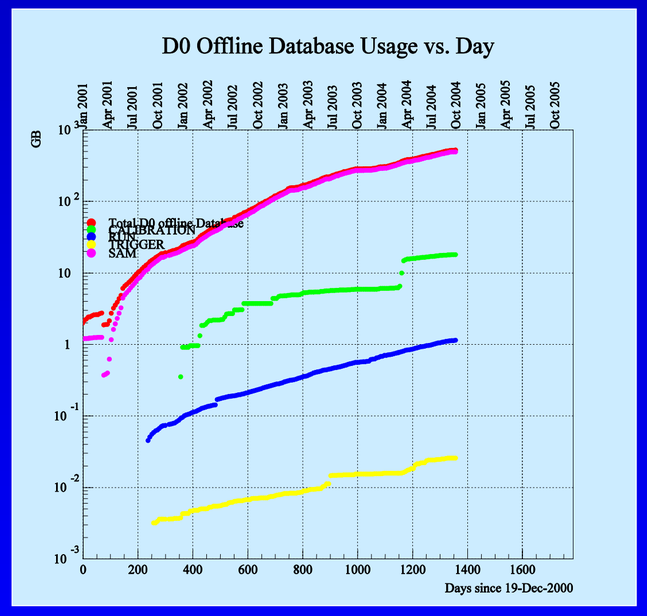
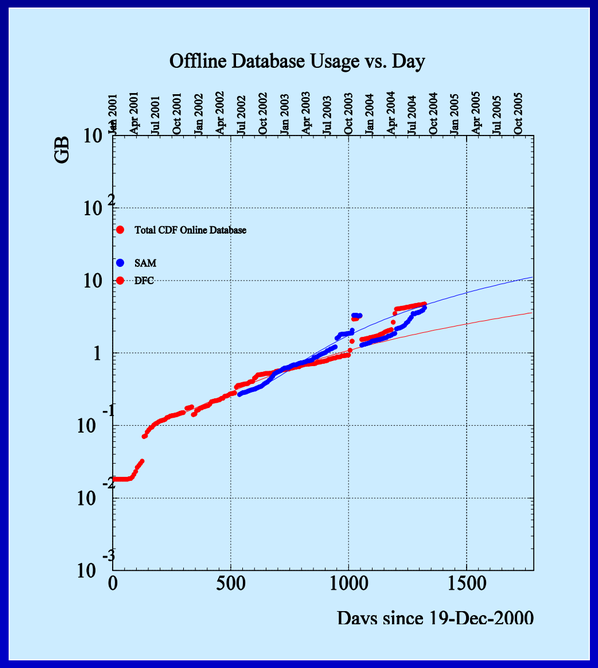
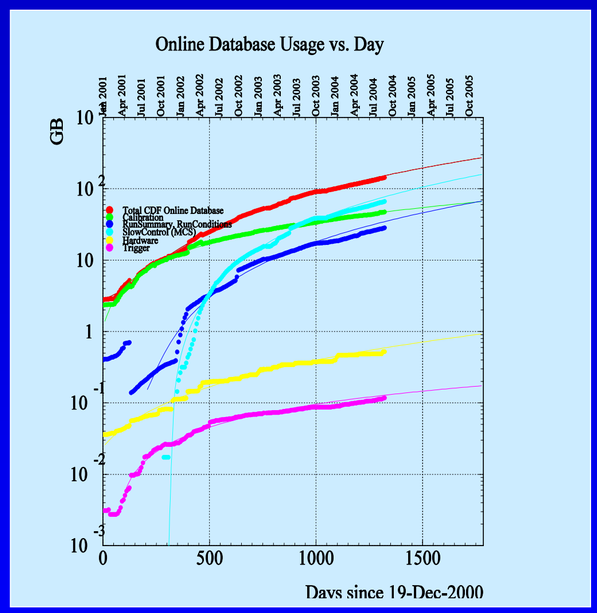
Fermilab Run II Database Requirements

- Online databases are maintained at each experiment and are critical for data taking.
- Offline databases are maintained in the Feynman Computing Center and are critical for data processing and analysis.
- High Availability for both online and offline database systems is required.
- Database Applications Overview
  - Detector and physics data
    - Detector Calibration
    - Trigger lists
    - Data Luminosity
    - Detector Slow Controls
    - Run and Run Quality information
  - Data Handling (The SAM Database)
    - Physics Metadata
    - File catalog
    - File replica management
    - Processing information
- Database storage growth is shown in the accompanying charts (D0 left, CDF right).



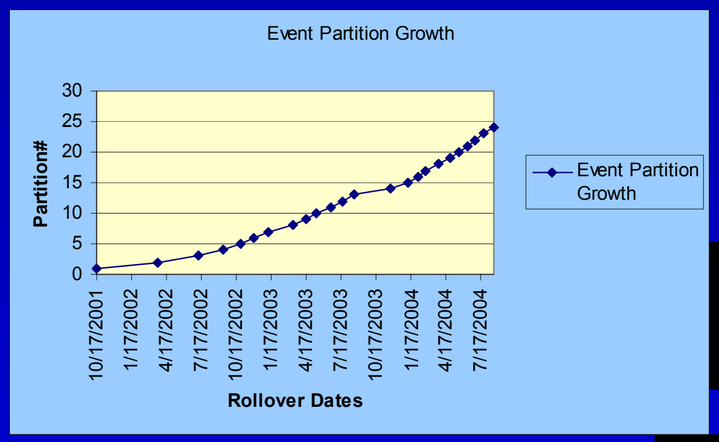




Oracle in Run II

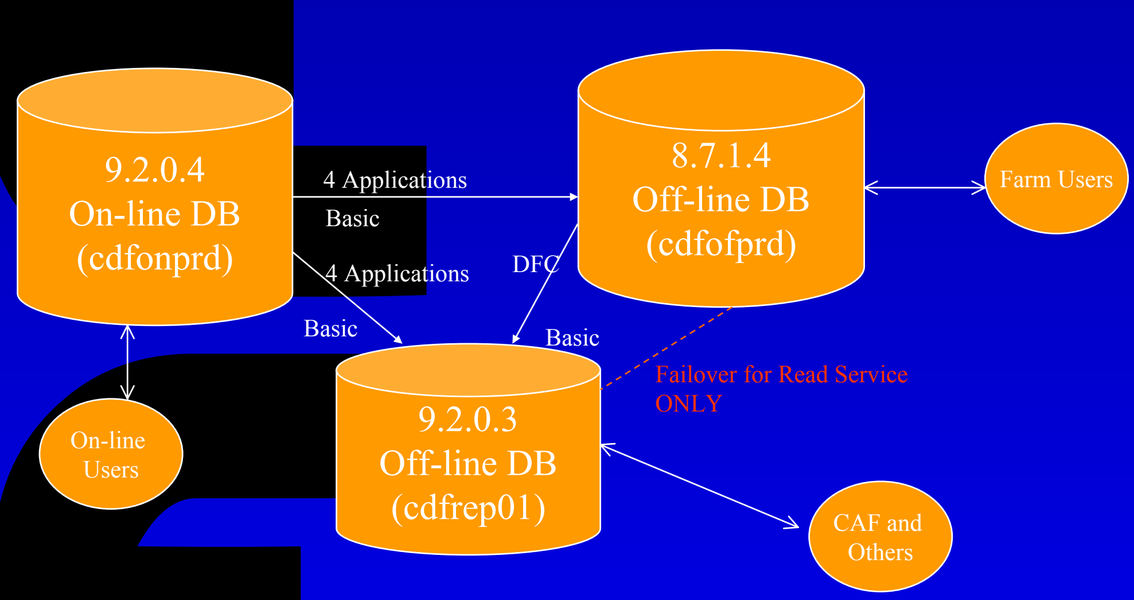
Table Partitioning

- Partitioning has been implemented for very large table(s) in the database.
- D0 uses a partitioned Events table with 50M events in each partition.
- Each partition is stored in its own tablespace and corresponding indexes are also partitioned and stored in their own tablespaces.
- Partitioning improves Query Optimization and Backup Performance
- Over 1 billion events are distributed over 24 partitions and a new partition is started about once a month.



Replication

- Replication is used to share data in a large user.
- CDF has the same database structure for online and offline databases. Oracle's asynchronous replication is used to refresh offline tables from online tables periodically.
- One replica is used by Farm Users and the other is used by CAF and other READ ONLY users.
- A key feature of CDF replication is Fail-Over from one replica to another for high reliability.
- CDF is planning to migrate to Oracle Streams replication available from version 9.2.x release soon.



Data Base Monitoring:

- Monitoring is done using Oracle Enterprise Manager (OEM, by Oracle Corp) and TOOLMAN,an in-house developed tool.
- *OEM monitors the following:*
  - Node up and down, Database Listener down,Intelligent Agent
  - Number of storage extents and space usage
  - Database Alerts – Db down , file corruption
  - Number of concurrent sessions, CPU usage,Memory usage
  - Hit ratios for Library, Buffer Cache and other database resources.

- ***TOOLMAN***
  - Provides an alternative method to OEM for monitoring Oracle databases.
  - Can be customized in several ways for the machine and databases it monitors.

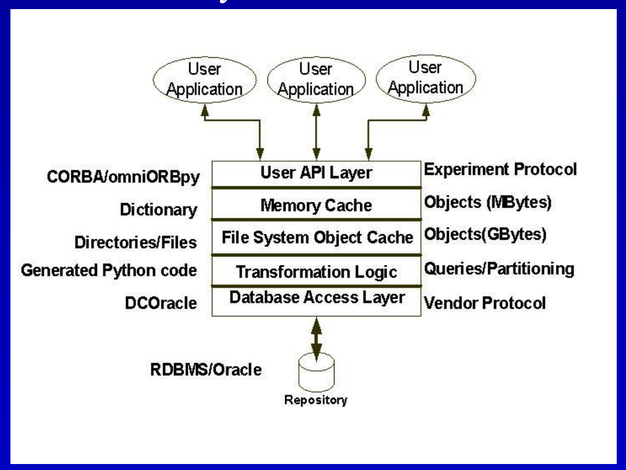
Run II Database Access

- For D0, only a subset of the online information was transferred to the offline database (Lower left).
- All access to the D0 offline database was through the Calibration DB server (DAN,upper right) or Data Handling server (SAM) .
- CDF employed Basic Oracle replication to transfer all online database information to offline databases (See poster 'Oracle in Run II').
- FroNtier is a web-based, highly scalable, approach which is being developed for CDF to provide high performance database access to read-only information (Lower right). http://whcdf03.fnal.gov/ntier-wiki

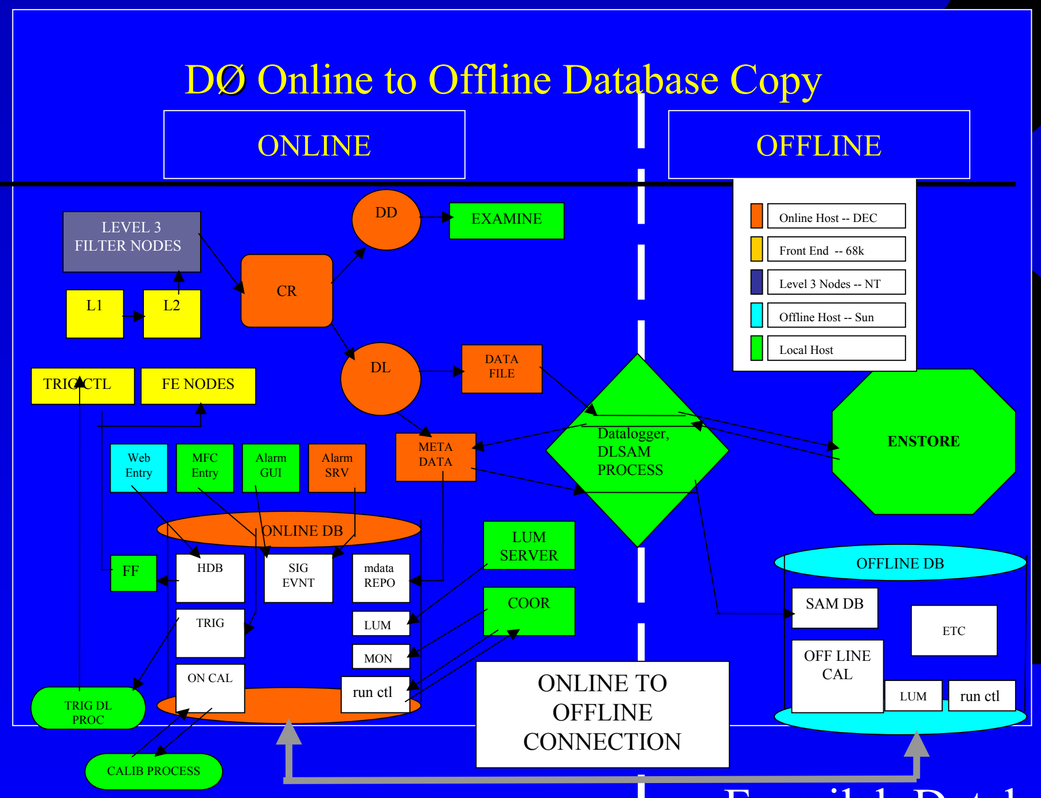
DØ Offline Caching Server: DAN (Database Access Network)

- CORBA interface to Client apps
- Memory (L1) and Disk (L2) caching
- Connection management to Database
- Server has common code base with SAM DB server

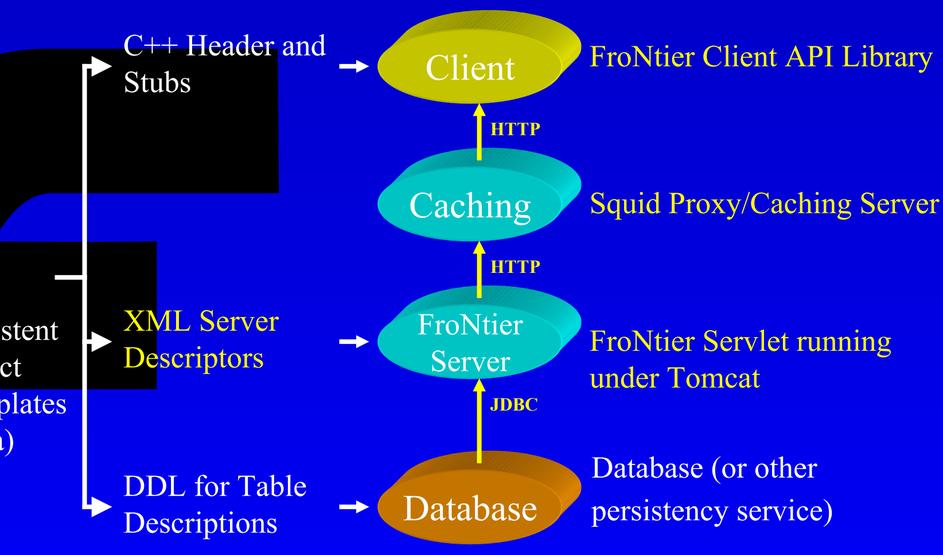
Read-only DB access



DØ Online to Offline Database Copy



FroNtier Overview

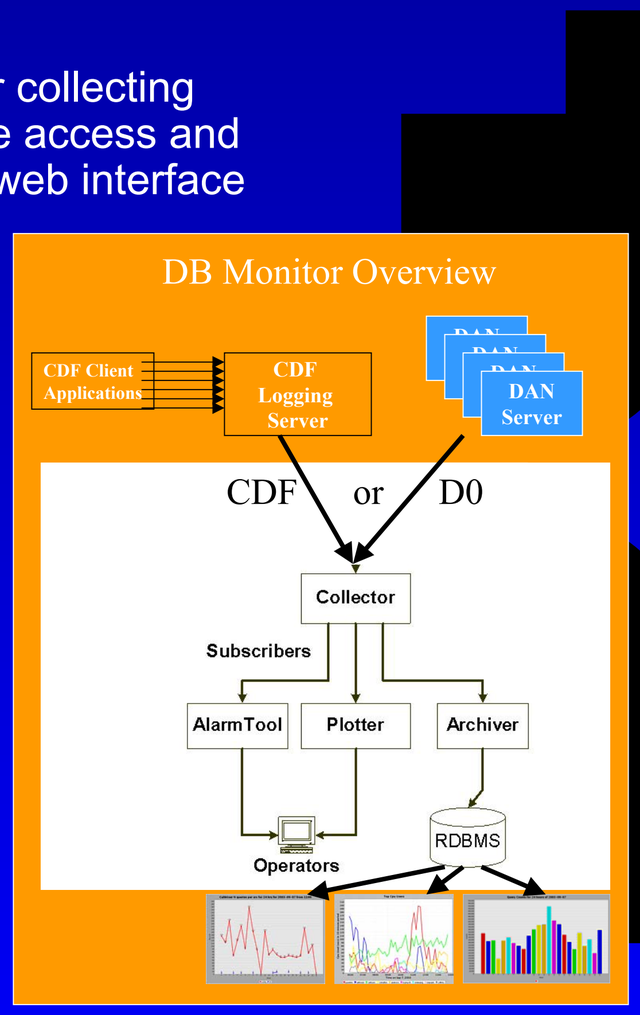


Run II Database Performance and Monitoring

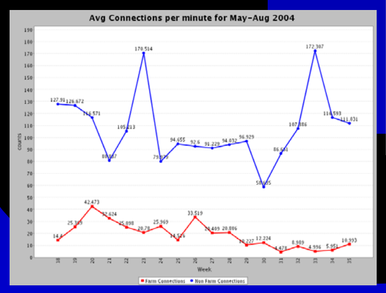
Database Monitoring is a crucial component of our Database Operation.

DBS Monitor

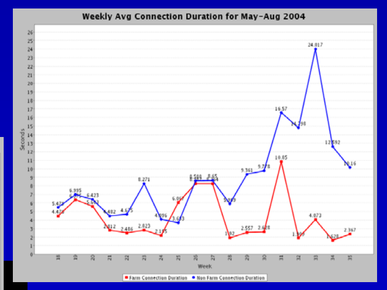
- DBS Monitor is used for collecting information on database access and presenting it through a web interface
- Project Goal: Common tools for Application Monitoring
- Information Generation is Experiment Specific
- The Collector gathers and parses data
- The Archiver uses a MySQL Repository
- Plotting tools use JavaFreeChart
- Histogramming uses JAIDA
- Admin and automation scripts are included.
- http://dbsmon.fnal.gov



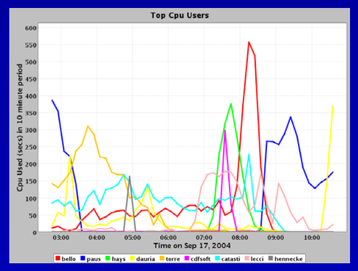
Number of connections per minute for CDF



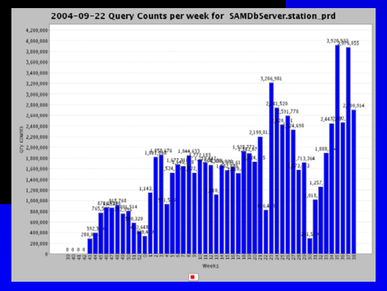
Average duration time for Database connections for CDF .



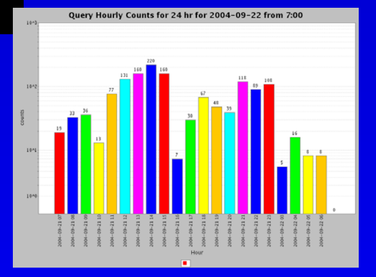
Top CPU users on CDF Database Applications over an 8 hour interval



Query counts per week for D0 SAM station server



Number of queries per hour for D0 Farm and Non-Farm servers



D0 Sam Servers query counts over 24 hours interval