U.S. ATLAS Regional Computer Center

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Outline

- U.S. ATLAS Regional Center
  - What is a Regional Center? (Facility's view)
- NERSC Hardware
  - PDSF HENP Cluster
  - HPSS Mass Storage
- U.S. ATLAS Computing
  - Roles and Responsibilities
- U.S. ARC Hardware & Personnel
  - Data Analysis Phase (2005+)
- Current Status & Future Plans

U.S. ATLAS Regional Center

- The U.S. ATLAS Regional Center (ARC) will provide U.S. ATLAS collaborators with **access** to ATLAS data (~100 TB/year of ESD & raw data) and most of the CPU needed to analyze it.
- The role of the lead laboratory and regional center is to provide an adequate level of **support** so that university researchers will be able to contribute significantly to the software development and ultimately to the efficient and effective analysis of ATLAS data.

U.S. ARC Facility

- Hardware & Data Access
  - CPU, Disk Storage, Tape Storage, Networking
- Software Access
  - ATLAS Software, HENP Software, Dev. Tools, etc.
- Service (People)
  - System Operation; User & Developer Support & Training; Code Management, Testing, & Distribution
- Reference Architecture for "Tier-2 Clusters"
  - Sanctioned hardware, standard load
  - Computational Grids, Cycle Scavenging, WAN Access

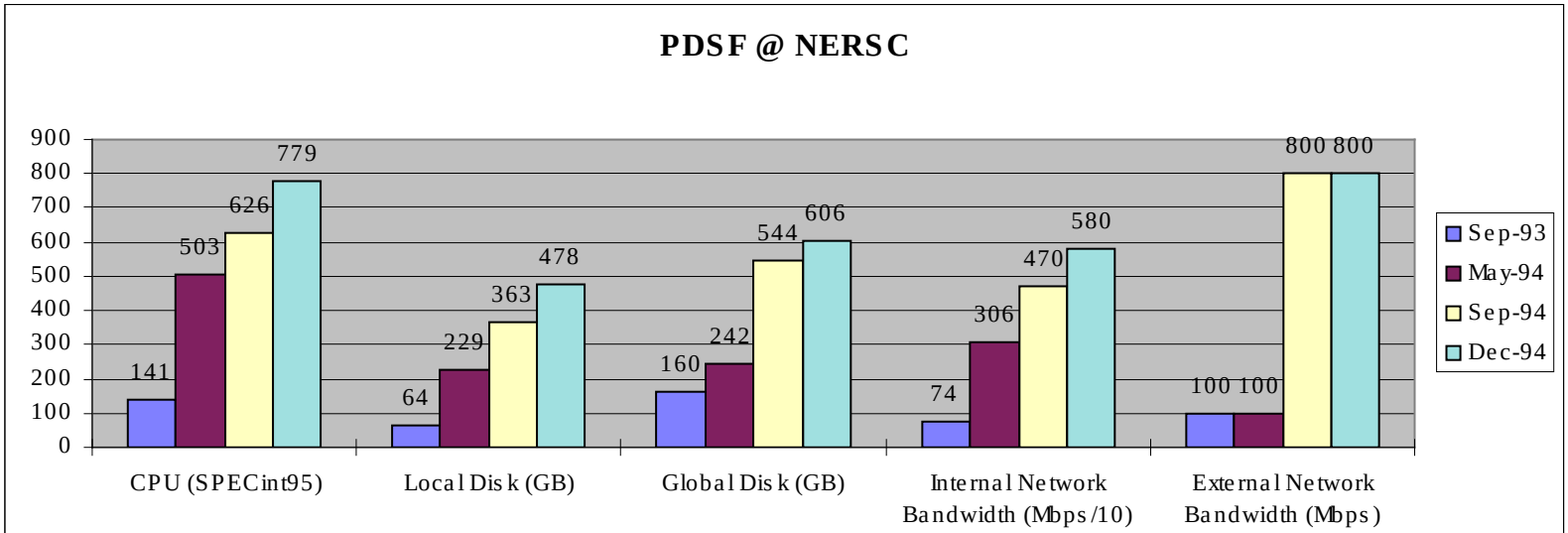
NERSC @ LBL

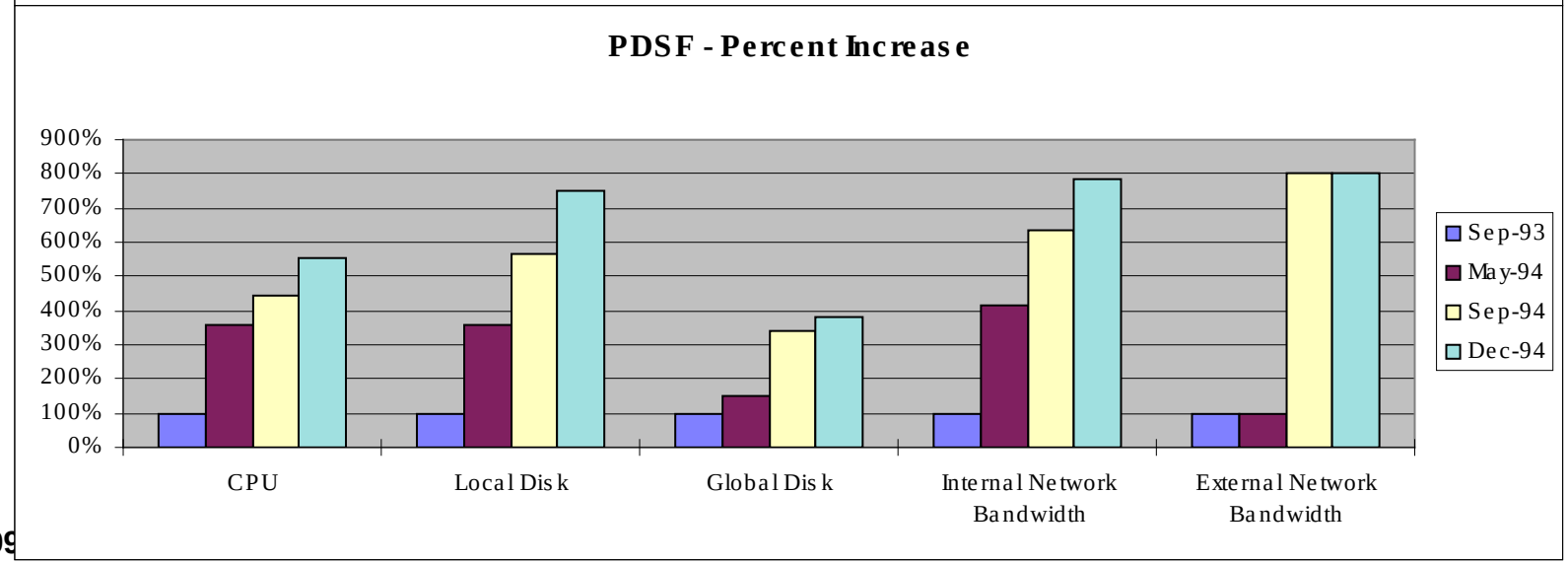
- National Energy Research Scientific Computing
- Largest non-classified compute facility in U.S.
- 2000 Active Users (1000 Heavy Users)
- HENP @ NERSC
  - Computing Science: Grand Challenge, Clipper, LDRD
  - Hardware: PDSF, HPSS, T3E, Viz Lab, Network
  - Nuclear Science: STAR, PHENIX, E895, NA49, etc.
  - Physics: ATLAS, BaBar, CDF, D0, etc.
- LBL: ESnet Site & ESnet Hub

NERSC's PDSF

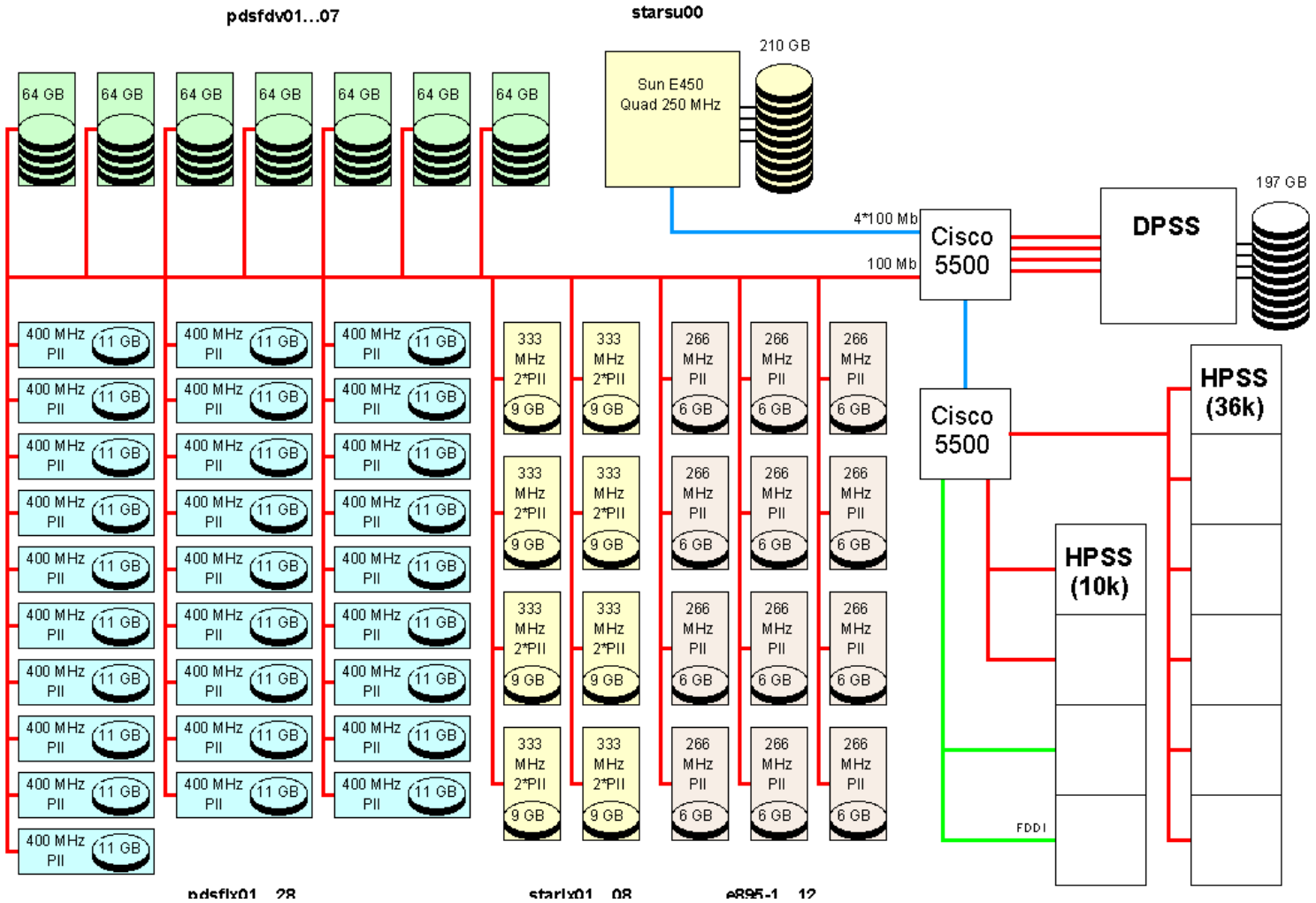
- Parallel Distributed Systems Facility
- Specialized hardware resource for use by HENP
  - ATLAS, BaBar, CDF, D0, E895, PHENIX, STAR, astrophysics, etc. (14 exp.s/grp.s, >200 users)
- NERSC/MICS operating funds (2 FTE)
- FY1998 upgrade funds
  - Replaced SSC vintage hardware
    - HP, Linux, Sun, SGI ⇒ Intel/Linux, Sun/Solaris
  - Upgrade PDSF ⇔ HPSS Network
  - LSF - Load Sharing Fac. (166 node/110 dual/66 quad)

NERSC PDSF - FY98 Upgrades





NERSC PDSF - Jan. 1999



NERSC HPSS Scale

- Current Size of NERSC HPSS
  - 4 independent systems
  - 10 tape robots (total 46000 tape cartridges)
  - 60 tape drives
  - 14 control & mover nodes
  - 2.5 TB disk (metadata & cache)
- Current Usage of NERSC HPSS
  - 68 TB of Data (48 TB user + 20 TB backup)
  - ~1.7 TB of I/O per day
    - 1 Backup System (W: ~300 GB/day)
    - 2 User Systems (W+R: ~700 GB/day each)

NERSC HPSS Service

- Quality of Service 2/8/98-12/31/98
  - Actual availability = 97.5%
  - Mean Time to Restoration = 2 hr. 6 min.
  - Maximum Time to Restoration = 31 hr. 30 min.
- Appropriate platform for code development & scalability testing (Large & Stable)
  - BaBar: OOFS Objectivity AMS to HPSS
  - LBL LDRD: DPSS ⇔ HPSS striped COS
  - HENP GC: migration, caching, and flushing
  - SLAC: systematic performance studies

NERSC HPSS Experience

- 20+ months of experience optimizing HPSS
  - 9 mths work w/ Op. Para.s before Feb.'98 prod'n startup
- NERSC is a Developer Site
  - All current HENP-HPSS Sites are User Sites
  - HENP-oriented HPSS Developer
    - Increased influence on HPSS Priorities
  - No HPSS Licensing Complications
    - e.g. Independent Namespaces
  - Local Code Optimizations are Legal
- NERSC MSG has done 2 HPSS imports (20 TB)
  - ESD imports from CERN (HPSS/EuroStore)

U.S. ATLAS Support

- Provide central software repository and reference environment for all U.S. developers
- Offer & coordinate training for developers
- Provide support FTEs for integration & coordination tasks during development
  - Code Management, Testing & Verification, Release & Distribution
- Investigate, develop, deploy, & maintain tools for U.S. Developers
  - e.g. SRT/CVS, GNU, Purify/Insure, CASE, Light, etc.

U.S. ATLAS Support (cont.)

- Provide central clearing house for information, tools, documentation
- General Support, Bug Reports, User requests
- Training & Documentation
  - Commercial courses (taught by outside prof.s)
    - OO Languages & Methodologies, Commercial Software (e.g. Objectivity Quick Start)
  - ATLAS Computing training of scientists & developers (taught by ATLAS personnel)
    - ATLAS Environment, Software, & Tools
  - Web based documentation & tutorials

Data Analysis Phase (2005+)

- Ultimate Target of ARC Facilities
  - Where we need to be in 2005 and beyond.
  - Based on 20% rule, no Reconstruction.
- 120 ATLAS Analysis Users (40 concurrent)
- 200 TB of Event Summary Data (ESD) from reconstruction at CERN each year
- 50,000 SPECint95 needed for analysis of ESD
- 250 TB of tape storage in 2005 (HPSS)
- 25 TB of disk storage in 2005

CPU & Storage (2005+)

- Assumptions (constant re-evaluation needed):
  - Cluster computing for CPU power
    - Single Operating System
    - Moore's Law: X2/18mths (conservative)
    - Replace 25% of "old" CPUs (conservative)
    - Dual/Quad CPUs in 2001+ (conservative)
  - NERSC Mass Storage (HPSS)
    - Extrapolate from STK Robot & 3490 Drives
    - Cost of HW constant, but capacity increases
    - HW maintenance ~10% of HW cost per year
    - Import of ESD tapes from CERN

FTE (2005+): Operations

- 6 FTE CPU Cluster
  - 6 FTEs for 200 boxes, 24/7 coverage
  - FTEs required depends on:
    - Coverage (24/7 vs 8/5)
    - Complexity (# of boxes, # of OSs, # of users, # of requests, level of customization)
- 2.5 FTE Mass Storage
  - HPSS Operation
    - 1.5 FTE added to NERSC MSG
  - HPSS Developer
    - 1 FTE added to NERSC MSG

FTE (2005+): U.S. ATLAS Support

- 2 FTE Librarian/Code Verification/Testing
  - maintaining ATLAS software environment
  - importing & exporting software
  - testing & verifying ATLAS code releases
- 1 FTE Web/Training/Documentation
  - maintain and coordinate Web & docs
  - coordinate user training
- 2 FTE General User Support
  - general user support for using ARC & ATLAS software
  - ensure usability of the U.S. ATLAS Regional Computing Center by ATLAS physicists

Current Status

- http://arc.nersc.gov/

Date Wed, 17 Mar 1999 192045 -0800
From John Milford <JWMilford@lbl.gov>
Subject Progress on Compile of ATLAS software

I have made some more progress. I have gotten all the way to compiling slug which I think is the second to last package. At this point I am getting a make failure with this message

gmake *** No rule to make target 'slugmain.o', needed by 'libcxxmain.a'. Stop.

Now I just have to figure out why this target is not being generated. I will pick up work on this tommorow morning after getting a little more perspective on the problem.

--John

Future Plans

- Funding Proposal