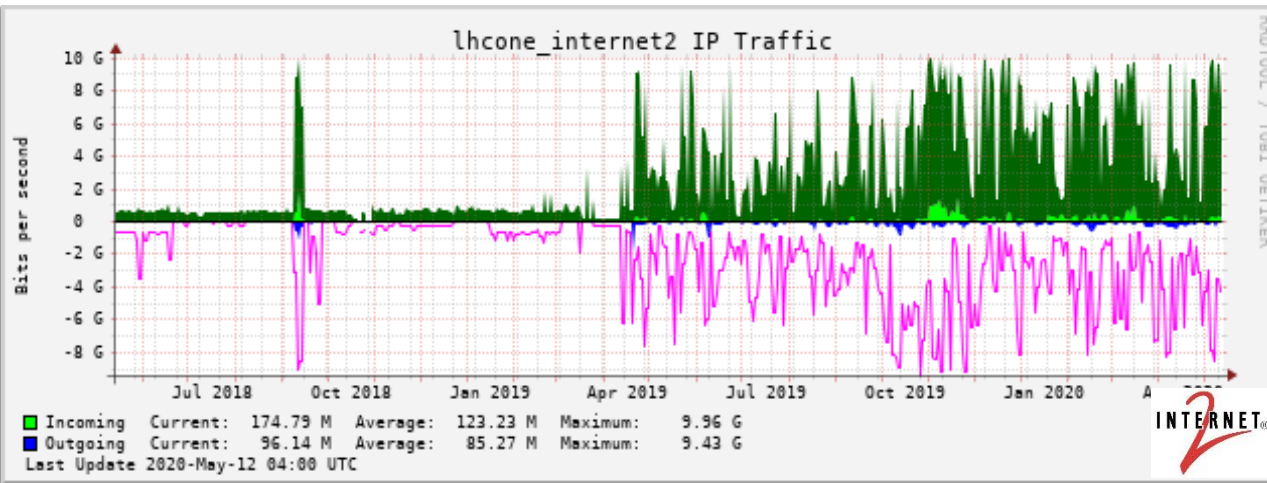
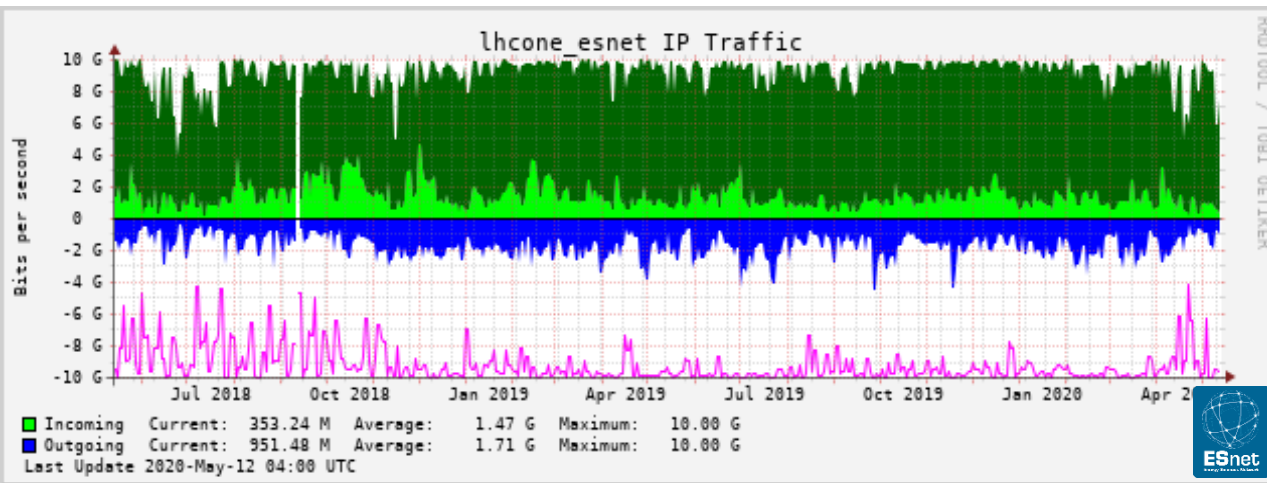
in AVERAGE:4.90G out AVERAGE:13.49G

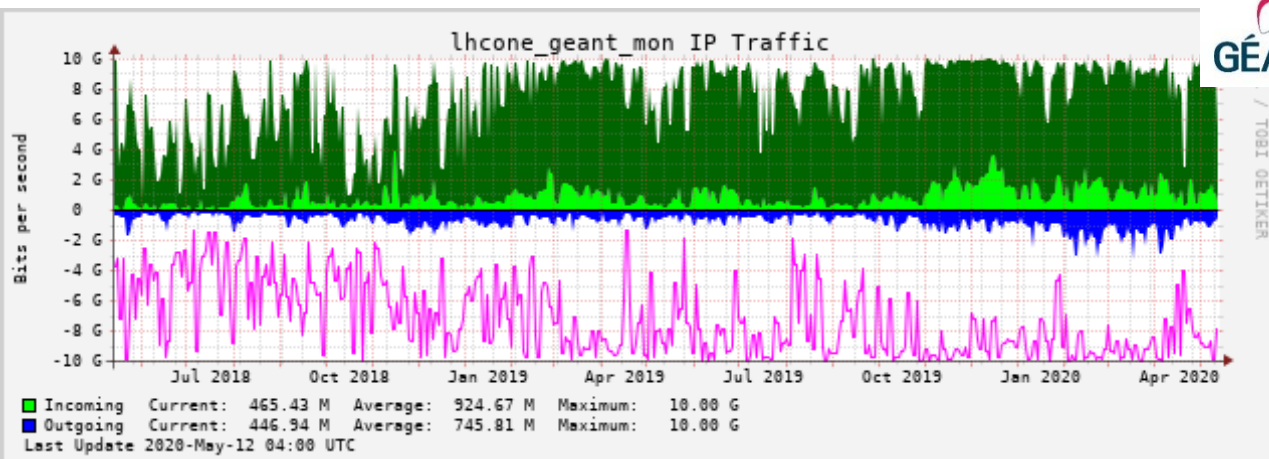
Max Bandwidth: 100G bits/sec



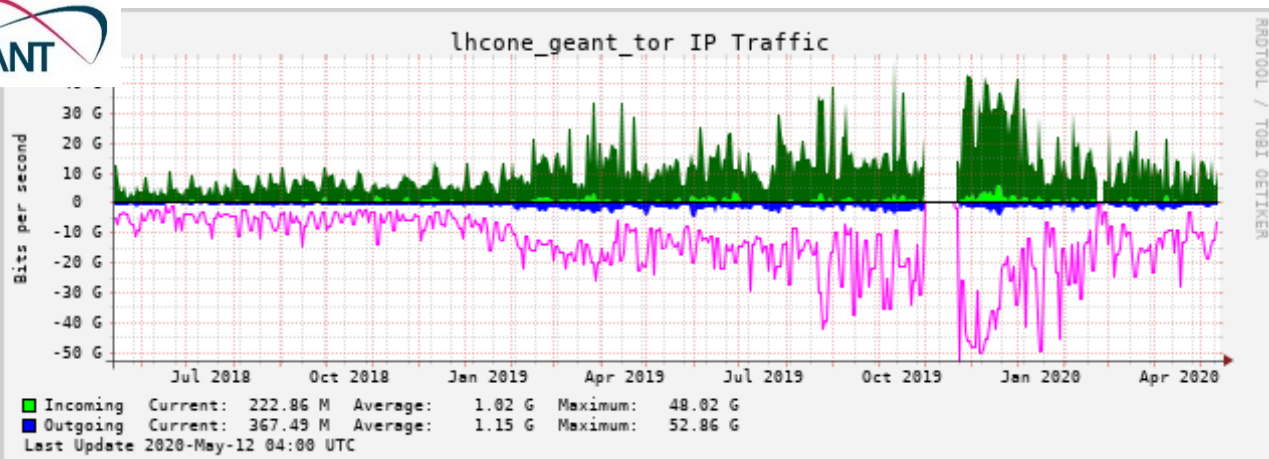
Provided by SINET5 operation center



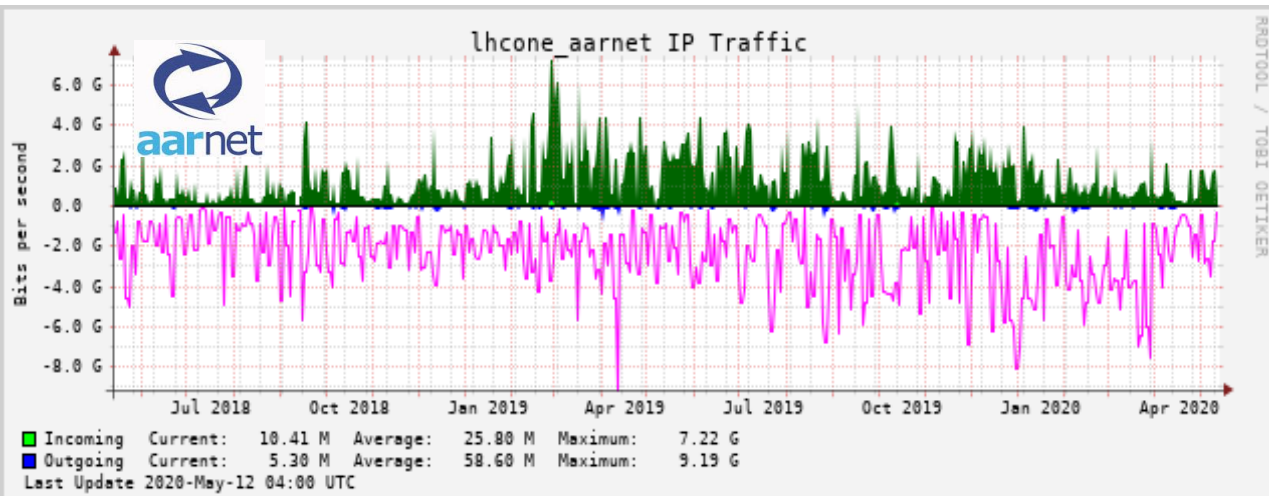




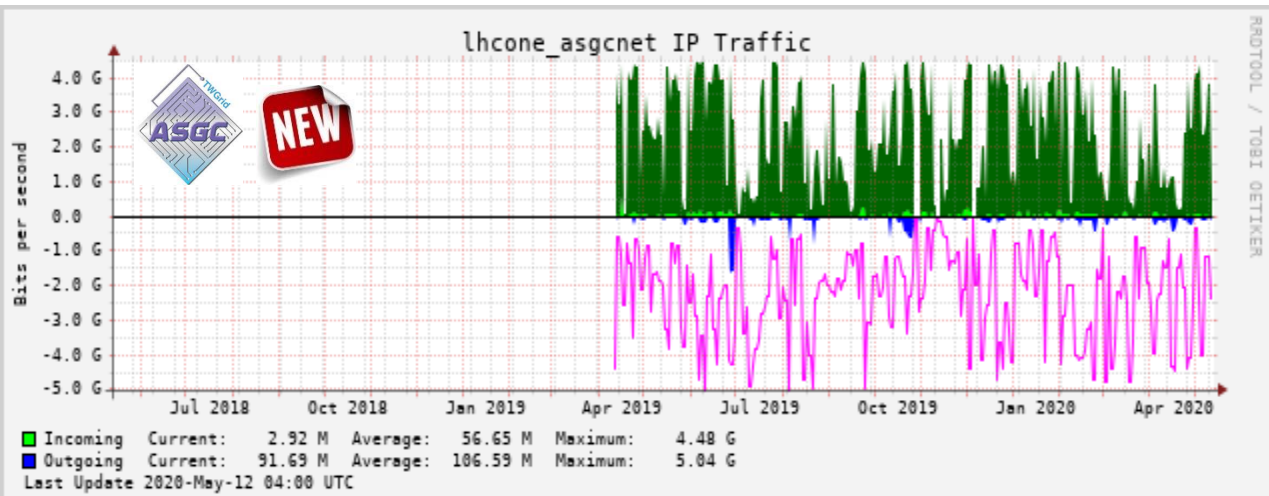
/ TOSI OETIKER



/ TOSI OETIKER



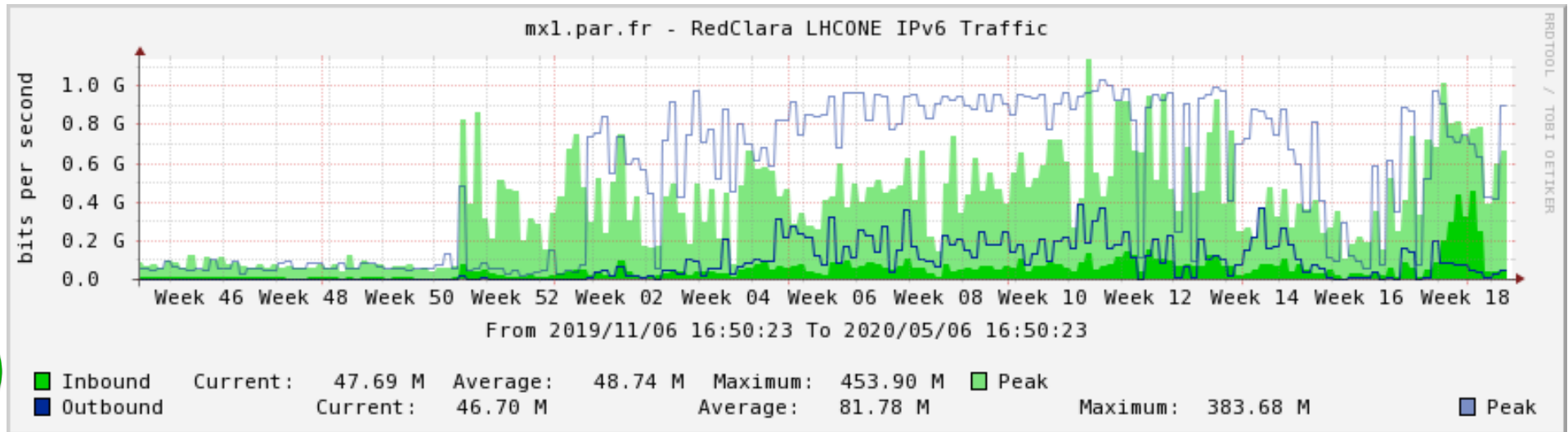
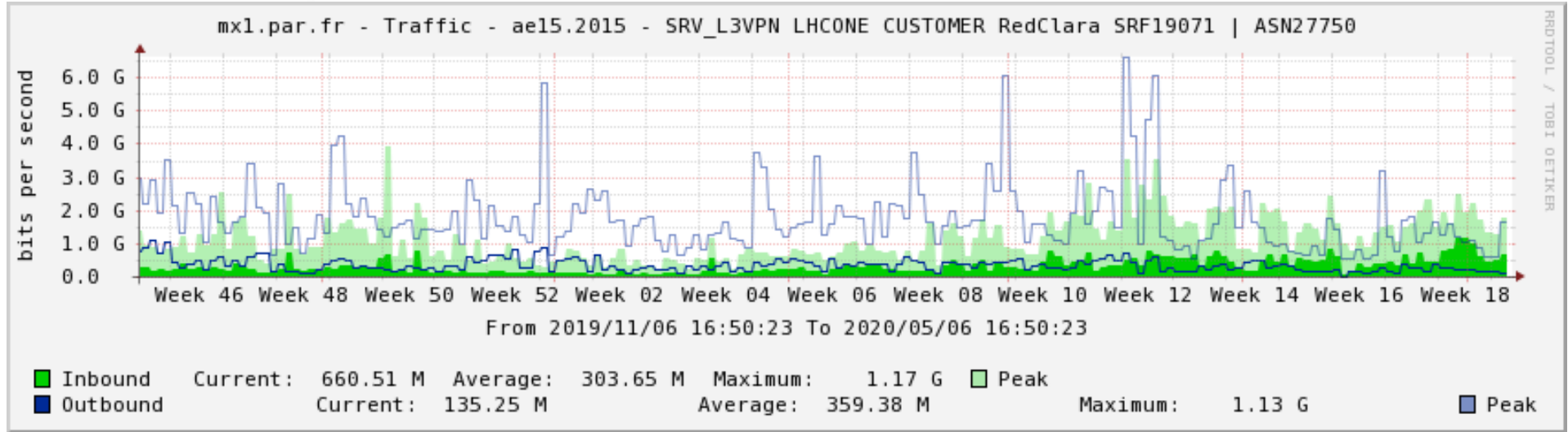
/ TOSI OETIKER



/ TOSI OETIKER



+ Red + Ciencia ● ● ● ●



- IPv6 traffic keeps increasing (around 70% of total traffic in some cases)
- Coverage of LHCONE is now almost complete (very few countries are missing)
 - EENet and REUNA are the latest joiners
- New peerings are mitigating the reachability problems

Thank you!

vincenzo.capone@geant.org

[@EnzinoCapone](https://twitter.com/EnzinoCapone) 

Thank you

www.geant.org

[@GEANTnews](https://twitter.com/GEANTnews) 



Networks · Services · People
www.geant.org



© GÉANT Association
As part of the GÉANT 2020 Framework Partnership Agreement (FPA),
the project receives funding from the European Union's Horizon 2020
research and innovation programme under Grant Agreement No.
856726 (GN4-3).