Technical Services Communications

4th LHC-CP Workshop
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Peter Sollander

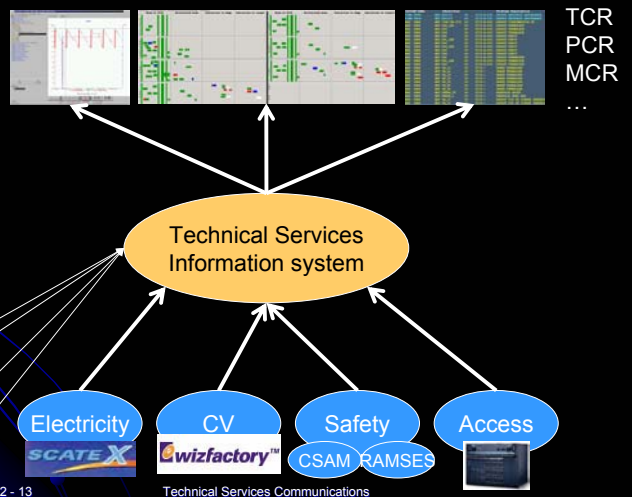
Outline

- Problem domain
- User Requirements
- Software architecture
- Hardware architecture
- Milestones

Problem domain

- The TCR supervises a large number of heterogeneous systems
  - ST systems like electricity, safety and cooling
  - External systems like accelerators, vacuum, cryo, …
- The TCR control system must integrate data from all sources and distribute it via different tools and interfaces
- The system must run 24 / 365!

Technical Services Communications



User Requirements

- Data Acquisition
- Data distribution
- Data representation
- Configuration
- Performance and scalability
- Reliability, availability, maintainability and safety (RAMS)

Data Acquisition

- Acquisition of intra-domain (ST) data
  - Electricity, CV, Safety, Access
  - SCADA access through standard interface
  - PLC access through dedicated driver
- Acquisition of extra-domain data
  - AB accelerator data, Cryo, Vacuum, …
  - Today, SL-Equip, Clogger, CMW, SPS2001
  - Tomorrow, DIP!

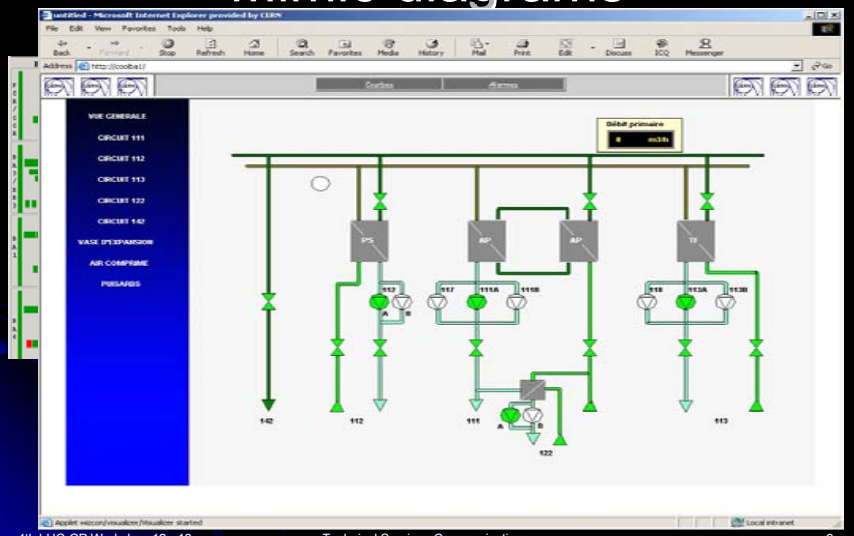
Data Distribution

- Make available ST data to other domains
  - Data Interchange Protocol
    - Transmit raw data
  - Alarms
    - Transmit technical alarms via the central alarm service LASER
  - Logging
    - Record technical events via the joint LHC/TCR logging system

Data Representation

- Mimic diagrams
  - “GTPM” diagrams for various accelerators, services
    - Very valuable overview diagrams with system dependencies
    - SPS views running since May 2002
    - CPS views deployed in MCR in 2003
    - QRL views under study
  - Integrate local SCADA views in TCR
    - Imported views must adhere to convention
    - ST HMI convention established based on SASG work
    - CERN HMI convention welcome
  - Detailed views for equipment lacking local controls

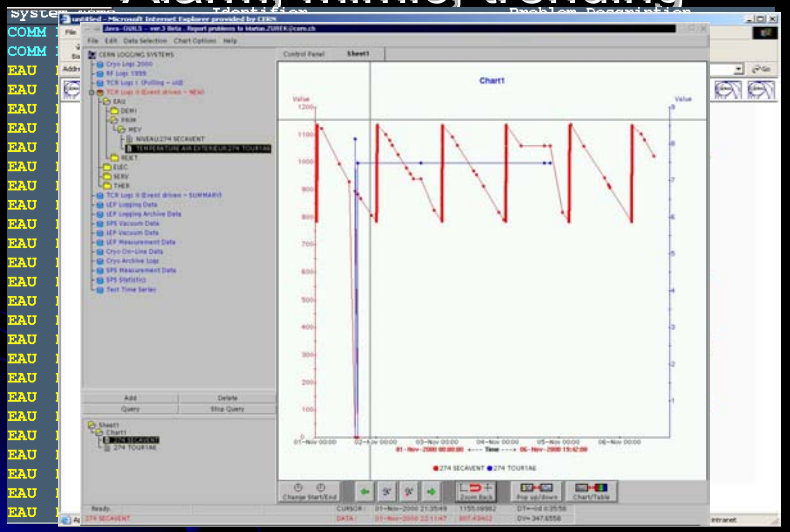
Mimic diagrams



Data representation (cont.)

- Alarms
  - Use LASER as TCR main alarm interface
    - Detailed alarm lists sometimes available with applications (ENS, CSAM)
- Trending
  - Use LHC/TCR logging interface (JavaGuils2)
  - Trend current values as well as logged data
- Integrate data representation tools

Alarm, mimic, trending



Configuration

- TDrefDB: Configuration database for all shared technical data
- Oracle database in B513
- Configures all modules in the control system from data acquisition to alarms and mimics
- Database must be correct and in sync with data sources
  - Procedures for data maintenance essential

Performance and scalability

- Performance
  - Average delay event to screen = 1s
  - Worst case (avalanche) delay = 60s
    - An avalanche estimated to 10000 events
- Scalability
  - TDrefDB holds 40000 tags
  - TCR monitors 40k tags + direct CAS points (vacuum, cryo, …)
  - Estimated size for LHC is 100000 tags
  - New system must be scalable to cover even larger quantities of data if necessary

Reliability, availability

- High availability constraints
  - TCR operates 24/365
  - Good protection against major failures
    - Redundant servers, UPS
  - No more than 1 short blackout per year
- High reliability constraints
  - No data loss (at least no alarms)
  - Reliable data, quality indication
- Monitoring
  - System monitoring, trouble shooting and repair tools to guarantee correct system behaviour
    - SPI-ME, Cyan Jaguar, …

Maintainability

- Technical Control Desk
  - Current maintenance procedure for TDS data
    - Ensures correct and complete data, monitors progress, coordinates efforts and assesses costs
  - 229 change requests issued in 2002
    - Updates , changes, deletions
      - ~2500 new points integrated
  - Integrated system maintenance procedure
    - Automates configuration, generates alerts, checks consistency

Solutions

- Several solutions evaluated
- Conclusion : Middleware, not SCADA
  - Heterogeneous data sources
    - PLC, Scada, SL-Equip, CMW, …
  - Use of external modules
    - Single alarm, mimic and trending tools able to combine and display data from various sources
  - Open, modular design
    - The system must be open enough to allow integration of new modules

The middleware solution

- Message Oriented Middleware
  - Move from TDS SmartSockets to SonicMQ already used by 4 AB projects
    - Cluster brokers and use queues to ensure availability and reliability
- Application server
  - Oracle application server, already used in AB and available at CERN through IT
    - Cluster application servers for availability and load-balancing
    - Use EJB to implement business logic (supervision, invalidation, composite states, …)
- Use common tools for alarms and logging
- Benefit from common environment

TIM Software Architecture

PLC driver: Java application acquiring data from PLCs and updates application server

Ddal: ST standard component to communicate with SCADA systems (Smartsockets interface replaced by JMS)

DIP Gateway: Collects data from other domains, publishes technical data as requested

SonicMQ: Middleware both for data acquisition and data distribution. Could be same broker

Oracle9i application server: Business logic, persistence, configuration, …

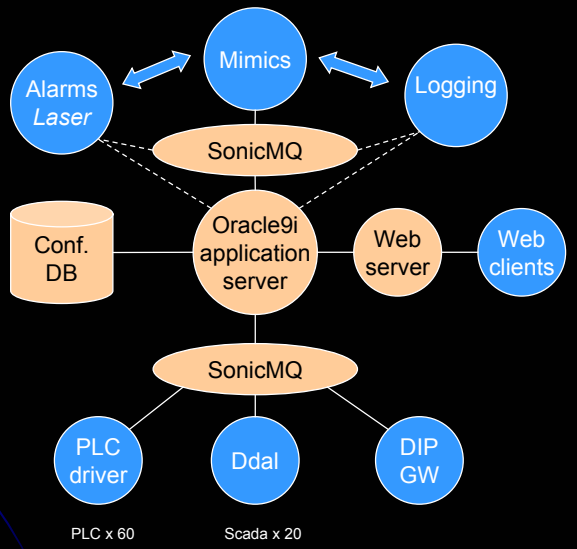
Conf DB: Oracle configuration and persistence database.

Web server, client: Web access to the data for administration

LASER: Alarm interface through Sonic or directly from application server

JViews: Mimic diagrams, GTPM and detailed.

Logging: Interface to the logging system through Sonic or directly from application server.



TIM Hardware Architecture

Data acquisition: Acquires data from PLCs and updates application server

Scada: Wizcon and ENS scada systems communicating directly with application server

DIP Gateway: Collects data from other domains, publishes technical data as requested

Application server and MOM cluster: Hosts Oracle9iAS and SonicMQ software.

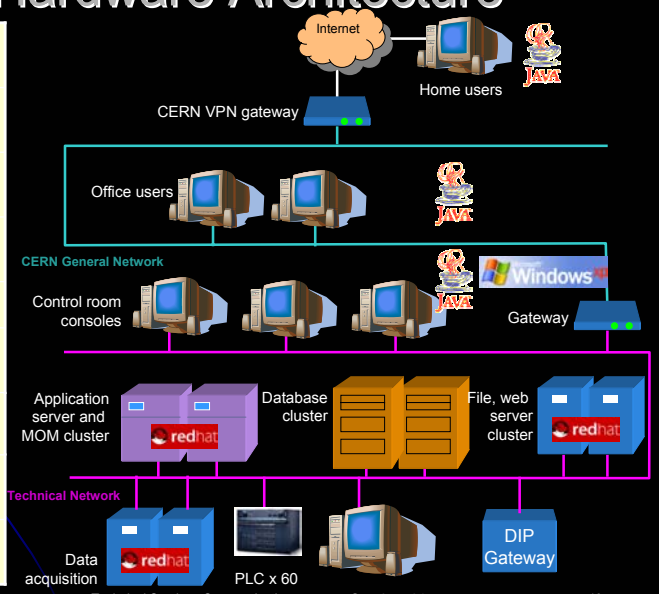
Database cluster: Configuration database and data persistence

File server: Reliable server for application files (views etc) and web server for operations portal

Control room consoles: Windows machines running user interfaces

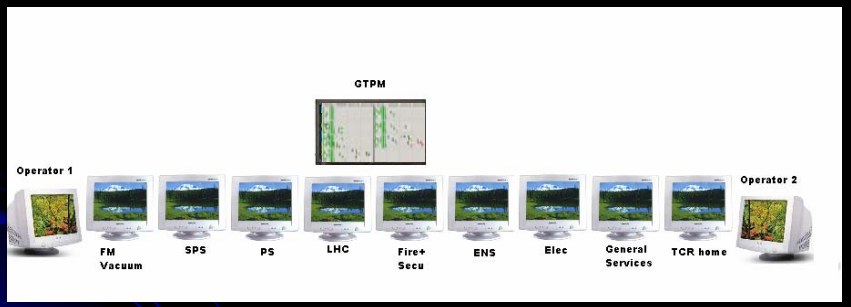
Office users: User interfaces and administration tools run from offices on the general network

Home users: On-call specialists may connect to the system through the CERN VPN

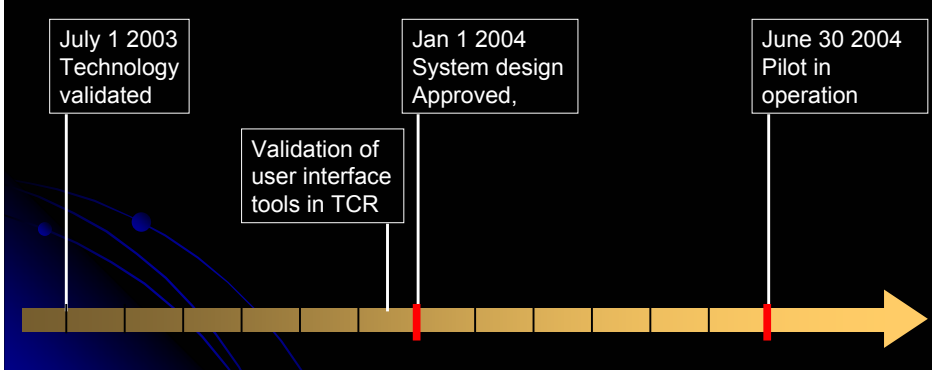


Future TCR console

One of the current proposals



Milestones



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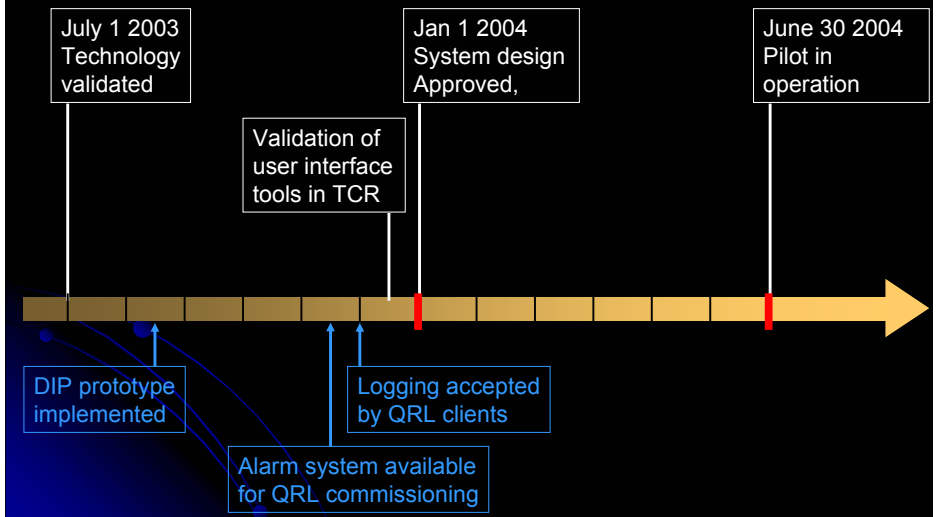

Questions?