UW-ATLAS Experiences with Condor

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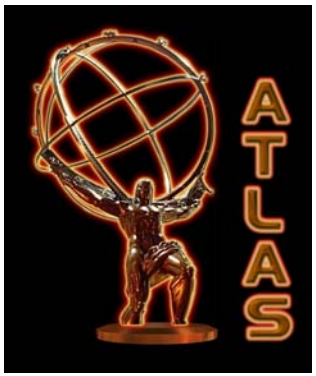


Condor
High Throughput Computing

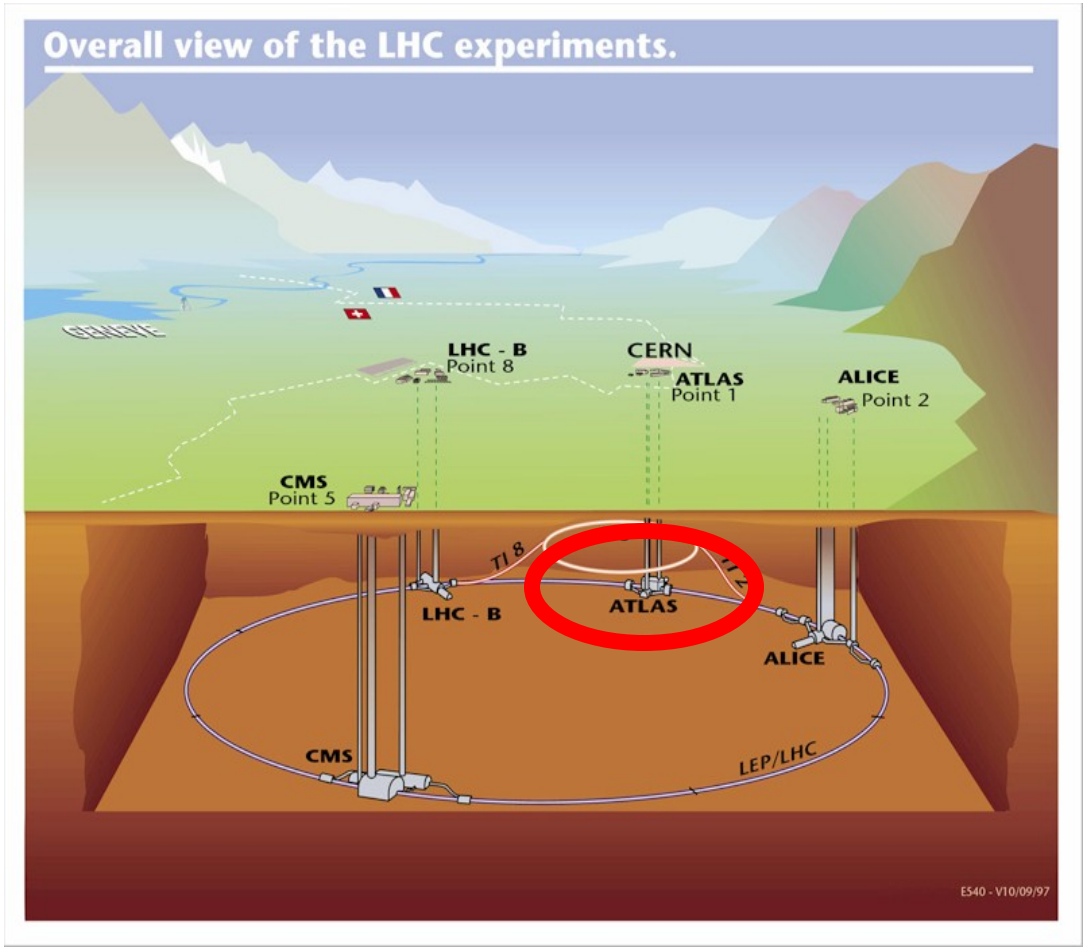
Paradyn / Condor Week, Madison, 05/01/08

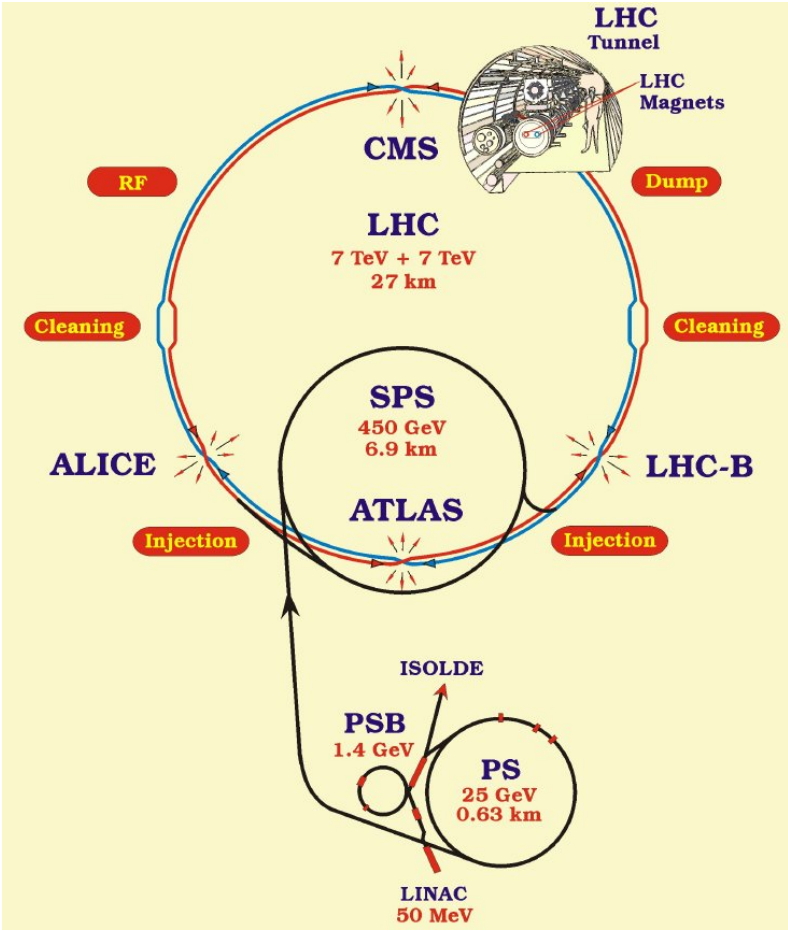
Outline

- **Our first success story with Condor**
  - **ATLAS production in 2004~2005.**
- **CRONUS system**
  - **A success story of using Condor glide-in**
- **A Tier3 model**
  - **Use of multi-layer Condor system**
- **The integration of PROOF and Condor**
  - **Distributed Analysis for ATLAS**

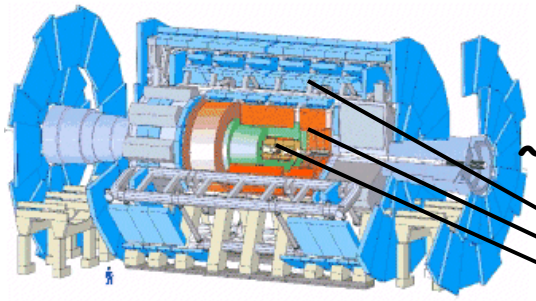
ATLAS at the LHC

Center of mass E	14 TeV
Design Luminosity	10^{34} cm^{-2} s^{-1}
Luminosity Lifetime	10 h
Bunch spacing	25 ns





ATLAS Physics/Computing



~PByte/sec

Online System

~100-400 MBytes/sec

CERN/Outside Resource Ratio ~1:2
Tier0/(Σ Tier1)/(Σ Tier2) ~1:1:1

Tier 0 +1

Offline Farm,
CERN Computer Ctr
~25 TIPS

10+ Gbits/sec

Tier 1

France

UK

Italy

BNL Center

Tier 2

Tier2 Center

~2.5+ Gbps

Tier 3

Institute
~0.25TIPS

Physics data cache

100 - 10000
Mbits/sec

Tier 4

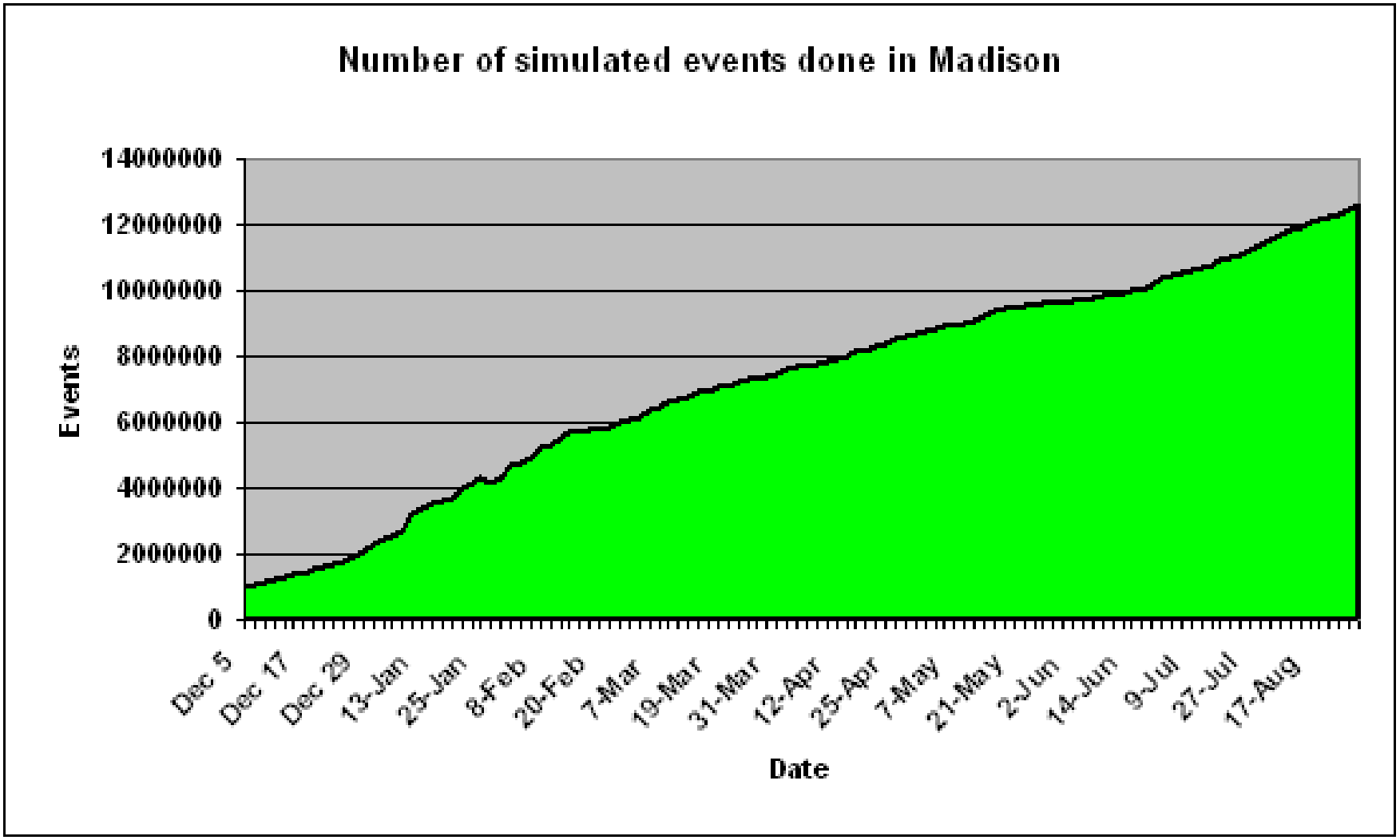
Workstations

Physicists work on analysis "channels"

Each institute has ~10 physicists working on one or more channels

Our first success story with Condor

- Our group started running ATLAS full simulation jobs on GLOW since October 2004
- First large production was from December 2004 to May 2005. Production extended to August 2005
- With help from Condor team, 12.5 million fully simulated Monte Carlo (MC) events was produced in 9 months
  - **Each event takes 10-20 minutes in 2 GHz cpu**
- The Wisconsin group was the largest single contributor of Higgs MC, providing over 90% of all the events produced within ATLAS Higgs Working Group.

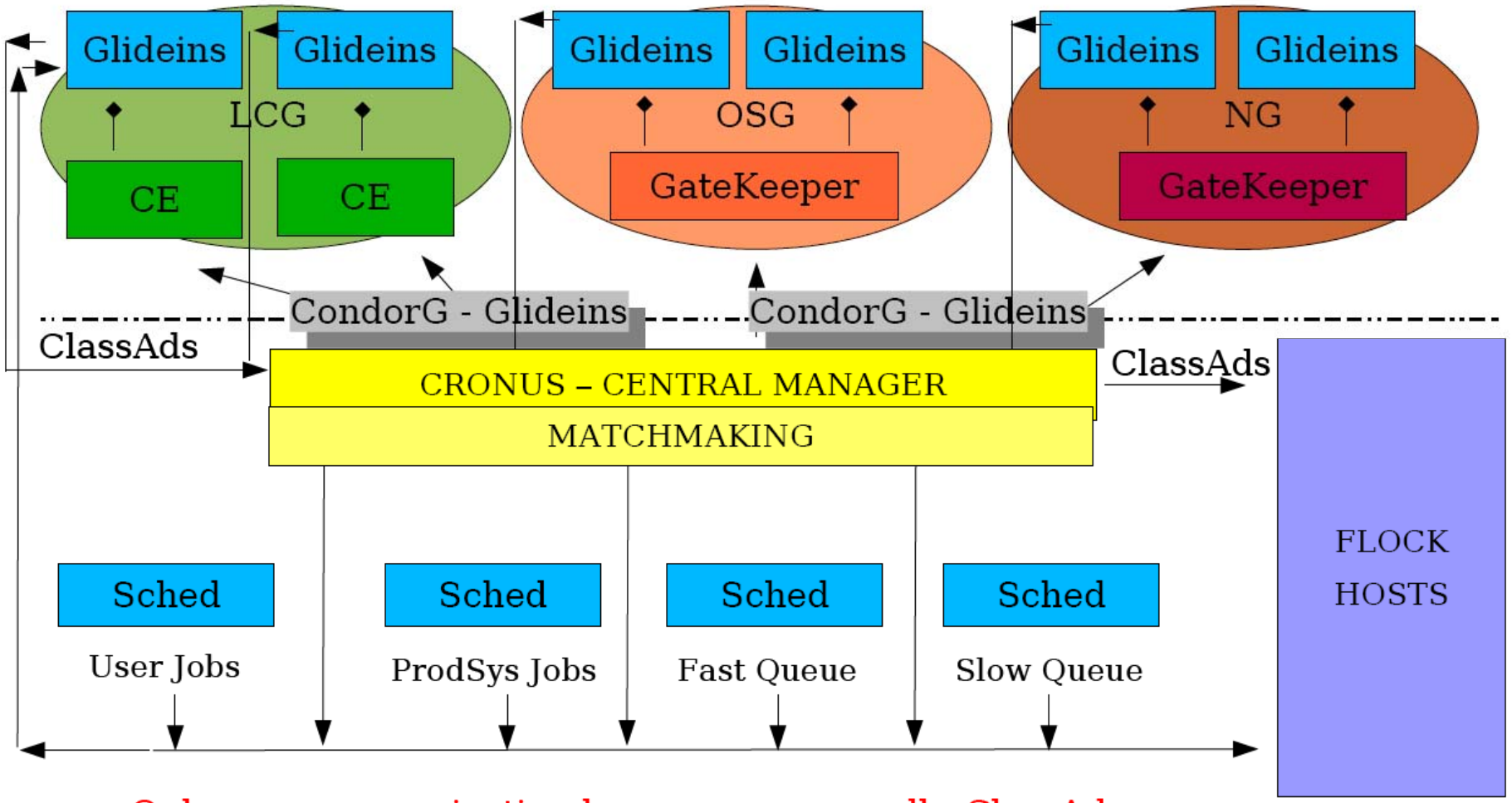

Number of simulated events done in Madison
Events
14000000
12000000
10000000
8000000
6000000
4000000
2000000
0
Dec 5
Dec 17
Dec 29
13-Jan
25-Jan
8-Feb
20-Feb
7-Mar
19-Mar
31-Mar
12-Apr
25-Apr
7-May
21-May
2-Jun
14-Jun
9-Jul
27-Jul
17-Aug
Date

CRONUS system

A success story of using Condor glide-in

- **CRONUS is the first Condor Glide-in Based ATLAS Production Executor.**
- **The development started from 2006 by Sanjay Padhi**

The concept of late binding is intrinsic to Condor via the ClassAds



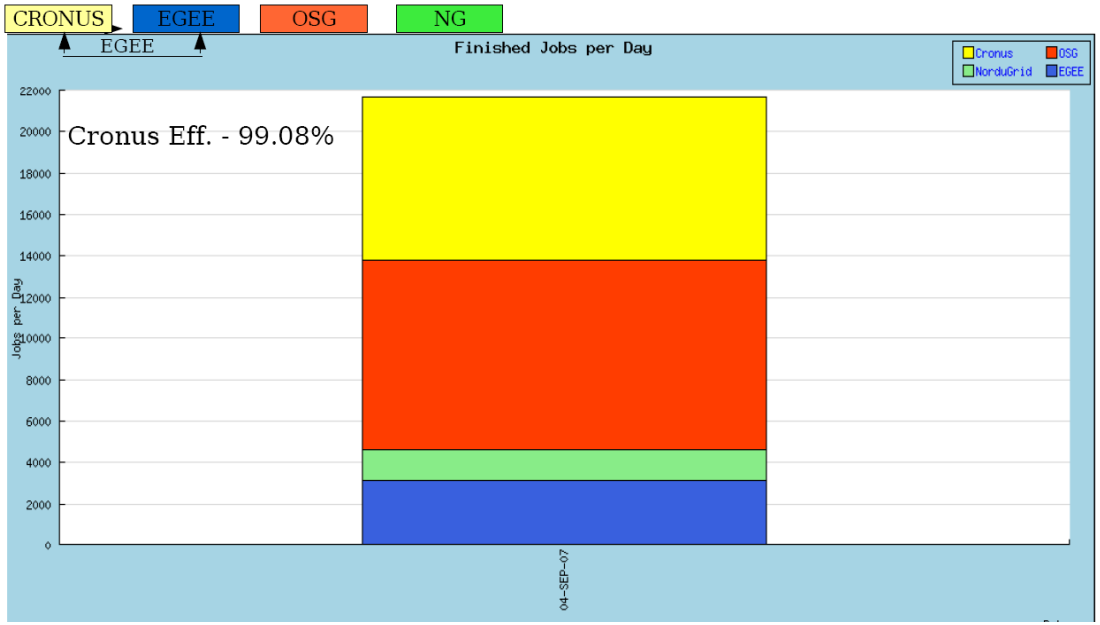
Only one communication language among all - ClassAds

Private Resources

Example of the CPU usage

Glide-In Scalability

ATLAS - CRONUS using ~ 5200 CPUs in parallel [http://lxb2170.cern.ch/condor_view/]

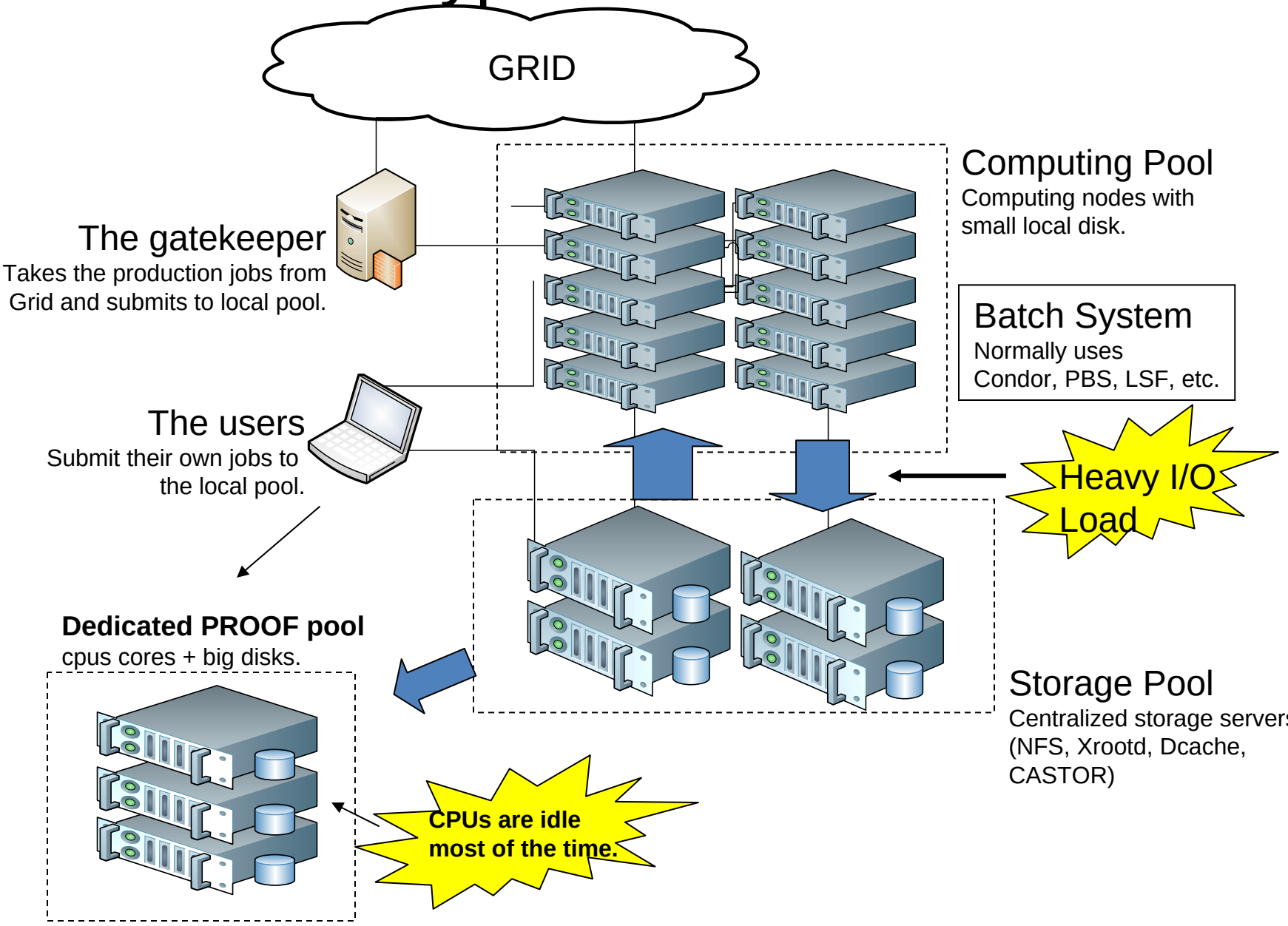


A Tier3 model

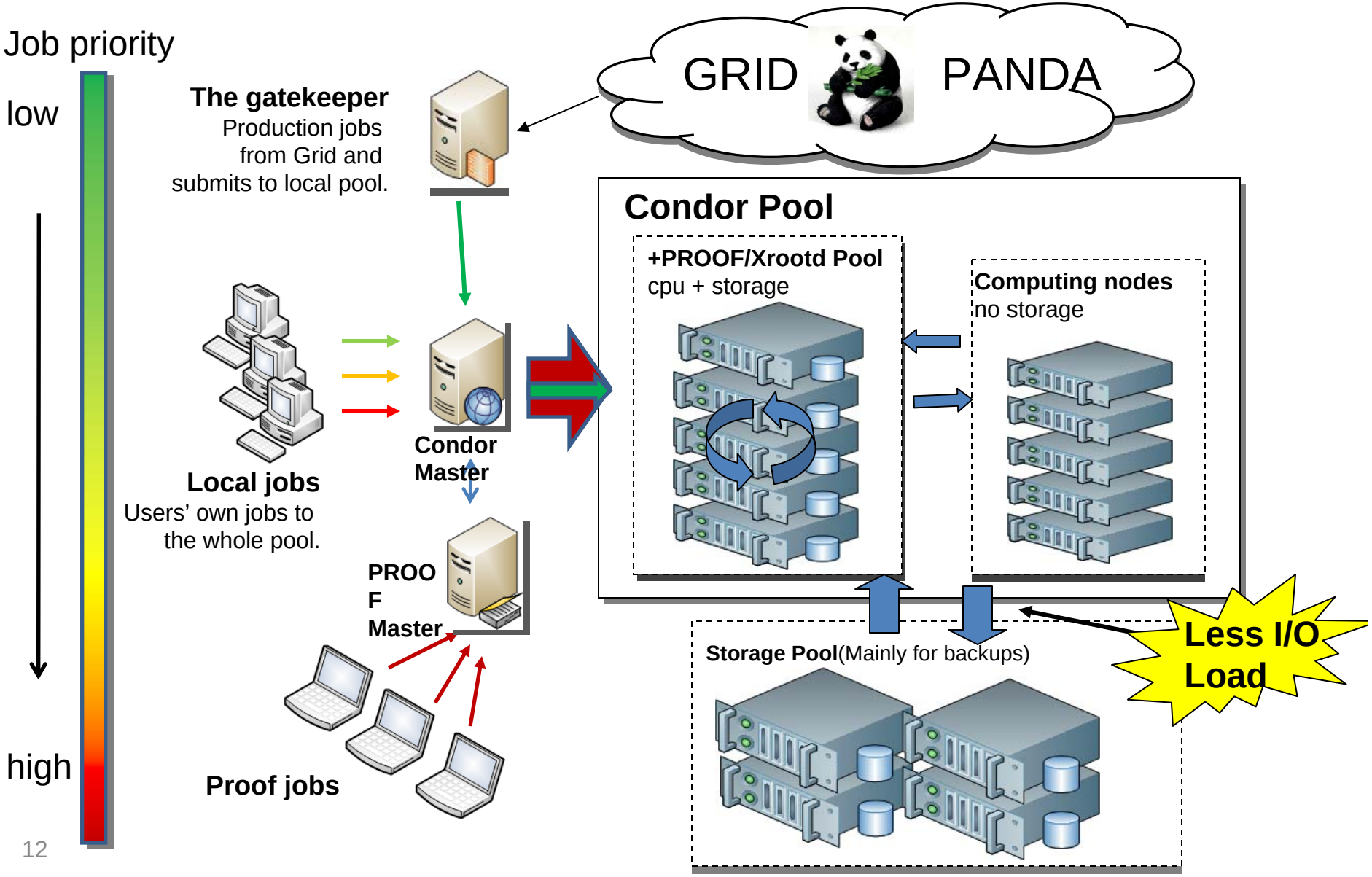
Use of multi-layer Condor system

- UW has a leading role in defining the computing model for universities in the ATLAS collaboration
- Accommodate Several requirements
  - Combination of CPU intensive with less CPU intensive jobs
  - Combination of I/O intensive jobs with less I/O intensive jobs
  - Distributed data analysis jobs (PROOF)

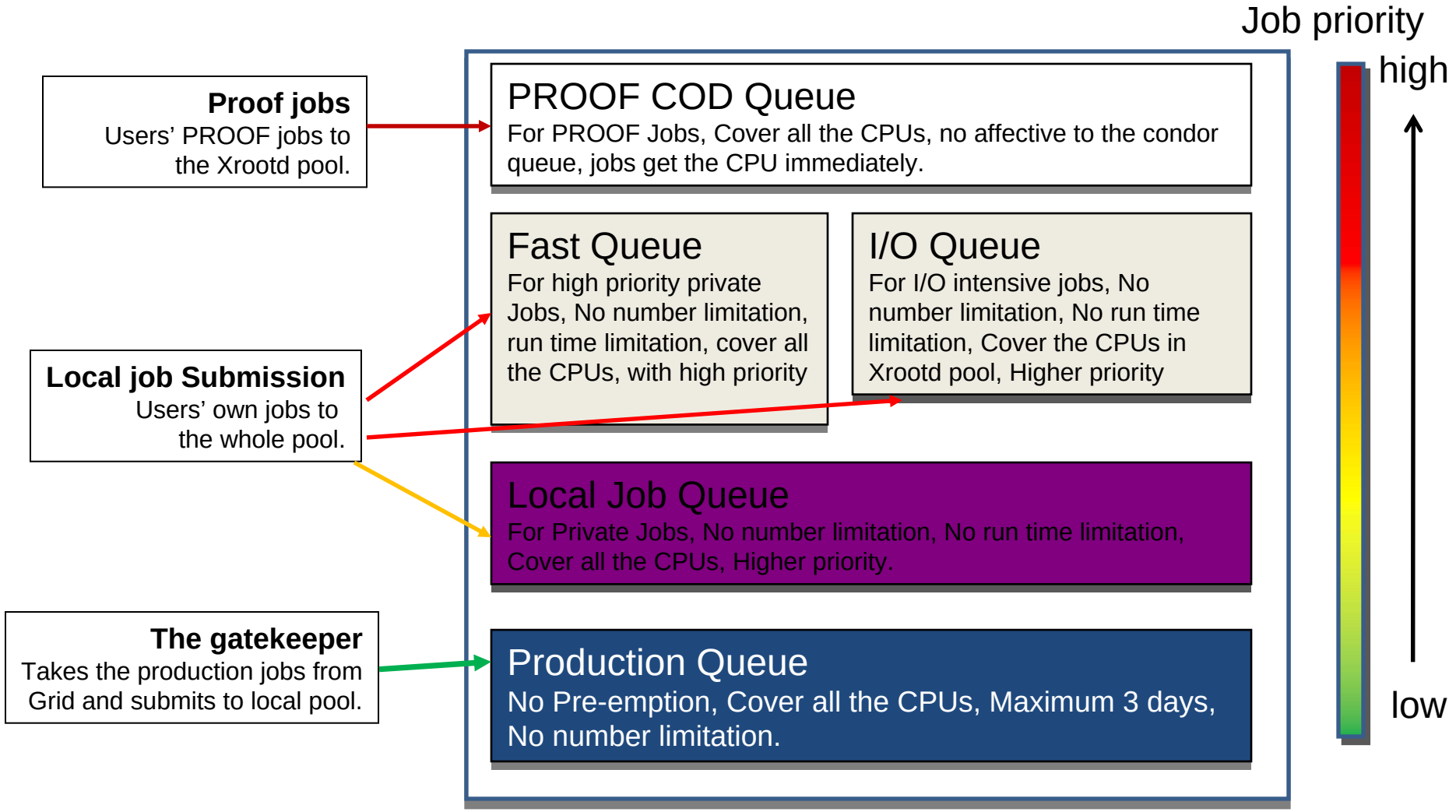
Typical Model



The way we want to go…

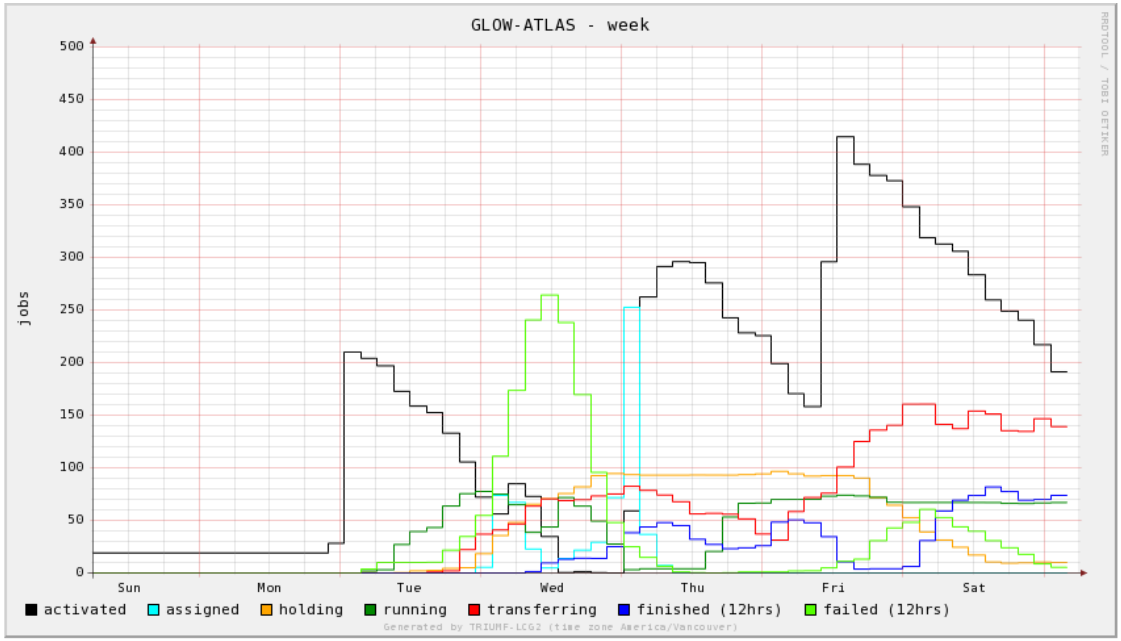


Multi-layer Condor System

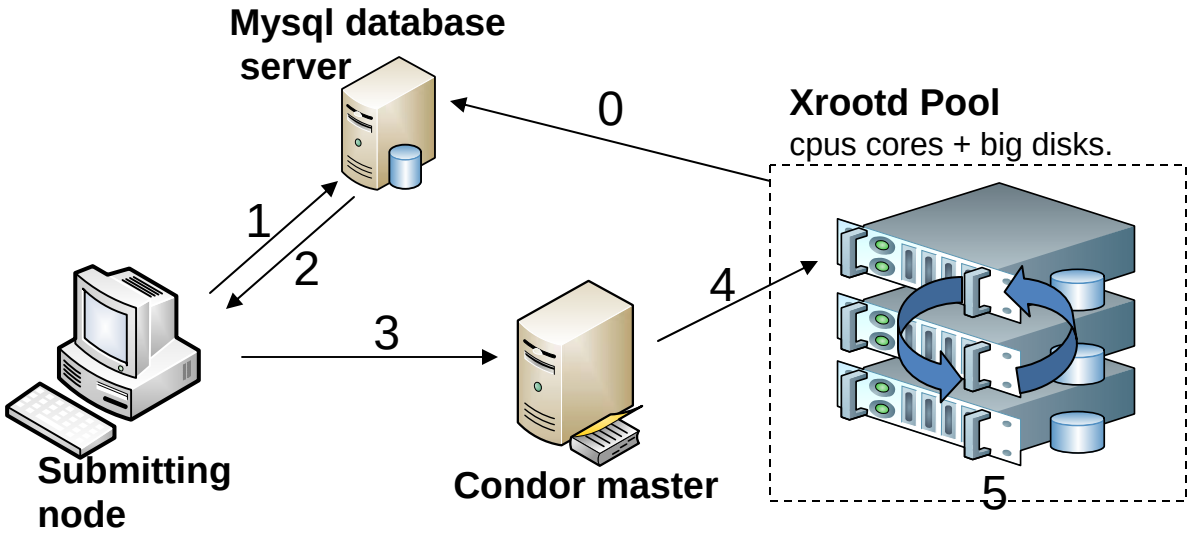


Production with PANDA

- **Following new ATLAS production rules, we integrated into ATLAS central production system PANDA**
- **Currently, about dedicated 100 CPU cores are used by PANDA**



The Principle of the I/O Queue



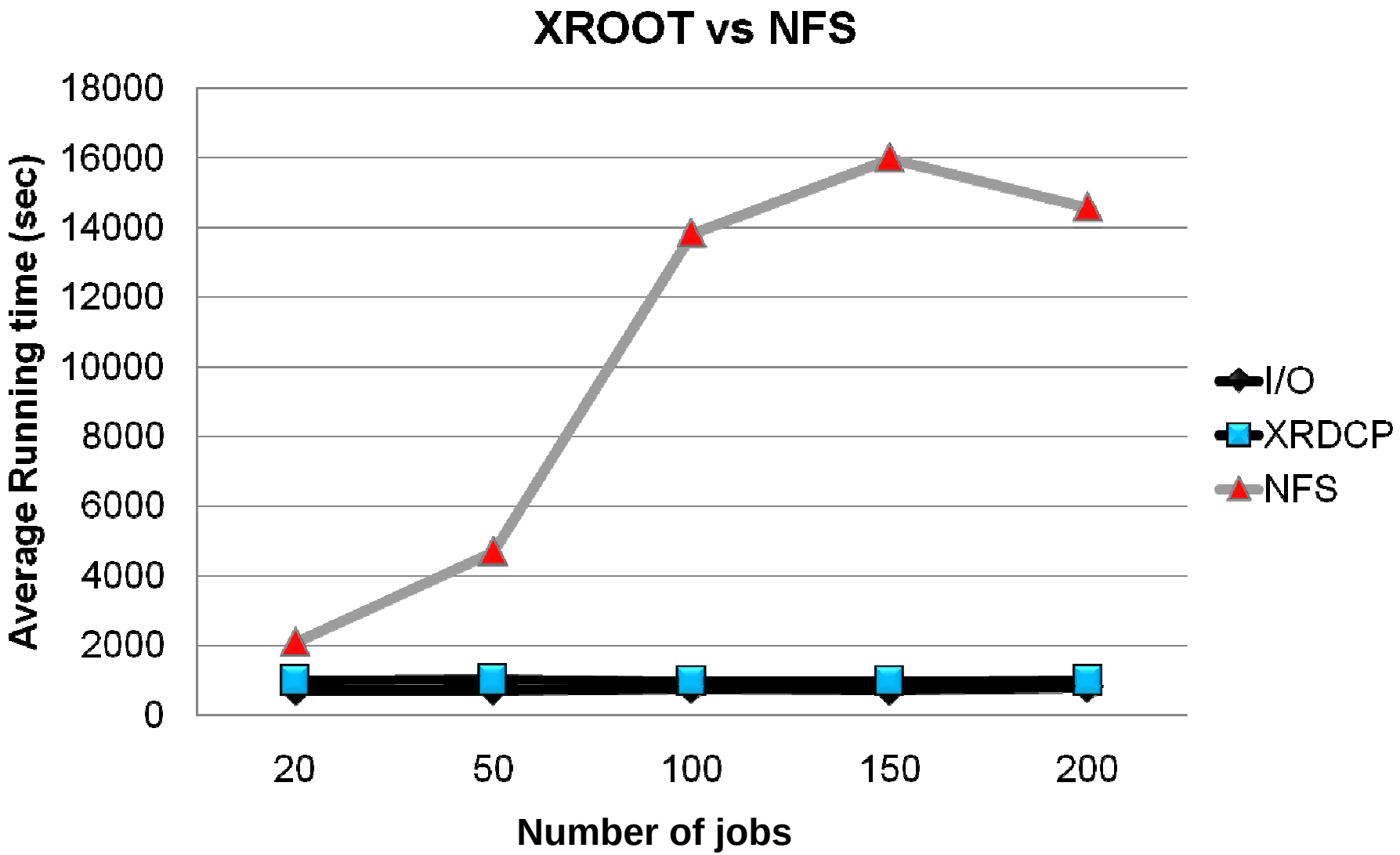
0. The cronjob provide all the file location in the Xrood pool.
1. Submission node ask Mysql database for the input file location.
2. Database provide the location for file and also the validation info of the file.
3. Submission node add the location to the job requirement and submit to the condor system.
4. Condor sends the job to the node where the input file stored.
5. The node runs the job and put the output file also to the local disk.
0. The cronjob provide all the file location in the Xrood pool.

I/O Queue Test Configuration

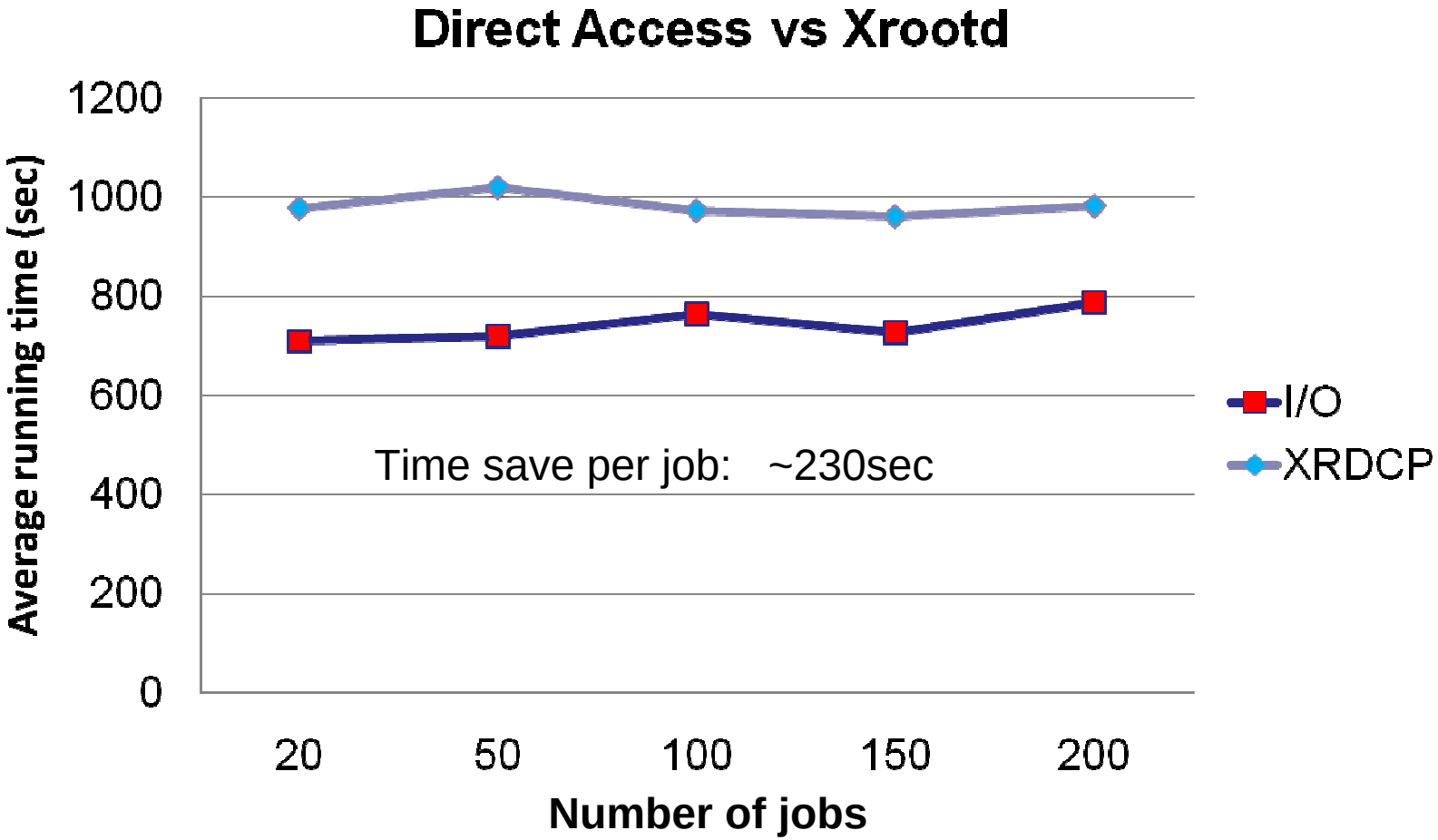
- **Input file (ESD files) size ~700MB**
- **Output File (CBNTAA) size ~35MB**

- **Each machine has ~10 ESD files**
- **42 running nodes**
- **168 CPUs cores**

Test Results

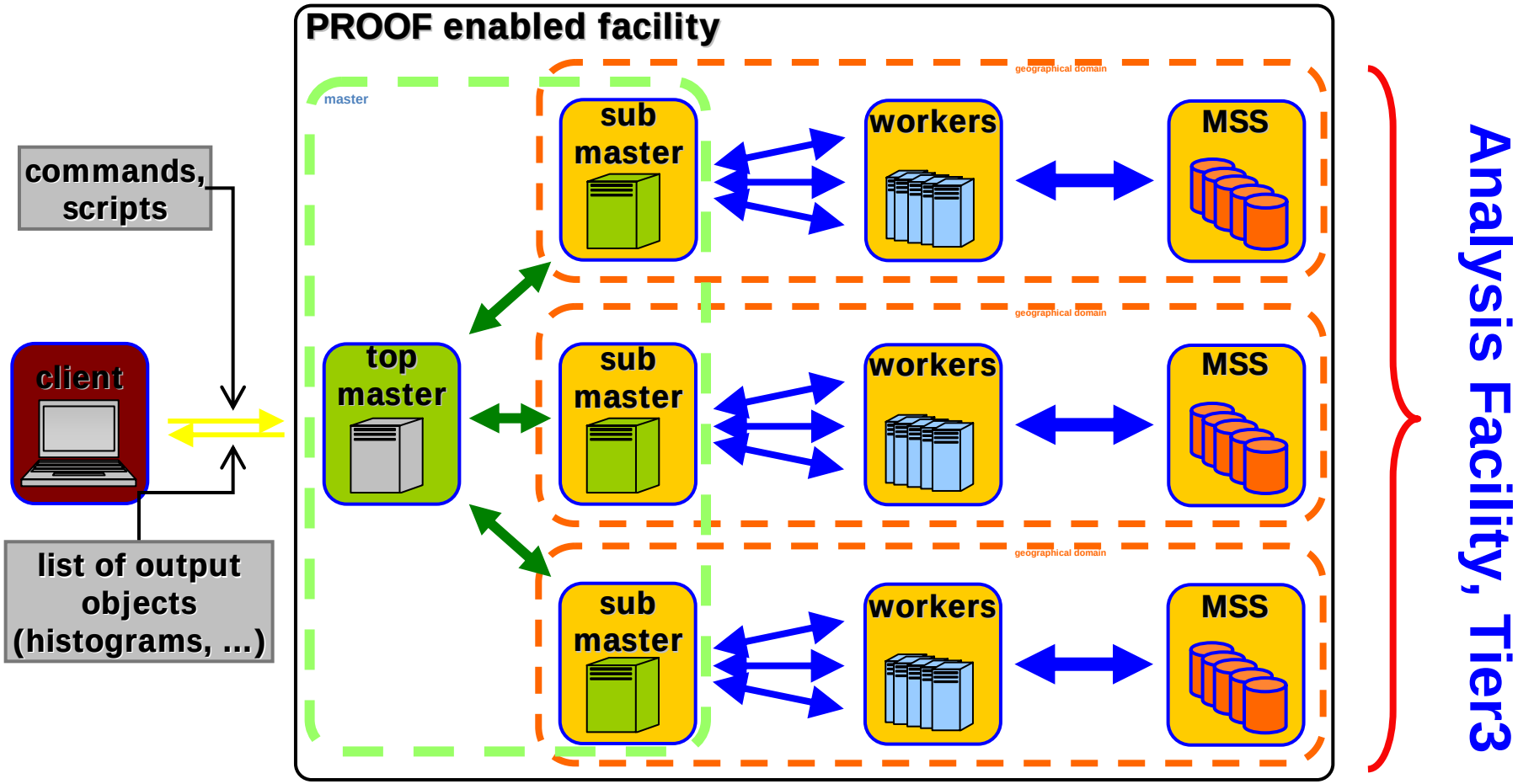


Test Results

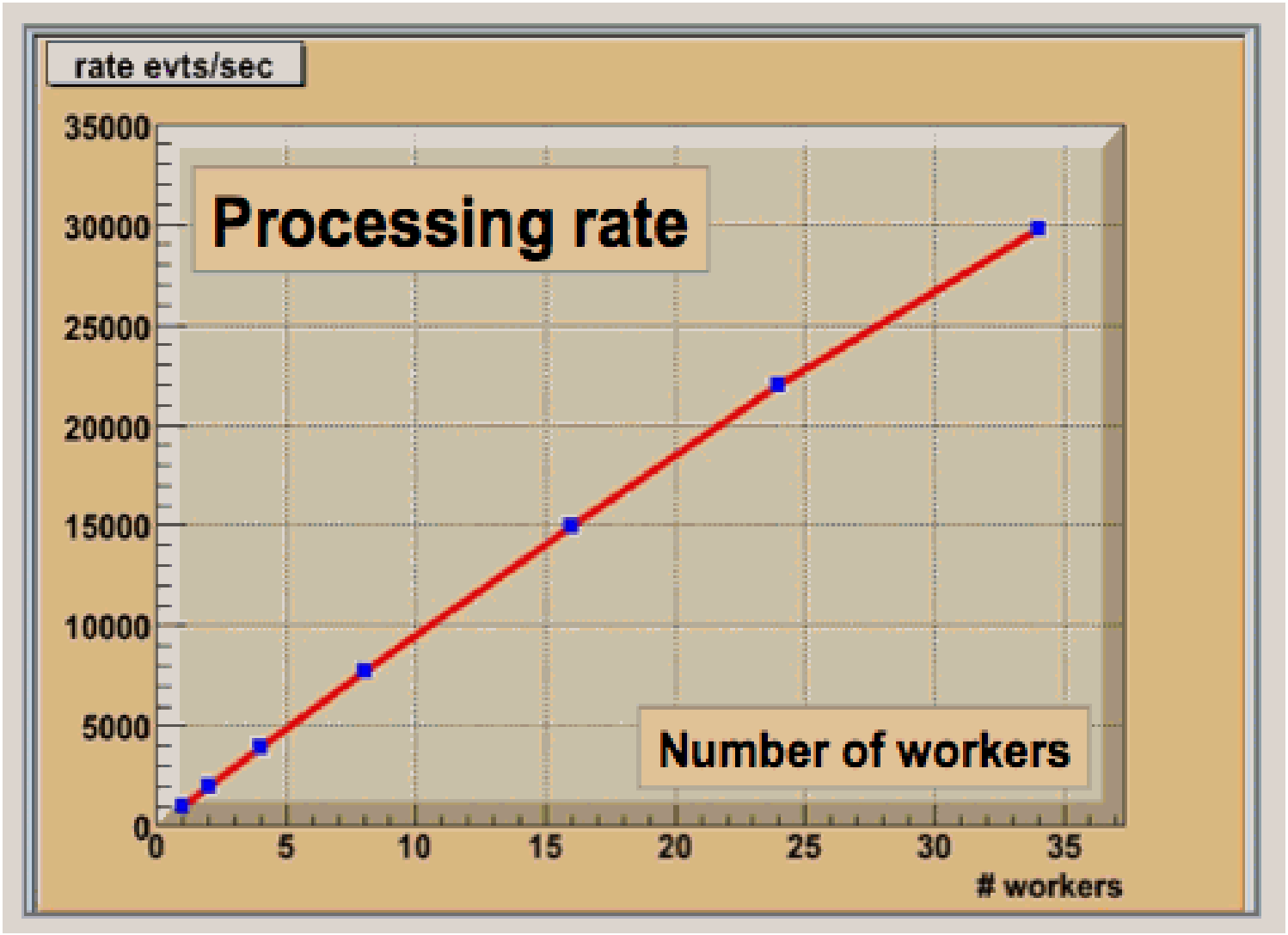


PROOF in a Slide

PROOF: Dynamic approach to end-user HEP analysis on distributed systems exploiting the intrinsic parallelism of HEP data

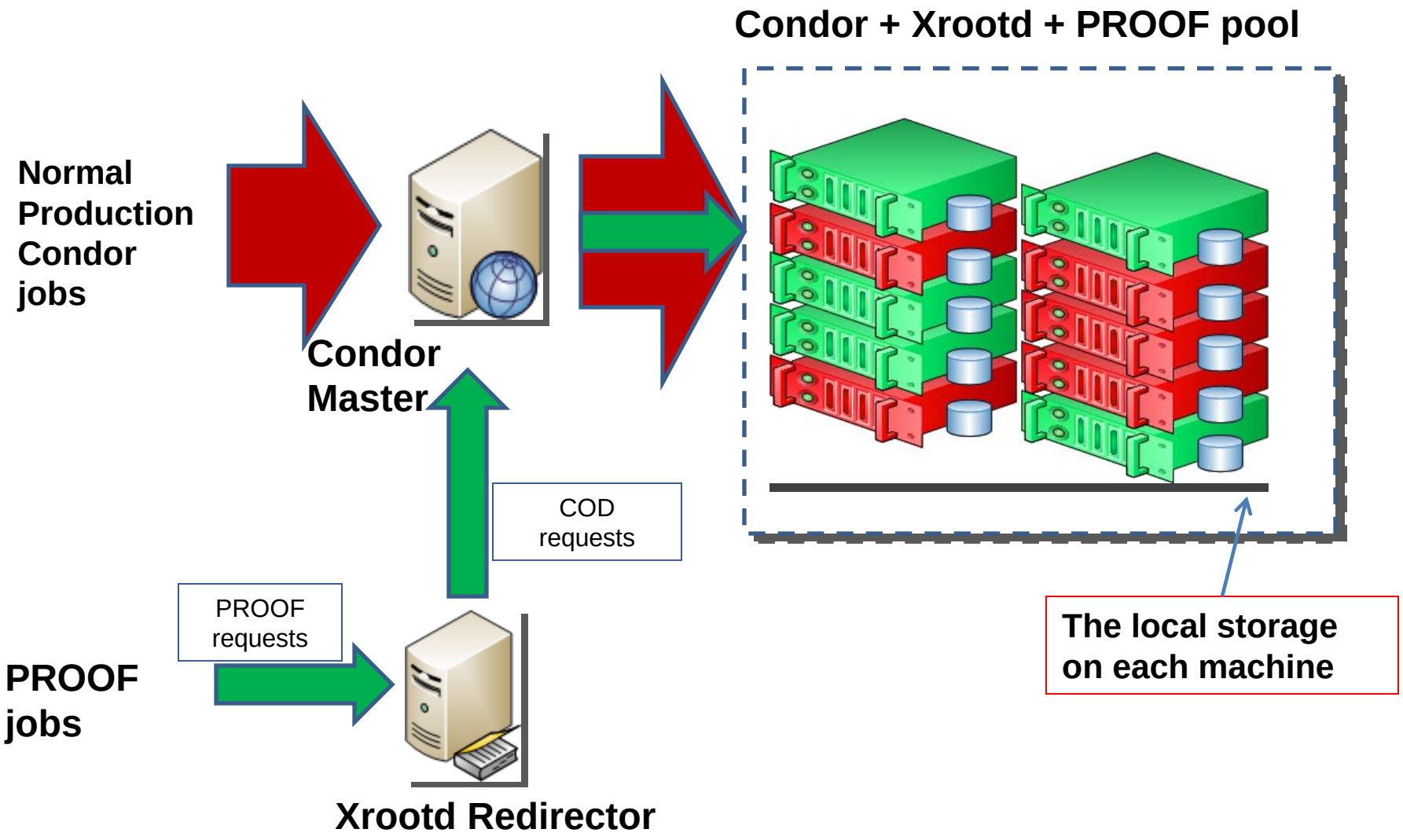


The end Point: Scalability

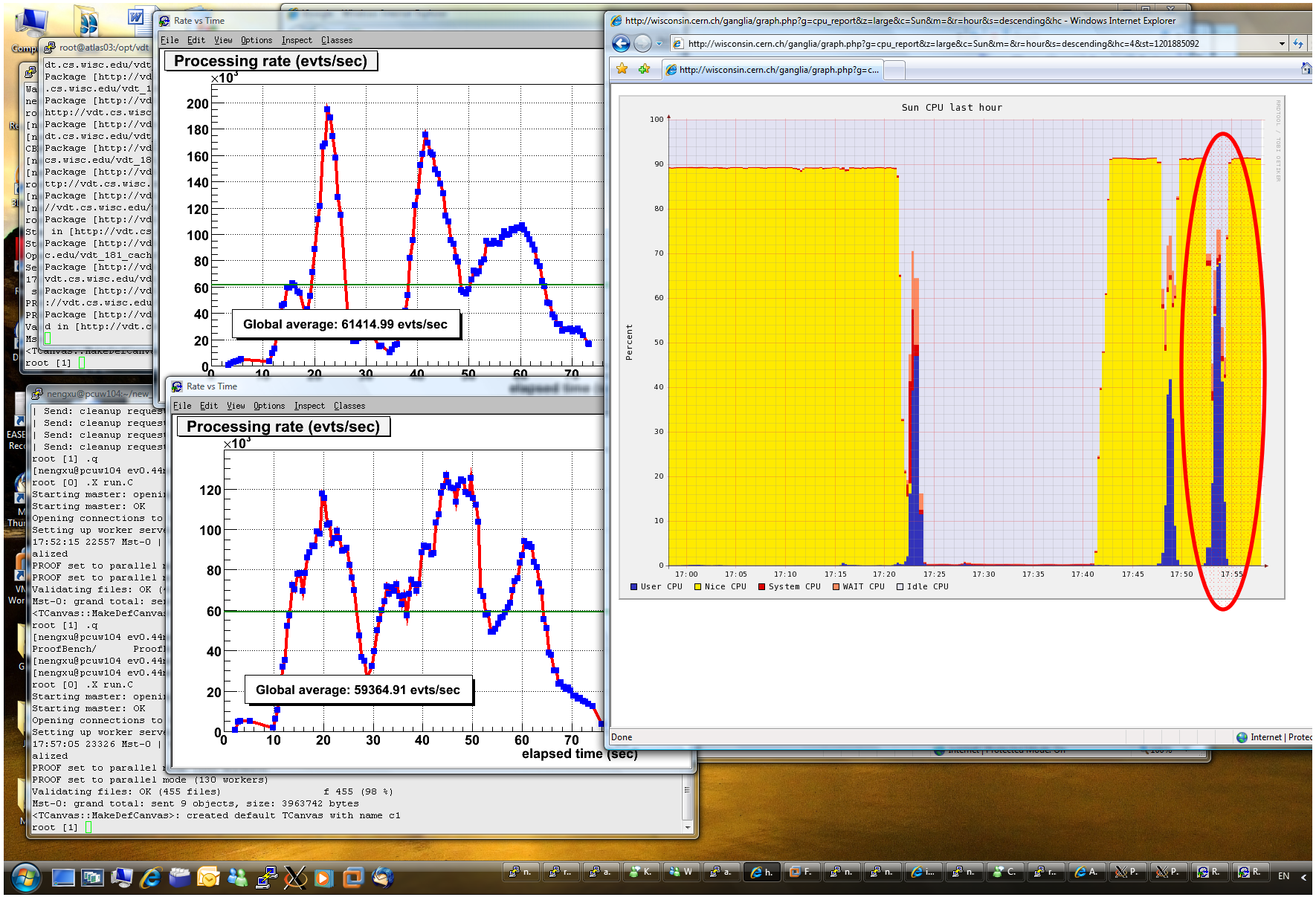


Courtesy of PROOF team

PROOF+COD Model



Single user with 2 sessions

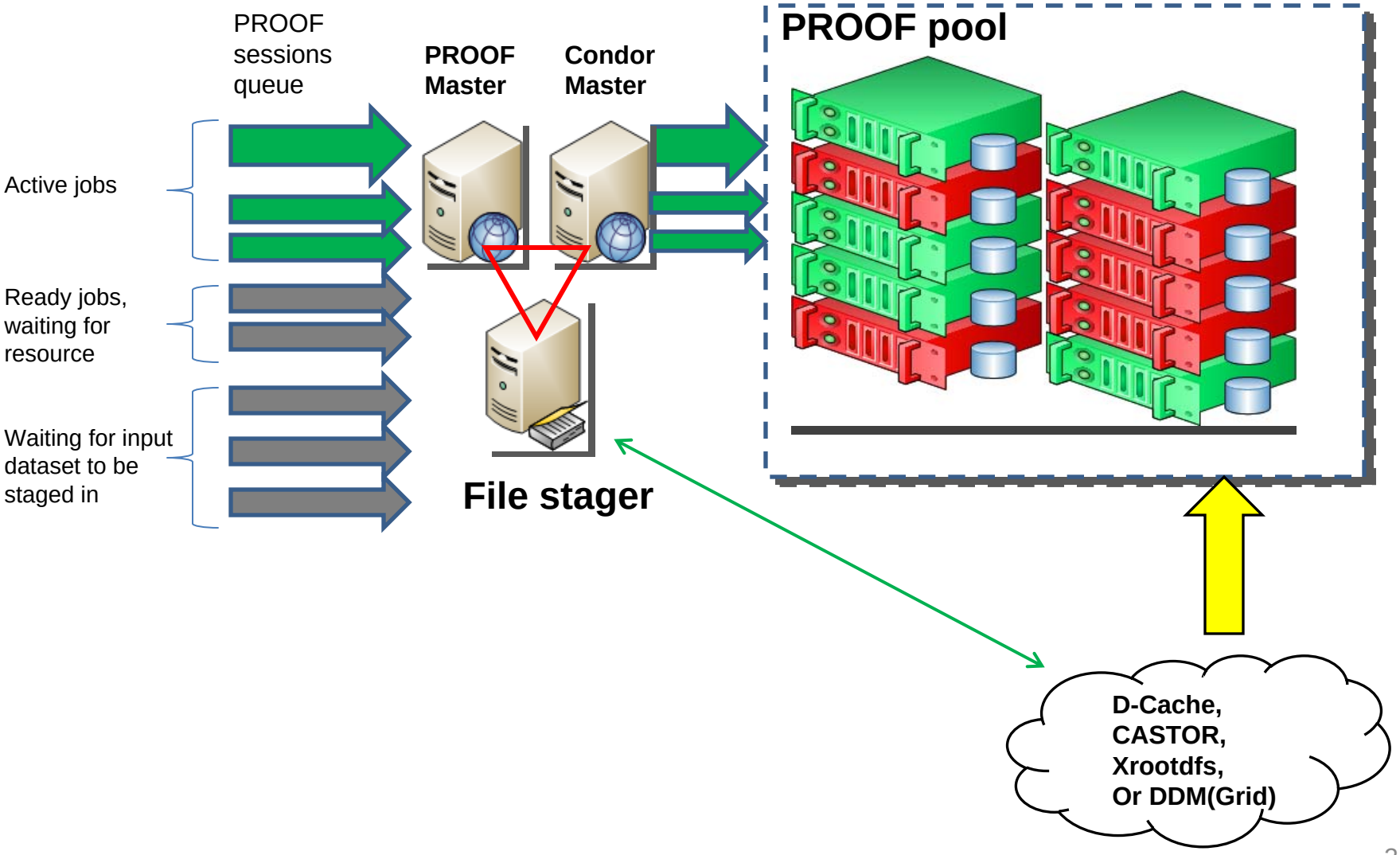


Integration of Condor and PROOF

- **The new Condor+PROOF model try to address following issues:**
  - **Multi-session scheduling**
  - **Automatic dataset stage-in and stage-out of data**

- **See talk by G.Ganis**
  - http://www.cs.wisc.edu/condor/PCW2008/condor_presentations/ganis_proof.pdf

PROOF+CONDOR Model



Outlook and Conclusions

- **Computing demand in High Energy Physics as reached unprecedented levels**

- **The UW-ATLAS group uses capabilities of Condor quite extensively**
  - **Massive Monte Carlo production**
  - **Development of a production system**
  - **Development of model for Tier3**
  - **Development of distributed analysis system**
    - **Integration of Proof/Condor**