Users at Fermilab and Computing Division Services and Directions

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Computing Division Supports

- Run II (CDF, D0, Accelerator Upgrades) ****
- MINOS
- MiniBoone
- Sloan Digital Sky Survey **
- CMS *****
- Lattice QCD Theory with distributed computational facilities**
- CDMS(DAQ) and Pierre Auger
- Test Beams
- BTeV ****
- SNAP(JDEM)
- DES investigations
- Future Neutrino experiments investigations
- Fixed Target Experiments' Analysis (mainly KTeV now)
- Services and Facilities used by all of the above and the lab in general

*represents Large Global Collaboration/Petabyte Datasets/Massive distributed computational power needed

Common Services

- Central Storage and Data Handling Systems
- Networking – local and wide area
- OS support (Linux and Windows)
  - Including central updates and patch management
- Databases, Helpdesk, Desktop and Server support, Mail, etc.
- Engineering and Equipment Support for experiments
- R&D on DAQ and Trigger systems
- Scientific Libraries and Tools
- Videoconferencing support
- And more…

Satellite Computing Facilities to FCC

- Feynman Computing Center (FCC) is out of power and cooling
- FCC UPS and Generator – good place for servers, core network etc.

"High Density Computing Facility" almost finished – computers being installed next week.
2500 KVA facility

Run II meets Lattice QCD – building re-use

Computing goes Global with Grid

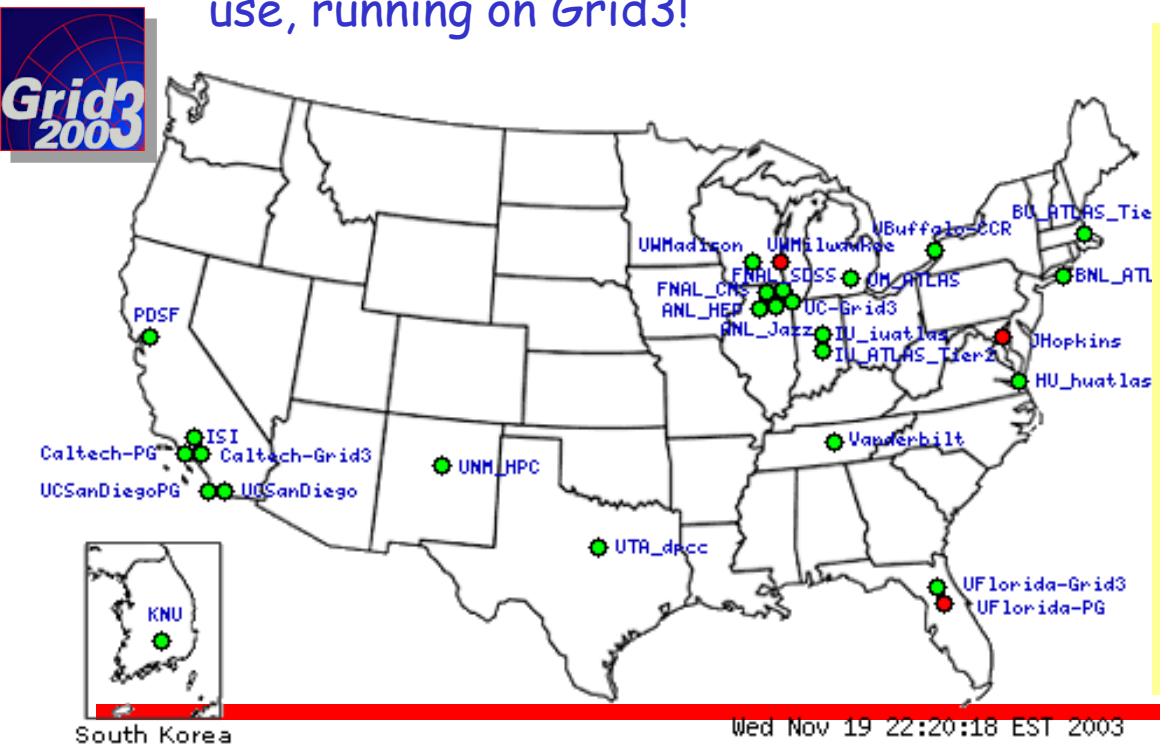
- Increasingly part of the computing for Fermilab experiments is provided off-site
- Fermilab has been in the lead in Grid Computing (even before it became a household word)
  - D0 SAMGrid (now adopted by CDF and MINOS)
  - DOE and NSF funded Grid projects
    - http://www.ppdg.net
    - http://www.ivdgl.org
    - http://www.griphyn.org

SAM-Grid

- SAM-GRID is fully functional distributed computing infrastructure in use by D0, CDF and MINOS (almost)
- ~30 SAM stations worldwide active for D0
- ~20 SAM stations worldwide active for CDF
- D0 successfully carried out reprocessing of data at 6 sites worldwide
  - http://www.fnal.gov/pub/ferminews/ferminews04-02-01/p1.html FermiNews article February
- SAM-GRID is evolving towards common (also evolving?) Grid standards and will run on top of LCG computing environment

Grid3

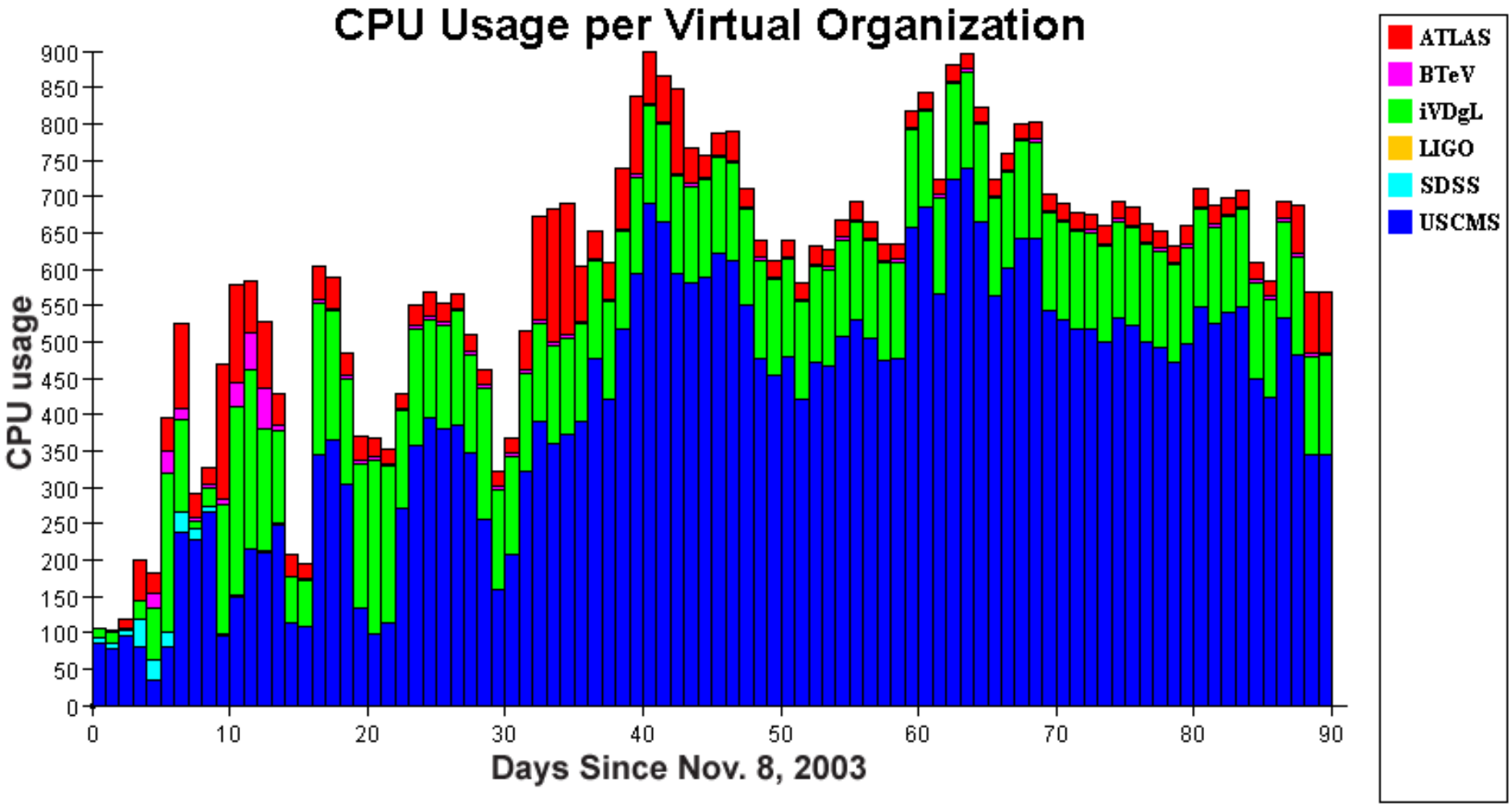
- Grid3 demonstrator for multi-organizational Grid environment
  - together with US Atlas, iVDGL, GriPhyN, PPDG, SDSS, LIGO
  - Fermilab and US LHC facilities available through shared Grid
  - Massive CMS production of simulated events and data movements
  - Hugely increase CPU resources available to CMS through opportunistic use, running on Grid3!



Grid2003: An Operational Grid - Huge Success !

- 28 sites (2100-2800 CPUs)
- 400-1100 concurrent jobs
- 10 applications
- Running since October 2003

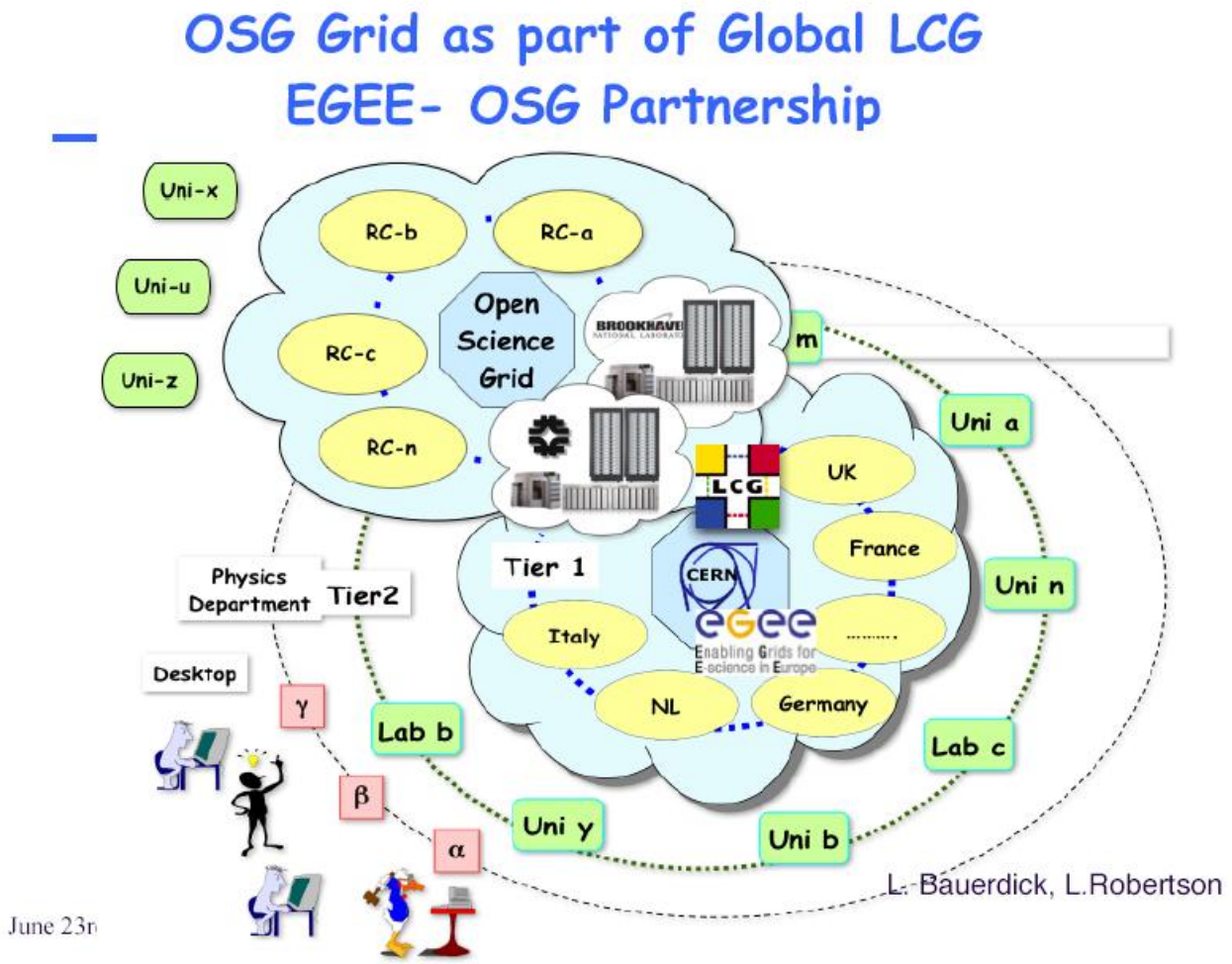
Grid2003: Early 3 Months Usage



Open Science Grid (OSG)

- Goals and White Paper at http://www.opensciencegrid.org
  - Join all of the LHC computing resources at labs and universities in the U.S.
  - Add, over time, computing resources of other high energy and nuclear physics experiments and other scientific partners from Grid Projects
  - The idea is to federate, over time, all of these computers and storage systems and services together into a Grid that serves the needs of all of these physics and related disciplines. But more importantly to invite other sciences to join this Open Science Grid and to invite educators, students and others to work with us as we evolve.
- Jan. 12 meeting in Chicago
  - > 60 participants from labs and universities, Computer Science and Physics and Biology, and Grid Projects
- May 20-21 Joint steering meeting (Physics Grid Projects, LHC experiments, Facility leaders) and partial definition of work plan
- Technical Working groups started – to work with European EGEE (Enabling Grids for E-science and Education) working groups
- Sep 9-10 in Boston
- Sep-November – ongoing Blueprint and Technical Working group meetings
- Grid3 will evolve to 1st version of Open Science Grid in March 2005

US OSG + European EGEE

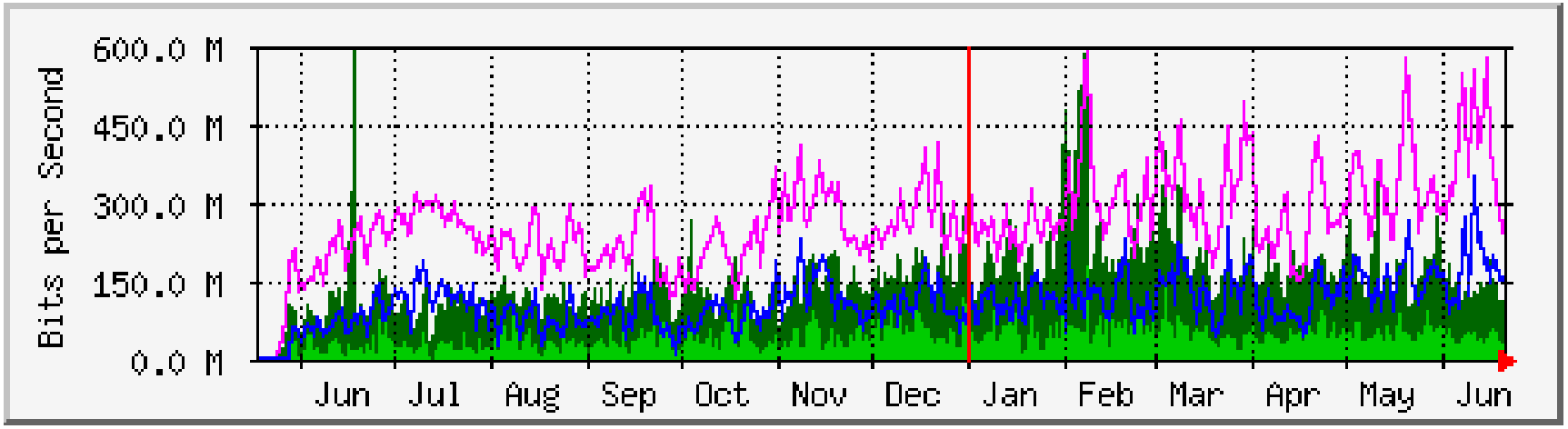


FermiGrid Strategy and Goals

- In order to better serve the entire program of the laboratory the Computing Division will place all of its production computing and storage resources in a Grid infrastructure called FermiGrid.
- Goals for FermiGrid are
  - to optimise use of resources at Fermilab
  - to make a coherent way of putting Fermilab on the Open Science Grid
  - to save some effort and resources by implementing certain shared services and approaches
  - to work together more coherently to move all of our applications and services to run on the Grid
  - to better handle a transition from Run II to LHC (and eventually to BTeV) in a time of shrinking budgets and possibly shrinking resources for Run II worldwide
  - to fully support Open Science Grid and the LHC Computing Grid and gain positive benefit from this emerging infrastructure in the US and Europe

ESNet OC12 Link pretty saturated

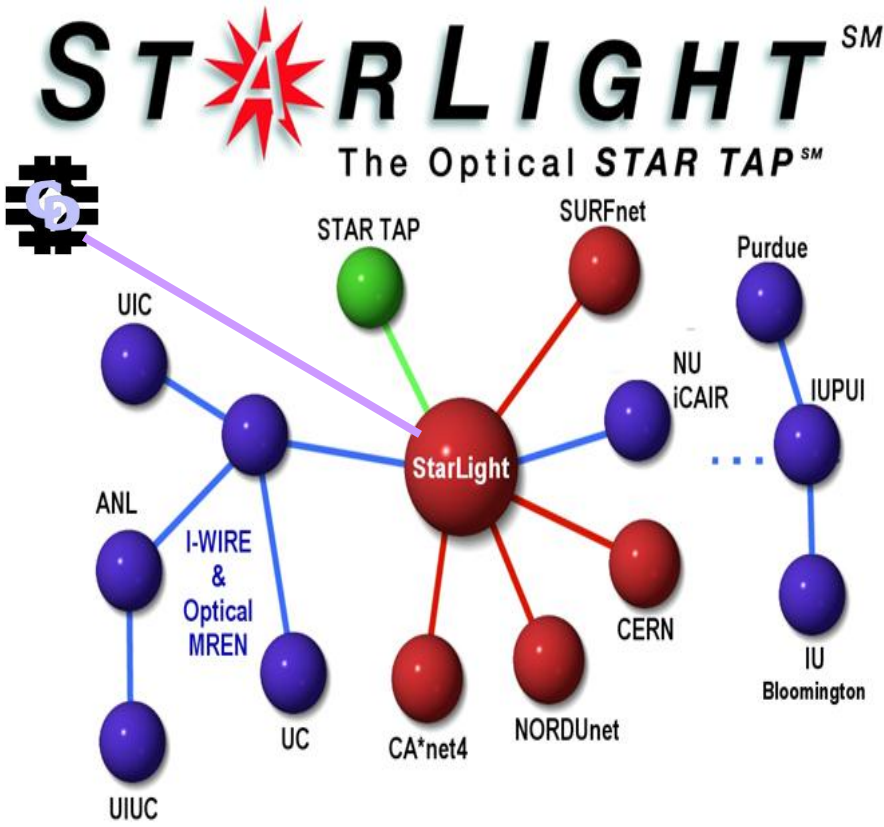
Fermilab Site production network traffic



GREEN	Incoming Traffic in Bits per Second
BLUE	Outgoing Traffic in Bits per Second
DARK GREEN	Maximal 5 Minute Incoming Traffic
MAGENTA	Maximal 5 Minute Outgoing Traffic

"FermiLight" – we are connected to Starlight with dark fiber

- 10 Gbps link – being used for R&D, CMS Service Challenges
- Potential for several partners to connect to FermiLight
- Potential for network R&D – 1 proposal funded



Optical networking interconnection point downtown Chicago.

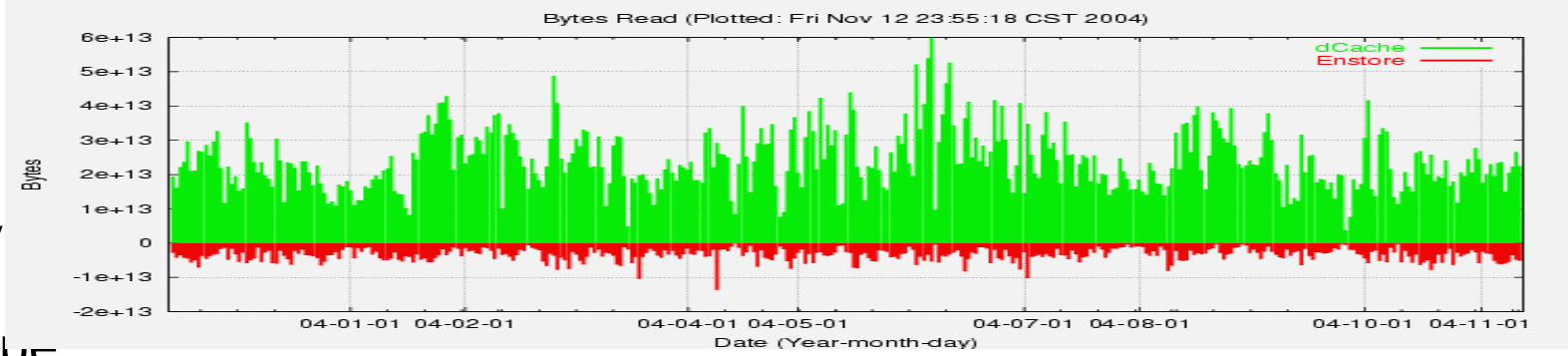
Owned by Northwestern University

Cyber Security

- Increasingly dangerous world – cyber attacks
- Working to keep our lab "Open" so collaboration and new ideas are not inhibited, yet we remain secure
  - Balance risk vs cost (of prevention and of lost opportunities and science)
  - We have some excellent processes for detection and prevention of incidents, system updates, registration of computers, Incident Response team
  - We put controls where we believe we need them
    - eg Business Systems, Core Network, Accelerator Control System, Authentication system, etc.
- DOE (broad DOE not HEP) pushing hard on us with a "fortress" mentality
  - Pushing back - not easy
- Our Kerberos infrastructure (although a bit of a bother) is actually protecting us from a lot of grief
  - CERN has had many root compromises
  - So called Teragrid exploits continue
  - Lot of talk in Government about "One Time Passwords"

State-of-the art Central Storage

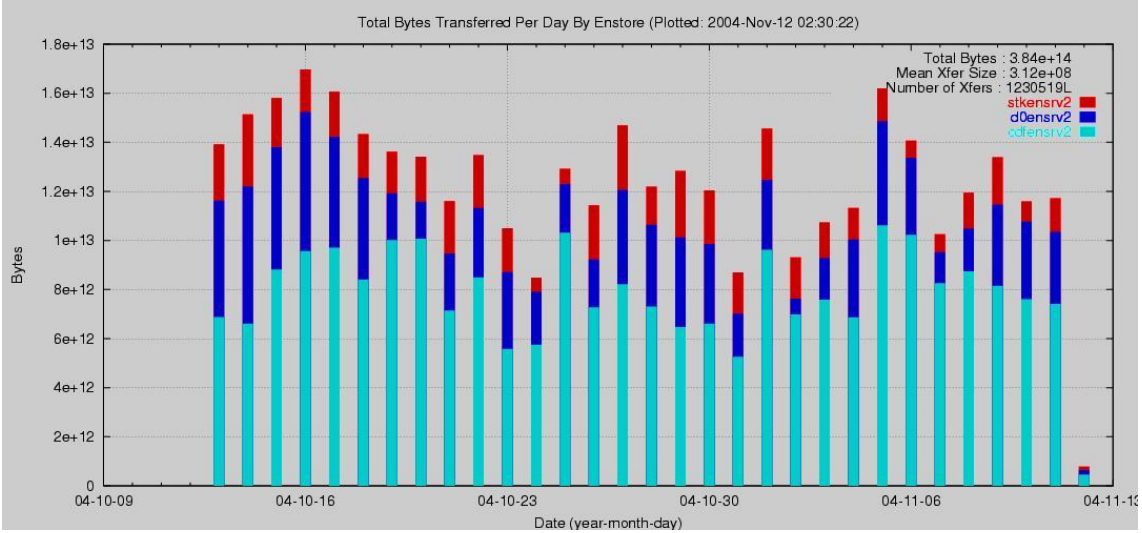
CDF dCache
Data read
Often exceeds
40 TB/day –
Up to 60 TB/day



Data to tape

Experiment	TB
CDF	1040
DO	869
CMS, MINOS,Miniboone, SDSS, Theory, legacy	418

Total Data on tape –
2.33 Petabytes



No more Computer Operators

- All our operations at all 3 facilities are "lights out" and totally automated
- Almost all active data is on tapes in one of our tape robots
- Legacy data service offered via Needfile facility – request to helpdesk
  - Data staged to disk cache
  - Might have to wait up to 2 weeks, but normally 24 hours

Helpdesk

- Have worked on upgrading this service and responsiveness
- New after-hours call center to talk to a live person (off-site service)
  - They will page primary responders for systems and services with 24X7 coverage
- Remedy helpdesk system and database at the core of all tracking and automated calls
  - Retries multiple times, escalates call
  - Our monitoring systems send mail that triggers and automatic help desk ticket and escalated call-in of help if necessary

Scientific Linux – a Fermilab initiative

HEPiX 2004: Proposal by CERN and Fermi:

- Fermi has de-Fermiized their own RHE-clone LTS
- CERN decided to support the effort
- Promise for SL to stay binary compatible with Red Hat Enterprise and sites (on core package set, to be defined)
- Experiments & Projects to acknowledge this binary compatibility of SL & RHE

  = Certify once, run anywhere.
- Positive echo so far.. (labs, EGEE, BaBar)
- CEL3 has been re-based on Scientific Linux

J. Iven, IT-ADC-LE 15 Jun 2004

Ramping up CMS Computing and LHC Physics

- Fermilab is the host for US-CMS and a "Tier 1" Computing center for the LHC
  - Manager of all US-CMS Computing – Lothar Bauerdick
- CD is working (with PPD) to support the creation of an LPC (LHC Physics Center)
  - Program of work to support physics analysis is being defined by Fermilab and University people
  - Leverage Tier 1 facility expertise and people
  - Create a great place to come to work, get access to data and experts
  - Talk to Avi Yagil and Sarah Eno about what YOU want to see