



CMS Network Issues

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Tier-1 to Tier-2 Connectivity

CMS has a documented model in which raw data is portioned out to Tier-1 centers and served directly to Tier-2 centers for nearly 2 years

- ➔ Reconstructed and Raw is assigned to each Tier-1, only AOD analysis data is replicated everywhere
- ➔ TDRs and Model documents have been written
- ➔ Discussions of architecture have happened with the WLCG

Yet we are still debating what network can carry the Tier-2 traffic

Tier-2 traffic is not less important to the experiment, nor is it lower volume

- ➔ Tier-1 to Tier-2 traffic is higher rate than CERN to Tier-1 traffic

Tier-3s also need access to the data



Networks End-to-End

CMS doesn't transfer data between memory blocks, nor do we transmit it between single systems

- ➔ CMS transfers data between storage elements
 - To tape at Tier-1s or to a large number of disk servers at Tier-2s
- ➔ These are groups of systems with responsibilities for receiving data over the WAN at reasonable rate and then serving the data to analysis applications
 - The optimizations are not always completely compatible
- ➔ Need to recognize that the end to end system is more than just to a single disk



Network Utilization and Optimization

So far the network bandwidth has not generally been the limitation

- ➔ During the challenge the highest transfer rate between either Tier-0 to Tier-1 or Tier-1 to Tier-2 is $\sim 2\text{Gb/s}$
- ➔ While 2Gb/s is not terrible it's about 2-3 times lower than we should be able to demonstrate.
- Given the amount of effort required to reach where we are now, we should not underestimate the work required.



Tier-0 to Tier-1 to Tier-2

In CMS Tier-0 to Tier-1 traffic is essentially part of the DAQ

- ➔ The DAQ rate of the experiment is roughly constant
- ➔ If one looks at the evolution of the DAQ rate for an experiment they change slowly

The Tier-1 to Tier-2 traffic is part of the physics mission of the experiment

- ➔ This traffic goes up with accumulated data collected
- ➔ This is the critical transfers for the analysis of the experiment