LHC-CP Workshop
Database breakout session

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The afternoon's objectives

- ➢ LHC Controls System will need proper data management
- ➢ Data volumes will be big and diverse
- ➢ Different areas of data management
  - control, measurements, logging, alarms, post-mortem
- ➢ Guidelines must be established for:
  - Data sharing and data integration
  - Methods and tools
- ➢ …before everybody starts his own niche development

How to reach these objectives?

- ↻ This afternoon is a good starting point
- ↻ Build on knowledge and experience we have gained

The presentations

- Oracle for LEP, **Ronny Billen / SL**
- LEP Control data and its sources, **Markus Albert / SL**
- LHC Production data, **Thomas Pettersson / EST**
- Complimentary database solutions, **Maciej Peryt / LHC**
- Data in PVSS SCADA systems, **Robin Martini / ST**
- Tools for database design and implementation, **Derek Mathieson / AS**

Some topics we have to address

➢ ***Time-stamping*** of measurement/logging data, how do we all stay synchronous?

➢ Plugged-in ***industrial*** systems, how to exchange data

➢ Object Oriented software ***mapping*** to RDBMS

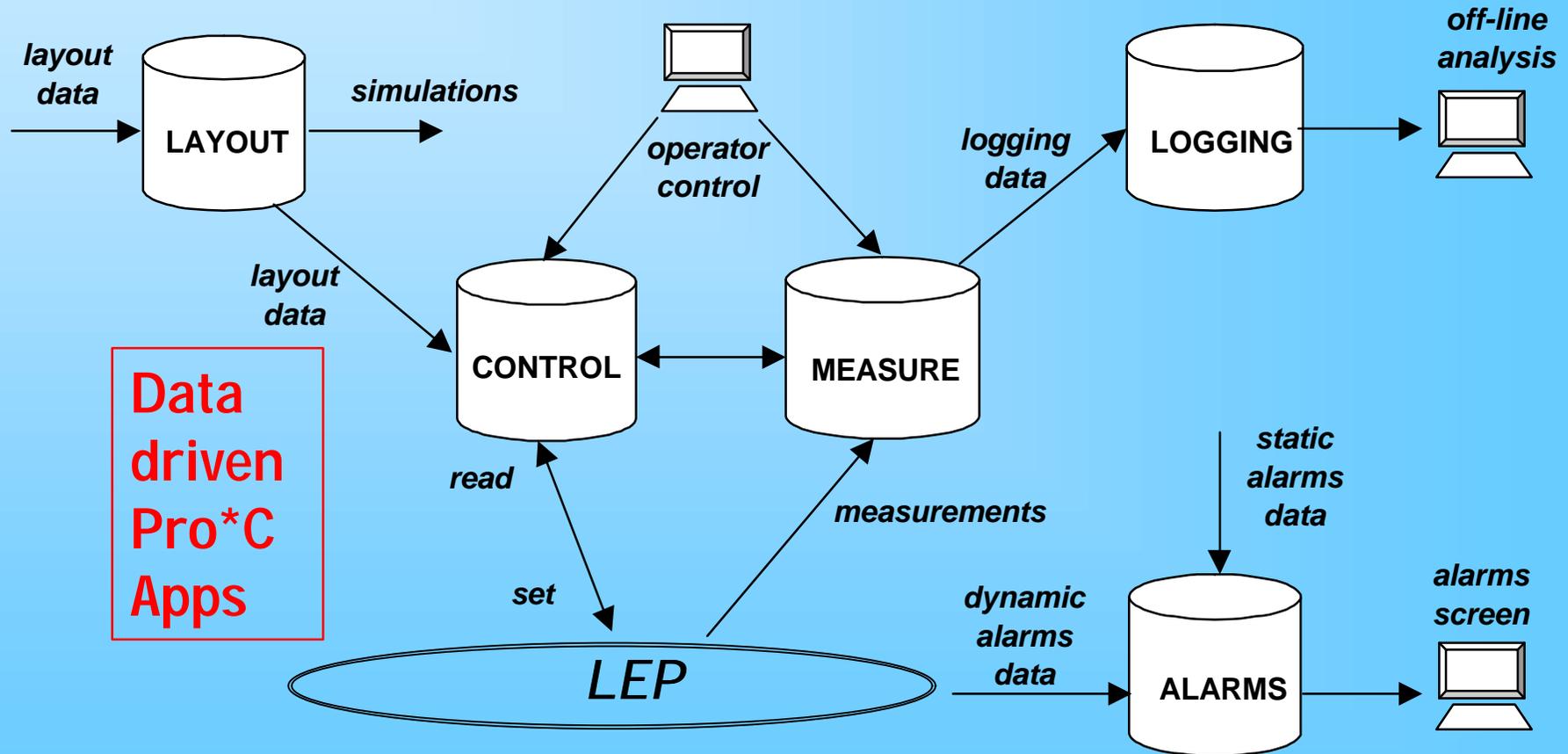➢ Design, development and implementation ***tools*** to use or not to use

Oracle for LEP

Ronny BILLEN

SL/MR/DBS

LHC-CP Workshop 5-6 April 2001   R. Billen, CERN

LEP operational Databases

layout data → **LAYOUT** → *simulations*

LAYOUT → *layout data* → **CONTROL**

operator control → **CONTROL**, **MEASURE**

CONTROL ↔ **MEASURE**

logging data → **LOGGING** → *off-line analysis*

CONTROL *read* / *set* → **LEP**

LEP → *measurements* → **MEASURE**

LEP → *dynamic alarms data* → **ALARMS** → *alarms screen*

static alarms data → **ALARMS**

Data driven Pro*C Apps

That was LEP…so now what?

➢ Copy & paste ? ☞ **We might to some extent…**

➢ LEP control was pretty data-centric… is this the right approach? ☞ **The data *IS* there in any case!**

➢ More industrial systems in LHC & different data

➢ Similar areas can probably be identified:

  • control, measurement, logging, alarms, *post-mortem (new)*

    ☞ **Only ALARMS project started so far…**

➢ Take advantage of new technologies

  • applications getting object oriented

  • Oracle has evolved as well

  • maintenance is an issue as usual

    ☞ **Let's worry about data model and functionality first!**

LEP Controls Data and its Sources

M. Albert, SL/OP

2nd LHC-CP Workshop, 5th April 2001

Database Session

Introduction

- LEP Controls Data was kept in an online

  $\Rightarrow$ brain of the LEP Control System

- It provided control and management of a large amount of equipment in a generic way.

- It offered the availability of beam adjustment and control in terms of physics parameters (Q, Q', Q_s ...), hw magnitudes (deflection angle) & hw settings (current) and allowed

  – proper settings management

  – reliable storing / retrieving of parameter settings

  – recording of all adjustments and stepping back

…and its Sources

- MAD (optics program)
  - initial physics parameters and equipment settings (hardware magnitudes)

- Machine Description Database (offline DB)
  -
  - equipment information (i.e. names, types, magnet connections to families, magnet-PC relationships)
  - different versions of LEP (real & study machines)

- Equipment Groups
  - configuration parameters
  - calibration curves
  - commands

Conclusions

- LEP Controls Data Management using an online ORACLE DB worked very well

- however :
  - data transfer was not always optimised
  - maintaining a single, up-to date data set needed considerable effort

- Centralised offline DB proved to be very useful

- Only a small subset of offline data was necessary to operate the machine (~500 Mbyte)

- LHC controls data not well defined yet, but one message can be clearly anticipated :
  It would be nice if equipment Groups maintain their data in a central, easily accessible and CERN supported DBMS (today it's ORACLE).
  ☞ Structure more important than the tool!

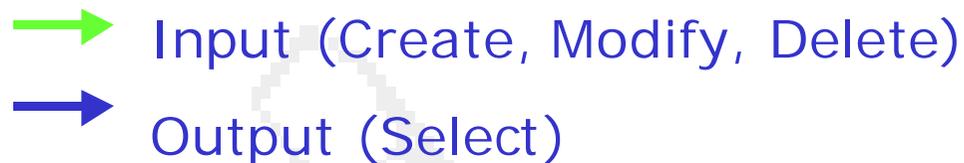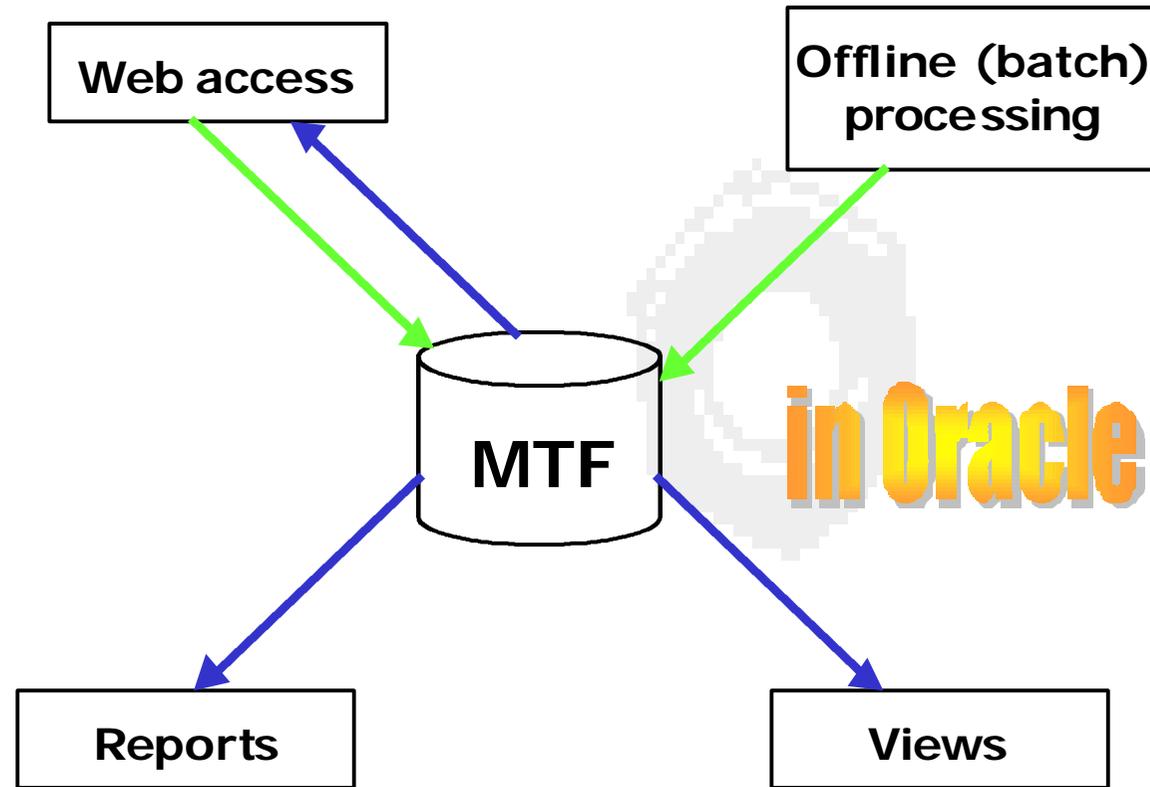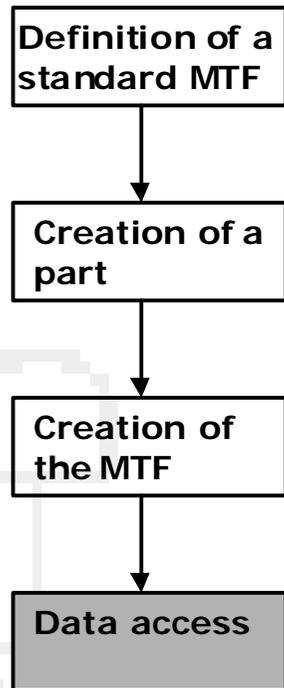# LHC data – what's there, what format and what policy?

Presently known (to us) general databases

- LHC Layout - mechanical, optical and survey

- LHC powering - but no new responsible person named

- LHC DMU- 3D information

- LHC MTA - Magnetic measurements

- LHC MMS - Dipole database(s)

- LHC ICP - Corrector MTF   (local and common)

LHC Production Databases for LHC controls
Data access - summary

Definition of a standard MTF

Creation of a part

Creation of the MTF

Data access

Web access

Offline (batch) processing

MTF

in Oracle

Reports

Views

Input (Create, Modify, Delete)

Output (Select)

Conclusion

- A policy has been formulated by the project.
  ☞ **Code de la route...**

- The tools are coming into place (EDMS, MTF, ...) and the formats are (mostly) under control.
  ☞ **Please no .pdf files!**

- Now the project engineers have to be convinced to actually use these tools (private vs
(LHC Controls Project's) needs must be conveyed to them....

- There is a need to start discussion on what data should be in the "LHC database" and who will manage it...

☞ **LHC-CP needs to tell Thomas what data is needed, he'll take care of the upstream data.**

☞ **InfoPlus.21 real-time database**

☞ **Oracle8i TimeSeries cartridge**

- **Very powerful tool for modeling and optimizing industrial processes.**

- **Does not provide much added value for our logging needs.**

- **Useful experience: nice example of user-friendly information management system.**

- **Provided numerous ideas that I used in the development of my software.**

- **Provides storage and retrieval of time-**

- **functions for managing time series.**

- **time series, but some functions not available.**

- **Can be easily modified/expanded by any fairly experienced Oracle application developer.**

◆

☺ **Simple and fairly powerful product on top of the best RDBMS.**

☺ **Oracle free at CERN, Time Series as well.**

☺ **Expertise on site.**

☺ **Unix environment very well supported.**

◆

☹ **Some code to be written to integrate with external data sources. Easy to do as information exchange through XML/HTTP.**

☹ **Client-side data extraction tools have to be developed. Prototype web interface written in PHP already exists.**

☹ **High-frequency time series not supported, but that's another story (post-mortem systems).**

☞ **50 kHz data storage possible using LOBs or nested tables**

Databases and PVSS for Technical Services Monitoring

1. The story so far

2. The way forward

The PVSS era

- Configuration requirements
  - same again please! ☞ **Copy & Paste**

- Data Logging requirements
  - same again please! ☞ **Copy & Paste**
  - Logging on ~~PVSS~~ and ORACLE ☞ **says consultant**
  - PVSS as logging agent to ORACLE
  - PVSS displays ORACLE logged data
    - integrate with local data

      ☞ **This looks interesting!!!**

The Challenges

- Naming Standards
  - different PVSS systems for different domains
  - devolution of responsibility
  - systems can and must work together
  - complex data point coding structure
- Configuration data update procedures
  - correct procedures ➡ quality
  - coordination, authorization
  - define technique (XML, ODBC)
- Define Data Logging strategy

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Database Tools in AS

By Derek Mathieson (AS-IDS)

Database Tools in AS

➢ <u>Oracle Designer</u>: good for RAD, prototyping, sharing objects…but no evolution, PL/SQL

➢ <u>Custom Apps</u>: fully Java, Java Servlets for UI, modeled on EJB 'entity beans'

➢ No EJB (yet) but using same principles

➢ All Code must conform to coding standards http://ais.cern.ch/apps/edh/CodingStandards

➢ <u>JAVA</u>: OO, fast development, platform independent, secure

➢ Object-Relational mapping not a problem

➢ <u>Oracle JServer</u>: JVM in the 8i DB: efficient, scalable, fast

➔ **Designer & JDeveloper, UML, XML, more focus on Java**

Conclusions of the database afternoon

☑ ***Oracle***

☑ Start working on the ***data model*** and ***functionality***, do not yet worry about implementation (LEP was not so bad)

☑ Tell equipment groups what LHC Controls ***need***

☑ If equipment groups do not use Oracle, ***impose*** the data model

☑ PVSS has limited data management; (logging) ***interface*** to Oracle must be implemented and tested

☑ ***Naming*** ... across PVSS domains needs to be looked into

☑ We'll be looking for ***Data Administrators***

☑ New-tech feasible (Java, 8i, TimeSeries,...) but...

💣 ***beware of the WEB***