



LHCONE services and status

Alice Forum

KISTI Daejeon, 23rd September 2015

Edoardo.Martelli@cern.ch

Summary



- Networking for WLCG
- LHCONE
 - Services
 - Status

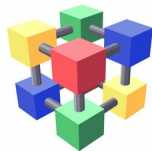
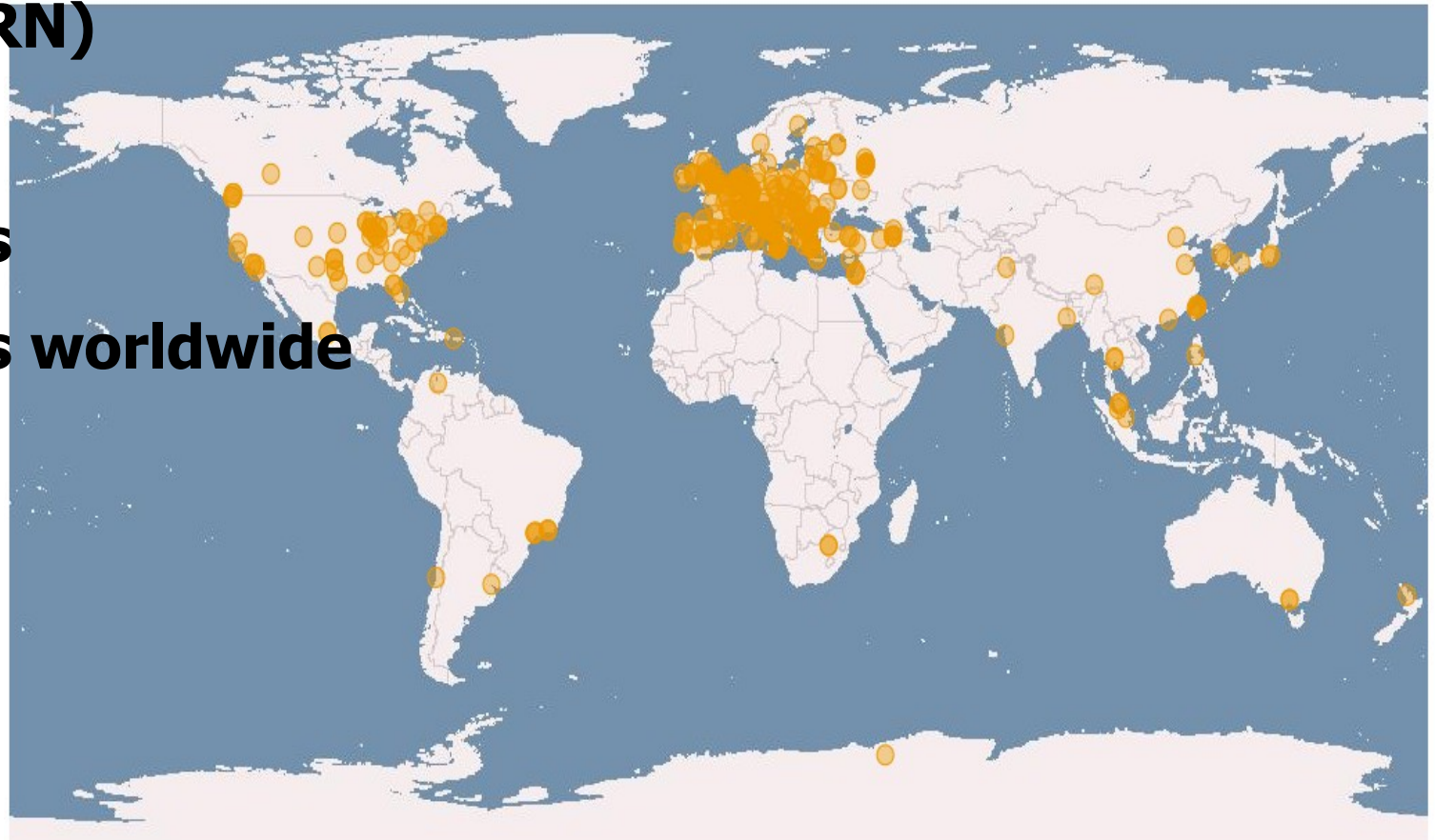
Networking for WLCG

Worldwide LHC Computing Grid



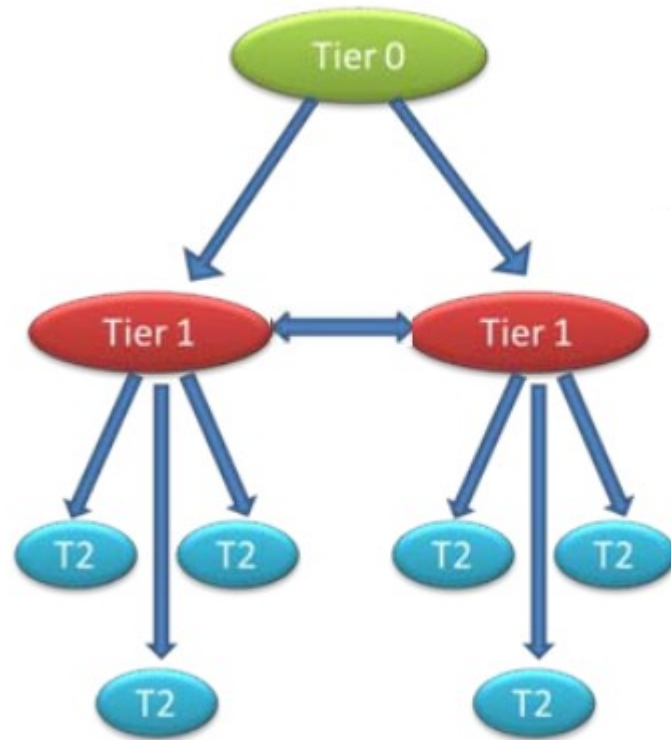
WLCG sites:

- 1 Tier0 (CERN)
- 13 Tier1s
- ~170 Tier2s
- >300 Tier3s worldwide



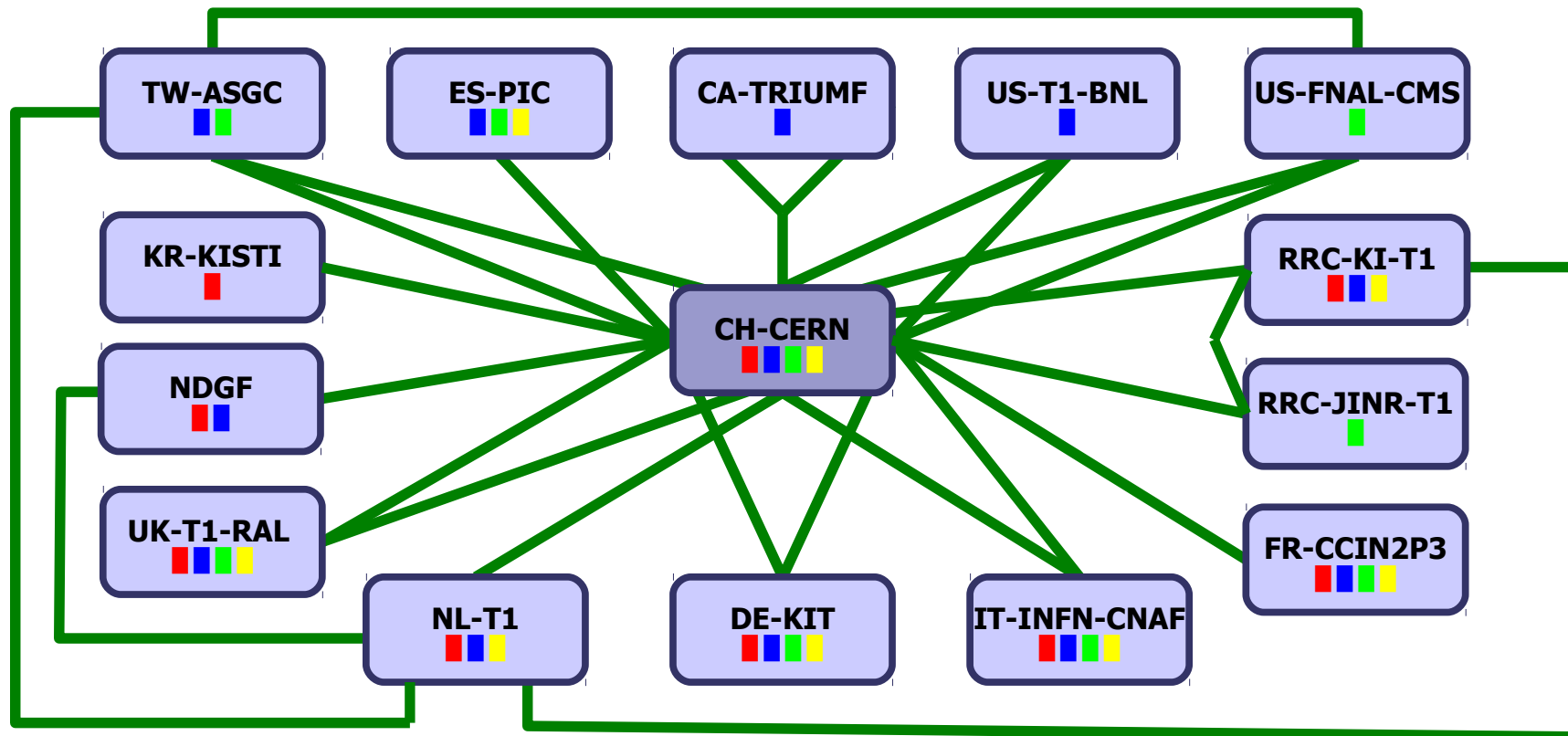
WLCG
Worldwide LHC Computing Grid

Original computing model



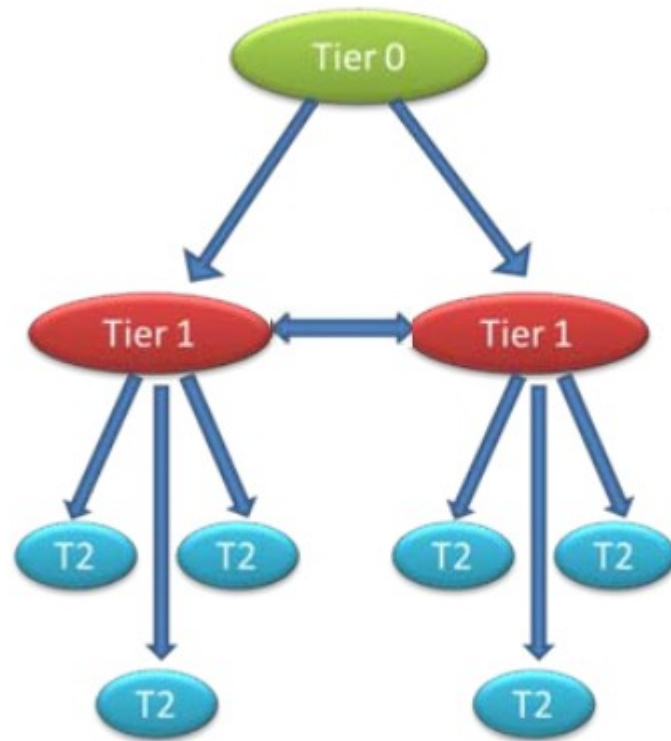
Original MONARCH model

LHCOPN: Tier0-Tier1 network

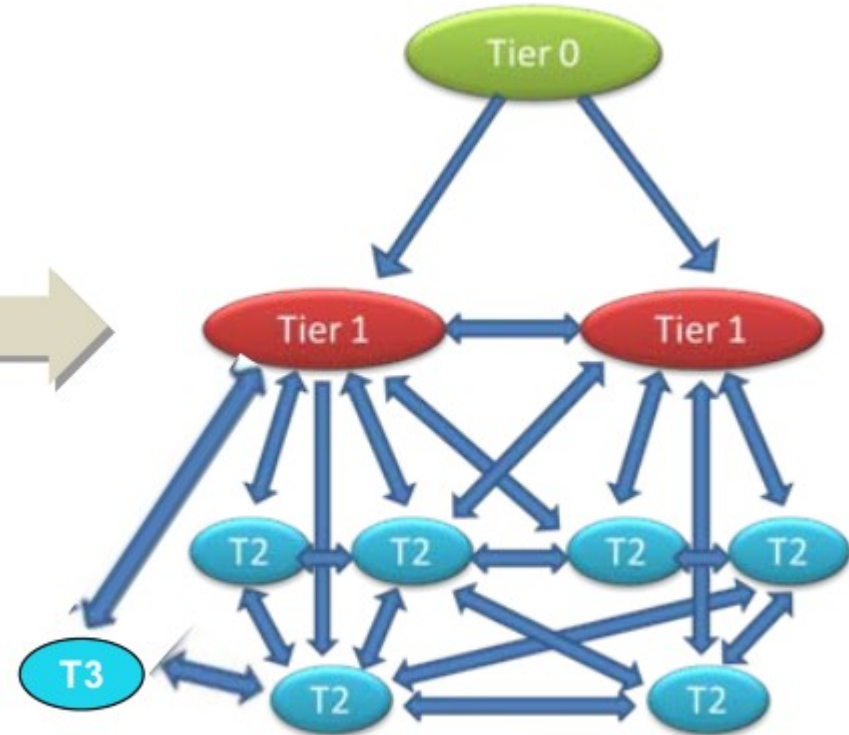


■ = Alice ■ = Atlas ■ = CMS ■ = LHCb
edoardo.martelli@cern.ch 20150821

Computing model evolution



Original MONARCH model



Model evolution

Computer Networks even more essential component of WLCG

Data analysis in Run 2 will need more network bandwidth between any pair of sites

LHCONE

T1-T2-T3 private network

LHCONE principles



LHCONE is a multi-domain network:

- **connecting any pair of sites**, regardless of the continent or network they reside in
- **scalable**: sites are allowed to grow
- **flexible**: sites may join and leave at any time
- **with a predictable cost tag**: by sharing expensive resources
- **dedicated to HEP**: no clash with other data transfer, resource allocated for and funded by the HEP community

L3VPN (VRF): routed Virtual Private Network -
operational

P2P: dedicated, bandwidth guaranteed, point-to-point links – *under development*

perfSONAR: monitoring infrastructure-
operational

LHCONE L3VPN service

LHCONE L3VPN service



Layer3 (i.e. routed) Virtual Private Network

Dedicated worldwide backbone connecting Tier1s, Tier2s and Tier3s at high bandwidth

Reserved to HEP data transfers and analysis

Benefits



Bandwidth dedicated to HEP data analysis, no contention with other research projects

Well defined cost tag for HEP networking

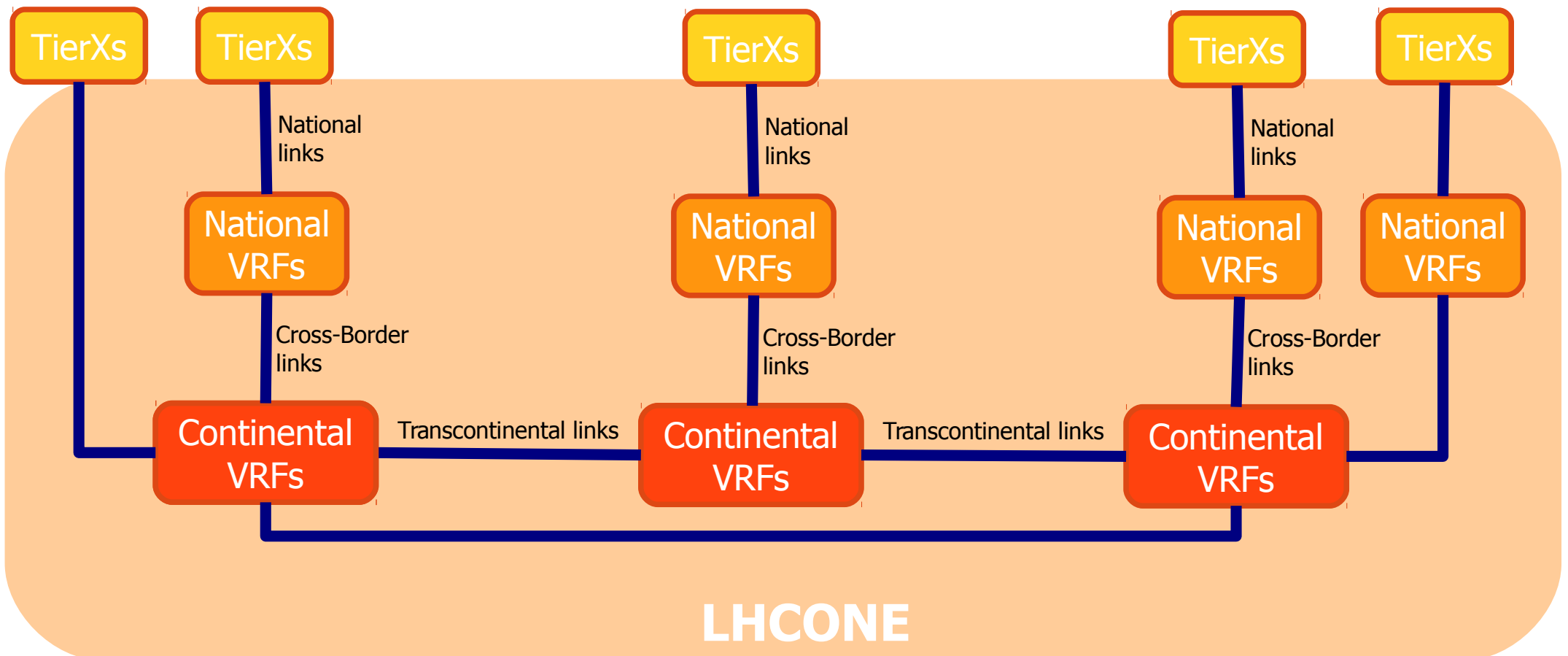
Trusted traffic that can bypass firewalls

LHCONE L3VPN architecture



- TierX sites connected to National-VRFs or Continental-VRFs
- National-VRFs interconnected via Continental-VRFs
- Continental-VRFs interconnected by trans-continental/trans-oceanic links

Acronyms: **VRF** = Virtual Routing Forwarding (i.e. virtual routing instance)



LHCONE P2P service

LHCONE P2P service



On demand point-to-point (P2P) links over a multi-domain network

Provides P2P links between any pair of TierX. The P2P links have guaranteed bandwidth (protected from any other traffic)

Accessible and configurable via software API

Work in progress: still in the prototyping phase

Challenges:

- multi-domain provisioning system
- intra-TierX connectivity
- TierX-TierY routing
- integration with WLCG software
- bandwidth allocation and protection

LHCONE perfSONAR service

perfSONAR



- framework for active and passive network probing
- developed by Internet2, Esnet, Geant and others

perfSONAR

<http://www.perfsonar.net/>

The screenshot shows the perfSONAR toolkit interface for a node named 'pS-Performance Node For CERN In Geneva, Meyrin, CH'. The browser address bar shows the URL <https://perfsonar-bw.cern.ch/toolkit/>. The page is divided into several sections:

- Host Information:** Organization Name: CERN, City, State, Country: Geneva, Meyrin, CH, Postal Code: 1217, Latitude, Longitude: 46.232498, 6.04593, Administrator Name: Stefan Stancu, Administrator Email: stefan.stancu@cern.ch
- Communities This Host Participates In:** HEPIX IPv6 testbed LHCOPN WLCG
- Host Status:** Primary Address: perfsonar-bw.cern.ch, MTU: 9000, NTP Status: Synced, Memory: 8GB, Globally registered: No
- Services Offered:**
 - Bandwidth Test Controller (BWCTL)** [1] **Running**
 - tcp://perfsonar-bw.cern.ch:4823
 - Testing Ports: 6001-6200(peer), 5001-5300(ipperf), 5301-5600(nuttcp), 5601-5900(owamp), 5001-5900(test)
 - Regular Testing** [1] **Running**
 - One-Way Ping Service (OWAMP)** [1] **Disabled**
 - tcp://perfsonar-bw.cern.ch:861
 - Testing Ports: 8760-9960(test)
 - Network Diagnostic Tester (NDT)** [1] **Disabled**
 - <http://perfsonar-bw.cern.ch:7123/>
 - tcp://perfsonar-bw.cern.ch:3001
 - esmond Measurement Archive** [1] **Running**
 - <http://perfsonar-bw.cern.ch/esmond/perfsonar/archive/>
 - Network Path and Application Diagnosis (NPAD)** [1] **Disabled**
 - <http://perfsonar-bw.cern.ch:8000/>
 - tcp://perfsonar-bw.cern.ch:8001
- Toolkit Administration:** Configure Tests, Administrative Information, Enabled Services, NTP, perfSONAR Logs, BWCTL Log Analysis, OWAMP Log Analysis, NDT Log Analysis
- Performance Toolkit:** Configuration Manual, Frequently Asked Questions, About, Credits

LHCONE perfSONAR service



LHCONE Network monitoring infrastructure

Probes installed at:

- VRFs interconnecting points
- Sites

Accessible to any Site for network healthiness checks

LHCONE perfSONAR MaDDash



MaDDash - Monitoring and Debugging Dashboard - Mozilla Firefox

WebHome < LHCONE < TWiki x MaDDash - Monitoring and Debug... x

https://maddash.aglt2.org/maddash-webui/ir

WLCG/OSG perfSONAR Dashboard

Dashboards Settings WLCG/OSG Networking Resources

Last page refresh time: August 21, 2015 15:47:29 PM CEST

LHCONE Mesh Config Dashboard

LHCONE Mesh Config - TCP BWCTL Test Between LHCONE Bandwidth Hosts

Throughput \geq 900Mbps Throughput $<$ 900Mbps Throughput \leq 500Mbps Unable to retrieve data Check has not yet run

LHCONE Mesh Config - OWAMP Test Between LHCONE Latency Hosts

Loss rate is \leq 0 Loss rate is \geq 0 Loss rate is \geq 0.01 Unable to retrieve data Check has not yet run

More information



Deployment:

<https://twiki.opensciencegrid.org/bin/view/Documentation/DeployperfSONAR>

MaDDash

<https://maddash.aglt2.org/maddash-webui/index.cgi?dashboard=LHCONE%20Mesh%20Config>

perfSONAR

<http://www.perfsonar.net/>

LHCONE Status

Over 15 national and international Research Networks

Several Open Exchange Points including NetherLight, StarLight, MANLAN, WIX, CERNlight and others

Trans-Atlantic connectivity provided by ACE, Esnet, GEANT, NORDUNET, SURFnet

55 end sites connected to LHCONE:

- 10 Tier1s
- 45 Tier2s

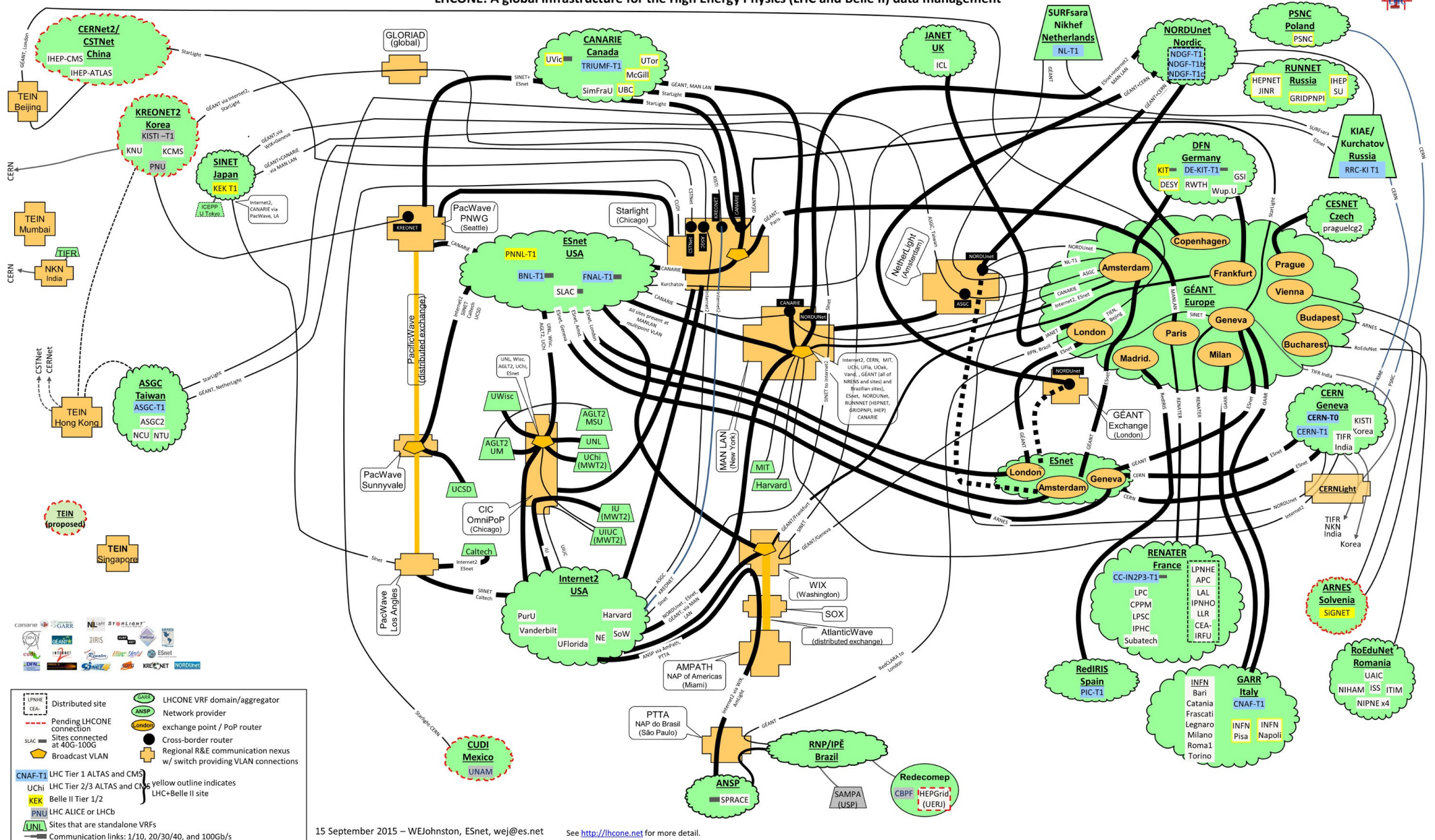
More Information:

- <https://indico.cern.ch/event/318811/contribution/5/material/slides/0.pdf>
- <https://twiki.cern.ch/twiki/bin/view/LHCONE/LhcOneVRF>

Current L3VPN topology



LHCONE: A global infrastructure for the High Energy Physics (LHC and Belle II) data management

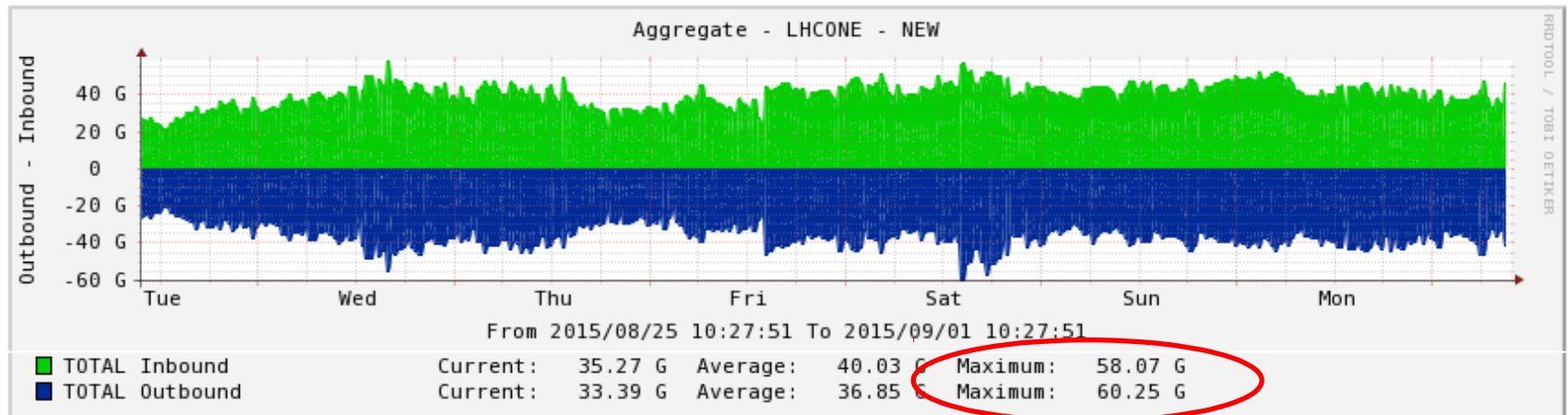


15 September 2015 – WEJohnston, ESnet, wej@es.net See <http://lhcone.net> for more detail.

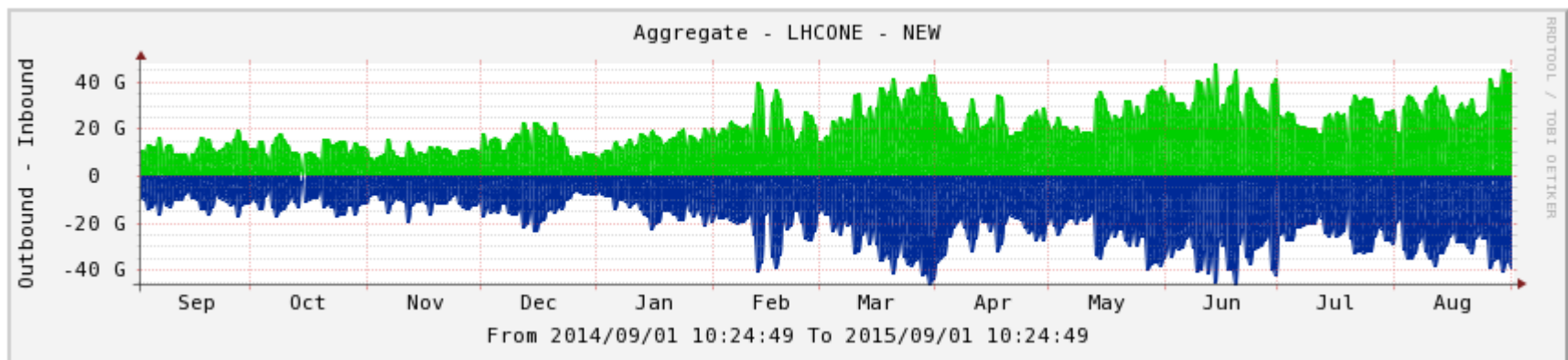
Geant VRF traffic



Weekly

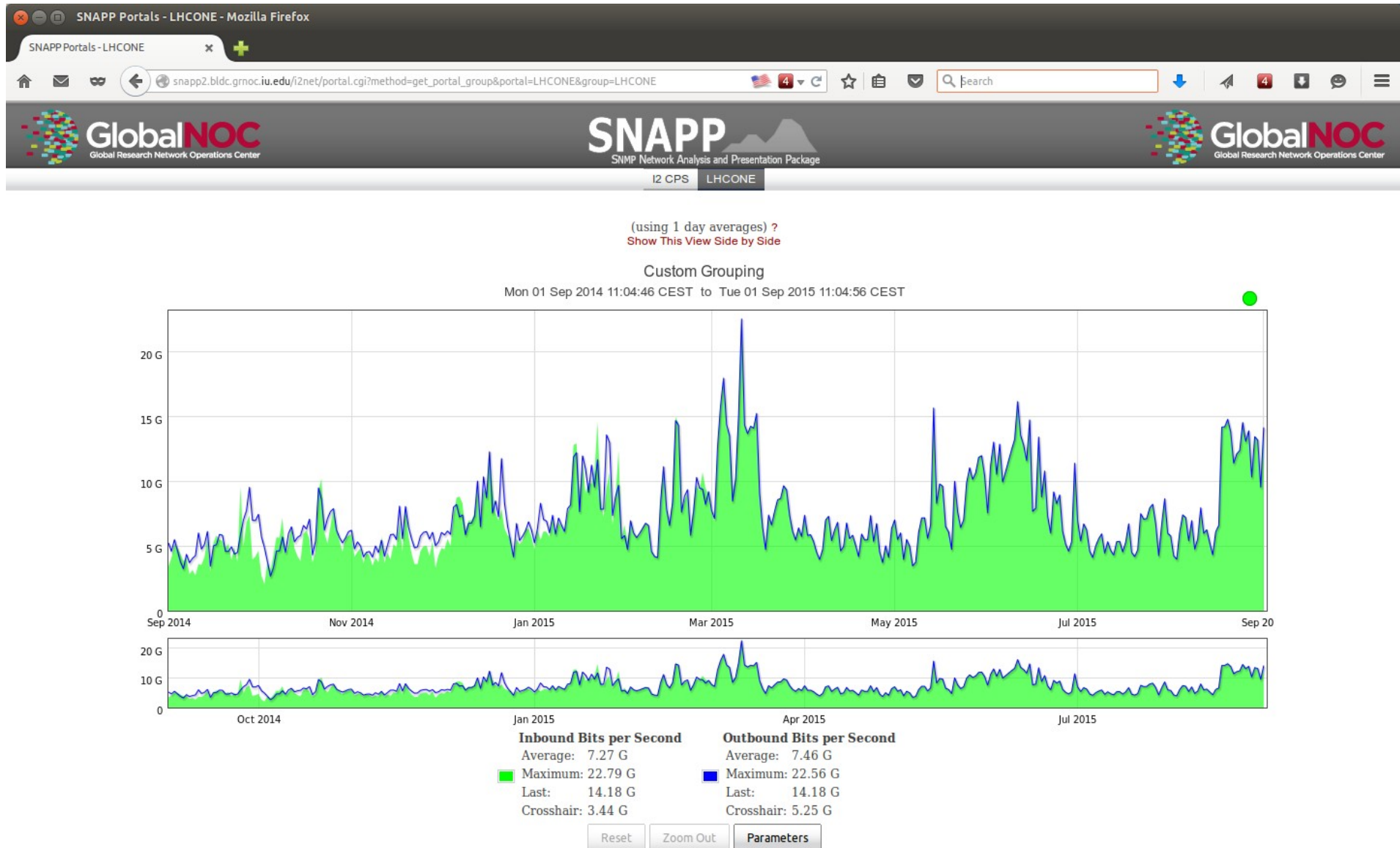


Yearly



https://tools.geant.net/portal/links/cacti/graph_view.php?action=tree&tree_id=30&leaf_id=6688 (login needed)

Internet2 VRF traffic

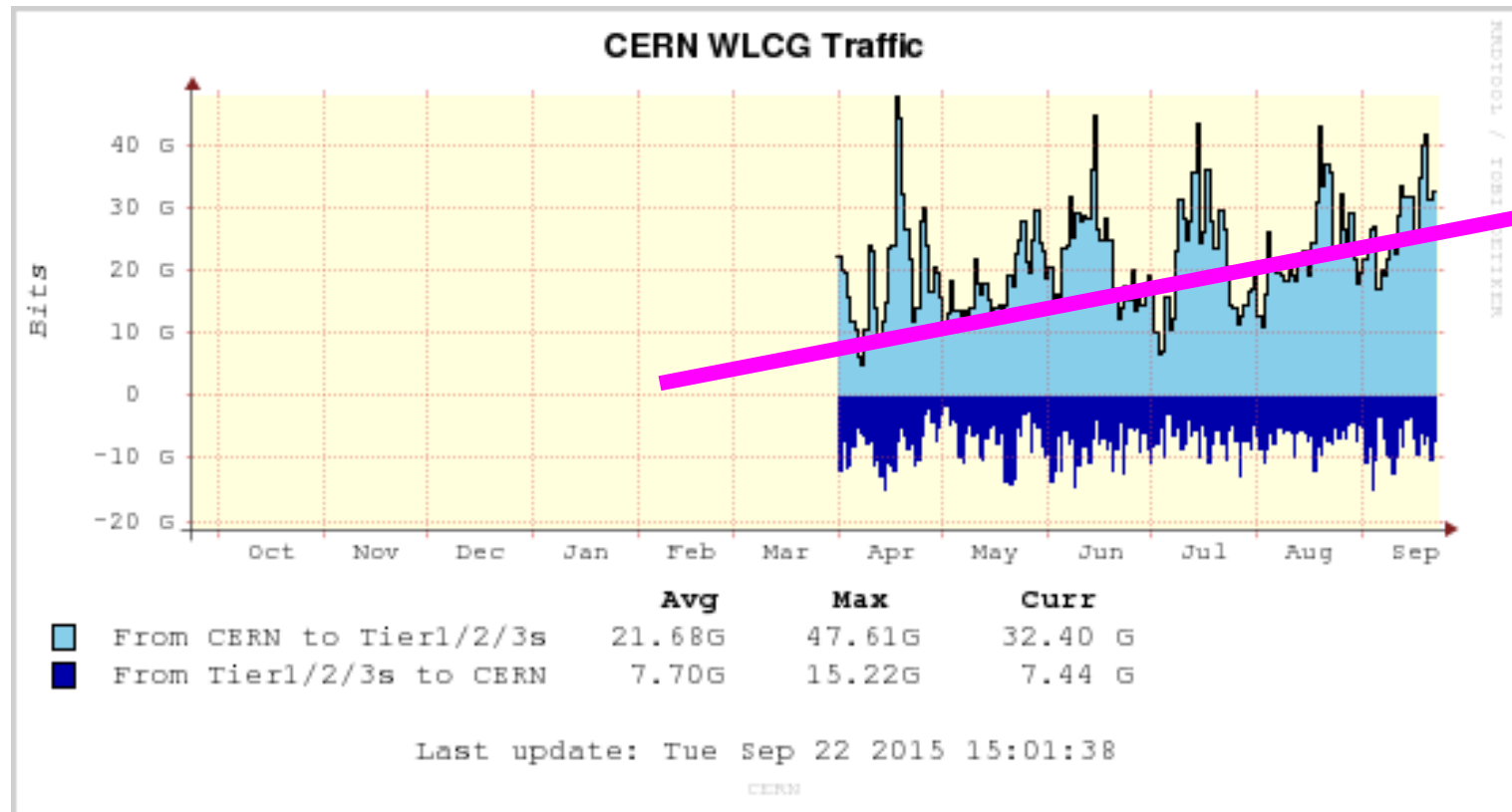


User: Public

Developed by Global Research NOC Systems Engineering Copyright 2011, The Trustees of Indiana University

http://snapp2.bldc.gnoc.iu.edu/i2net/portal.cgi?method=get_portal_group&portal=LHCONE&group=LHCONE

Tier0 traffic

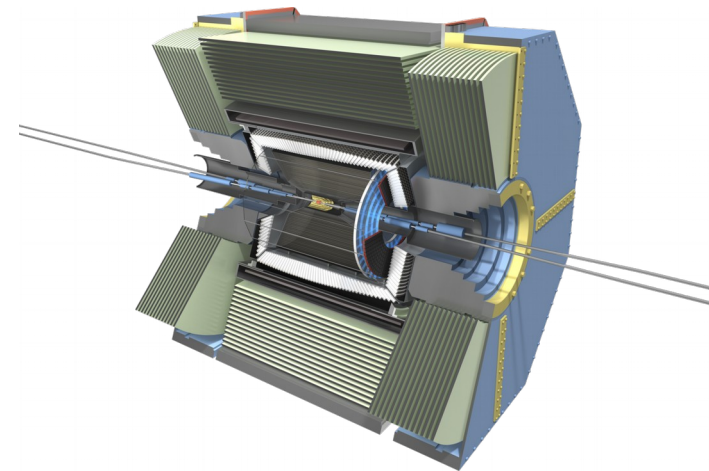


Open to other HEP collaborations



L3VPN has been recently opened to:

Belle II experiment



Pierre Auger Observatory



Acceptable Use Policy



The LHCONE AUP (Acceptable Use Policy) has been recently defined to regulate the utilization of the L3VPN service (<https://twiki.cern.ch/twiki/bin/view/LHCONE/LhcOneAup>)

Being currently audited

The screenshot shows a Mozilla Firefox browser window displaying the LHCONE Acceptable Use Policy (AUP) page. The page title is "LHCONE Acceptable Use Policy (AUP)" and it is dated 2015-02-20 by EdoardoMARTELLI. The page content includes a preamble, definitions, and a list of participating collaborations and related information. The definitions section is partially visible, listing terms such as HEP Site, HEP Service, LHCONE Site, LHCONE Prefix, LHCONE Node, LHCONE Traffic, LHCONE Provider, and LHCONE Management Board.

Log In
LHCONE

LHCONE Web
Create New Topic
Index
Search
Changes
Notifications
Statistics
Preferences

Public webs

Twiki > LHCONE Web > LhcOneAup (2015-02-20, EdoardoMARTELLI)

LHCONE Acceptable Use Policy (AUP)

As agreed upon by the participants [LHCOPN-ONE meeting](#) on 2015/02/10. The final deadline for comments is 2015/02/27.

- ↓ [LHCONE Acceptable Use Policy \(AUP\)](#)
 - ↓ [Preamble](#)
 - ↓ [Definitions](#)
 - ↓ [Participating Collaborations and related information](#)
 - ↓ [Scope](#)
 - ↓ [LHCONE L3VPN Acceptable Use Policy \(AUP\)](#)
 - ↓ [Announcement of IP Prefixes for LHCONE Traffic \(LHCONE Prefix\)](#)
 - ↓ [Authorized source and destinations nodes \(LHCONE Nodes\)](#)
 - ↓ [Eligibility for Becoming a LHCONE Site](#)
 - ↓ [Non-compliance with the AUP](#)
 - ↓ [Compromised Security](#)
 - ↓ [Roles and Responsibilities](#)
 - ↓ [Related documents](#)

Preamble

The LHCONE is a dedicated network architecture inter-connecting participating HEP Sites and allowing those sites to pool their computing resources for a more efficient distribution, storage, processing and analysis of HEP data.

Definitions

- **HEP Site:** a high energy physics laboratory or university participating in and formally tied to one or more of the participating Collaborations listed in the next chapter;
- **HEP Service:** a computing resource primarily used to distribute, store, process and analyse the data generated by HEP Sites
- **LHCONE Site:** a HEP Site connected to the LHCONE L3VPN service;
- **LHCONE Prefix:** an IP subnet announced by a LHCOPN Site to the LHCONE L3VPN;
- **LHCONE Node:** a device using an IP address from a LHCONE Prefix to source or receive data;
- **LHCONE Traffic:** IP data traffic carried by the LHCONE L3VPN network, i.e. data traffic generated by a LHCONE Node and sent to another LHCONE Node;
- **LHCONE Provider:** National or International Network Service Provider (NSP) which provides network resources for the LHCONE L3VPN service;
- **LHCONE Management Board:** the Management Board of one of the Collaborations listed in the next section. Each LHCONE Management Board has ultimate jurisdiction on its affiliated HEP/LHCONE sites.

More information



LHCONE meetings:

<https://indico.cern.ch/category/5793/>

LHCONE websites:

<http://lhcone.net>

<https://twiki.cern.ch/twiki/bin/view/LHCONE/WebHome>

Mailing lists:

lhcone-operations@cern.ch

lhcone-architecture@cern.ch

lhcone-asia-pacific@cern.ch

Join the lhcone-asia-pacific@cern.ch



If you have a CERN account:

<https://e-groups.cern.ch/e-groups/Egroup.do?egroupId=10143913>

Otherwise ask e.m@cern.ch

Questions?

