

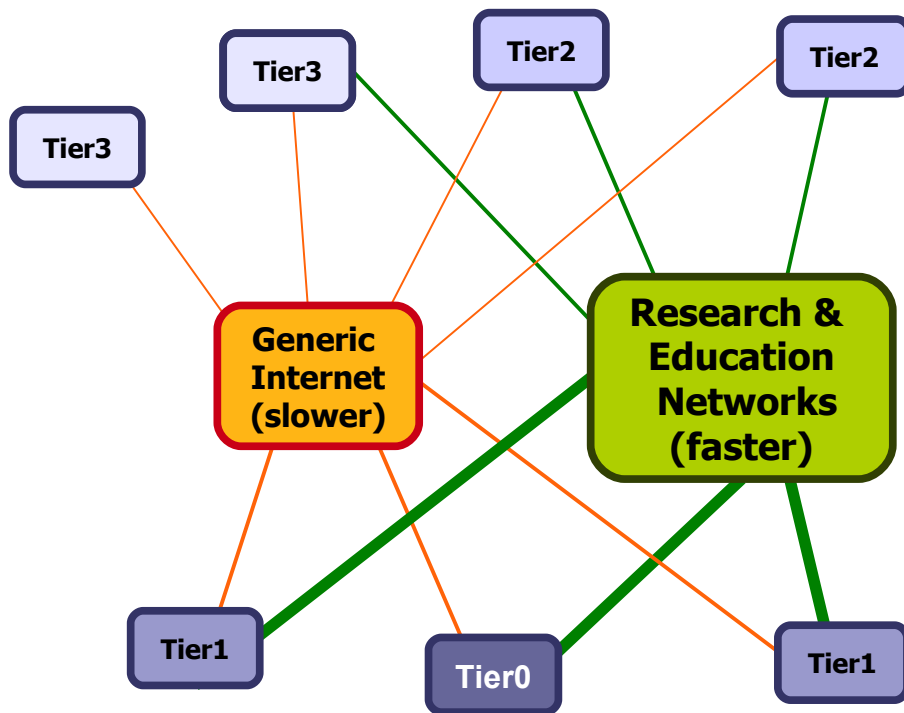
# Networking for WLCG: LHCONE

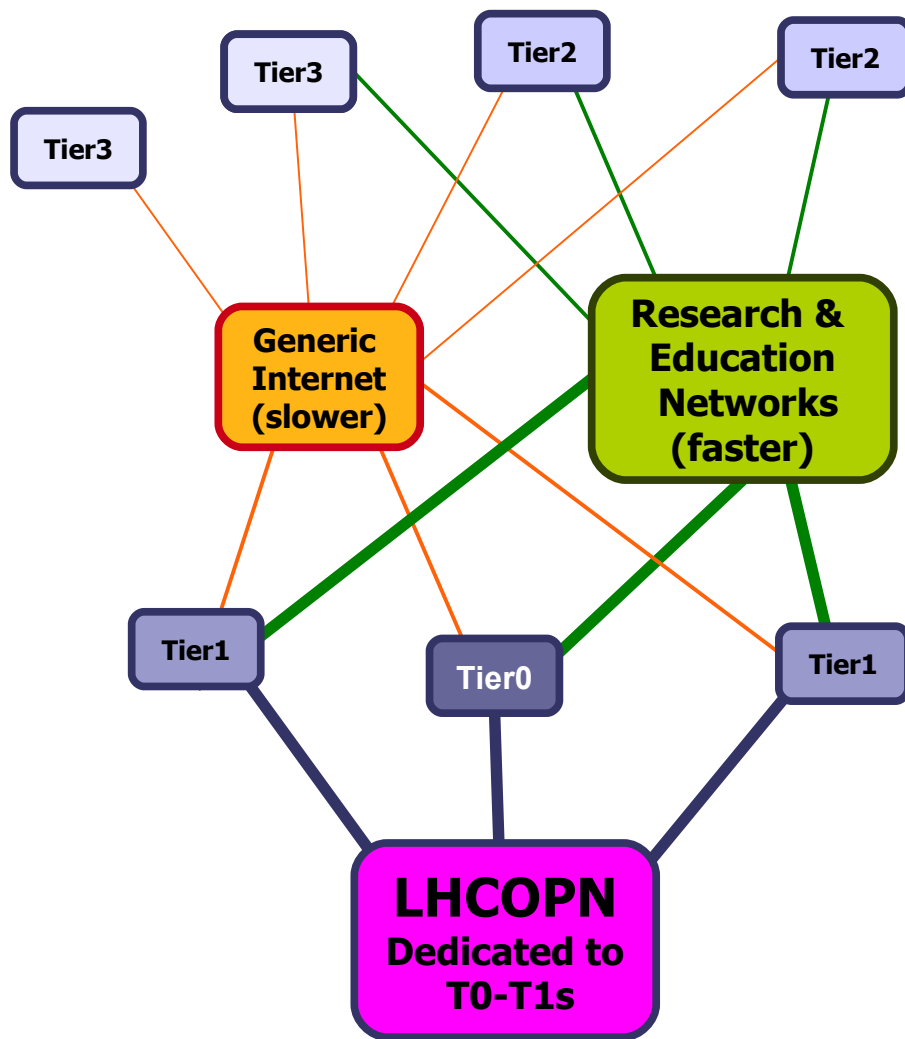
**HEPiX 2011 - Vancouver**

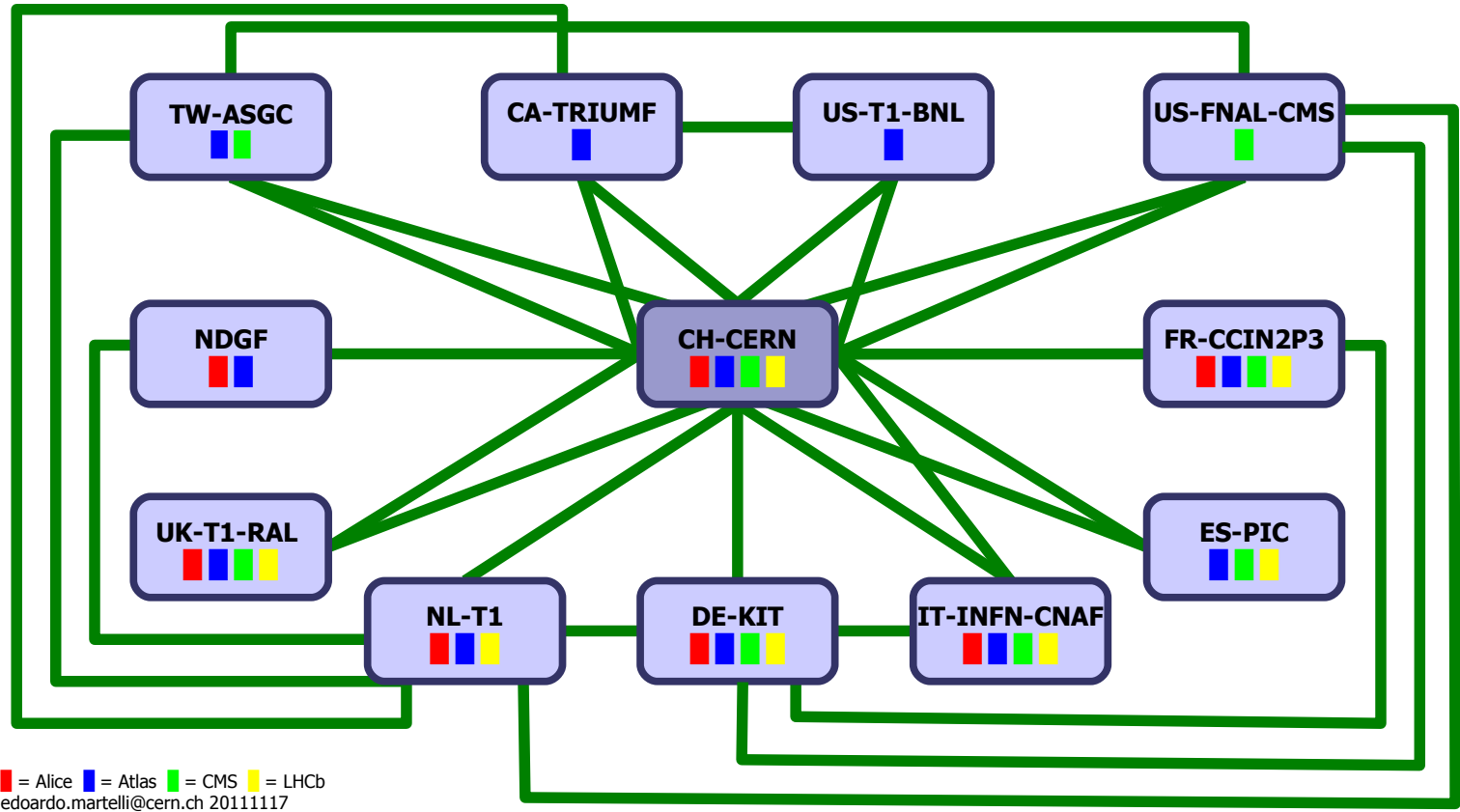
[edoardo.martelli@cern.ch](mailto:edoardo.martelli@cern.ch)

- Evolution of LHC networking
- New computing model
- LHCONE
- Services
- Challenges and opportunities

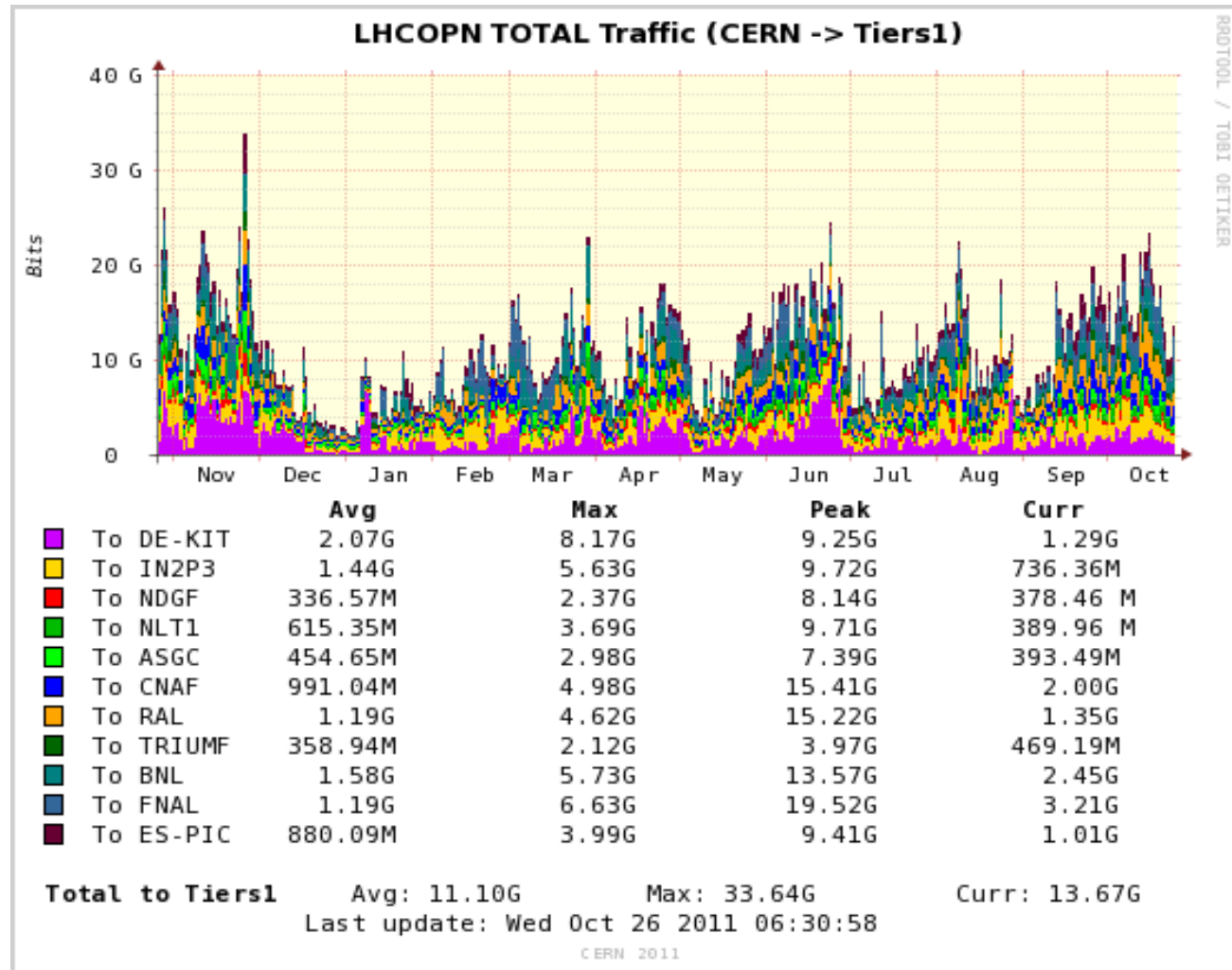
# Evolution of LHC networking











# New computing model



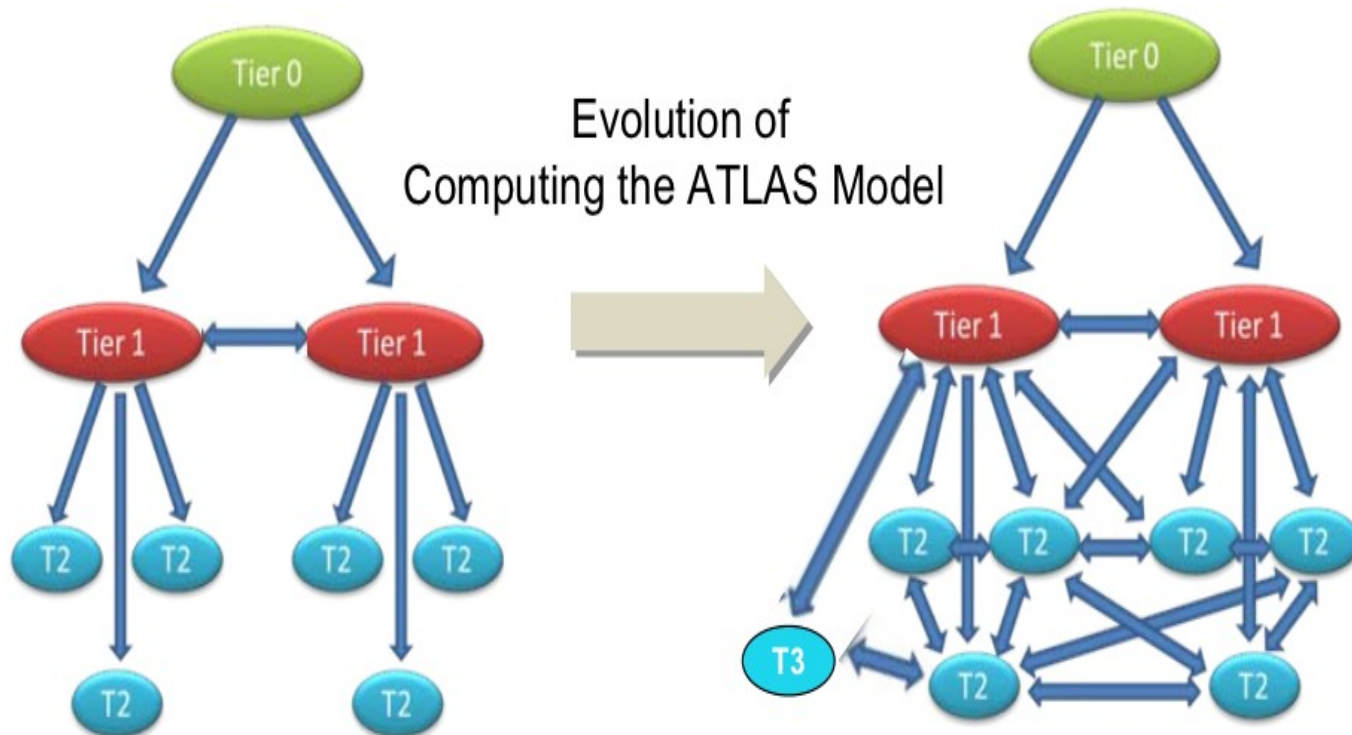
**“The Network infrastructure is the most reliable service we have”**

**“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*





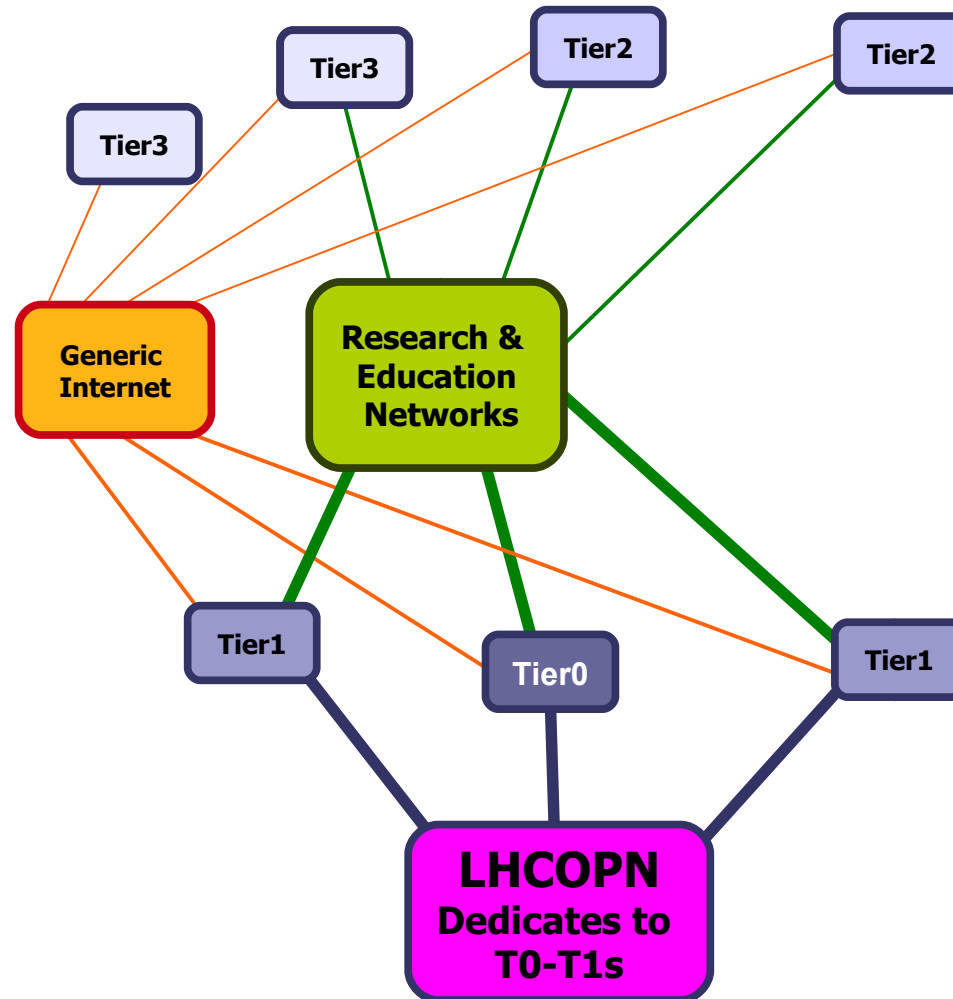
- Better and more dynamic use of storage
- Reduce the load on the Tier1s for data serving
- Increase the speed to populate analysis facilities

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

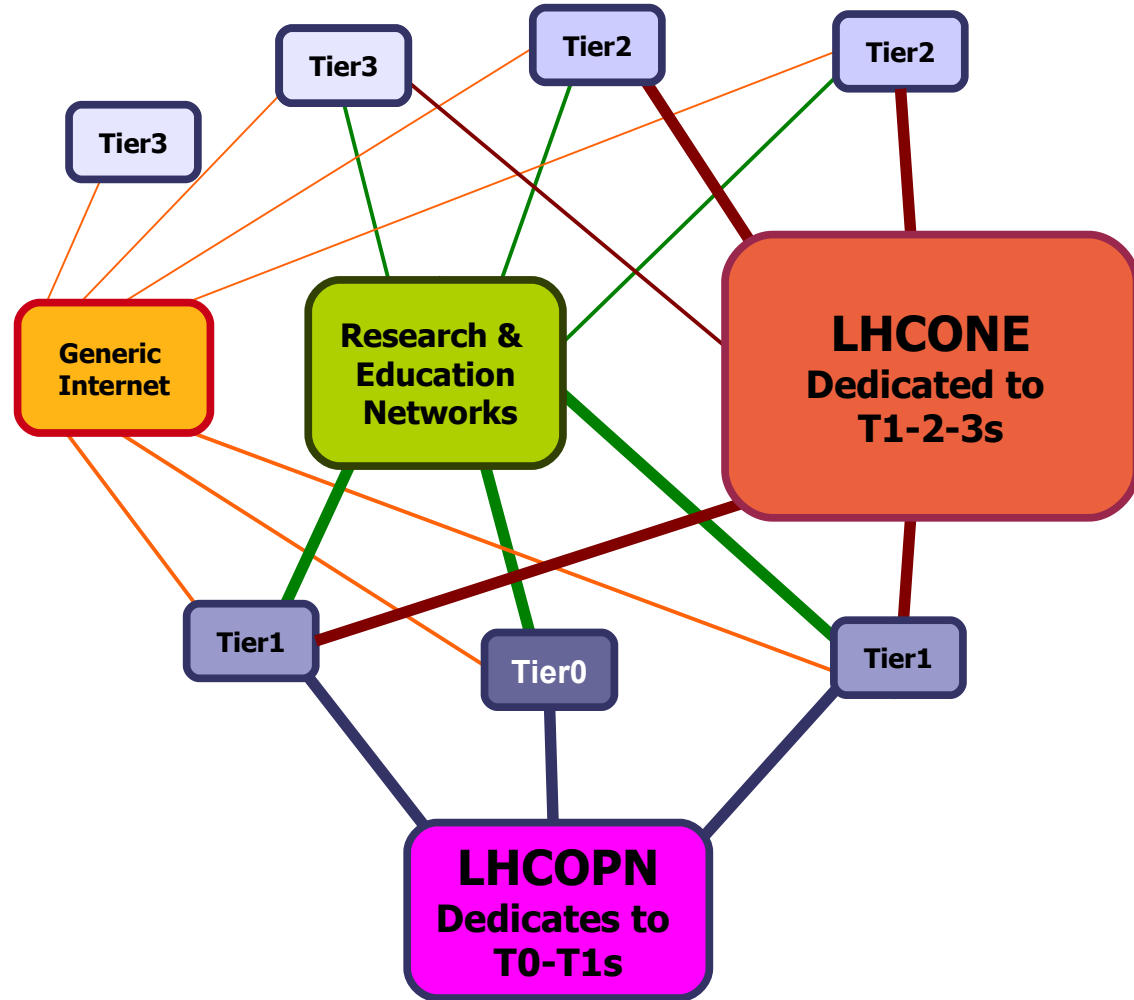
- **Connect any pair of sites, regardless of the continent they reside in**
- Bandwidth ranging from 1Gbps (*Minimal*), 5Gbps (*Nominal*), 10G and above (*Leadership*)
- Scalability: sites are expected to grow
- Flexibility: sites may join and leave at any time
- Predictable cost: well defined cost, not too high

# LHCONE

## LHC Open Network Environment

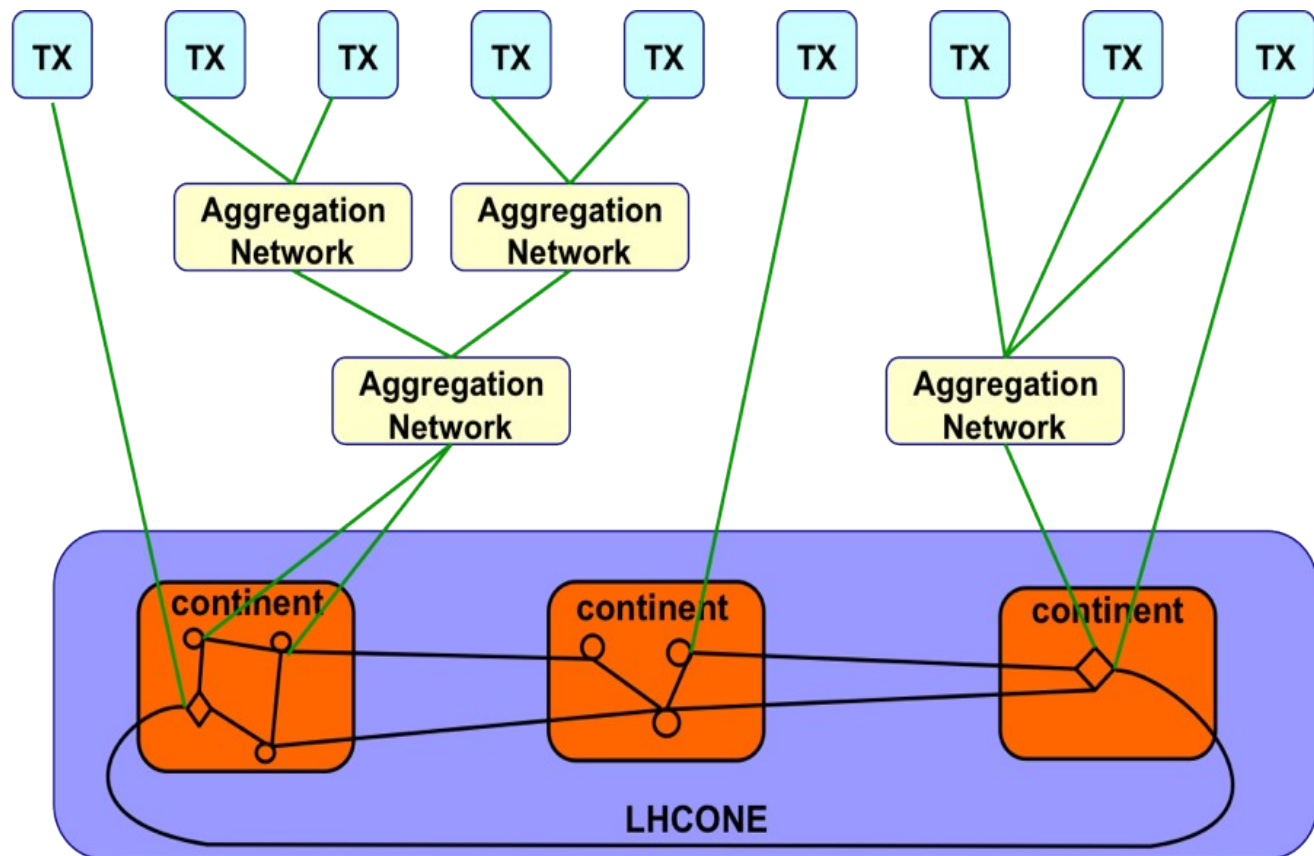








- Serves any LHC site according to its needs and allowing the site to grow
- A collaborative effort among Research & Education Network Providers: sharing cost by federating expensive resources
- Based on Open Exchange Points: easy to join, neutral
- Multiple services for different needs
- Traffic separation: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



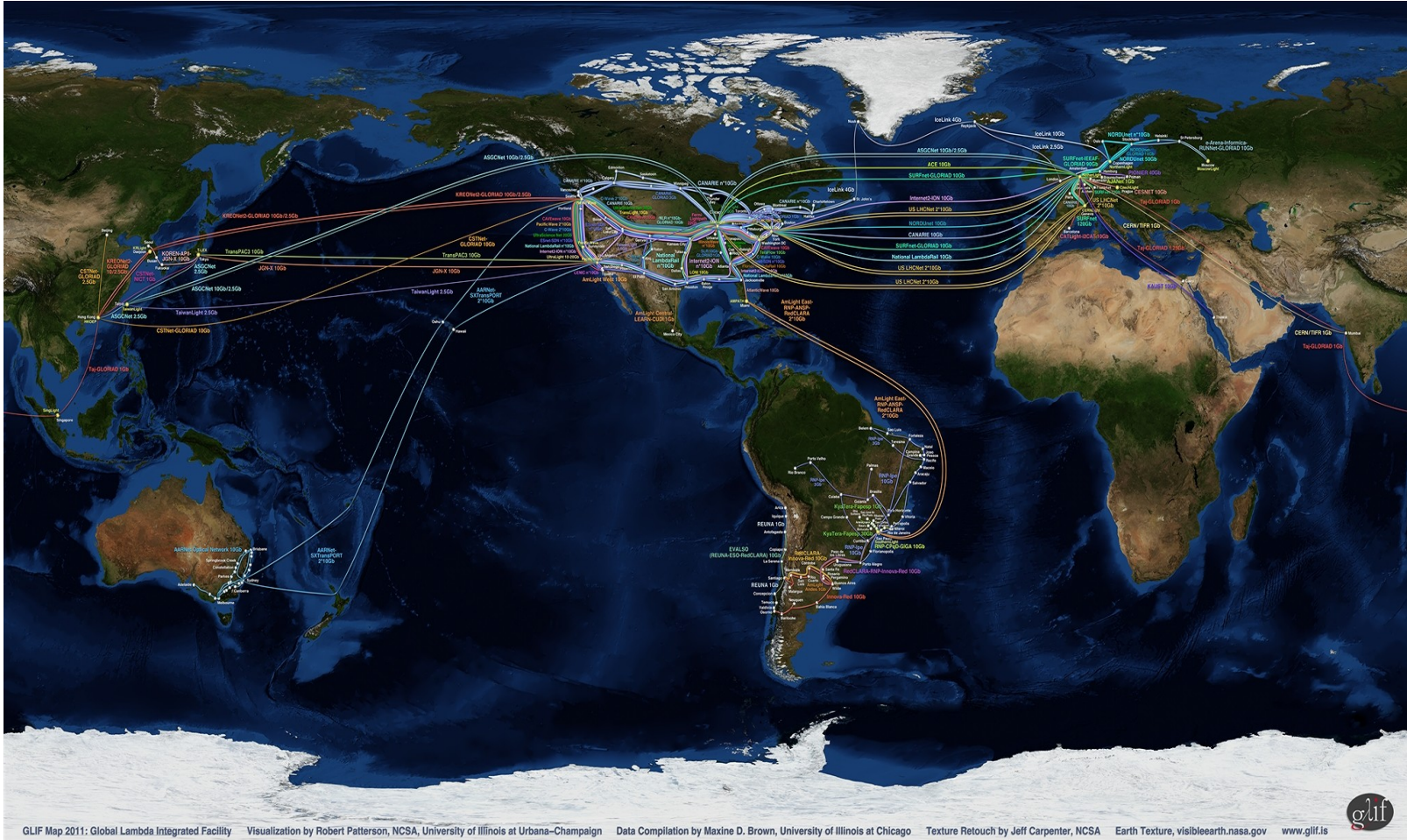
- ◇ distributed exchange point
- single node exchange point

## **LHCONE building blocks:**

- Single node exchange points
- Continental/regional distributed exchange points
- Interconnecting circuits between exchange points

All sharing a common policy





# LHCONE Services

## Services:

- **Dedicated circuits**
- **Shared VLAN/Backbone**
- **Monitoring**

## Point-to-point links connecting pair of TierXs

- Dynamically provisioned
- Secure (private traffic)
- Guaranteed bandwidth



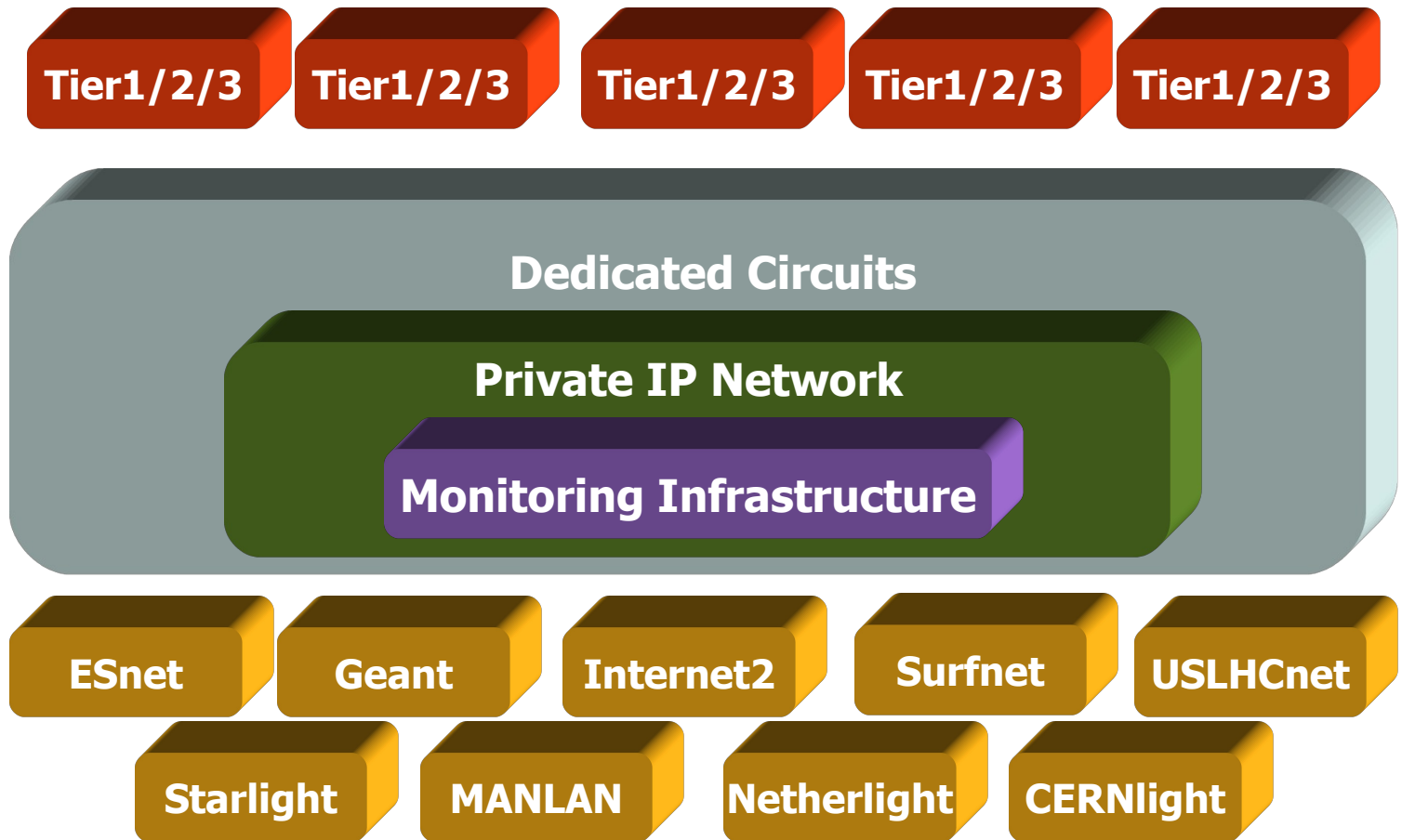
## A private network reaching all the locations

- 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



# Challenges and opportunities

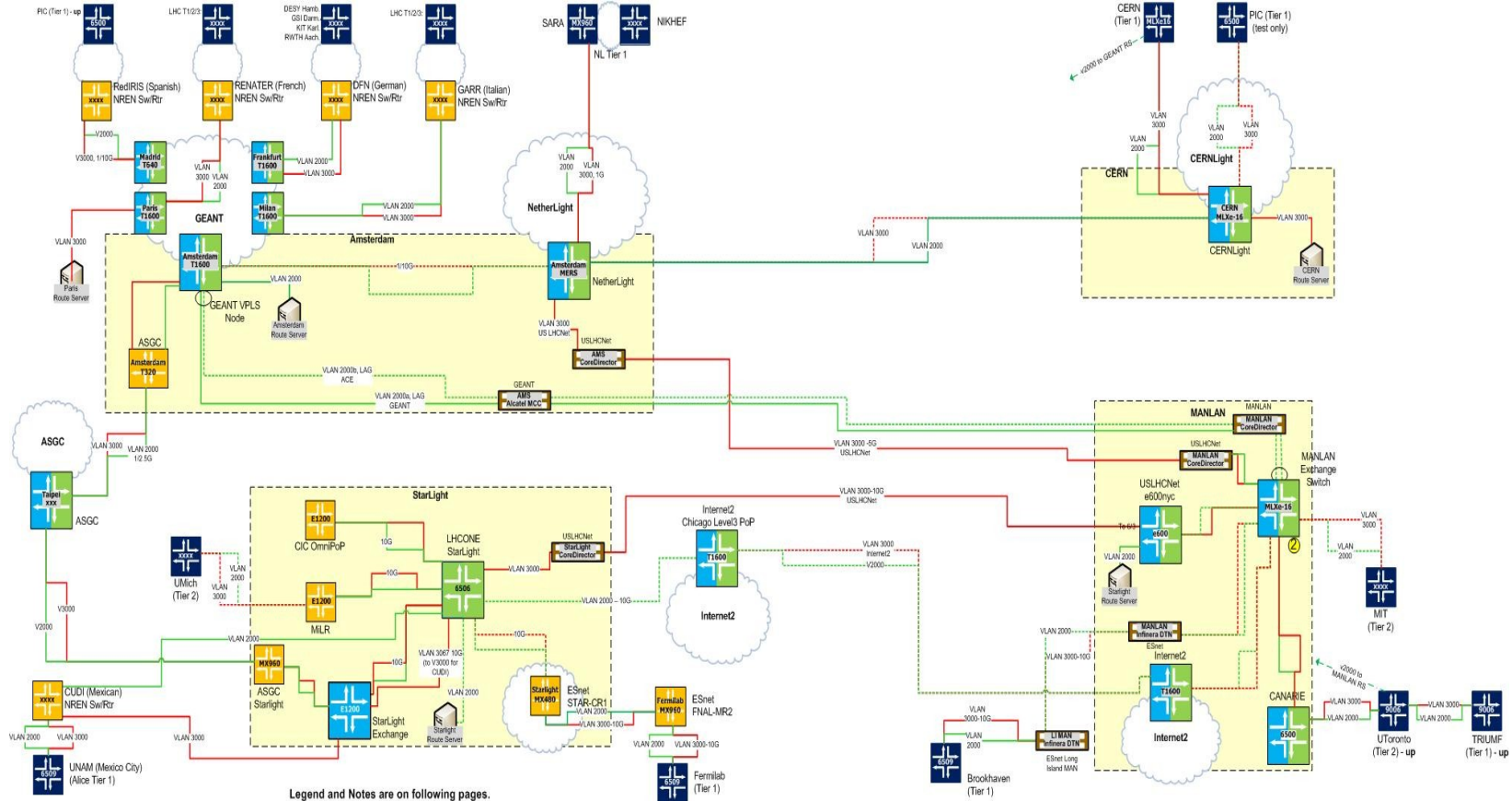
## **LHCONE is a community effort**

- 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/>**