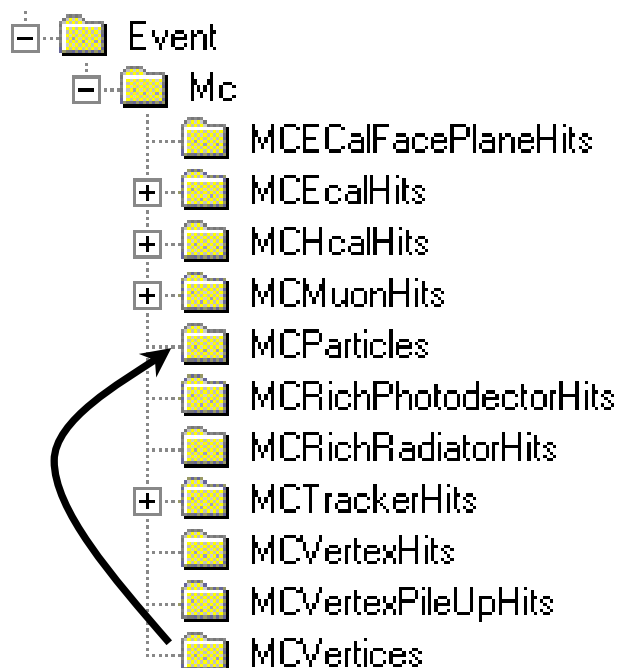# Event Storage

- ↖ **GAUDI - Data access/storage**
- ↖ **Framework related issues**
- ↖ **Data management aspects**
- ↖ **Should we go for a Data Challenge?**

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Structure of the Data Store

📁 Event
  📁 Mc
    📁 MCECalFacePlaneHits
    ➕ 📁 MCEcalHits
    ➕ 📁 MCHcalHits
    ➕ 📁 MCMuonHits
    📁 MCParticles
    📁 MCRichPhotodectorHits
    📁 MCRichRadiatorHits
    ➕ 📁 MCTrackerHits
    📁 MCVertexHits
    📁 MCVertexPileUpHits
    📁 MCVertices

- ↖ <u>Tree</u> - similar to file system
- ↖ <u>Identification</u> by logical addresses:
  "/Event/Mc/MCParticles"

- ↖ <u>Tree node</u>
  - ↗ has data members (payload)
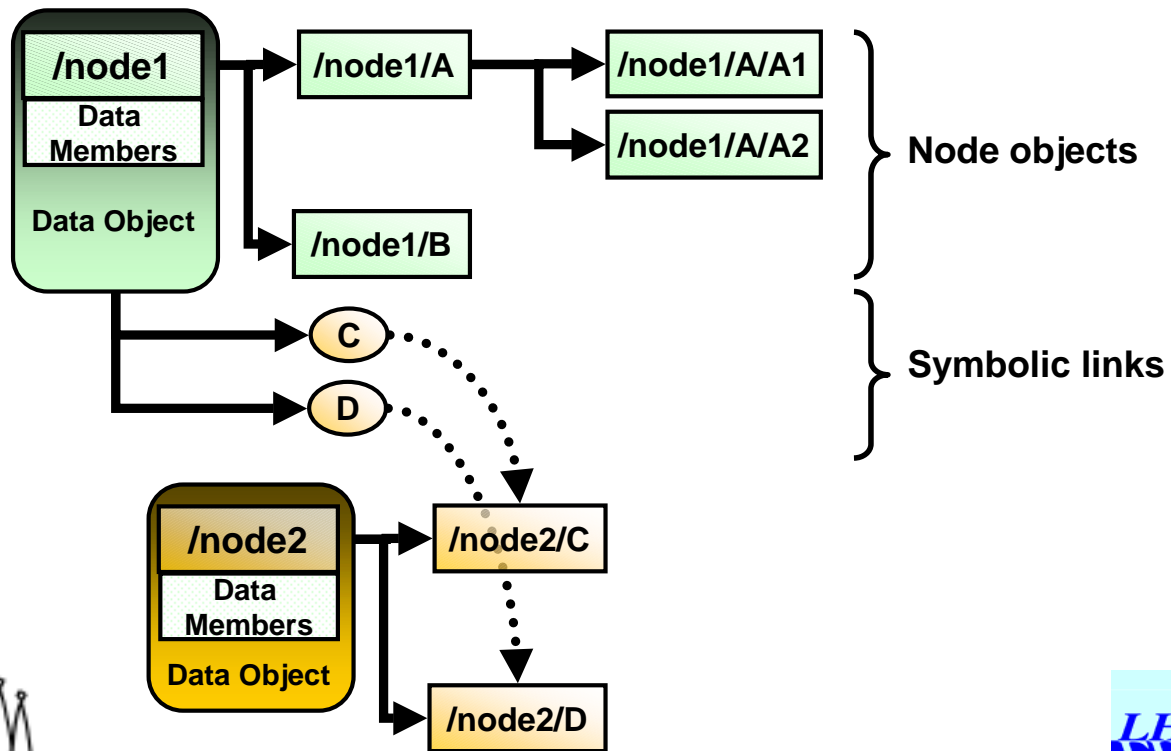 - ↗ contains other node objects (directory structure)

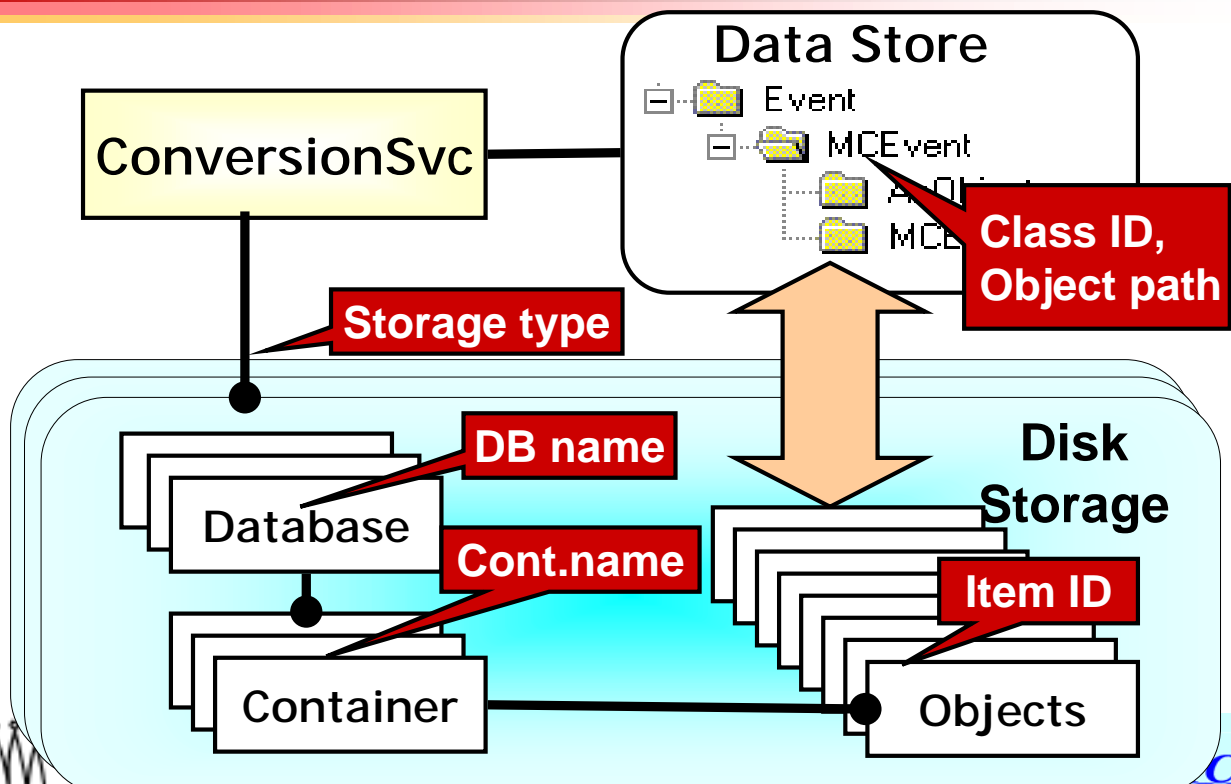GAUDI   M.Frank LHCb/CERN

Layout of the Data Object

/node1	→ /node1/A	→ /node1/A/A1
Data Members		/node1/A/A2
Data Object	→ /node1/B	Node objects

C, D → Symbolic links

/node2, Data Members, Data Object → /node2/C, /node2/D

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Generic Model: Ingredients

ConversionSvc

Data Store
- Event
  - MCEvent

Class ID, Object path

Storage type

DB name

Database

Cont.name

Container

Disk Storage

Item ID

Objects

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Generic Model: Extended Object ID

- **Storage Type**
- **Class ID**

- **Storage Type dependent part**

- **OID** → **Objectivity**

OR

- **Link ID**
- **Record ID**

**ZEBRA
ROOT
RDBMS**
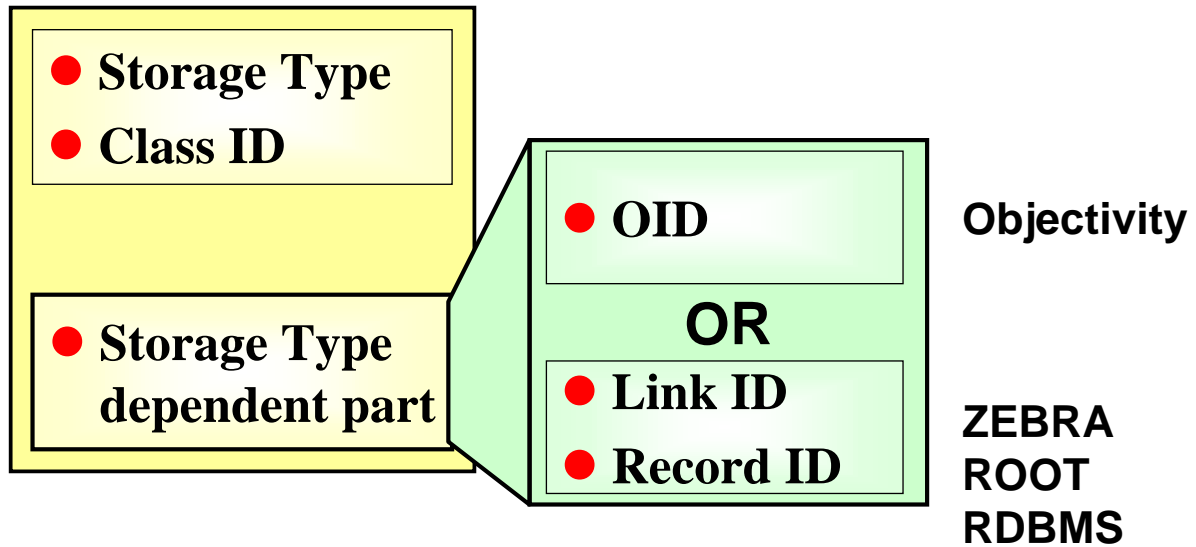
Data Serialization

↗ Object serialization a la ROOT/MFC/Java to a byte stream

```
StreamBuffer& MCVertex::serialize( StreamBuffer& s ) {
  ContainedObject::serialize(s);
  s >> m_position
    >> m_timeOfFlight
    >> m_motherMCParticle(this)
    >> m_daughterMCParticles(this);
    return s
}
```

↗ Machine & technology independent data format
↗ Store object as BLOB in database

Questions

↖ Are the *Blobs* a problem?

↖ Is a *data dictionary* necessary?

    ↗Generation of converters

    ↗C++ and Java interoperability

    ↗Handling of schema updates could possibly be automated

↖ Is *schema evolution* sufficiently supported?

    ↗Persistent schema + Transient schema

↖ Does this model also work for the online?

Binary Large Objects (BLOB)

✚ Only one type of persistent objects

✚ No updates to persistent schema

    ↗Objectivity/DB

– Low level access to object properties is lost

– Knowledge about data interpretation may not be lost

Language Independent Data Description

✚ Automatic generation of C++/Java stubs

✚ Automatic generation of *Converters*

✚ Store dictionary *with the data* in the database

－ Argghh! Another pre-processor????

－ Can only describe data, no "real" behaviour

Event Tags and Collections

↖N-Tuple like quantities with reference to event

↖We simply need them

↖Content must be configurable

  ↗"Official" tags from online, collaboration wide data processing

  ↗Group tags

  ↗User tags

↖Must support queries

  ↗SQL ?

Schema Updates

- **↖** Is our class ID/version mechanism sufficient
  - **↗** Class identifier   equivalent   Major match
  - **↗** Class version   equivalent   Minor match

- **↖** Objectivity's mechanism is not sufficient

- **↖** How do we supply data to "improved" objects?
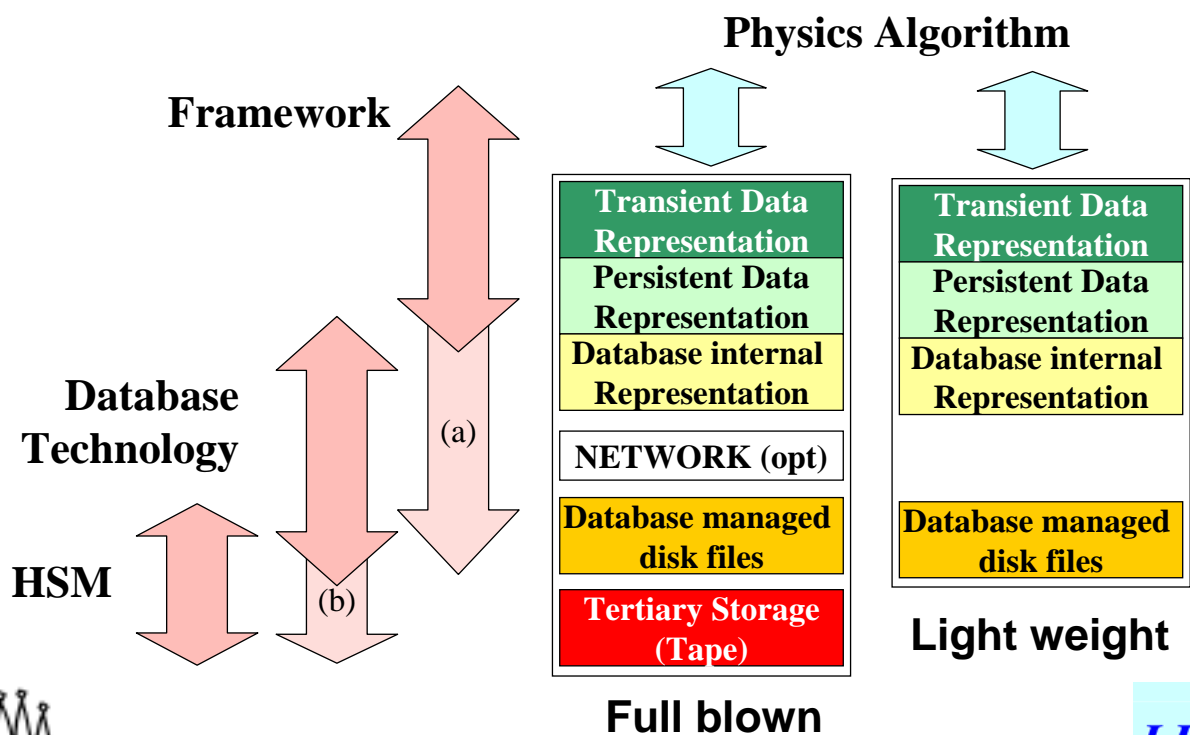 - **↗** Is this possible at all ?

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Data Storage Hierarchy

Physics Algorithm

Framework

Database Technology

HSM

(a)

(b)

| Transient Data Representation |
| Persistent Data Representation |
| Database internal Representation |
| NETWORK (opt) |
| Database managed disk files |
| Tertiary Storage (Tape) |

Full blown

| Transient Data Representation |
| Persistent Data Representation |
| Database internal Representation |
| Database managed disk files |

Light weight

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What to do?

- *"Never believe something will 'scale',
  you've been there or not"*

- *"Individually all components work fine,
  when put together only then the problems show."*

↖Data Challenges
- ↗ Identify missing components
- ↗ Check out persistency model
- ↗ Possibility to stress the database technology

Data Challenges

↖ Babar
- ↗ 1st: Test the data processing chain
- ↗ 2nd: Test of Objectivity

↖ ALICE
- ↗1st/2nd: Test of ROOT I/O + Data management

↖ CMS
- ↗ Simulation/analysis environment using Objectivity

First Data Challenge (1)

- What should be tested?
  - Processing scenarios
    - Simulation (online like?)
    - Reprocessing
    - Physics analysis
- Use of "the" complete database technology
  - GAUDI is open
    - Test one database or several?
  - Focus on the "usability" questions
    - Does the database fulfill basic performance needs

First Data Challenge (2)

- Identify missing components
  - Data management
  - Farm management
  - HSM
- "Dummy" data processing software
  - Emulate the software's behavior
    - Intelligent guess of object access
- Small dedicated facility
  - A few disconnected boxes
  - No interference with other users (reboot,...)
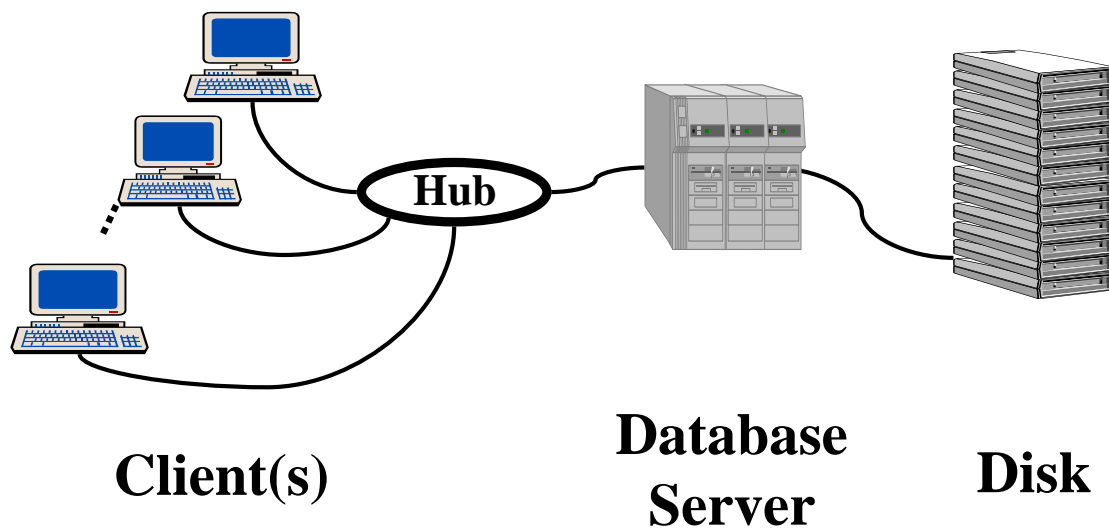
First Data Challenge: Setup

Client(s)　　　　**Database
Server**　　**Disk**

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Second Data Challenge

- ↖ Test full processing chain
- ↖ Test missing components from DC1
- ↖ Complete data processing software
  - ↗ Simulation, reconstruction, analysis programs
- ↖ Small dedicated facility
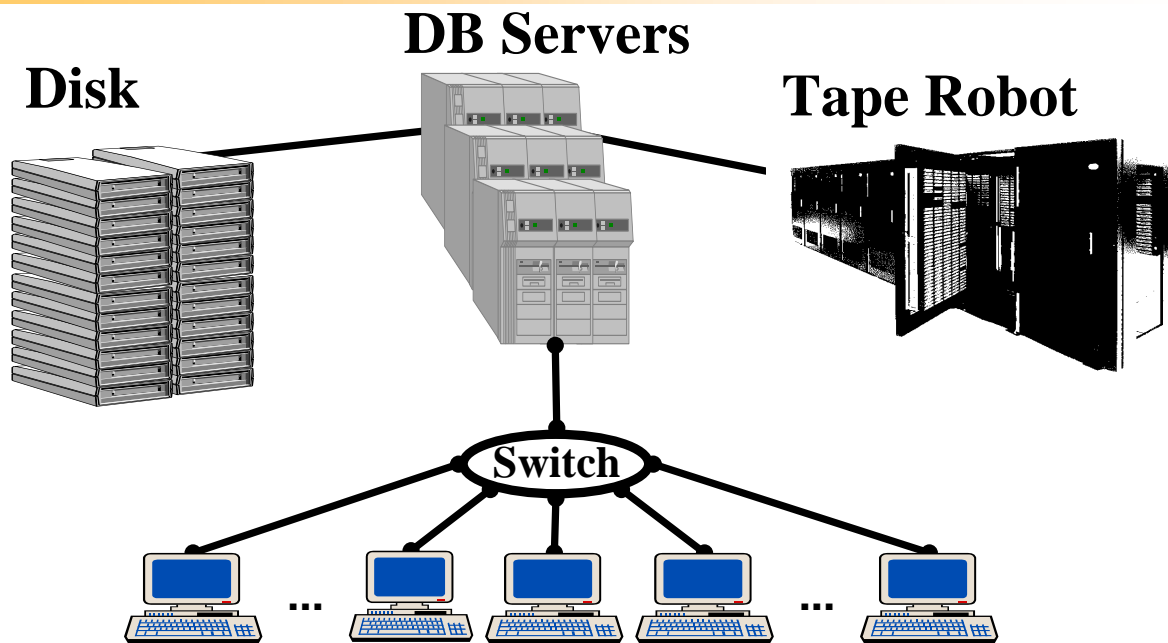 - ↗ Cannot be a "dedicated" LHCb facility
  - ↗ IT farm project
- ↖ GRID ?

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Second Data Challenge

DB Servers

Disk

Tape Robot

Switch

... ...

Conclusions

- ↖ There are open questions to be solved
- ↖ Questions about the framework
  - ↗ Data modeling
  - ↗ Schema handling
- ↖ Questions about technologies to be used
  - ↗ Database technology
  - ↗ Data management
- ↖ Once these are addressed
  - ↗ Should we go for a Data Challenge ?

Conclusions

↖ I only gave the discussion input

↖ We have to define to TODO list together

Let's go for the discussion

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