Minutes of LHC-CP Link Meeting 3

Subject : LHC Controls Project

Date : 16:00 12th September 2000

Place : 112/R-018

Participants :

Billen, R		SL-MR
Brahy, J		LHC-IAS
Bruning, O		SL-AP
Carlier, E		SL-BT
Charrue, P		SL-CO
Ciapala, E		SL-HRF
Di Maio, F		PS-CO
Epting, U		ST-MO
Gavaggio, R		LHC-VAC
Gras, JJ		SL-BI
Jonker, M		SL-CO
King, Q	(Secretary)	SL-PO
Lamont, M		SL-OP
Pezzetti, M		LHC-ECR
Schmidt, R		AC-TCP
Tyrrell, M		SL-CO
Vanden Eynden, M	(Acting chairman)	SL-CO
Walckiers, L		LHC-MTA

Excused :

Lauckner, R	(Chairman)	SL-DI
Rodriguez Mateos, F		LHC-ICP
Wolf, R		LHC-MMS

Absent :

De Rijk, G	SL-MS
Gayet, P	LHC-ACR
Martel, P	EST-ISS

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Agenda :

1. Minutes from previous meeting	
2. Mandate for alarm services	M. Tyrrell
3. Activities of SL/CO	P. Charrue
4. AOB	

1. Minutes from Previous Meeting

The minutes from the second meeting were approved.

The acting chairman, Marc Vanden Eynden, explained what the core team had been doing during the summer months. Two sub-project mandates have been written, for the LHC alarms and top down analysis of the LHC controls system. The first of these was presented during the meeting, and the second will be ready for distribution to the link men next week. Furthermore, work is ongoing on the integration of industrial components and the real-time requirements for LHC.

The chairman then mentioned that there had been some confusion about the procedure for launching sub-projects. He explained that the procedure involves:

- Preparation of a written mandate.
- Presentation of the mandate to the LHC-CP link men for discussion and approval.
- Presentation of the mandate to the LHC-CP steering committee (SLTC) for approval and resource allocation.

2. Discussion: Mandate for LHC Alarm Services M. Tyrrell

The head of the Alarm Services section of SL controls group, Mark Tyrrell, gave a presentation (see attached slides) of the Mandate for LHC Alarm Services (http://cern.ch/service-alarms/mandate.stm).

He explained that the new alarm system will be used for all systems and sub-systems of the associated with the LHC. The alarm system provides a service for reporting and archiving problems with the process of operating equipment. Problems may be serious (alarms) or less serious (warnings), but all categorised as Fault States (FS).

Detection of Fault States is the responsibility of the equipment groups. The alarm system will receive notification of Fault States from the equipment via a clearly defined interface standard (or contract). This standard will also define a hierarchical naming convention with Fault Families (FF) containing Fault Members (FM) and Fault Codes (FC).

A Fault State is described by

- static information stored in a database and indexed by the triplet FF, FM, FC.
- dynamic information which must be transported through the alarm system along with the triplet.

The alarm system will include a "business layer" which will support several methods for reducing the number of alarms which will be displayed on the operator screens. This will include:

- Multiplicity reduction
- Node reduction
- Oscillating Fault State detection

The business layer will also provide other services including testing faults, archiving, GSM notification, and publishing of the filtered fault states via a middleware. Display applications and other software applications will then be able to access the fault states.

In summary, Mark explained that the mandate was for the analysis, development and commissioning of the new alarm system for LHC (SPS and hopefully other areas). In the first instance, a survey of user requirements would be made using a questionnaire, and in two years a prototype system would be tested with the new QRL services.

He emphasised that the new system would run in parallel with the existing system, and that all existing alarms and new alarms (for the QRL for example) would be linked to both old and new systems. Only once the new system was working reliably would the old system be decommissioned.

An extended discussion followed which was summarised by the chairman:

- The LHC Alarms sub-project core team should include representatives from several CERN entities, in particular ST Division and the LHC experiments.
- It was noted that the Alarms project is dependent upon the choice of middleware by the PS/SL middleware project. The middleware will be used to publish fault states for application programs and will be the communication layer upon which the Alarm API contract will be based.
- It was noted that archiving alarm events (as opposed to fault states) could help the post mortem of equipment failures, but Mark Tyrrell was clear that the alarm system should not be seen as a post mortem tool. He did say that the system would support "Instant Fault States", in which the start and end times are the same, and this could be seen as a way to support alarm events.
- As with LEP and SPS, the alarm system will use the concept of accelerator mode to condition alarms. It was noted that many other systems, the interlock system for example, would also be interested in the accelerator mode and therefore a system for distributing the mode would be needed (presumably the controls middleware). This is an important subject for future debate.
- Mark Tyrrell has proposed a test facility for fault states for the new alarm system. This was considered very important (and not currently available for SPS/LEP). A similar concept will be included in the interlock system.
- The importance of the Fault Naming convention was reiterated. It was noted that P. Gayet is the LHC-CP core team member working on naming conventions.
- The questionnaire for the Alarms survey should be reviewed by the LHC-CP link men before distribution.
- The bridge linking PS alarms to the new alarm system is not expected before 2002.
- It was emphasised that the declaration of fault states is the responsibility of the equipment and not the alarm system. In particular, it not expected that the alarm system will retrieve alarms from PLCs. Instead, the supervising SCADA system must publish the fault states, following the alarm interface contract rules.
- It was stated that there is no relationship between the LHC alarm service and the INB status of LHC. This is because a separate INB approved safety alarm system will be deployed by ST (CSAM). This will be seen as a "client" of the alarm services like any other process.

3. Activities of SL/CO — P. Charrue

Pierre Charrue, the head of the SL Controls group, presented the mandate for his group (http://sl-div-co.web.cern.ch/sl-div-co/PowerPoint/CB17AUG2000.PPT). This emphasised the need to collaborate with other groups and divisions, and in particular, IT Division.

In the brief discussion which followed it was noted that:

- IT and SL divisions use incompatible AFS and NFS filesystems, respectively. The choice of file system will be a critical issue when passing responsibility for SL controls computing to IT. It was noted that AFS is not supported by the LynxOS real-time operating system, used by SL front end systems, and the AFS has problems which do not make it the ideal choice for a controls system. It was mentioned that IT are going to support AFS and NFS for the PS division and that the new SL Helix project (HP eradication and Linux integration) would address these issues.

4. AOB

None.

Actions	People
Review RT requirements for end of 2000.	M. Lamont, R Lauckner
Prepare mandate for new LHC-CP sub-projects (Top Down Analysis of LHC Control System) to be presented at the next LHC-CP meeting.	LHC-CP Core Team

Mandate for LHC Alarm Services.

M.W.Tyrrell.

CERN / SL / CO / AL

What are we talking about ?

- Information concerning problems with the process
- Process:
  - everything concerning LHC - CERN Site:
    - PS complex / injector for SPS
    - complete SPS complex
    - complete LHC complex

What are we talking about ?

- examples:
  - beam transfer dumps targets
  - power converters magnets vacuum
  - cryogenics RF beam monitoring
  - interlocks safety radiation
  - control system experiments experimental areas
  - technical services:
  - water electricity air-conditioning
  - environment
  - etc.

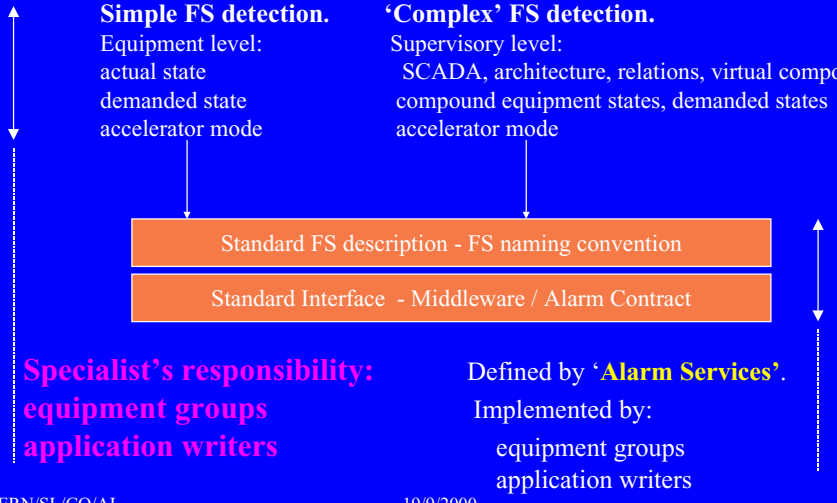
What are we talking about ?

- process environments:
  - electrical, ENS commercial SCADA (Supervisory Control And Data Acquisition)
  - cryogenics, PCView commercial SCADA
  - experiments, commercial SCADA, probably PVSS
  - SPS, main PS commercial system using PC's
  - SPS targets WinCC commercial SCADA
  - technical services, 'Smart Sockets' commercial system
  - accelerator equipment groups, in-house systems
  - etc.

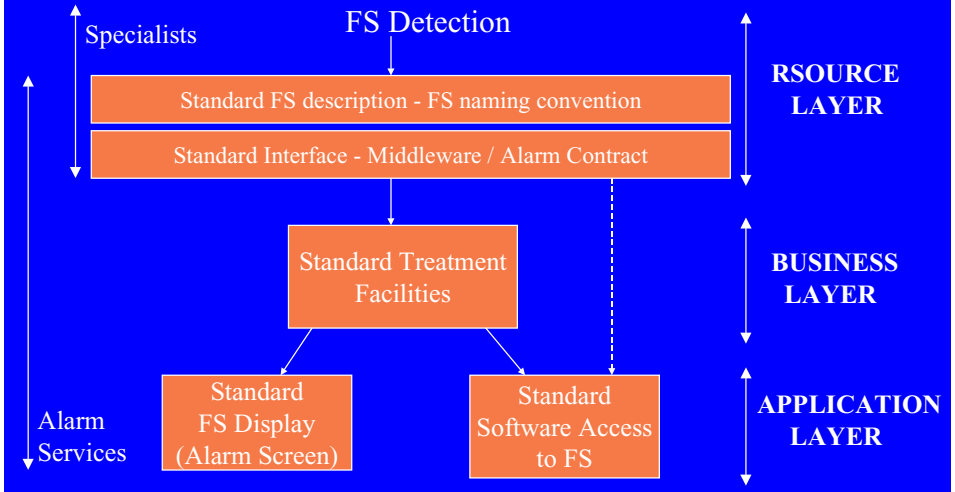
What are we talking about ?

- Problems
  - something ‘wrong’ with a part of the process
  - could be very serious, an ‘alarm’:
    - fire, loss of beam, …..
  - could be a warning:
    - fire detector fault, power converter current drift, …
  - because the ‘problems’ range in severity, we call them: ‘Fault States’ (FS):
    - we do not consider ‘normal states’ - mimics
    - we do not consider ‘normal events’ - maintenance

FS Detection.



Alarm Chain - Overview.

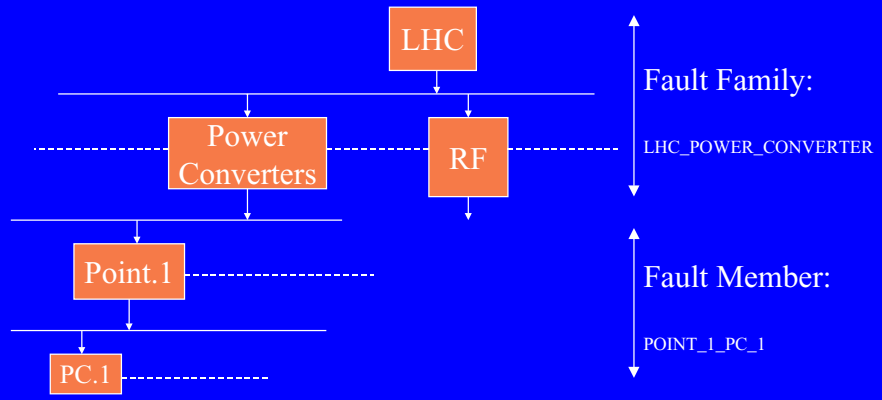


Resource Layer - FS Naming.

- Group ‘systems’ together which have similar (FS), e.g. power converters, vacuum sector valves, fire detectors,…….:
  - we call the ‘group’ the ‘Fault Family’ (FF)
  - an instance of the ‘group’ we call the ‘Fault Member’ (FM)
  - to the problems of the (FF), we associate a ‘Fault Code’ (FC) & a text describing the problem.
- The (FS) ‘key’ is: (FF), (FM), (FC)

Resource Layer - FS Naming.

- Hierarchical naming:



LHC / POWER_CONVERTER / POINT_1 / PC_1

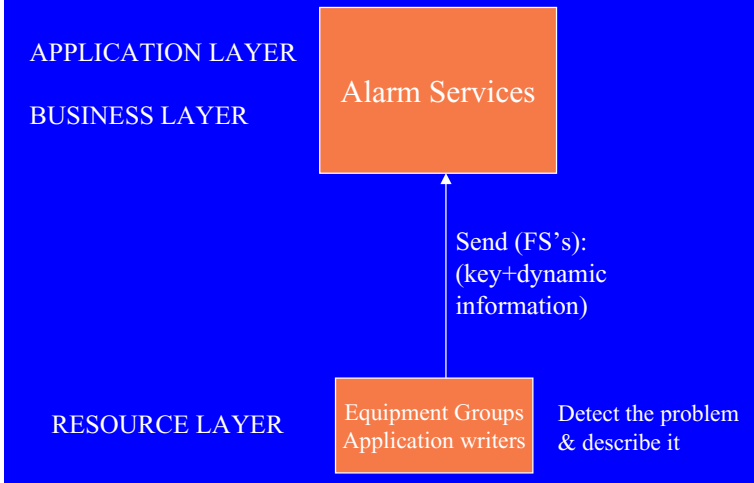
Resource Layer - FS Description.

- Static:
  - installation concerned, location, responsible, action to be taken,……
  - this information is stored in a database
- Dynamic:
  - arrival time / GPS time, analogue values, dynamic text,…(NOT a Post Mortem facility)
  - this information is generated in real time at (FS) creation time & is part of the (FS) description

Resource Layer - Alarm Contract.

- Properties of the contract:
  - **specialists** will require some form of FS management
  - publish subjects of active FS's for business layer
  - start / stop publishing
  - send list of defined FS
  - send a given FS as a 'test' - (prefix, terminate)
  - etc.

General Alarm Chain Topology.



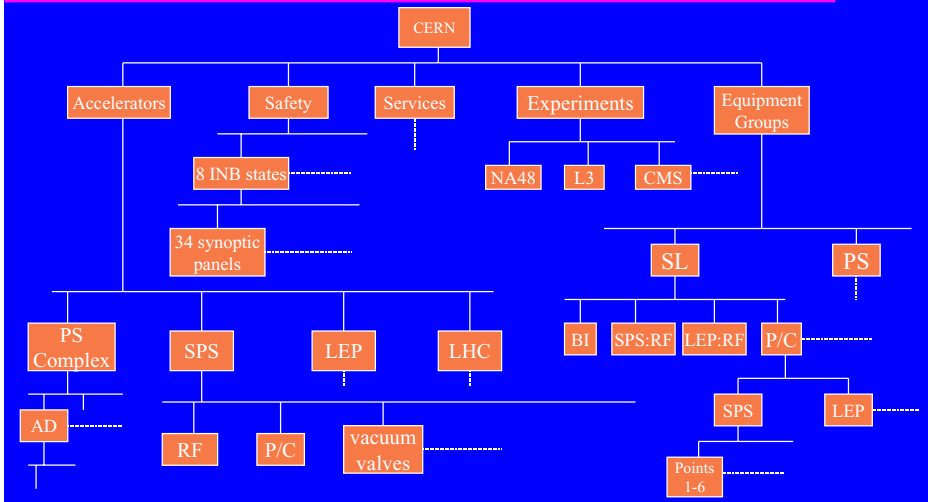
Business Layer - FS Treatment.

- FS reduction: (not detail equipment analysis)
  - multiplicity reduction, mask similar FS's
  - node reduction, a defined node FS masks others
  - masking an oscillating FS
  - placing FS's in maintenance
  - FS conditioning on accelerator mode
- Archiving, GSM connection, ...
- Publish FS subjects for application layer
  - tree structure

Application Layer.

- Alarm Console:
  - subscribe to subjects according to needs of users
  - display FS's in a standard way
  - offer interactive facilities on the FS list
- Application software:
  - possible for any software to subscribe to any FS subject - includes the business & resource layers

Hierarchical 'subject' example.



Application layer

Mandate Points.

- Purpose:
  - to provide a solution for: naming, receiving, processing, transmitting and displaying all alarm conditions inherent to the operation of the future LHC machine.
- Scope:
  - to provide: a functional specification, architectural design, implementation, commissioning.

Mandate Points.

- Milestones:
  - requirements survey by end 2000
  - presentation of survey results Q1 2001
  - requirements Q2 2001
  - functional specification, interfaces Q3 2001
  - prototype for LHC QRL tests 2002
  - full operational system for LHC Sector Test 2003 - switch off current system