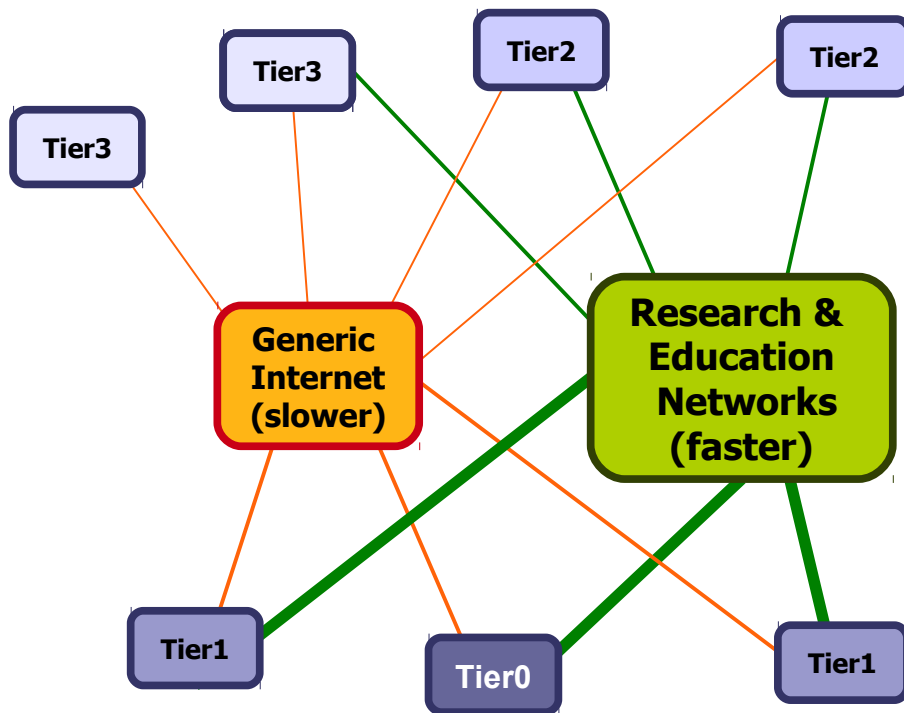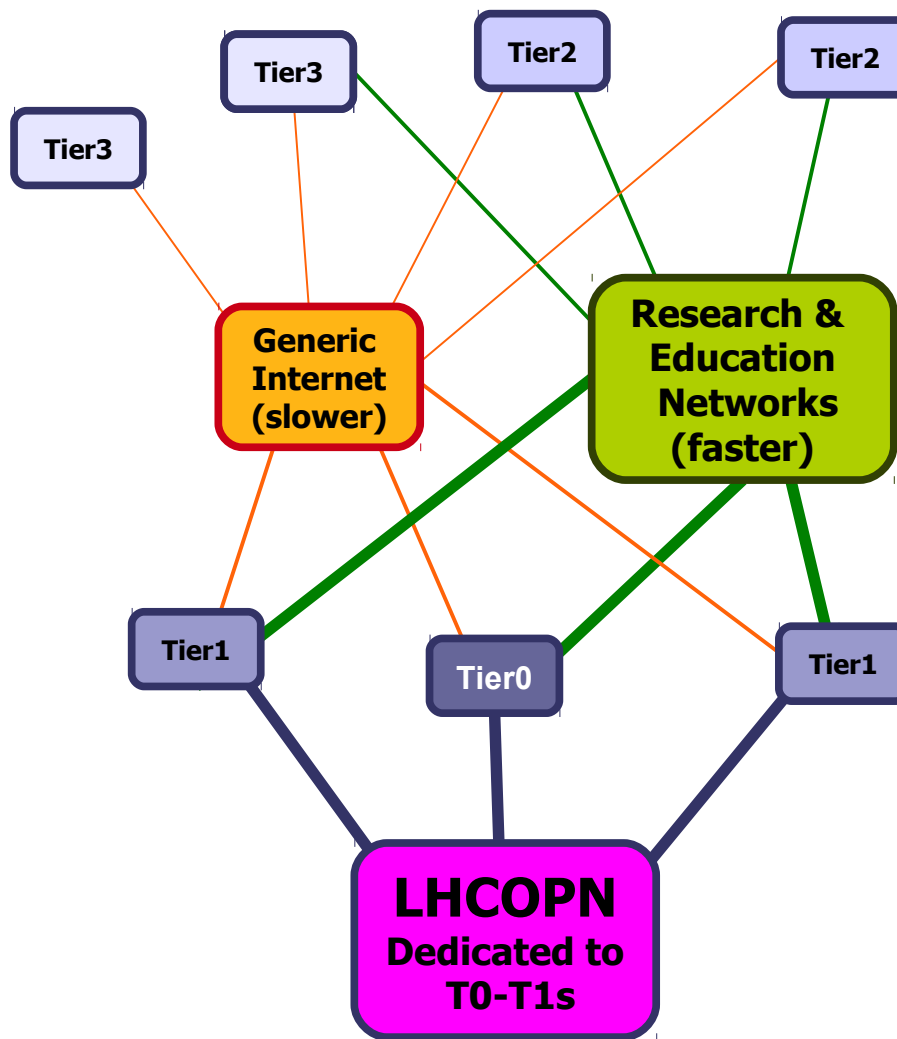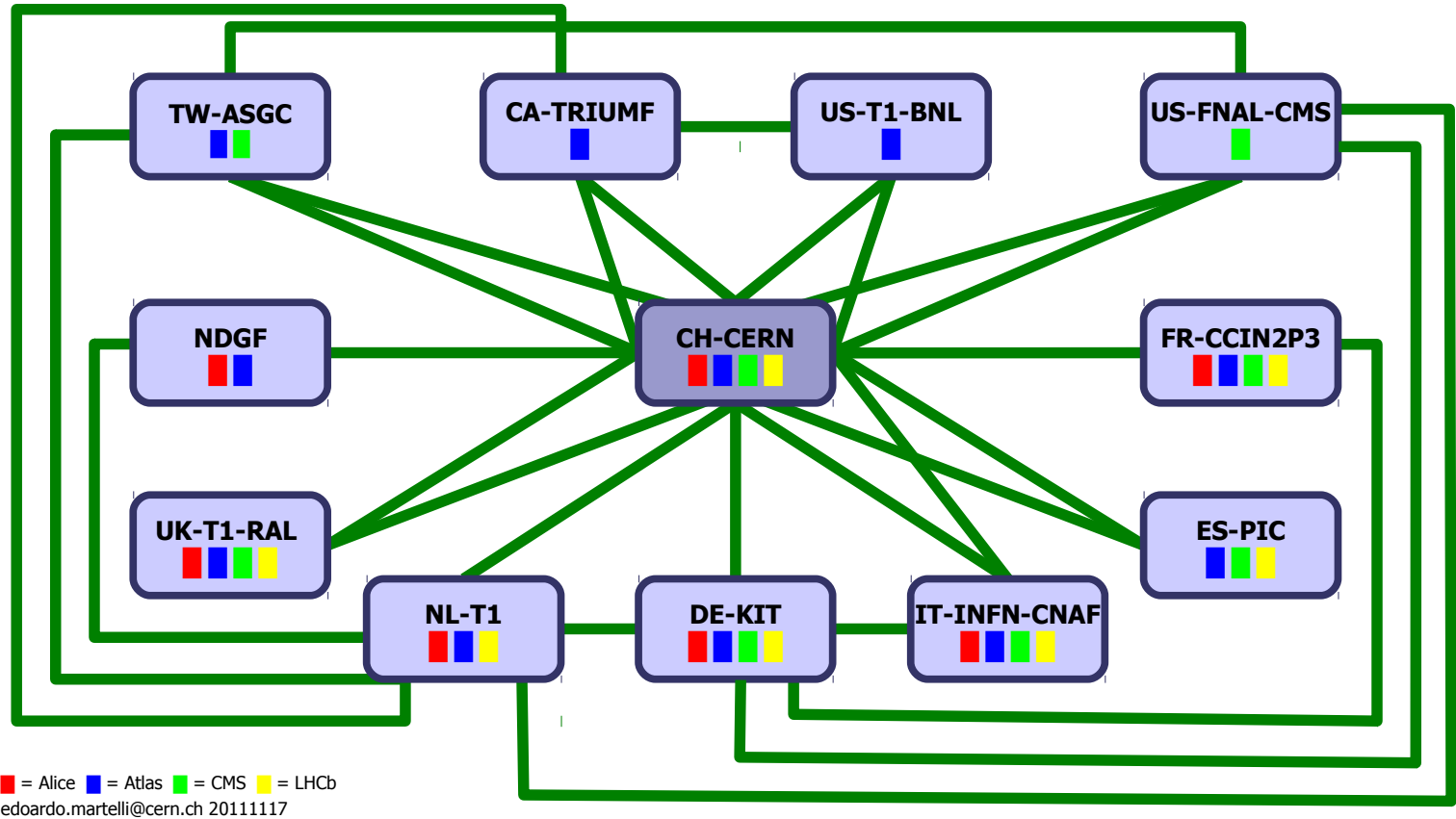# Networking for WLCG: LHCONE

HEPiX 2011 - Vancouver

edoardo.martelli@cern.ch
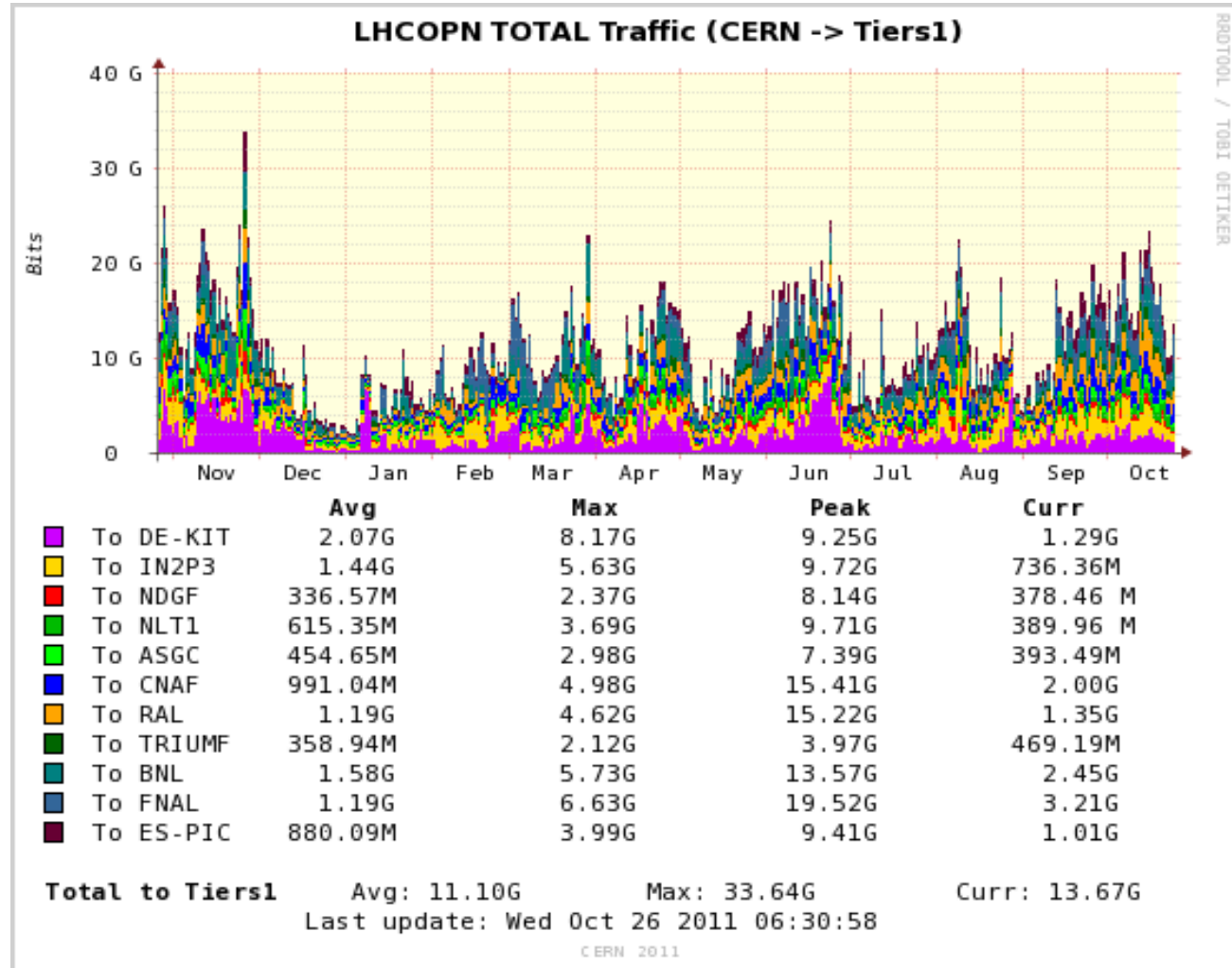
- Evolution of LHC networking
- New computing model
- LHCONE
- Services
- Challenges and opportunities

Evolution of LHC networking

T0-T1s private network

■ = Alice ■ = Atlas ■ = CMS ■ = LHCb
edoardo.martelli@cern.ch 20111117

LHCOPN TOTAL Traffic (CERN -> Tiers1)

		Avg	Max	Peak	Curr
■	To DE-KIT	2.07G	8.17G	9.25G	1.29G
■	To IN2P3	1.44G	5.63G	9.72G	736.36M
■	To NDGF	336.57M	2.37G	8.14G	378.46 M
■	To NLT1	615.35M	3.69G	9.71G	389.96 M
■	To ASGC	454.65M	2.98G	7.39G	393.49M
■	To CNAF	991.04M	4.98G	15.41G	2.00G
■	To RAL	1.19G	4.62G	15.22G	1.35G
■	To TRIUMF	358.94M	2.12G	3.97G	469.19M
■	To BNL	1.58G	5.73G	13.57G	2.45G
■	To FNAL	1.19G	6.63G	19.52G	3.21G
■	To ES-PIC	880.09M	3.99G	9.41G	1.01G

Total to Tiers1   Avg: 11.10G   Max: 33.64G   Curr: 13.67G

Last update: Wed Oct 26 2011 06:30:58

CERN 2011

New computing model

"The Network infrastructure is the most reliable service we have"

"Network Bandwidth (rather than disk) will need to scale more with users and data volume"

"Data placement will be driven by demand for analysis and not pre-placement"

Ian Bird, WLCG project leader

Evolution of Computing the ATLAS Model
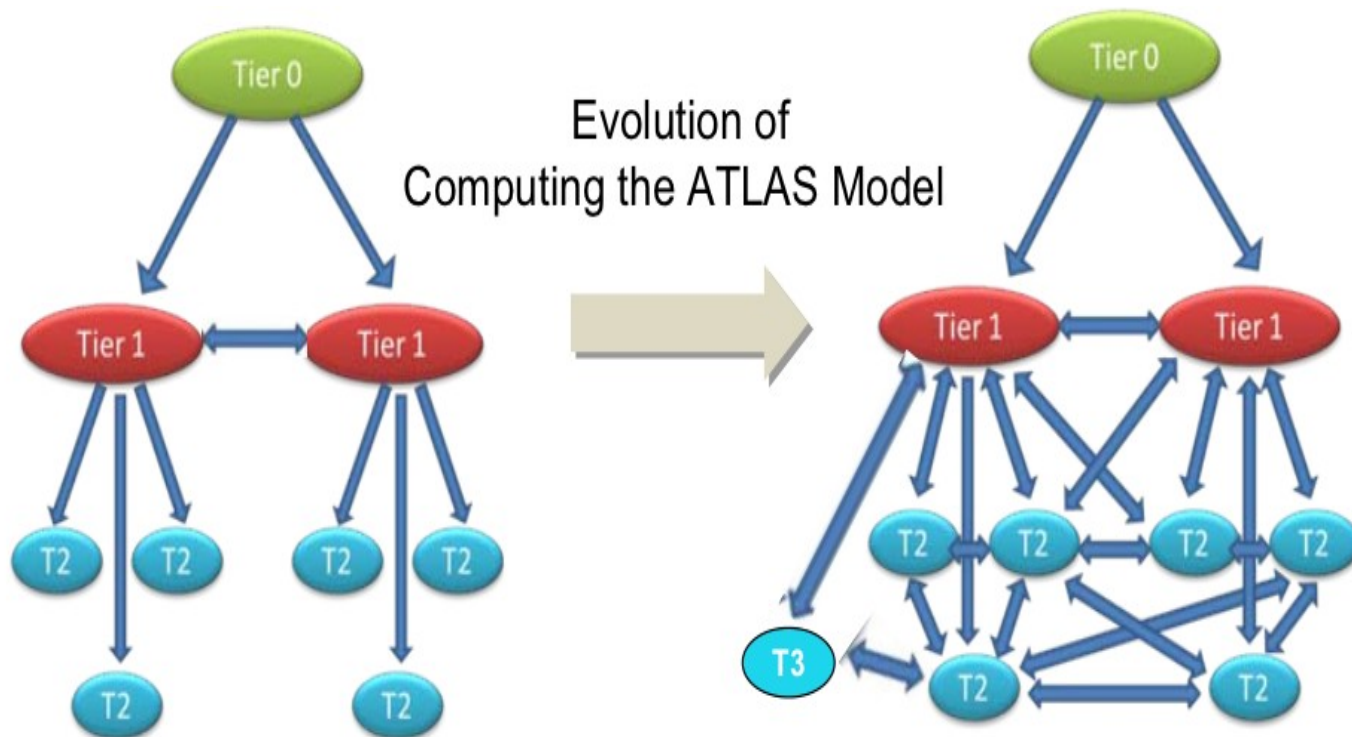
- Better and more dynamic use of storage

- Reduce the load on the Tier1s for data serving

- Increase the speed to populate analysis facilities

Needs for a faster, predictable, pervasive network connecting Tier1s and Tier2s

- **Connect any pair of sites, regardless of the continent they reside in**

- Bandwidth ranging from 1Gbps (*Minimal*), 5Gbps (*Nominal*), 10G and above (*Leadership*)

- Scalability: sites are expected to grow

- Flexibility: sites may join and leave at any time

- Predictable cost: well defined cost, not too high

LHCONE
LHC Open Network Environment

Connecting Tier 1-2-3s

LHCONE concept
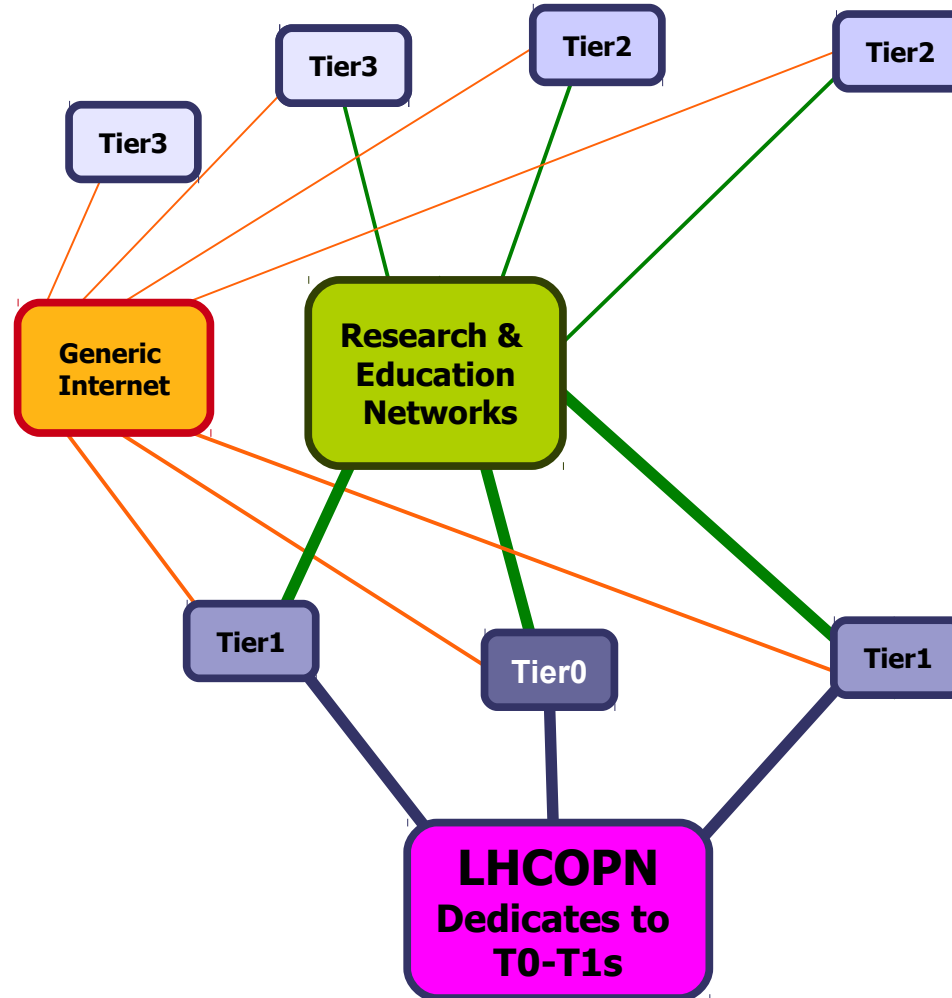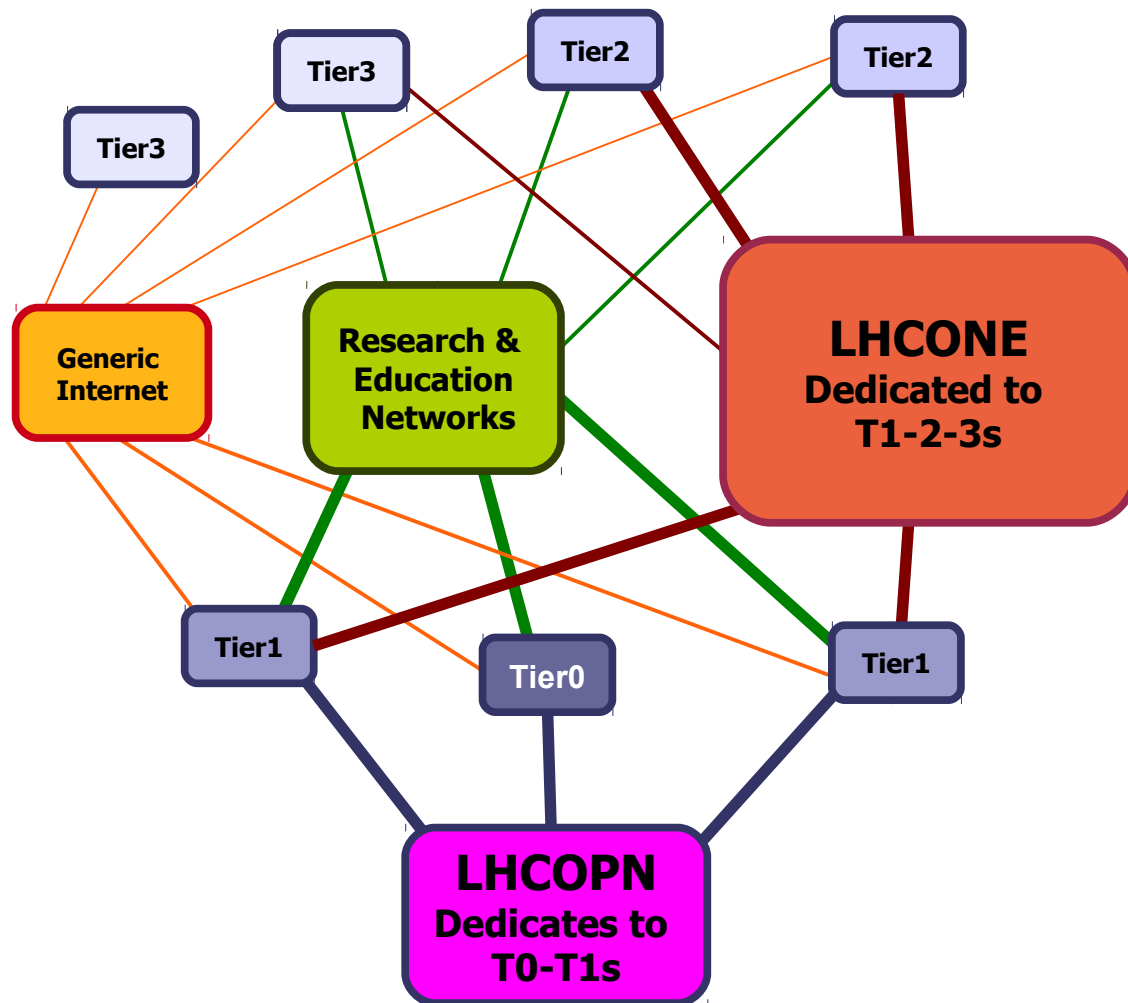
- Serves any LHC site according to its needs and allowing the site to grow
- A collaborative effort among Research & Education Network Providers: sharing cost by federating expensive resources
- Based on Open Exchange Points: easy to join, neutral
- Multiple services for different needs
- Traffic separation:
  - no clash with other data transfers
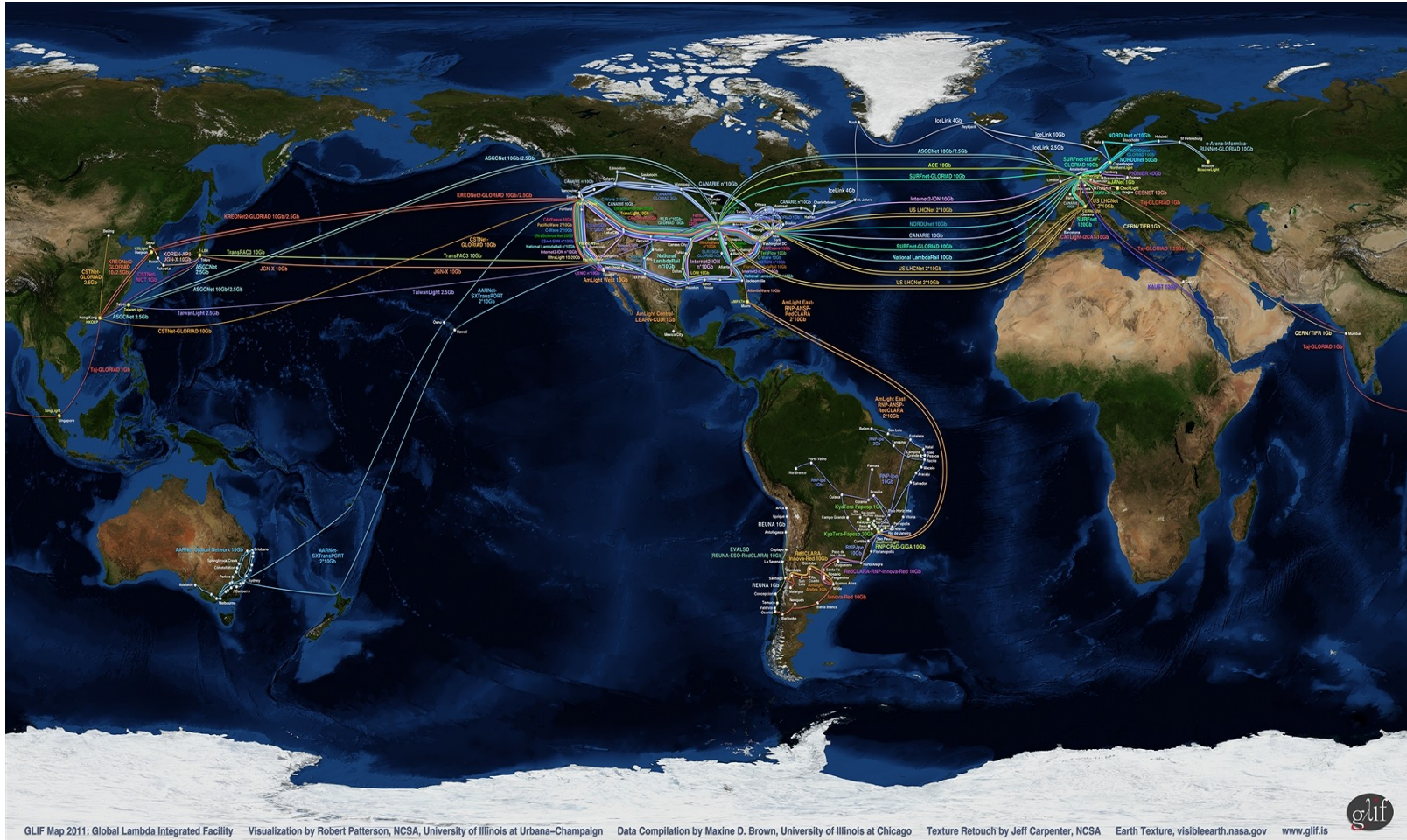 - resource allocated for and funded by HEP community
  - secure

CS
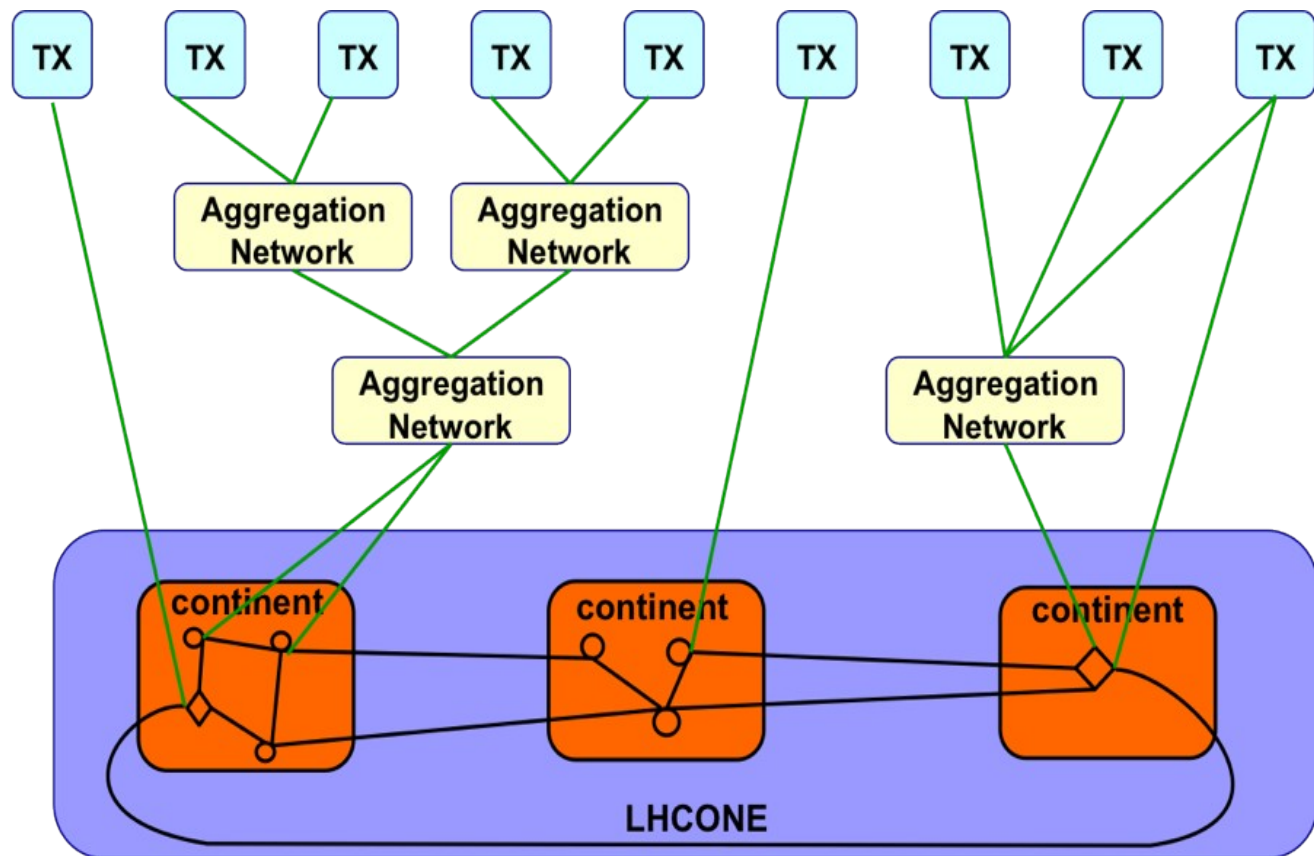
◇ distributed exchange point
○ single node exchange point

LHCONE building blocks:

- Single node exchange points

- Continental/regional distributed exchange points

- Interconnecting circuits between exchange points

All sharing a common policy

Underlying infrastructure

GLIF Map 2011: Global Lambda Integrated Facility   Visualization by Robert Patterson, NCSA, University of Illinois at Urbana–Champaign   Data Compilation by Maxine D. Brown, University of Illinois at Chicago   Texture Retouch by Jeff Carpenter, NCSA   Earth Texture, visibleearth.nasa.gov   www.glif.is

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LHCONE Services

Services:

- Dedicated circuits

- Shared VLAN/Backbone

- Monitoring

Point-to-point links connecting pair of TierXs

- Dynamically provisioned

- Secure (private traffic)

- Guaranteed bandwidth
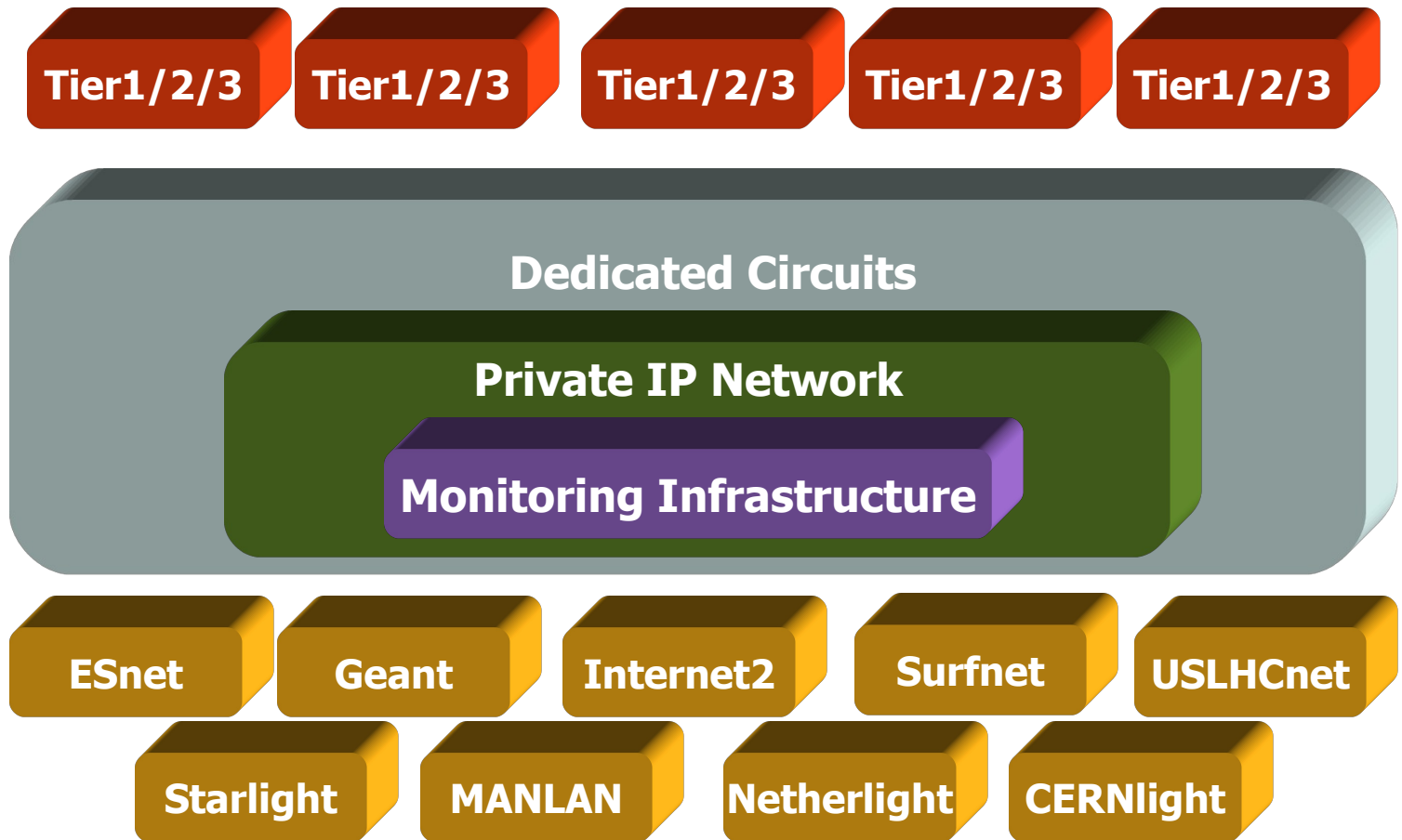
Shared VLAN/Backbone

A private network reaching all the locations

- Any TierX can join the shared network

- Cost sharing of expensive resources (i.e. transoceanic links)

- Best effort

- Built on top of the Dedicated links service

- Private: Only worker nodes allowed to use it (can bypass statefull firewalls)

A distributed monitoring system to ensure:

- LHCONE healthiness

- single site connectivity healthiness

Tier1/2/3 **Tier1/2/3** **Tier1/2/3** **Tier1/2/3** **Tier1/2/3**

Dedicated Circuits

Private IP Network

Monitoring Infrastructure

ESnet **Geant** **Internet2** **Surfnet** **USLHCnet**

**Starlight** **MANLAN** **Netherlight** **CERNlight**

Challenges and opportunities

LHCONE is a community effort

- All stakeholders involved: TierXs, Network Operators, LHC Experiments, CERN.

- Exact roles and responsibilities not yet defined

- Ensure stability, reliability and performance of a large system not centrally controlled

- Coordination among "competitors"

- Develop a common provisioning system

- Raise awareness of networking needs at TierXs

- More network capacity to be provided by Network Operators

- Foster collaborations among Network Operators and among Network Users

- New technologies to provide the best services
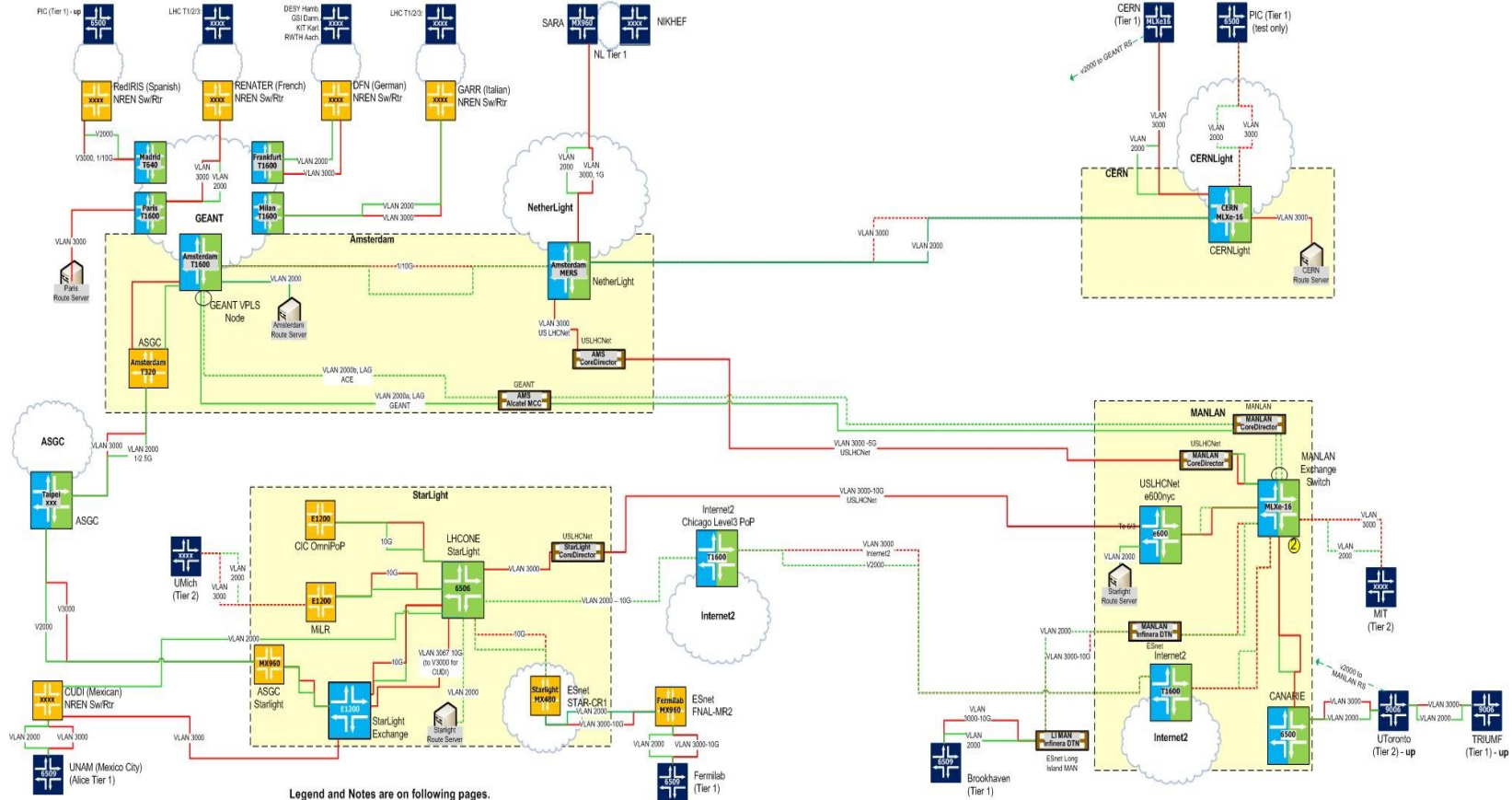
Conclusions

- The Network is a key part of the LHC data processing and will become even more important

- Collaboration and Open policies are crucial to success

More information:
http://lhcone.net/