CORAL Project

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DISTRIBUTED DATABASE ACCESS IN THE LHC COMPUTING GRID WITH CORAL

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WLCG Workshop
CERN

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Context

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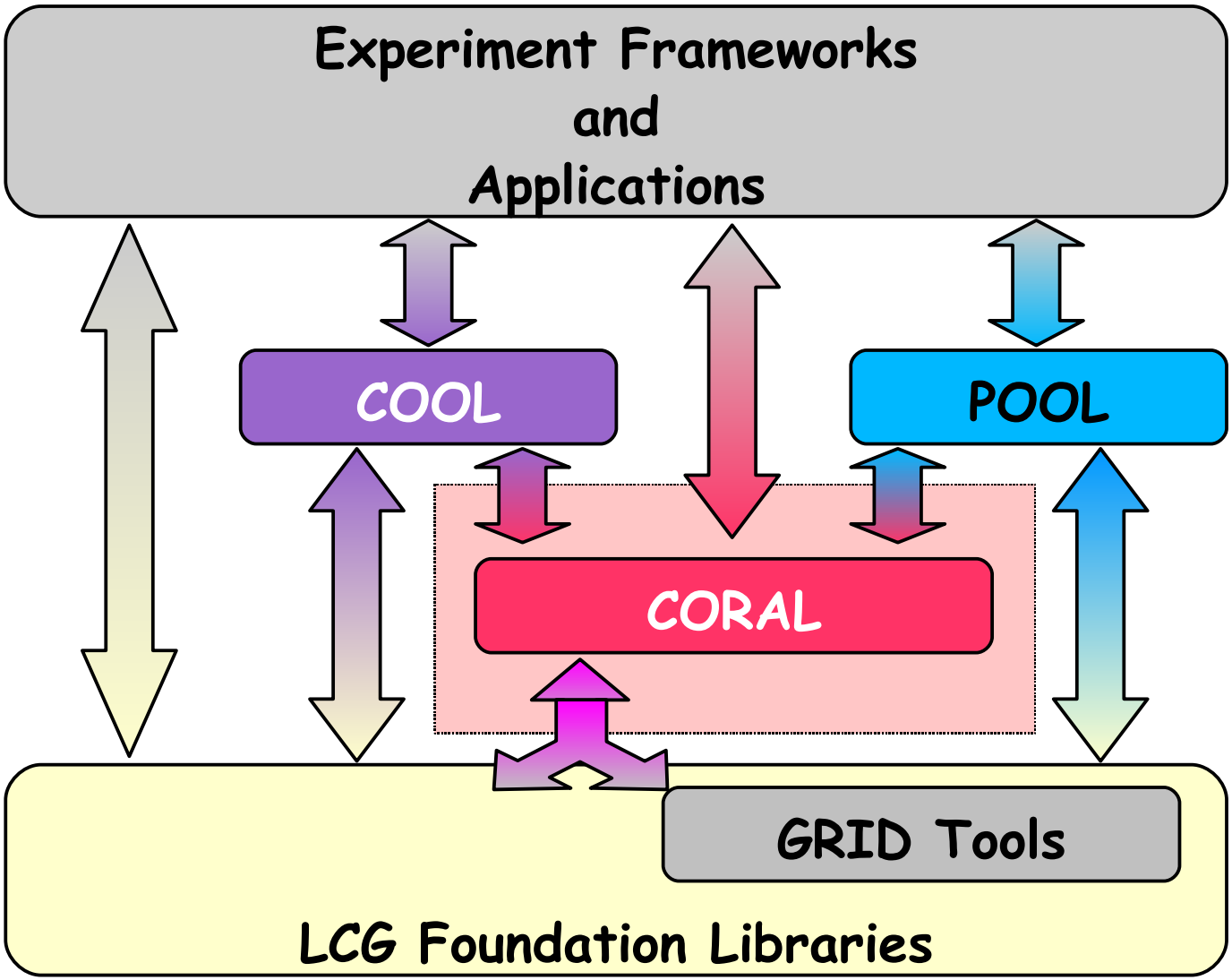

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C++ SQL-free API

Example : Table creation

```
coral::ISchema& schema =
session.nominalSchema();
coral::TableDescription tableDescription;
tableDescription.setName( “T_t” );
tableDescription.insertColumn( “I”, “long long” );
tableDescription.insertColumn( “X”, “double” );
schema.createTable( tableDescription);
```

Oracle

```
CREATE TABLE “schema”.“T_t” ( I NUMBER(20), X BINARY_DOUBLE)
```

MySQL

```
CREATE TABLE “schema”.”T_t”      ( I BIGINT, X DOUBLE PRECISION)
```

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Evolution

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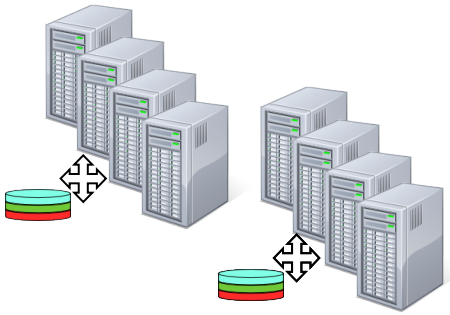
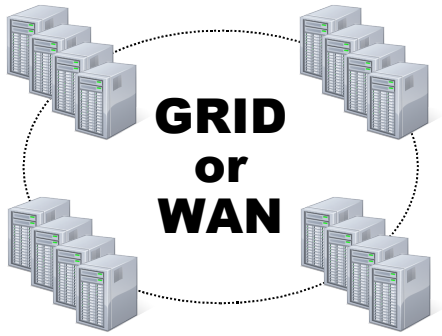




Single Instance RDBMS — **2003**

Clustered RDBMS — **2005**

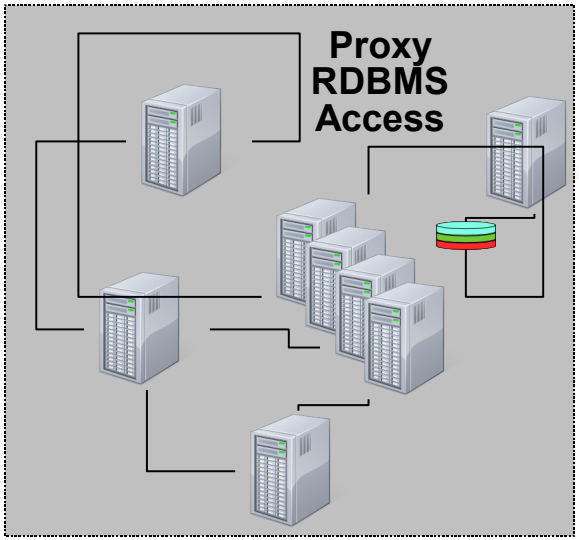
Distributed RDBMS — **2006**

2003
Fail-safety & Server resources usage

2005
Data Source Fail-over & Client Recovery

2006
Data Source Indirection, Thread-safety

Today
Security, Replication, Scalability



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Fail-safety & Resources Use

- Keep the 1000s concurrent clients alive
  - Client-side data source retry
  - Client-side data source fail-over
- Keep database servers responsive
  - A conection and session is not the same thing
  - Client-side connection pooling
  - Client-side connection sharing
    - multiple transactions per shared connection
  - Bulk operations
  - Row pre-fetching
  - Bind variables

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Robustness & Recovery

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- Clustered database challenge
  - Transparent fail-over
  - Physical data source independence
- Magic does not happen
  - Applications need to be ready for disasters
  - Rollback & re-connect
- CORAL healing effects
  - Logical data source descriptors
  - Connection policy customization
  - Failures intercepted early for a connection or session

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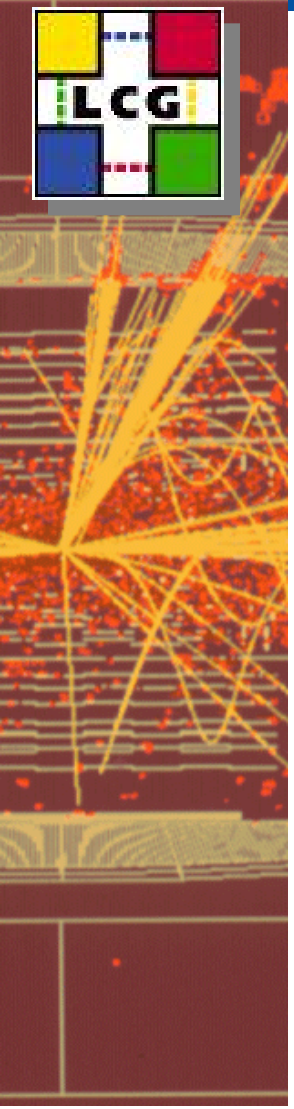
GRID and distributed data



- Distributed data access challenges
  - Transparent data source location
  - Secure single sign-on
  - Community or group data access rights
- The CORAL way
  - Data source indirection
    - callback hook for user customization
  - Data source lookup service
    - XML (can be shipped with the job input data)
    - via GRID LFC file catalog
  - GRID certificates via GRID LFC file catalog
  - Database roles via GRID LFC file catalog

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Thread Safety

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- Concurrent programming challenges
  - Responsive Applications
  - Getting data faster in shorter time
  - Getting the job done quicker
- Thread-safe design is hard
  - intrusive
  - performance is not 100% sure
  - dead-lock scares developers
- CORAL helps to
  - not worry about connection pooling and sessions
  - access database schema
  - launch concurrent transactions even with a shared database connection

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Future

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- Code refactoring and stabilization
  - due to experience from production deployments
  - reducing dependencies on external packages
  - simplifying internal component architecture
- The new development
  - CORAL Server project
    - Proxy server
    - Thin client
    - Database cache proxy

For more information go to:

http://pool.cern.ch/coral

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Python Scripting Support & Tools

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- Why?
  - Almost all LHC Computing GRID software provides Python binding, CORAL does too
  - Rapid prototyping
  - Testing code done quickly
- Python binding - PyCORAL
  - Minimalist approach
  - Only abstract interfaces and CORAL data types
- CORAL Tools
  - Large scale database services deployment need
    - development & testing, integration, production
  - Relational schema level utilities
    - schema inspection with table dependency tracing
    - schema to schema copy
    - schema + data copy with selection

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