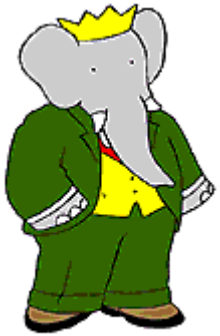

BaBar Bookkeeping

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Stanford Linear Accelerator Center
Tim Adye
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University of California, Irvine
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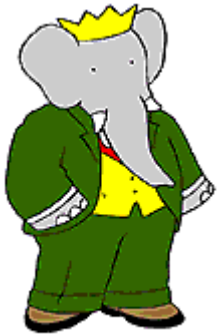
University of Liverpool

CHEP 2006
Feb 15th, 2006, TIFR, Mumbai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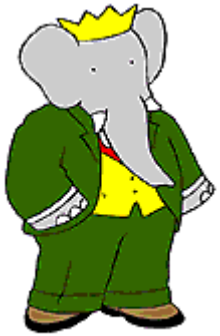
BaBar Computing Model 2 (CM2)

- In 2003 it was decided that BaBar's initial computing model was not going to scale for the whole experiment. An effort to create a new computing model was started, called CM2.
- Resulting in changes to the event store, event structure, and included the need for a new bookkeeping system.
- Initial report on the Bookkeeping: D. Smith, *et al.*, Talk 338, CHEP 2004.
- Other talks at CHEP 2006 about changes due to CM2:
  - Simulation production – D. Smith, Talk 299
  - Condition database – D. Smith, I. Gaponenko, Talk 352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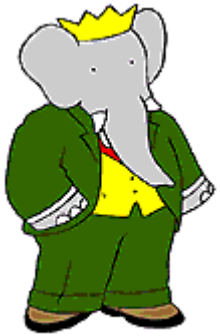
Overview of Bookkeeping

- CM2 event store is in ROOT files.
- Different event components can be placed in separate files.
- Related files of many events called “Collections”, these are the unique elements of the event store.
- Collections are organized in lists, called “Datasets” for use, and there is a *n* to *m* relation between them.
- Also the relation between data run number and collection is kept in a *n* to *m* relation.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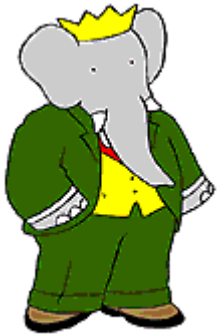
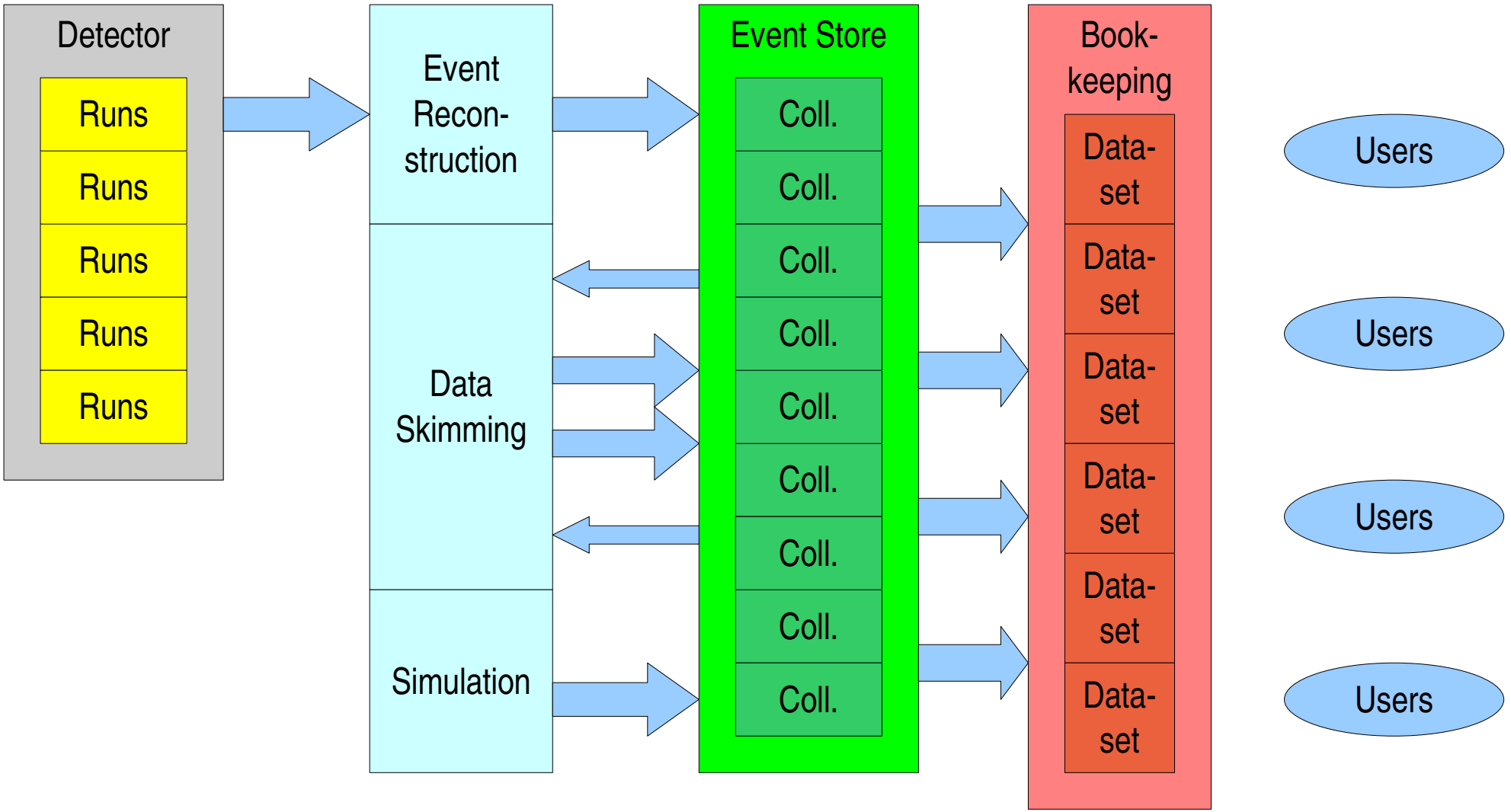
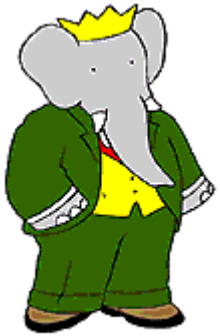
Overview of implementation

- All information for bookkeeping stored in a relational database.
- Use of SQL Abstraction keeps code DB independent, and allows DB schema changes to be independent from code.
- Currently MySQL and Oracle are supported.
- The system was implemented as a software framework in OO-Perl, providing object classes and command line interfaces.



Cartoon of data management

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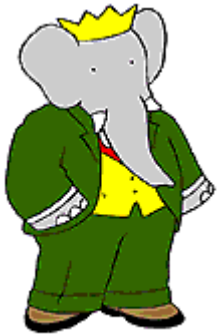
Dataset evolution

- Datasets need to change with the changing state of data.
  - New data becomes available.
  - Changes in quality checks, removes and adds data.
  - Reprocessing, old versions of data shouldn't be used.
- Need to know what happened: Dataset history:
  - The record of the changes to the datasets are kept.
  - At any point the datasets at any state in the past can be selected
- Need stability in the place of change: Dataset tagging:
  - Place a tag on a dataset and give it a name.
  - People can select this state of the dataset at any time.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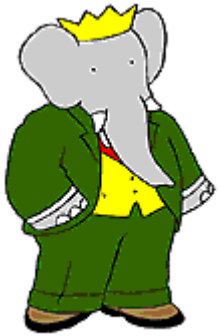
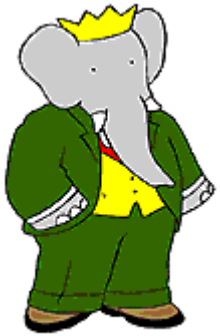
Dataset updates

- Data analysis needs data quickly as it is available, datasets must evolve quickly to support this.
  - Initial datasets were static lists, hard to keep updated.
  - Next classes of datasets were recreated periodically. Updates happened daily, or every other day.
- Changes to collection lists and status are monitored, changes are applied to affected datasets.
  - New collections go into datasets, new datasets are created.
  - Collections not to be used are removed.
  - Changes applied every 10 mins now.



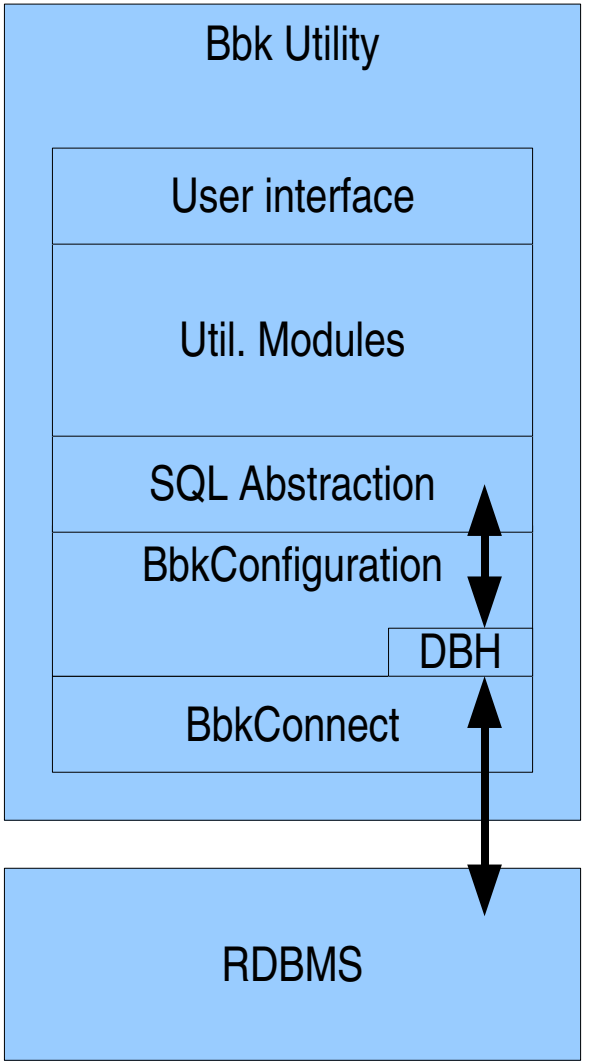
Size of current use

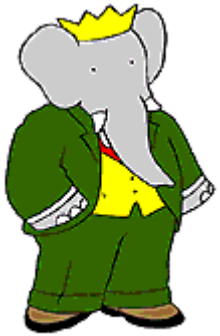
- Event store is 660.4 TB with 1.1M files.
- The Bookkeeping system keeps track of this as 751k collections.
- The collections are organized into 60.7k datasets.
- Size of database is ~2 GB. Can be downloaded as compressed daily snapshot of ~190 MB.
- Selection of information in any dataset done in less than 2 secs.
- Will scale fine to future size of experiment.



Design of a Bookkeeping utility

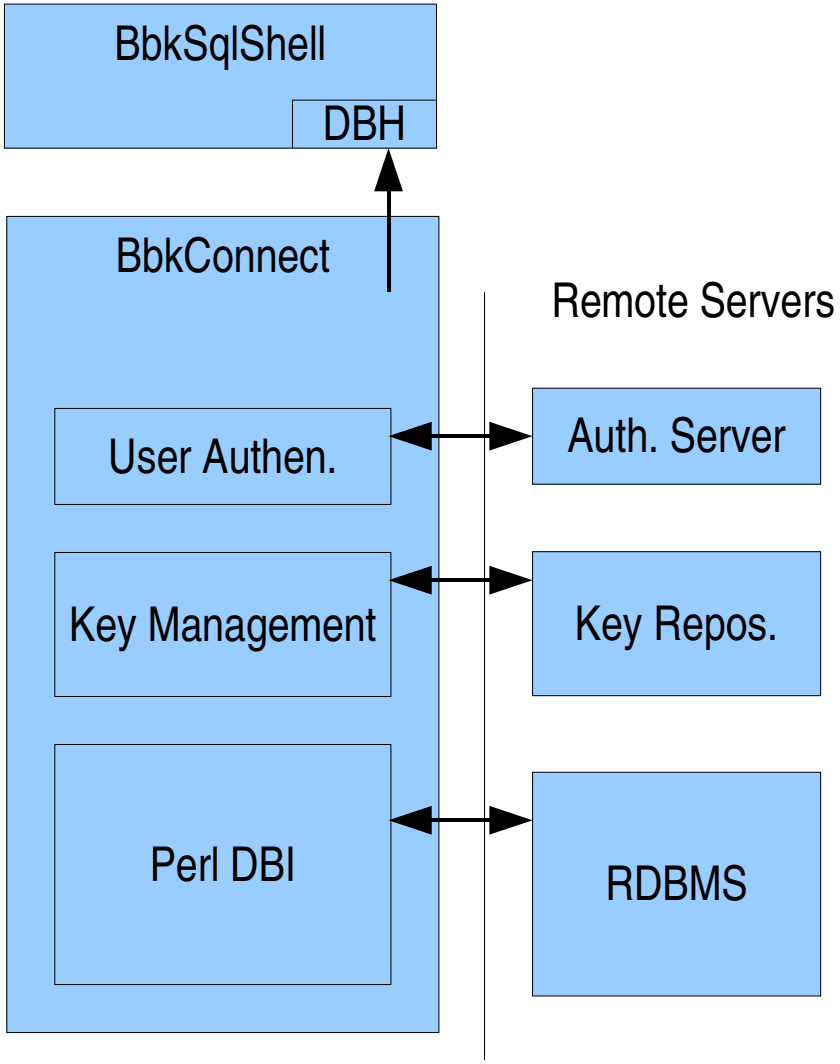
- Utilities built from modular design
  - All information kept in RDB
  - Connection module
  - Configuration module
  - SQL Abstraction module
  - Utility code modules
  - User interface

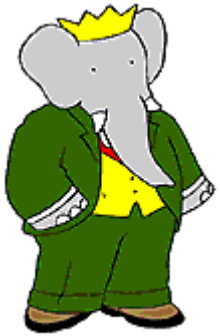




BbkConnect

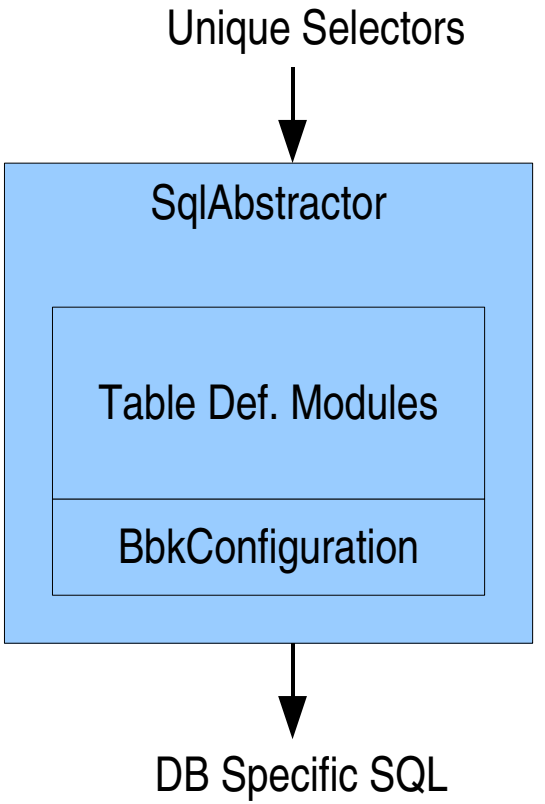
- Database connection manager
  - independent of bookkeeping DB.
  - Distributed user authentication.
  - Central key distribution.
  - Default settings control.
  - Network database connections.
- Defined now for all RDBMS in BaBar not just bookkeeping system.

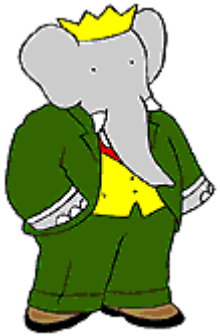




SqlAbstractor

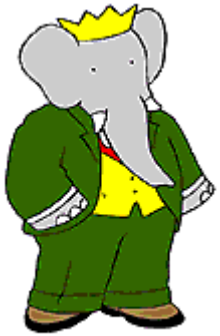
- Abstracts SQL to constraints and selectors
  - All tables and fields given unique labels.
  - Code selects on unique labels, and constrains selects on unique labels.
  - Abstractor class creates SQL for RDB including all needed joins between tables.
- Used for Bookkeeping, Task Management, and Simulation Production DBs.
- Code ready to go to CPAN.





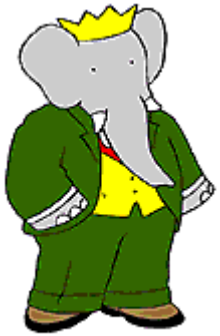
Task Manager

- Skim and analysis data production management:
  - define tasks to apply to datasets.
  - Tasks are divided into jobs, and provides job management with batch system.
  - Output of tasks managed as collections to be placed back into bookkeeping system.
  - Currently used to manage data skimming, many tasks currently defined, managed millions of jobs (approaching 20M), produces hundreds of thousands of collections.



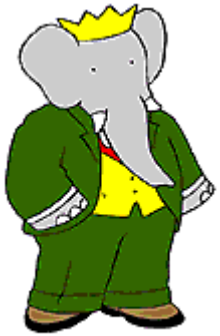
User applications

- BbkDatasetTcl
  - used to create analysis job control file (Tcl) with collections for analysis jobs.
- BbkLumi
  - determines luminosity information for datasets.
- BbkUser
  - Exposes all SQL abstraction selectors to command line.
- BbkExpertTcl
  - Create control tcls bases on selectors from SQL abstraction.



Multiple database design

- Utilities can be used to connect to any number of datasets.
  - For scaling to data size, new reprocessing go into new datasets:
    - First full reprocessing in CM2 with release 14 – bbkr14
    - Next full reprocessing with release 18 – bbkr18
  - For scaling to distributed use, the databases are mirrored:
    - Updates to database done to master in SLAC.
    - Updates mirrored to remote sites.
- Default management system can control use of utility:
  - Analysis with release 18 gets bbkr18.
  - Analysis at remote site gets local mirrored database.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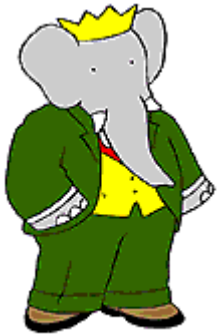
Data distribution

- System includes data distribution utilities:
  - Distribution controlled by datasets.
  - From large sites with over 100TB to laptops with 10GB.
- Includes data management.
  - Datasets can be removed.
  - If datasets change, collections no longer in dataset removed.
- Records which datasets are local:
  - In local bookkeeping databases, information on which files, collections, and datasets hosted are kept.
  - Local user tools use this, to provide only what exists.



System is working well

- Bookkeeping system has been in use for about 2 years now.
- Manages all meta-data of BaBar event store, and scales well
- Simplifies management of data for most analysis into only a few dataset names.
- For the developer set up a framework with rich set of modules for management of meta-data.
- For the user a small set of easy to use utilities.
- Development continues, to cover more user's needs, and make it still easier for analysis and production management of data.