SRB and Data Management

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Introduction

- What is SRB
- CCLRC and SRB
- Using SRB in CMS
- Using SRB in the e-Minerals Mini-Grid
- Future Projects
- Questions

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Managing Data

- Historically data has been **STORED** rather than **MANAGED**
- Problems arising from this include
  - Scaling
  - Distribution
  - Access Control, Authentication, Security
  - Data Migration
  - Data Curation

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What is SRB?

- Storage Resource Broker (SRB) is a software product developed by the San Diego Supercomputing Centre (SDSC).
- Allows users to access files and database objects across a distributed environment.
- Actual physical location and way the data is stored is abstracted from the user
- Allows the user to add user defined metadata describing the scientific content of the information

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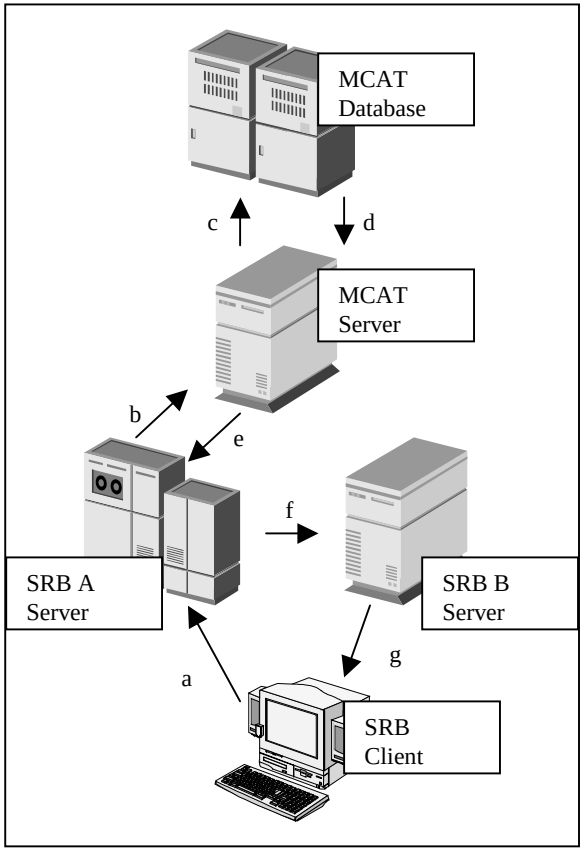
How SRB Works



- 4 major components:
  - The Metadata Catalogue(MCAT)
  - The MCAT SRB Server
  - The SRB Server
  - The SRB Client

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The MCAT Database

- MCAT database is a metadata repository that provides a mechanism for storing information used by the SRB system.
- Includes both
  - Internal system data required for running the system
  - Application (user) metadata regarding data sets being brokered by SRB.

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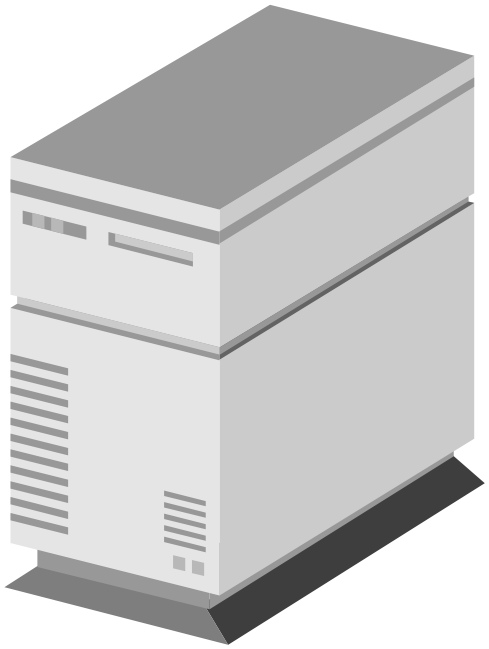
The MCAT Server



- At least one SRB Server must be installed on the node that can access the MCAT database. This is known as the MCAT SRB Server.
- MCAT SRB Server works directly against the MCAT database to provide SRB Services
- All other SRB Servers interact through the MCAT

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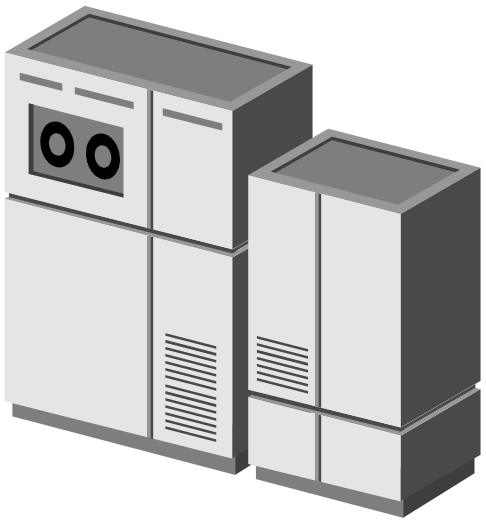
The SRB Server



- The SRB Server is a middleware application that accepts requests from clients and obtains/queries/manages the necessary data sets.
- It queries the MCAT SRB Server to gather information on datasets and supplies this back to the SRB client.

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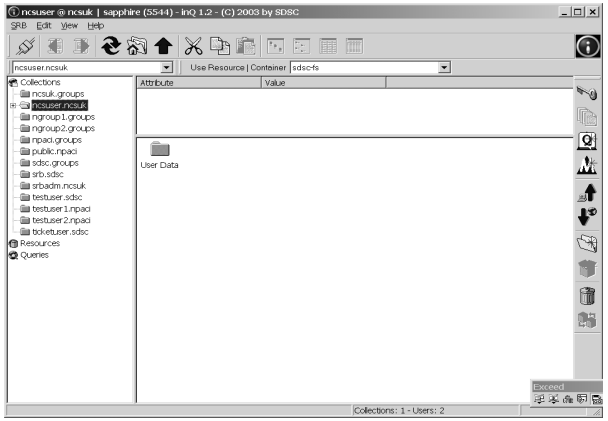
SRB Clients



- Provides a user interface to send requests to the SRB server.
- 4 main implementations of this:
  - Command line
  - MS Windows (InQ)
  - Web based (MySRB).
  - Java
- Web Services (MATRIX) in beta
  - Precursor to GRID Services

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Concepts

- Location: A physical node running an SRB Server
- Physical Resource: A storage area managed by an SRB Server
- Logical Resource: One or more Physical Resources – can be distributed
- Collection – Data abstraction of resources

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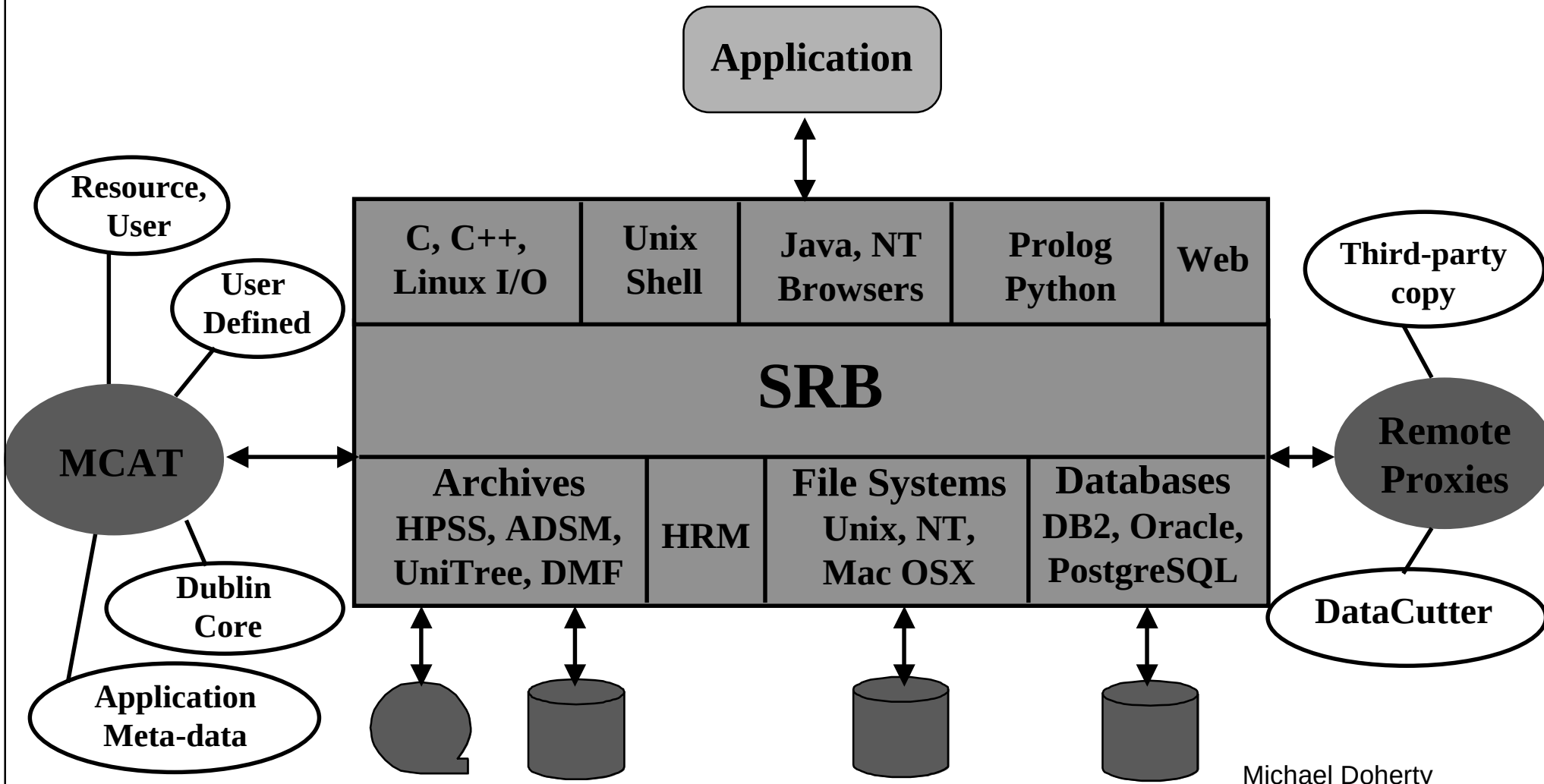
SRB in Detail



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Administration

- Users/Locations/Resources must be managed
- Two methods for doing this
  - Java MCAT Admin Tool
  - Command line tools

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CCLRC and SRB

- The Data Management Group in CCLRC started working with SRB in November 2002 after a fact finding mission to the USA.
- There was an immediate requirement for a storage based product that allowed the addition of searchable metadata
- Generated lots of internal interest, which led to a number of projects with SRB

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SRB Example: CMS

- Largest project using CCLRC SRB services at present is the CERN CMS experiment.
- SRB Chosen for 'Pre-Challenge Production', producing data for Data Challenge 2003/2004 (DC03/DC04)
- Need to prove data can be transferred, replicated and stored at LHC rates
- Need to coordinate data in the DC

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CMS: Why SRB

- Not originally planned to SRB for DC
  - Planned RLS based system
- Nothing available CMS-wide on the timescale (end of year) for DC2003
- Needed stable and supported product for 6 months continuously

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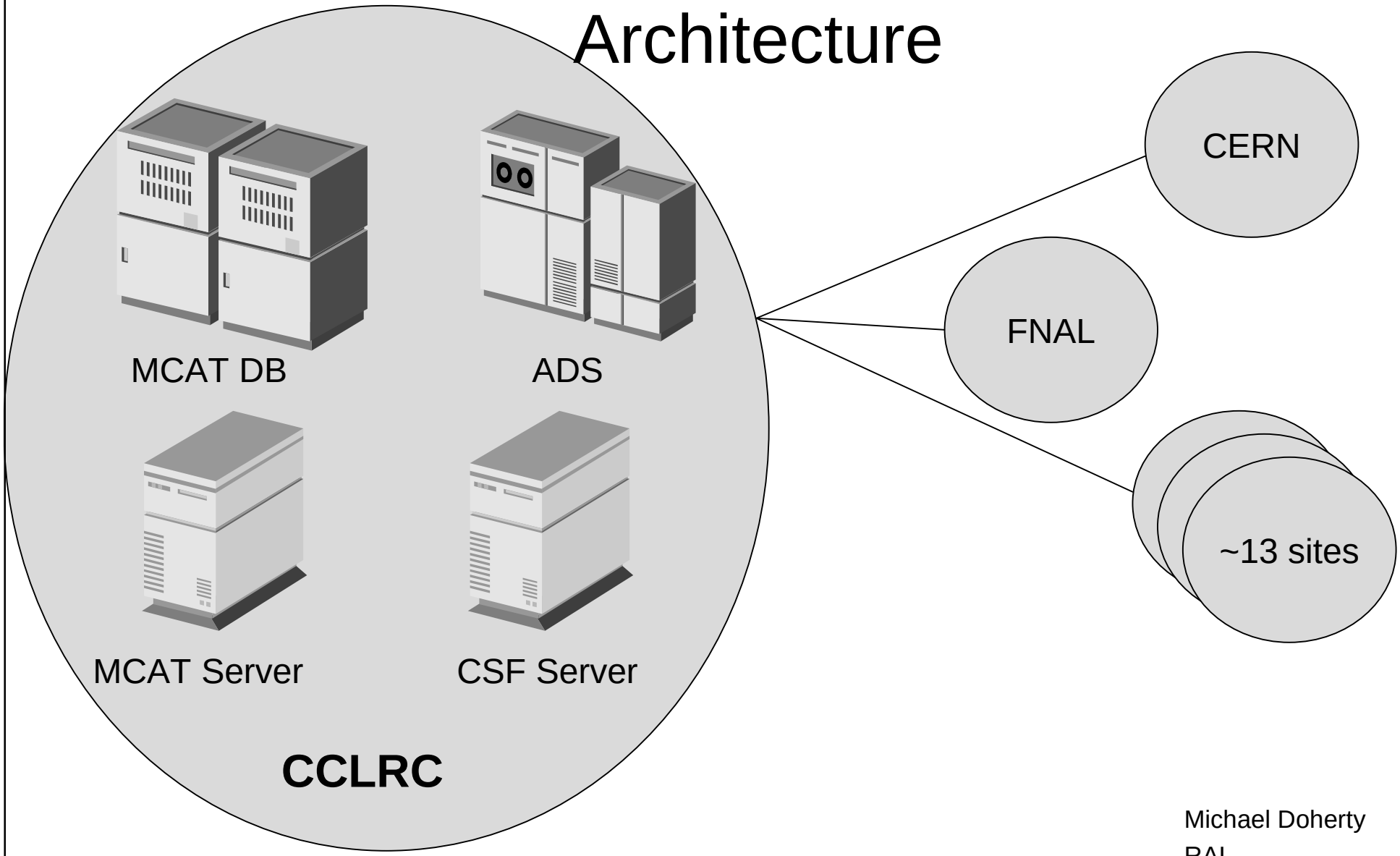
Architecture



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MCAT: CCLRC Database Service

- MCAT requires professionally run database
- Two IBM x440 clusters, one based at Daresbury Laboratory and the other at Rutherford Appleton Laboratory.
- The clusters connect to their own 1TB RAID 5 storage arrays via a independent fibre channel Storage Area Networks (SAN).
- Run Oracle Real Application Clusters software on Redhat Advanced Server for high availability/scalability RDBMS
- CMS MCAT hosted by 2 nodes
- Can load balance

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Atlas Datastore (ADS)

- The Datastore currently has an on-line, nominal capacity of 1 Petabyte
- Based on an STK 9930 (PowderHorn) tape robot.
- The ADS team recently migrated from IBM 3590 (10GB) tape drives to STK 9940B (200GB) drives.
- CCLRC have written a custom SRB driver for this for CMS

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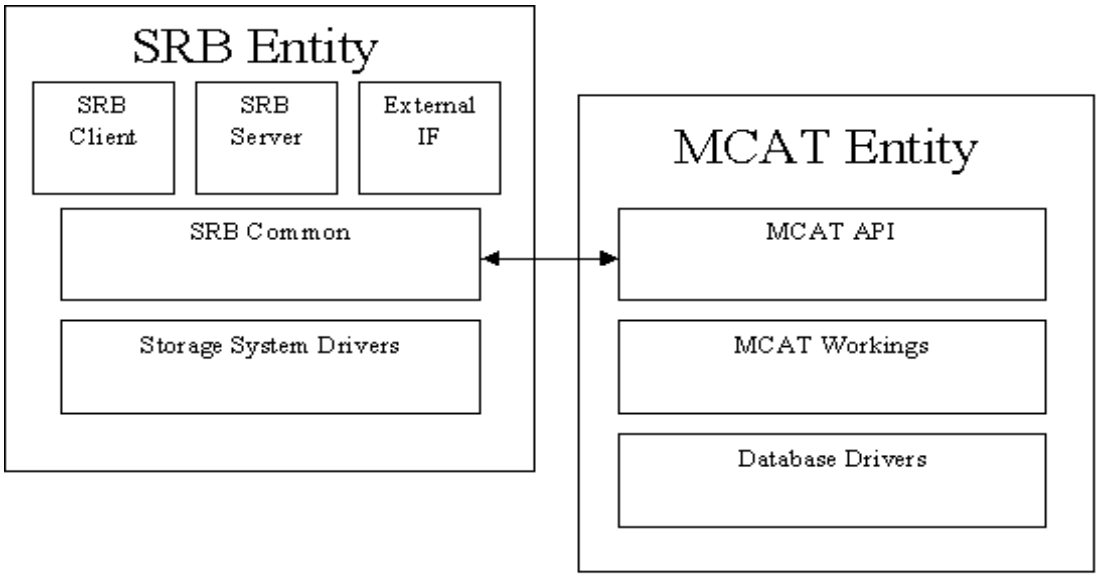
ADS Driver for SRB



- Implemented Storage System Driver
- Implement (most) of the 16 standard calls that implement the driver layer such as copy, move, delete and create.
- Some functions have no equivalent in ADS

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CMS Results (So far)

- How long does it take to register and replicate 500GB between to widely separated locations?
  - *Tested 200GB which took approximately 6 hours, almost completely network limited*
- How long does it take to register and replicate 50k 10kB files?
  - *SRB has a bulk file registration mode which they have clocked at 400 files per second. Registered and replicated 1000 files in a few seconds*
- What is the maximum sustainable transfer rate out of a single server and what is the maximum rate a server can accept data from three servers?
  - *About 80-90% of network speed for 5 streams x number of servers*
- How many files can be registered in a day?
  - *No inherent limits*
- How many parallel streams can a server accept?
  - *Unknown, very small load on CPU with 10 streams*

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CMS Data Volume

- Started on 1 July 2003
- 320,000 files
- 13 Sites world wide
- 30 Resources
- 12TB data

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SRB Example: e-Minerals

- [Environment from the Molecular Level]
- UK e-science project for modelling the atomistic processes involved in environmental issues

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e-Minerals Requirements

- Data Management Requirements
  - Scientists want to store input and output files from simulations in different locations
  - manage their own files/data via the web
  - give access to other project members
  - give temporary access to others

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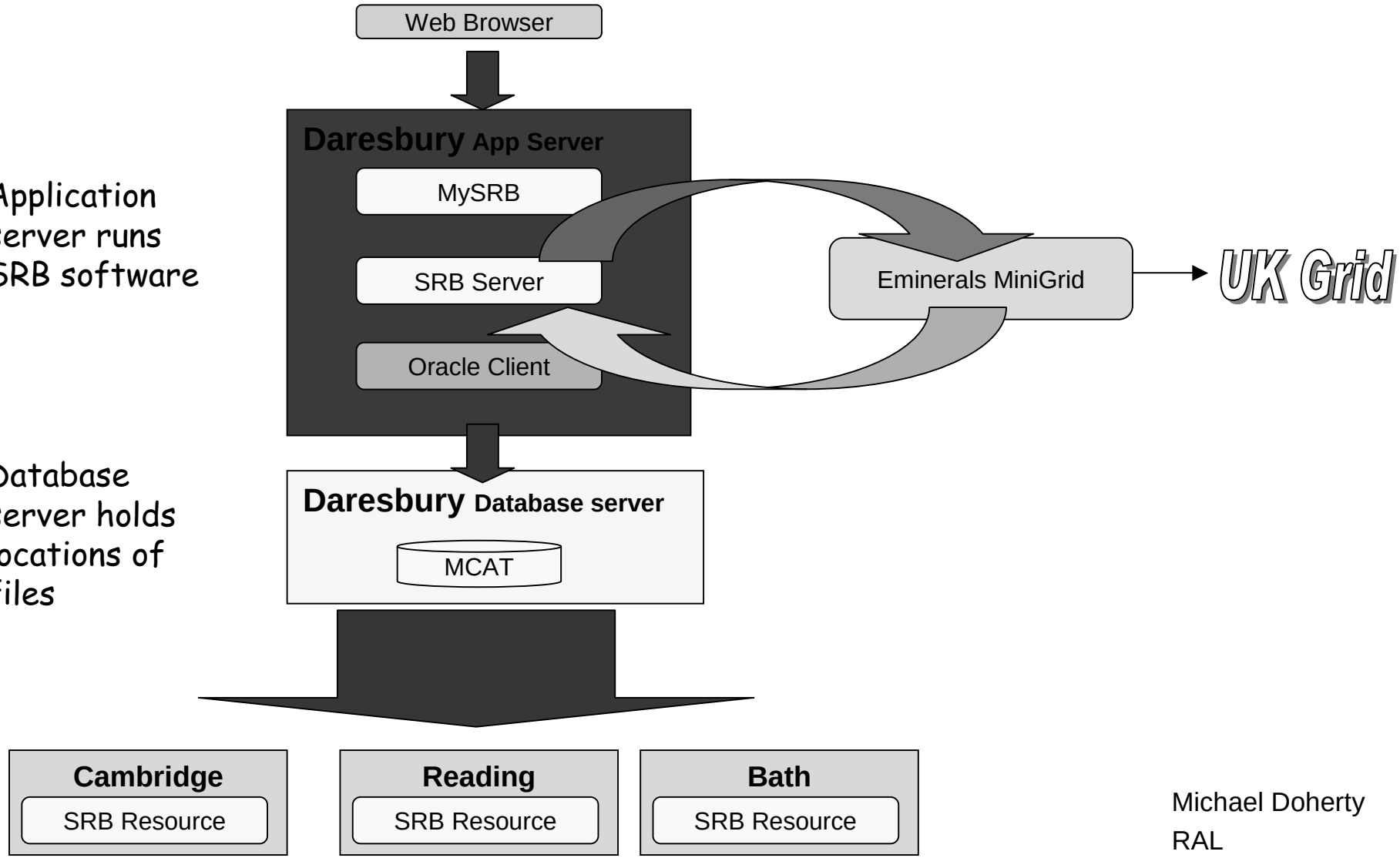
Architecture

Application server runs SRB software

Database server holds locations of files



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Future Projects

- E-Materials Project: A mini grid similar to E-minerals above.
- National Crystallographic Service (Southampton University): For both data management and storage in the ADS.
- British Atmospheric Data Centre (BADC) archive. For both data management and storage in the ADS.

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Future Directions?

- 3 major areas that CCLRC are commencing work with in collaboration with SDSC.
  - Web/Grid Services
  - High Performance Testing
  - Database Advice
  - Training

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Summary

- Have established links with SRB community and SDSC
- Implemented SRB on projects
- Set up test systems for new projects
- Can help community with
  - SRB Test Systems
  - SRB Productions Systems
  - SRB Local Support
- Will contribute to future versions

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Questions

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