LHCb Online Infrastructure Monitoring Tools

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Motivation

- Large nature of the experiment:
  - Large number of PCs:
    - 1747 PCs (55 Windows, 1692 Linux)
    - 34 Virtual Machines
  - Different system architectures

- Need to monitor and maintain infrastructure operation parameters reliably

- Central tool to globally monitor the infrastructure
Layered approach

- Heterogeneous nature of the computer infrastructure required a layered approach to monitor different sets of parameters:
  - Hardware Layer – The hardware infrastructure
  - Operating System Layer – The software infrastructure/environment
  - PVSS Infrastructure – The supervisory control software running the experiment
  - Application Layer – Specific software needed for system control and operation
To monitor the parameters for the different monitoring layers a set of tools was developed:

- Monitoring and Control Servers (FMC Tools):
  - Gather and publish computer parameters
  - Publish data based on DIM (Distributed Information Management)
  - Operating system dependent (Linux/Windows)

- Graphical User Interface and “aggregation” Tools
  - Provide a centralized interface
Monitoring and Control Servers

- OS dependent:
  - Slightly different approach according to the OS (Linux/Windows)
  - Linux:
    - Collaboration with Università di Bologna
    - Each of the monitoring servers must be running on the node to be monitored which publish the node data
  - Windows:
    - A server on a central PC connects to the windows nodes, gathers the data and publishes the data for all of the nodes
Monitoring and Control Servers

- Hardware Layer:
  - OS independent monitoring/control:
    - IPMI Server – gathers and controls PCs power status via the IPMI (Inteligent Platform Management Interface) interface
    - Virtual Machine Server – gathers and controls Virtual Machines power status
  - OS dependent:
    - Memory Server – monitors memory usage
    - CPU Info Server – gathers CPU information
    - CPU Stat Server – gathers CPU usage
    - File System Server – gathers FS usage
    - Network Interface Server – monitors network traffic statistics
Monitoring and Control Servers

- **Operating System Layer:**
  - OS server – gathers operating system and kernel information

- **PVSS Infrastructure Layer:**
  - PVSS pmon process – A process monitor agent linked to each PVSS Project that runs independently from it. This agent monitors and publishes the state of PVSS processes. It can also act on these processes (start/stop/reset)

- **Application Layer:**
  - Process Monitor Server – gathers info on the running processes on each PC
  - Task Manager Server – gathers the data for the running processes on each node and is also able to start processes on these nodes.

Note: For the Windows systems central starting/stopping of processes is not “yet” implemented
GUI and “aggregation” tools

- Based on PVSS SCADA system and DIM
- Developed within the JCOP (Joint Controls Project) framework group at CERN

- FwFMC – Subscribes to the DIM services and commands published by the FMC Servers and provides a GUI for easy interaction and monitoring
- FwSystemOverview – Reutilizes the data subscribed from FwFMC and presents it in synoptic panels
  - Adds PVSS Project monitoring and control capabilities
  - Adds grouping capabilities

- PVSS provides easy data archiving and alarm handling capabilities
LHCb Architecture

- 1747 monitored PCs:
  - 55 Windows / 1692 Linux
  - 34 are Virtual Machines
  - 1470 are for the HLT Farm
  - 167 controls PCs running PVSS Projects
  - 110 for infrastructure support, webservers, reconstruction, ...

- All PCs power control available (IPMI/VM Servers)
- Memory and CPU monitoring only the most sensitive ones
- All PVSS projects and individual managers are monitored
- Processes and Task Manager Servers running on all the control PCs
LHCb Architecture
LHCb Usage

- LHCb developed the interface using 2 hierarchies:
  - Hosts monitoring and control
  - PVSS Projects monitoring and control

- Hierarchies divided by sub-detector and function:
  - Easy to check global state of the system
  - Easy to check state of a particular system
  - Allows individual sub-detector access to their infrastructure
LHCb Usage

- Host Management:
  - Easily switch ON/OFF Hosts
  - Check CPU and memory usage
  - Check File System usage
  - Monitor single processes and services memory usage
  - Possibility to act globally on a group (power wise)

- Great for recovering the system after a power-cut!
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LHCb Usage

- PVSS Project Management:
  - Based on PVSS Pmon calls over TCP/IP
  - Have a global overview of the state of the individual PVSS projects and managers:
    - Statistics about projects running/stopped
    - Statistics about number of managers blocked/abnormally stopped
  - Detect mismatches between expected configuration and configuration running
  - Act on PVSS projects and managers like logging on the local machines
  - Act Globally on a group (Start/Stop/Restart Projects)
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LHCb Usage

- Globally Manage PVSS Managers
  - Filter managers by type, system, state, options...
  - Start/stop filtered managers
  - Change filtered managers startup properties

- Great for updates to control software running from repositories!
Conclusion

- Very elegant and user friendly central management tool
- Easy and complete monitoring
- Global overview and fine control:
  - PCs status
  - PVSS Projects and managers
  - Applications processes and services
- Monitor different systems with the same interface
- Expandable to other TCP enabled devices