Central UNIX Computing at Fermilab

Stephen Wolbers

Fermilab

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History of UNIX at Fermilab

- Early use of UNIX was driven by:
  - Demand, need, desire for more CPU (at low cost)
  - Farms (ACP II project)
  - E769 data sample

- Also driven by desire for features/machines/software
  - SUNS in Accelerator Division
  - NEXT in Theory
  - SUNS in various applications

- Other early UNIX
  - CDF L3 Trigger
  - Seed Project workstations
  - CDFSGA

- Common characteristic – Distributed Systems
  - Systems were developed to meet specific needs
  - Some coordination (FUE, UPD, UPS)
  - Generally Independent
  - Workgroup Clusters

Central Systems History

(Incomplete and biased)

- fnsg01
  - ◦ SGI 4D/240
  - ◦ Delivered in 1990
  - ◦ No user tape access
  - ◦ First central UNIX system
  - ◦ Central development machine for UNIX farms
  - ◦ Central distribution platform for code and products
  - ◦ Still in use

- Farms
  - ⋄ Rapid growth from 25 $\rightarrow$ 300+ nodes
  - ⋄ Single-purpose, small number of "users"
  - ⋄ Talked about at length elsewhere

- FNALU
  - △ Central system for general-purpose computing
  - △ Slow growth to allow "learning"
  - △ Testbed for AFS

- CLUBS
  - △ Batch processing, replacing Amdahl mainframe
  - △ Focus on data access
  - △ Scalable
  - △ Difficult Project

- CDFSGA
  - SGI 4D/480
  - connection to disk/tape for data access
  - connection to STK silo for data access
  - Long development time

- Many “workgroup clusters”
  - ◇ About 675 supported systems
  - ◇ Growth was (and is) hard to handle
  - ◇ Maintenance and Support Difficult (8 full-time central system managers)

Current Issues

- Move computing from VMS to UNIX
- Continue to provide large CPU for event reconstruction
- Expand data access for the larger datasets
- Provide additional UNIX capability (products, software)
- Be prepared to change

Current and Near-Term Systems

(No mention of CAP in this talk)

- FNALU
  - Hardware (interactive + batch)
    SGI 4D/480 (8 processor SMP)
    SGI 4D/420 (2 processor SMP)
    2 IBM RS6000/560
  - Hardware (AFS servers)
    3 IBM RS6000/350
  - Disk
    96 GB of disk (AFS space)
  - Tapedrives
    3 8mm tapedrives
  - Software
    UNIX Products – Fermilab written and supported
    UNIX Products – Public Domain
    UNIX Products – Commercial
  - Product Distribution
  - Backups

- FNALU Upgrades
  - △ SGI Challenge

    SGI Challenge (4 processors, 150 MHz)

    256 MB memory

    Available by end-year
  - △ SUN Sparc 20

    4 processors, 50 MHz, 1 MB cache

    New “flavor” of UNIX
  - △ AFS file servers

    4 SUN Sparc 5’s

    Frees up IBM’s for remote product serving
  - △ Software

    “PC” software (EXCEL, WORD)

    Framemaker

- CLUBS
  - Compute Nodes
    5 IBM RS6000/370
    6 SGI Crimson R4400
  - I/O
    Tape servers (RS6000/370)
    Unitree (RS6000/580)
    Ultranet
    STK silo
  - Batch
    Load leveler
  - AFS

- CLUBS Upgrades
  - Expansion of batch capacity
    3 RS6000/370
    R4000 → R4400 Crimsons
  - I/O systems
    RS6000/570 tape servers
  - Upgrade to STK silo

- CDFSGA Upgrades
  - ○ SGI Challenge XL
    8 150 MHz (soon 200 MHz) processors
    (4 MB cache)
    512 MB main memory
  - ○ 170 GB fast-wide disk
  - ○ Upgrade to STK silo (currently 3480 single-density)
  - ○ Goal: Reliable central UNIX platform for CDF

- D0 UNIX
  - ◇ SGI Challenge L
    4 150 MHz processors
    256 MB memory
  - ◇ 170 GB fast-wide disk
  - ◇ Future robotic connection
  - ◇ Goal: Enhance D0 UNIX computing

- Farms
  - △ Add memory to worker nodes
  - △ Reconfigure I/O nodes
  - △ Plan for "next-generation farms"
    More CPU (30,000 MIPS?)
    Faster interconnects (FDDI, ATM, SMP, TB2)
    Better I/O systems (no 8mm!)
  - △ Constraints
    RUN1B and reprocessing
    Monte Carlo (B physics, LHC, etc.)
    Fixed-Target Run

- Business Computing
  - ○ OSF/1 Alpha (General Ledger System)
  - ○ RS6000 (Computerized Maintenance Management)
  - ○ Shift from the IBM 4381

- Sloan Digital Sky Survey
  - ◇ Large Computing Load
  - ◇ Different data and computing need compared to HEP offline computing
  - ◇ Interesting challenge

- Others
  - △ CAD-CAM
  - △ Online DAQ
  - △ Publications/Library
  - △ Information Management

Goals

- High availability
- High reliability
- Services
  - Backups
  - Archive
  - Access to data
  - Significant CPU
  - Software
- Architectures
  - SGI IRIX
  - IBM AIX
  - SUN SunOS
  - DEC OSF/1 (possibly)
  - HP UX (possibly)
- Supportable
  - Budget
  - Personnel

Conclusions

- Central UNIX Computing exists at Fermilab
- Serves the needs of many at the Lab
  - ◇ HEP scientists
  - ◇ Engineers
  - ◇ Business Services
  - ◇ Lab Services
  - ◇ Product Developers
  - ◇ Others
- Huge Distributed UNIX Computing
- Ideas for better support and service
  - ◇ AFS
  - ◇ DCE/DFS
  - ◇ FNALU
  - ◇ Fewer Supported Operating Systems (?)