

# LHCONE L3VPN status update

**Enzo Capone**

*Head of Research Engagement and Support*

LHCONE-OPN Meeting

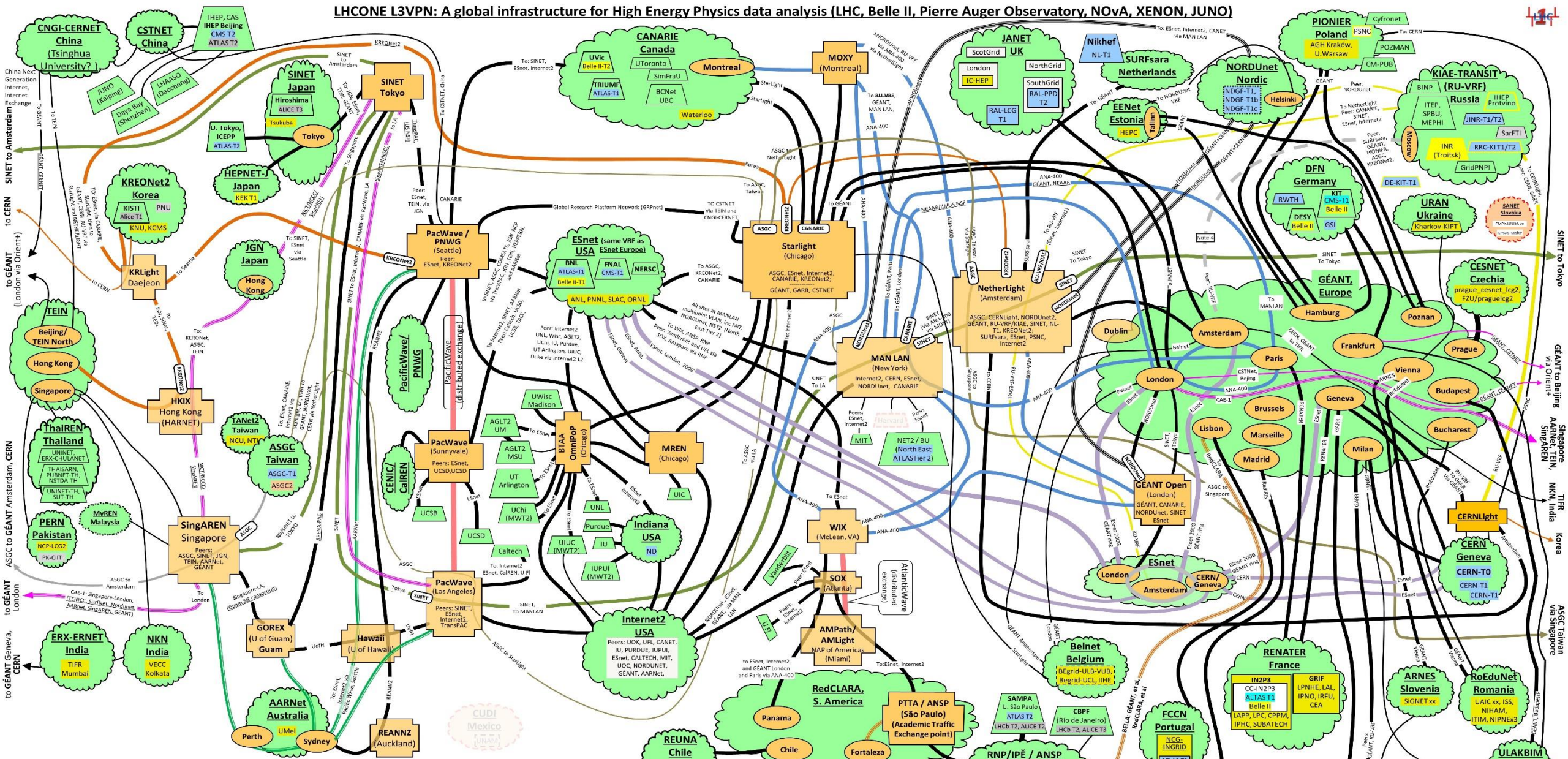
18<sup>th</sup> March 2023

# LHCONE around the world





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



LHCONE Map Ver. 5.9, 2022-10-20 – WEJohnston, ESnet, wej@es.net

**LHCONE VRF domain/aggregator** - A provider network.

- ANSP: Connector network – provides, e.g., an L2 path between VRFs.
- London: Provider network PoP router
- CUDI: Not currently connected to LHCONE
- Exchange point

**SINET** NREN/site router at exchange point

**Communication links:**

- 1/10, 20/30/40, and 100Gb/s or N x 100G
- Underlined link information indicates link provider, not use
- Dotted outline indicates distributed site
- Blue dashed outline indicating a WLCCG federation site not currently on LHCONE

**International infrastructure by provider/collaboration**

- various
- AARNet
- GÉANT
- SINET, Japan, global ring
- ASGC, Taiwan
- ESnet transatlantic, USA
- NICT/NCCC/SingAREN
- SINET
- NORDUnet
- KIAE, Russia
- KREONet2, Korea
- BELLA: GÉANT, et al
- RedCLARA, et al
- UNL: Sites that are standalone VRFs

**Color coding for 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
- JUNO: JUNO

**Colored outline indicates LHC+ Belle II site**

**NOTES**

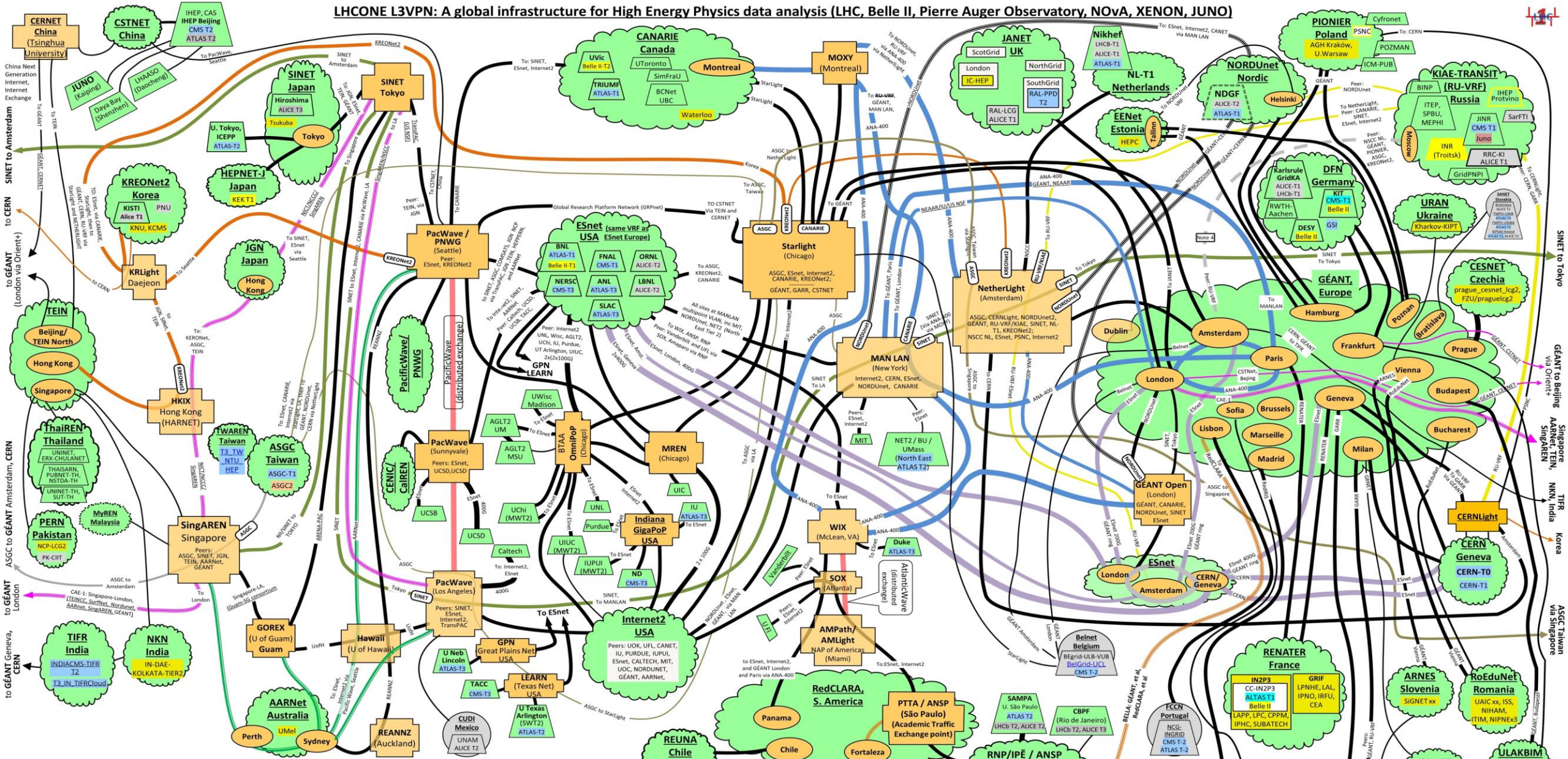
- ONLY links involved in LHCONE are shown
- LHCOPN links are not shown on this diagram
- For map explanation see "Interpreting the LHCONE Map" at <https://www.dropbox.com/s/1pad0f580117az/AApD85K8f8H9fPfcIA4cCtoa?dl=0>
- 4 GÉANT and CANARIE have shutdown the peering between their VRF and KIAE, as a result of the Ukraine war.

**Additional site information:**

- REUNAR** Chile: UTFSM/CCTVal
- RedCLARA** S. America: Panama, Fortaleza
- PTTA / ANSP** (São Paulo) (Academic Traffic Exchange point)
- SAMPA** U. São Paulo ATLAS T2, ALICE T2
- RNP/IPÉ / ANSP** Brazil: SPRACE CMS T2, HEPGRID UERJ CMS T2
- Belnet** Belgium: BEgrid-ULB-VUB, BEgrid-UCL, IHE
- FCCN** Portugal: NCG-INGRID ATLAS T2
- RedRIS** Spain: CIEMAT-LCG2, UAM-LCG2
- GARR** Italy: CNAF LHC-T1, Belle-II; INFN Bari, Catania, Frascati, Legnaro, Milano, Roma1, Torino
- ULAKBIM** Turkey: Tubitak ATLAS T2
- KAUST** Saudi Arabia
- DTN1**



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



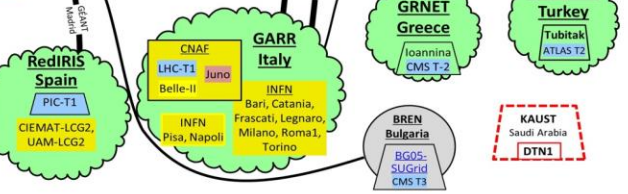
LHCONE Map Ver. 6.0, 2022-11-15 – WEJohnston, ESnet, wej@es.net

- LHCONE VRF domain/aggregator - A provider network.
- Connector network - provides, e.g., an L2 path between VRFs.
- Provider network PoP router
- WLCG sites that are not connected to LHCONE
- Exchange point
- NREN/site router at exchange point
- Communication links: <math><100G=1.5pt, 100G=4pt, 200G=5pt, 400G=6pt, 800G=7.5pt</math>
- Underlined link information indicates link provider, not use
- Double dash outline indicates distributed site
- Future site

- ### International infrastructure by provider/collaboration
- various
  - AARNet
  - GÉANT
  - SINET, Japan, global ring
  - ASGC, Taiwan
  - ESnet transatlantic, USA
  - NICT/NCCC/SingAREN
  - SINET
  - KfIA, Russia
  - KREONet2, Korea
  - BELLA: GÉANT, et al, RedCLARA, et al
  - ANA-300/400 - Various links provided by CANARIE, ESnet, GÉANT, Internet2, NORDUnet, SURFNet, SINET, IU/NSF

- LHC-T1 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
- JUNO
- UNL Sites that are standalone VRFs

- ### NOTES
- ONLY links involved in LHCONE are shown
  - LHCOPN links are not shown on this diagram
  - For map explanation see "Interpreting the LHCONE Map" at <https://www.dccpbox.com/sh/padof580/1raz/AA0s8K8t859fH9fCjA4eCtoq2dl=0>
  - GÉANT and CANARIE have shutdown the peering between their VRF and KfIA, as a result of the Ukraine war.

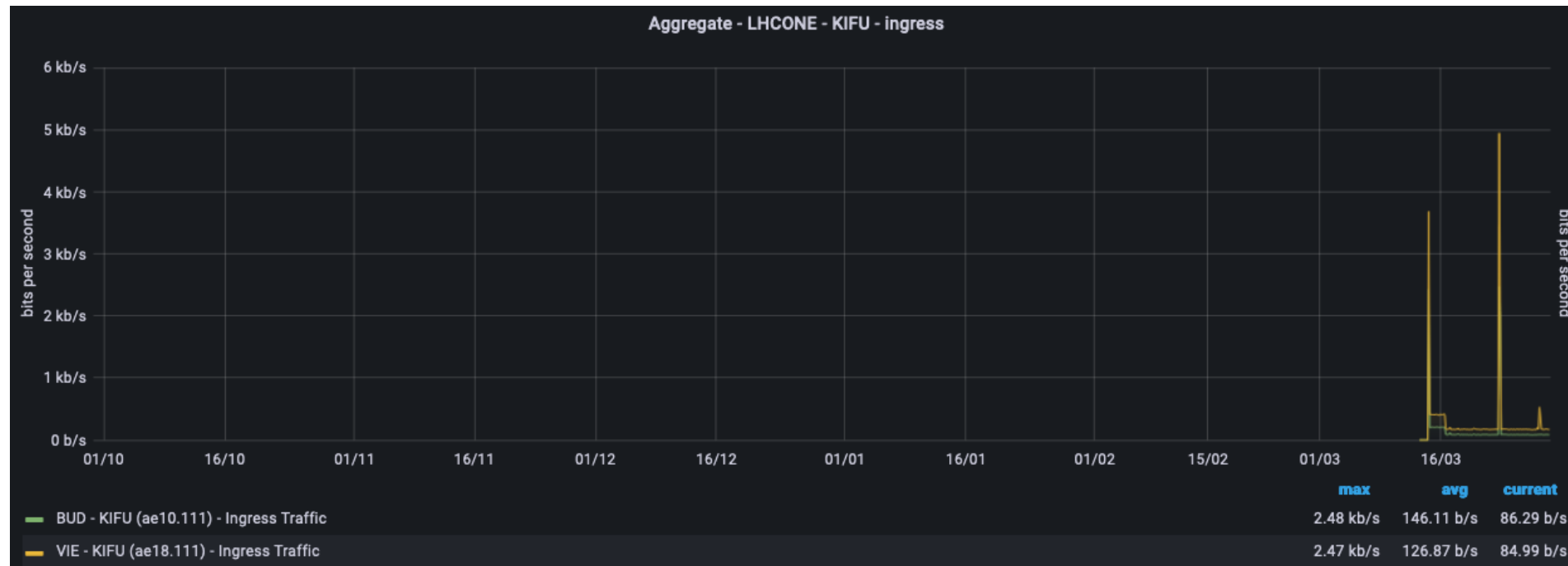


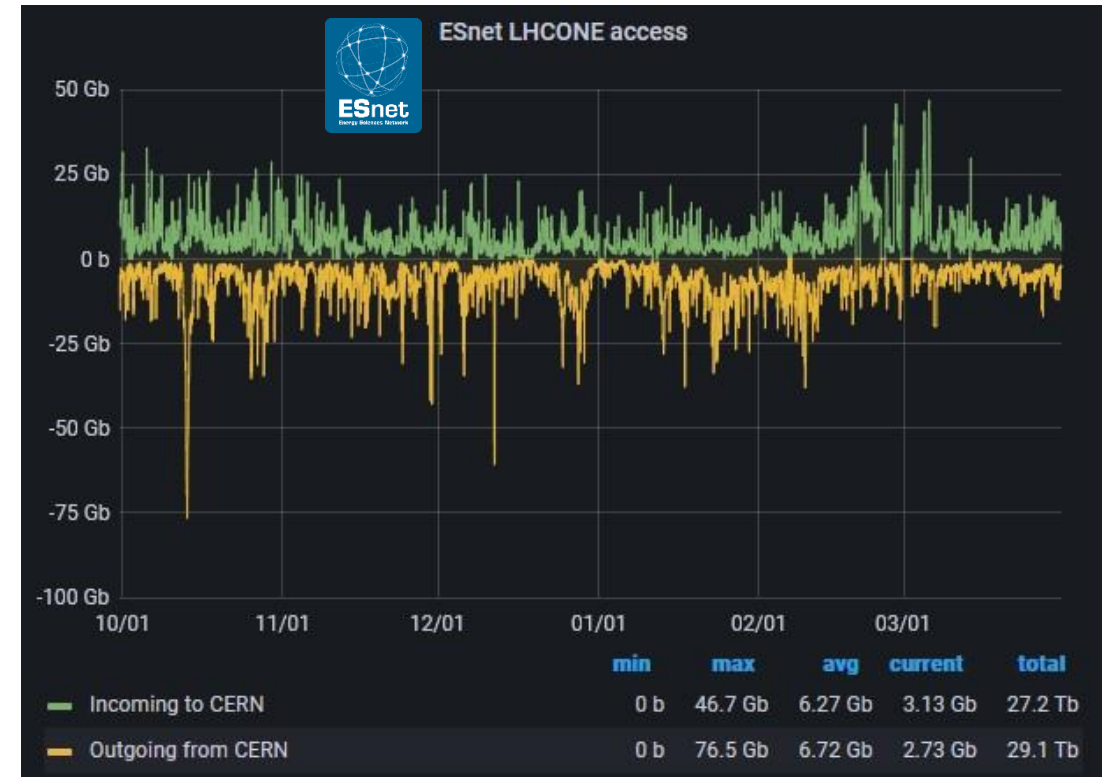
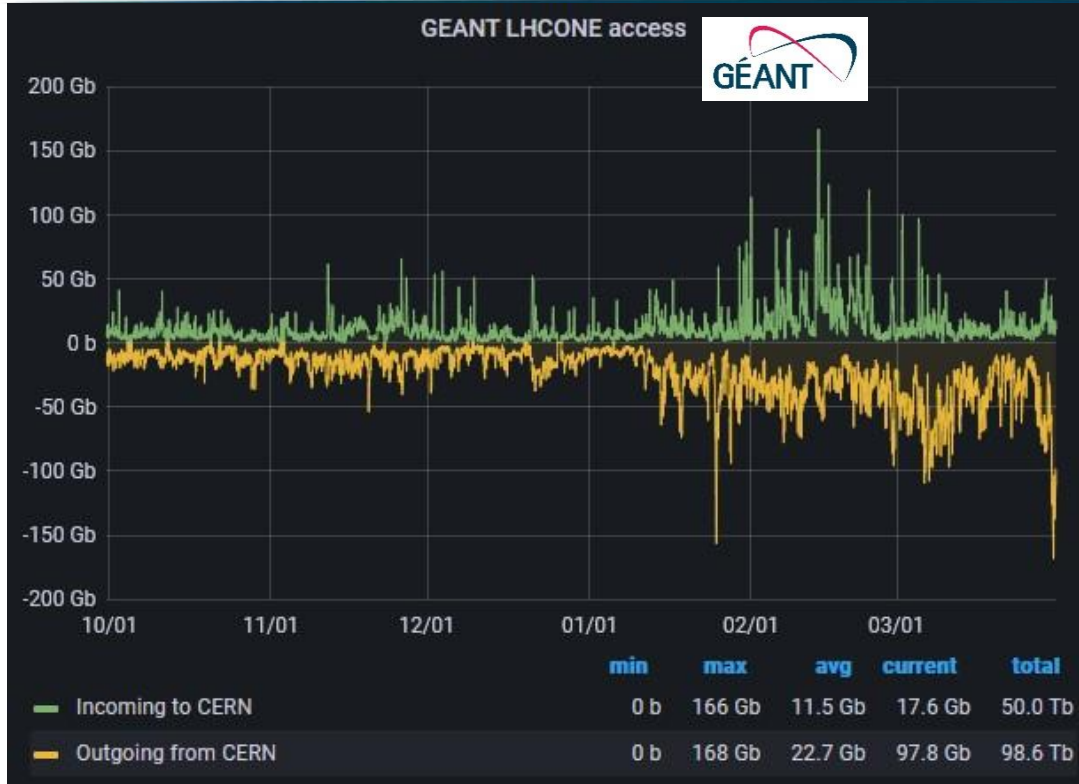


- CERN upgraded LHCONE access to 2 x 400G
- RAL expanded the announced IP prefixes
- Lawrence Berkeley National Laboratory (ESnet)
- University of Massachusetts – Amherst (ESnet)

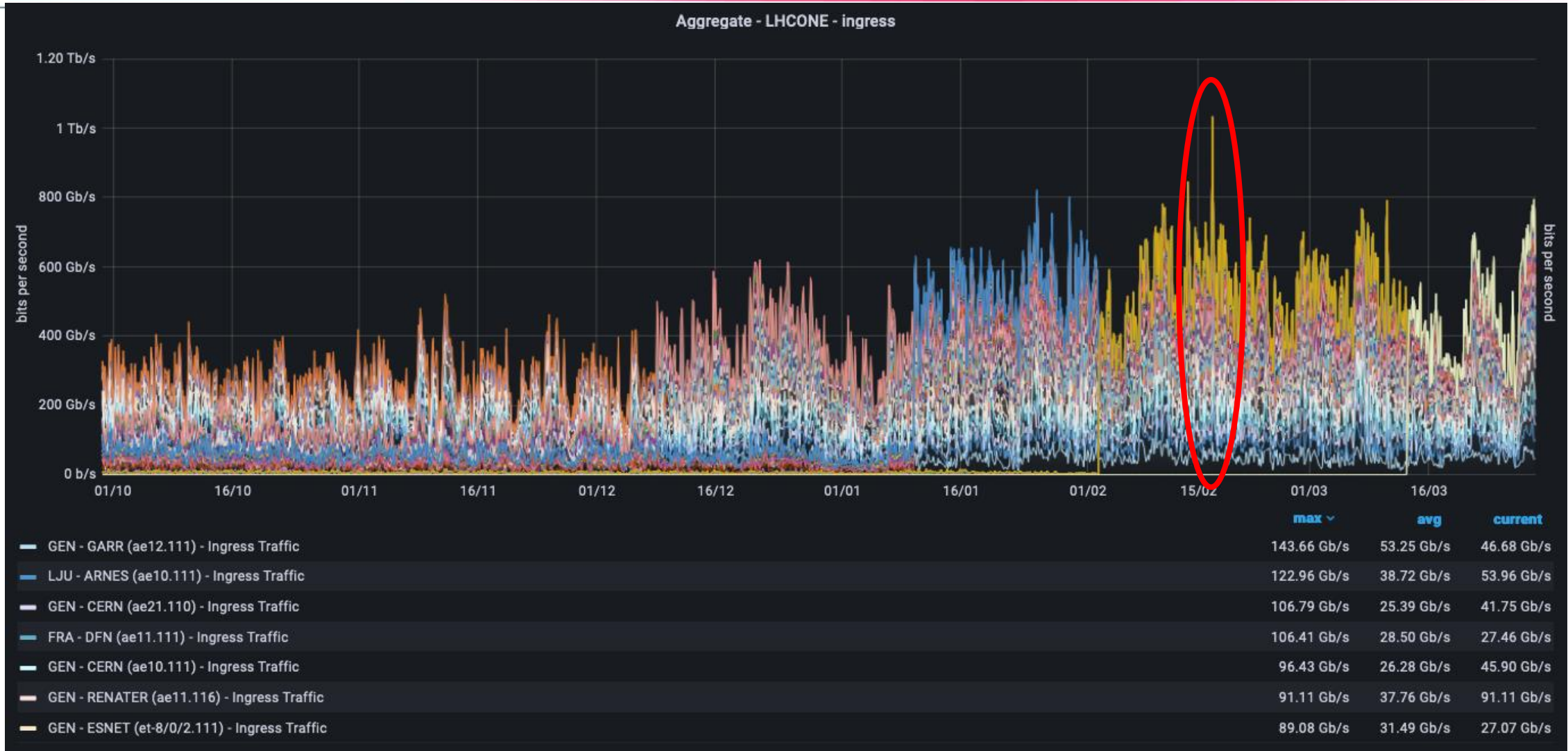
## NRENs and sites news

- New NORDUnet peering in AMS
- KIFU joins LHCONE
  - HU-HGCC-T2 (ALICE and CMS)
  - T3-HU-Debrecen (CMS)

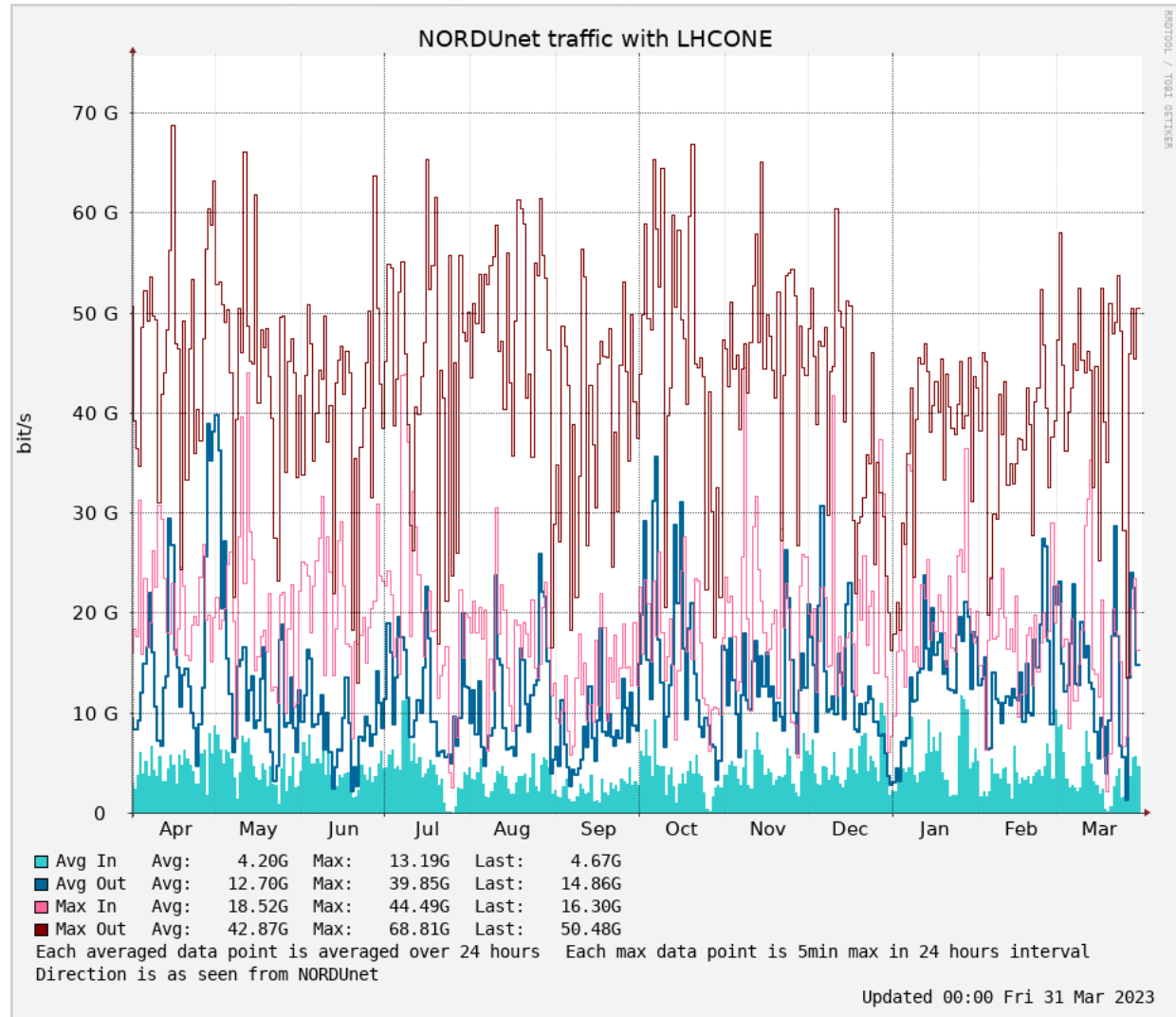


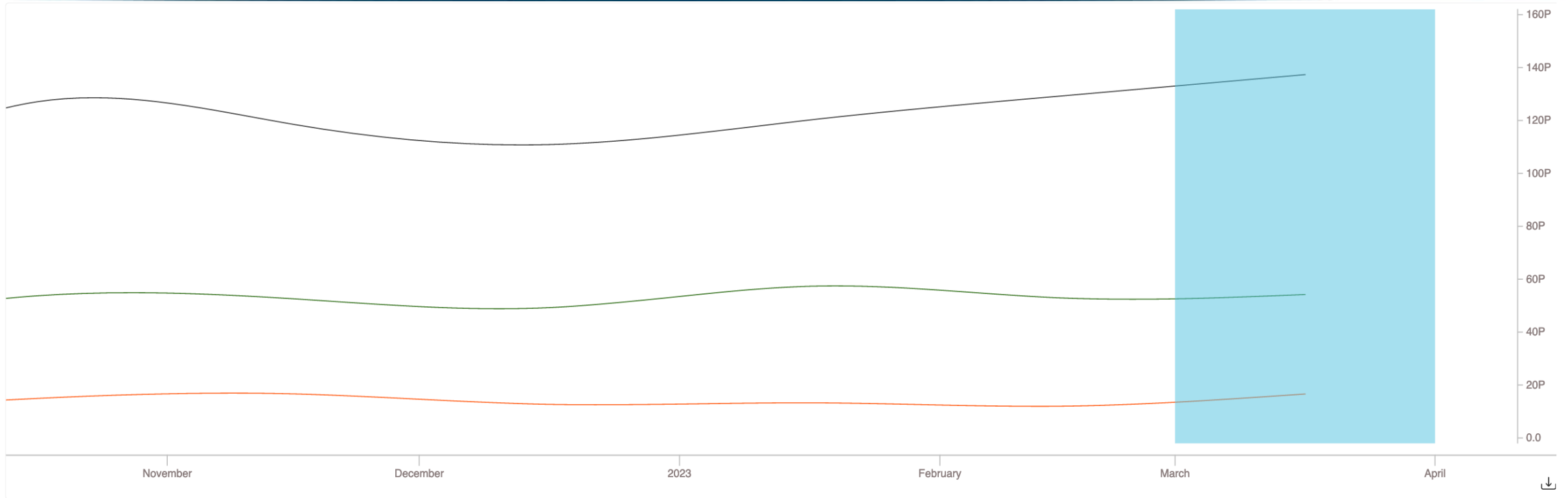


# GÉANT overall





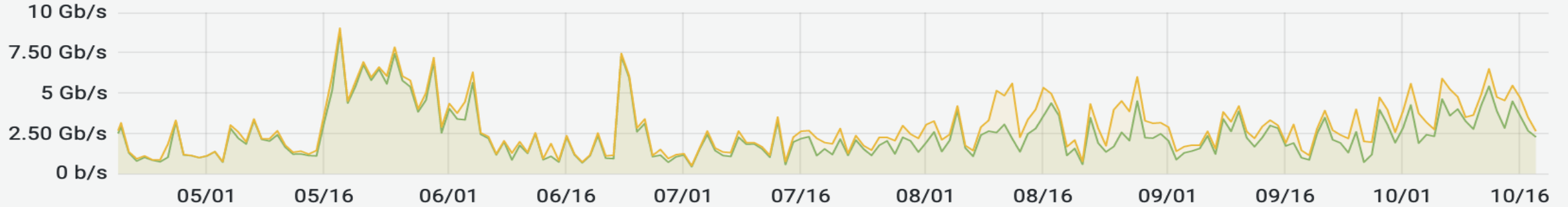




	Bytes	Percent of Total	One Month Change	One Year Change
<b>OSCARS</b>	16.63PB	12.1%	+38.8%	+25.9%
<b>LHCONE</b>	54.22PB	39.5%	+2.35%	+15.5%
<b>Normal traffic</b>	66.5PB	48.4%	+3.62%	+39.5%
<b>Total</b>	137.35PB		+6.36%	+27.4%

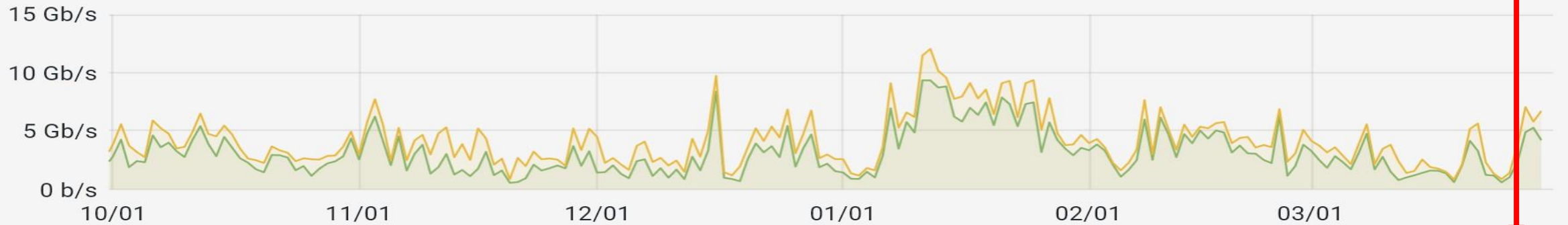


### Aggregate



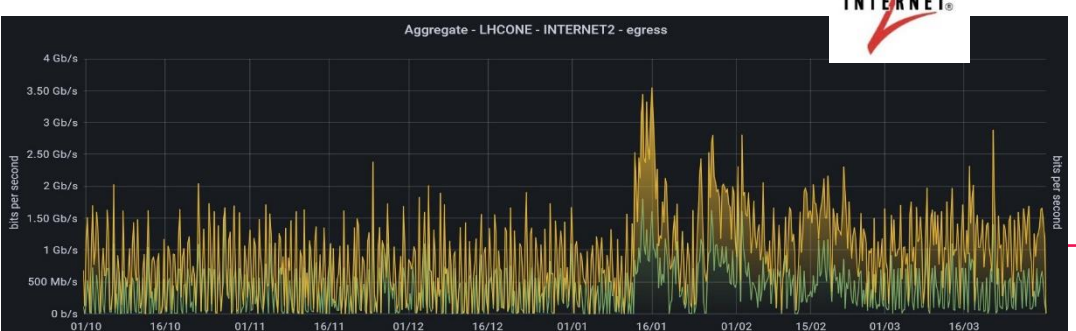
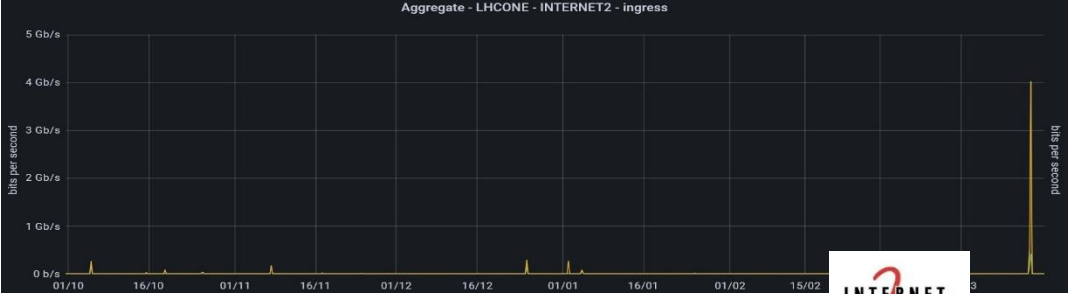
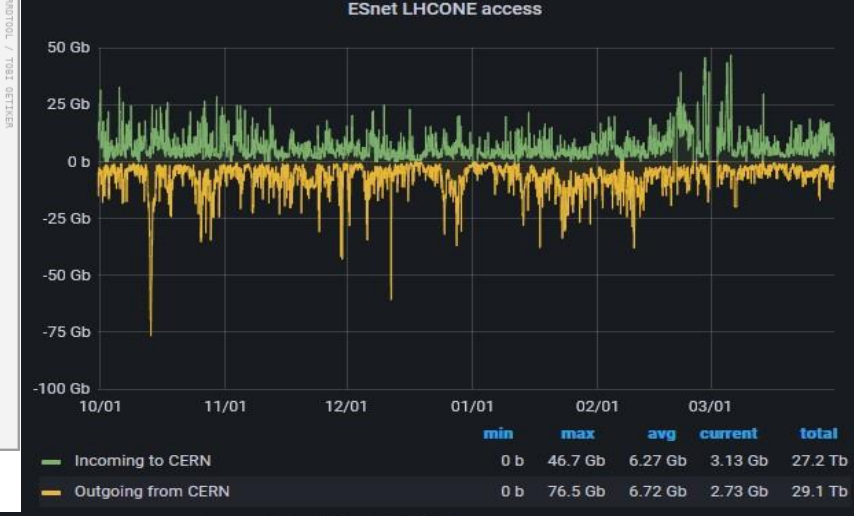
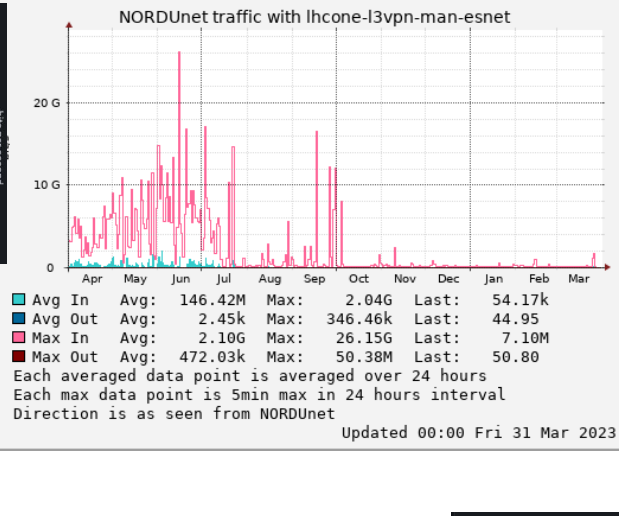
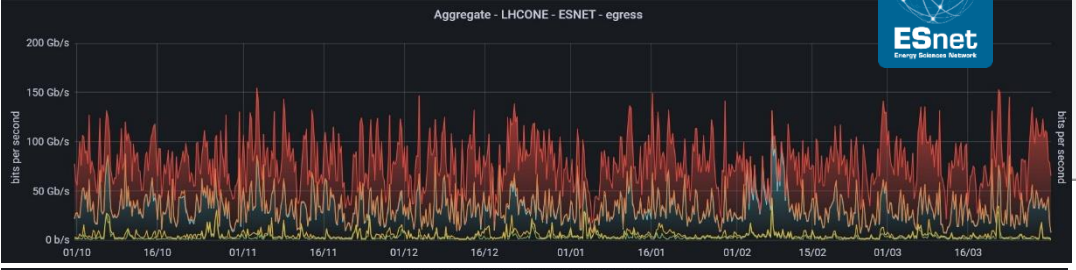
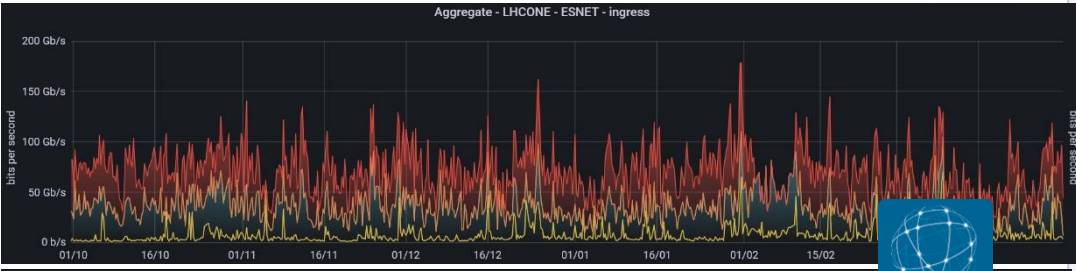
	<b>min</b>	<b>max</b>	<b>avg</b>
Input [1d sums]	431 Mb/s	8.77 Gb/s	2.43 Gb/s
Output [1d sums]	488 Mb/s	9.02 Gb/s	2.94 Gb/s

### Aggregate

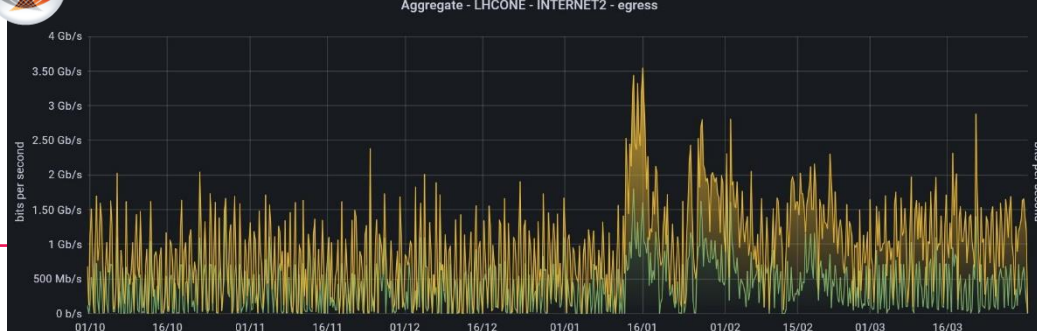
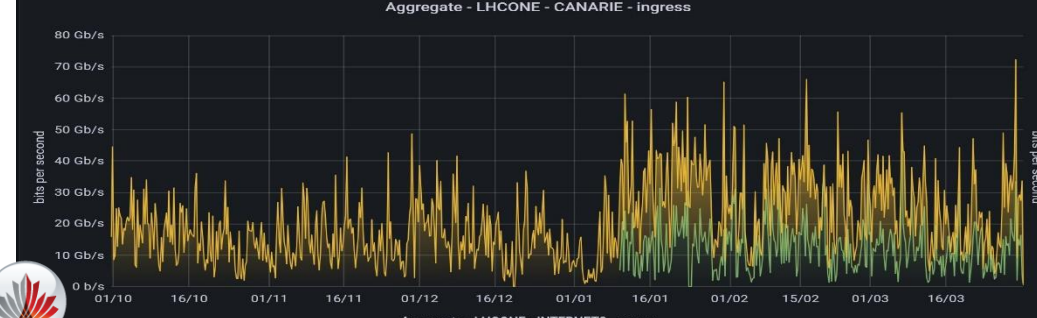


	<b>min</b>	<b>max</b>	<b>avg</b>
Input [1d sums]	548 Mb/s	9.34 Gb/s	3.13 Gb/s
Output [1d sums]	835 Mb/s	12.0 Gb/s	4.18 Gb/s

# EU <-> North America



canarie

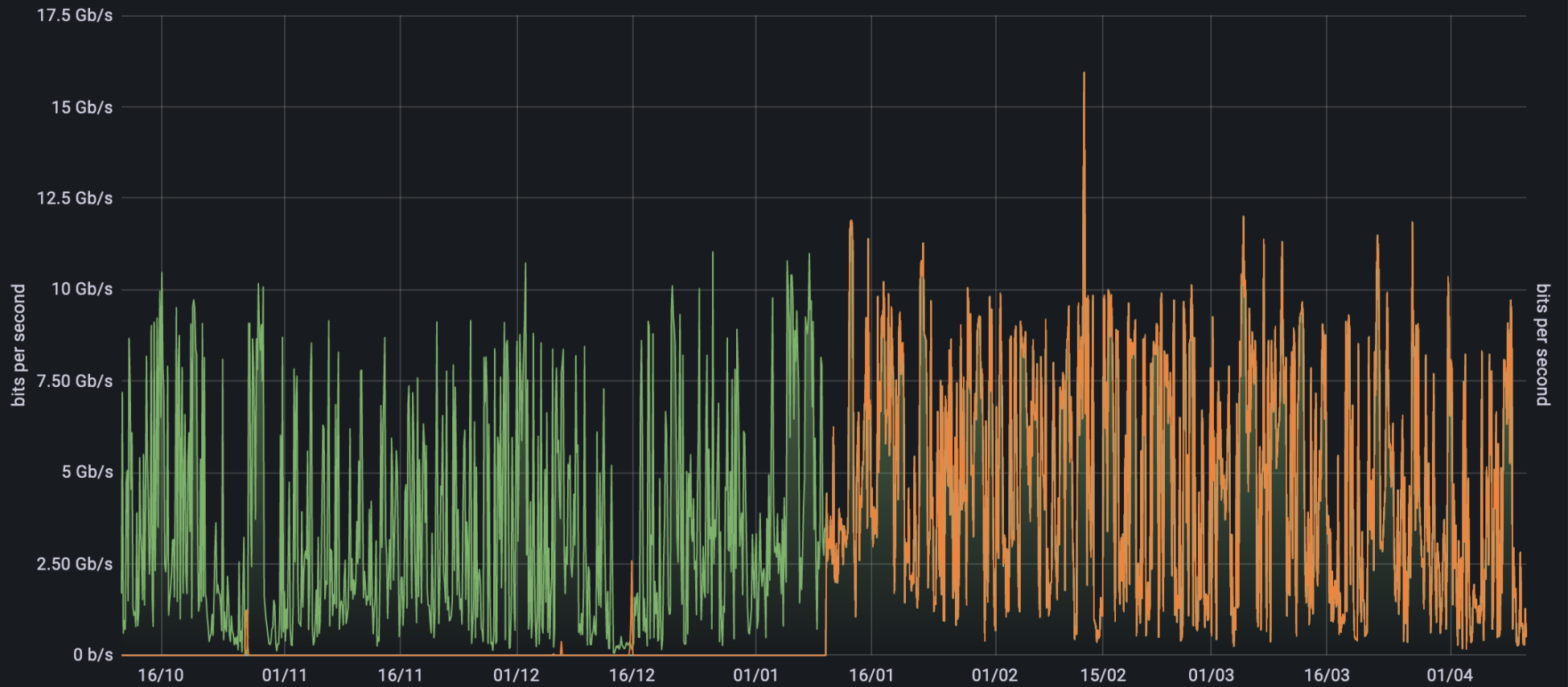




# EU <-> Latin America

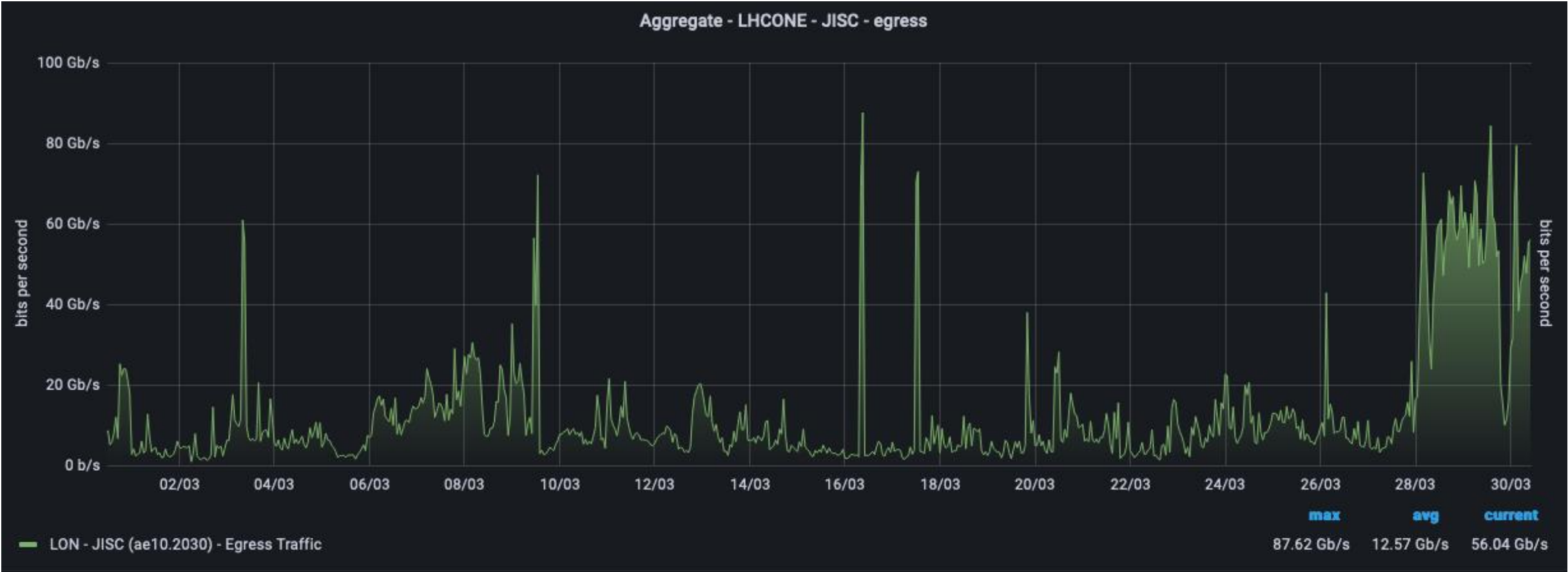


Aggregate - LHCONE - REDCLARA - ingress



	max	avg	current
LIS - REDCLARA (ae11.2018) - Ingress Traffic	15.94 Gb/s	4.13 Gb/s	499.36 Mb/s
LON - REDCLARA (et-9/1/5.2016) - Ingress Traffic	918.27 b/s	106.59 b/s	74.24 b/s
LON - REDCLARA (ae28.2062) - Ingress Traffic	5.66 Mb/s	5.37 kb/s	82.32 b/s
PAR - REDCLARA (ae15.2015) - Ingress Traffic	2.58 Gb/s	4.96 Mb/s	83.20 b/s

# Highlight of the year





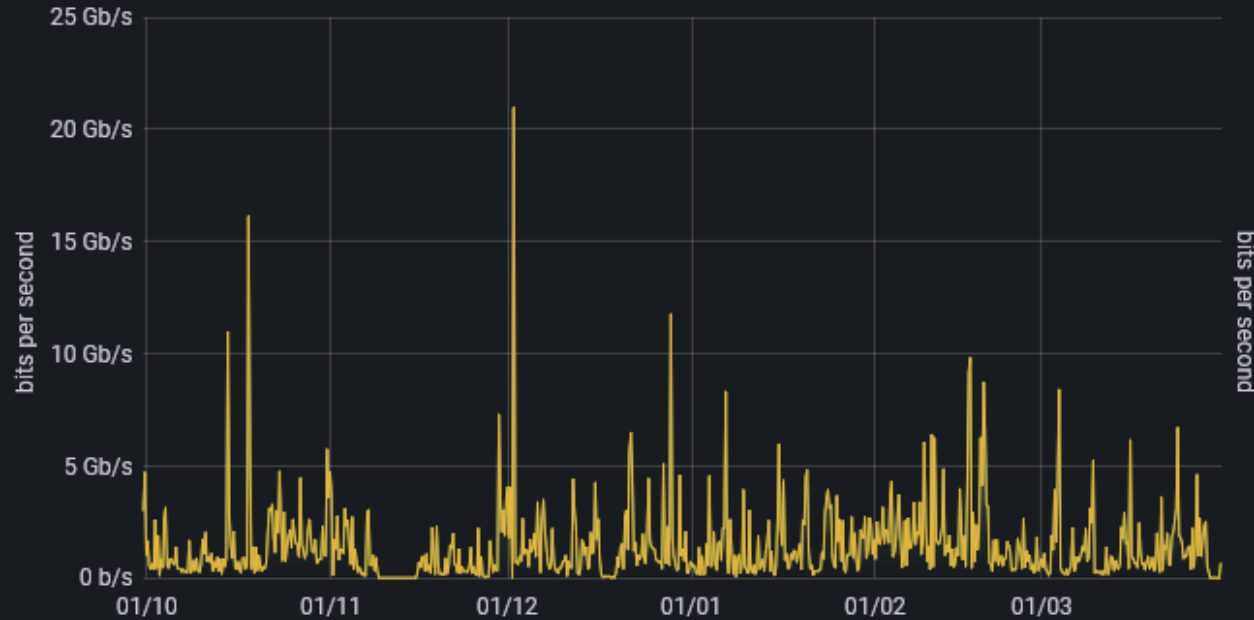
# Highlight of the year



HARIDUS- JA  
TEADUSMINISTEERIUM



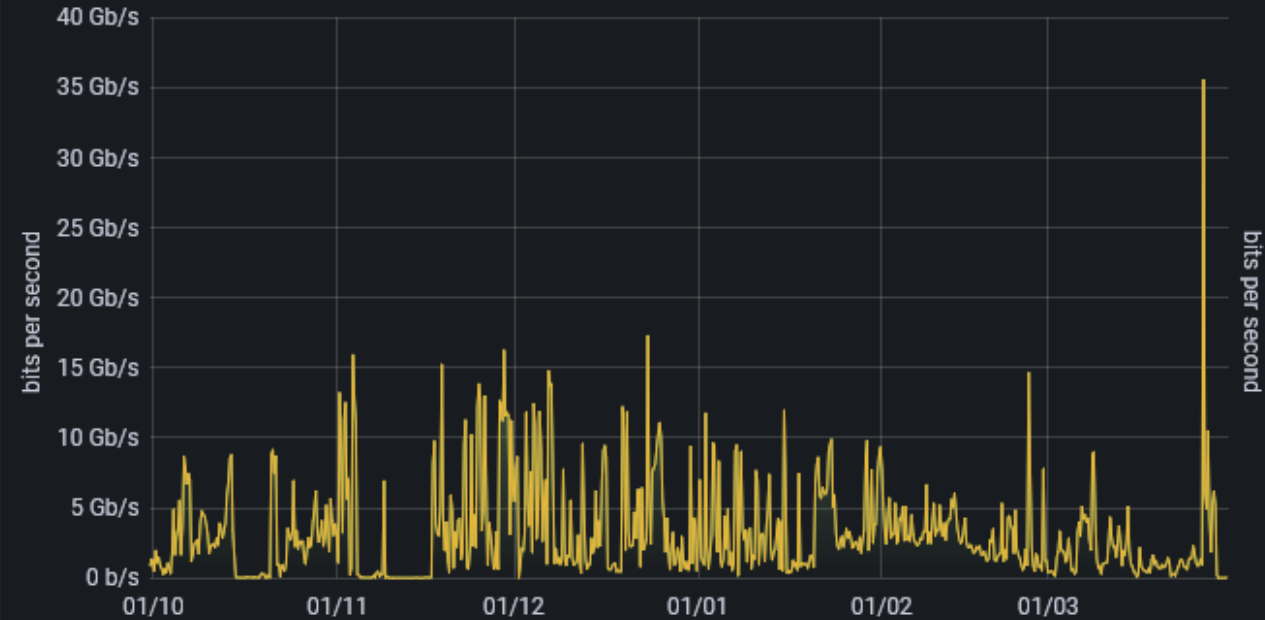
Aggregate - LHCONE - EENET - ingress



**max** **avg** **current**

TAL - EENET (ae10.111) - Ingress Traffic	20.97 Gb/s	1.41 Gb/s	683.07 Mb/s
TAL - EENET (ae10.111) - Ingress Traffic	197.87 b/s	88.55 b/s	87.04 b/s

Aggregate - LHCONE - EENET - egress



**max** **avg** **current**

TAL - EENET (ae10.111) - Egress Traffic	35.52 Gb/s	3.23 Gb/s	69.76 Mb/s
TAL - EENET (ae10.111) - Egress Traffic	1.21 kb/s	457.95 b/s	479.92 b/s

# Thank you!

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Thank you

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