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

System Overview set of tools

- 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

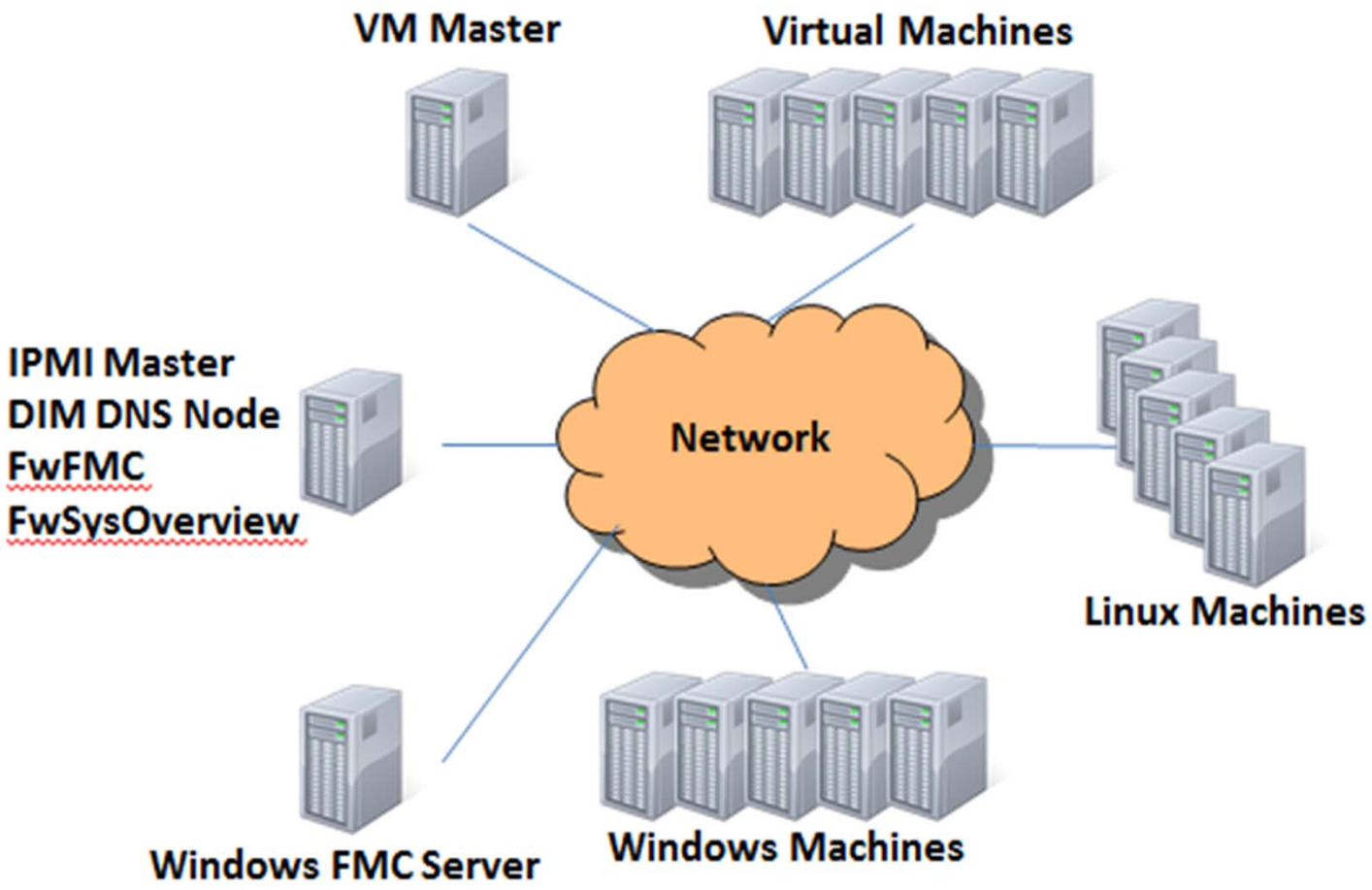
- FwFMC – Subscribes to the DIM services and commands published by the FMC Servers and provides a GUI for easy interaction and monitoring
- FwSystemOverview – Reutilizes the data subscribed from FwFMC and presents it in synoptic panels
  - Adds PVSS Project monitoring and control capabilities
  - Adds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

- PVSS provides easy data archiving and alarm handling capabilities

LHCb Architecture

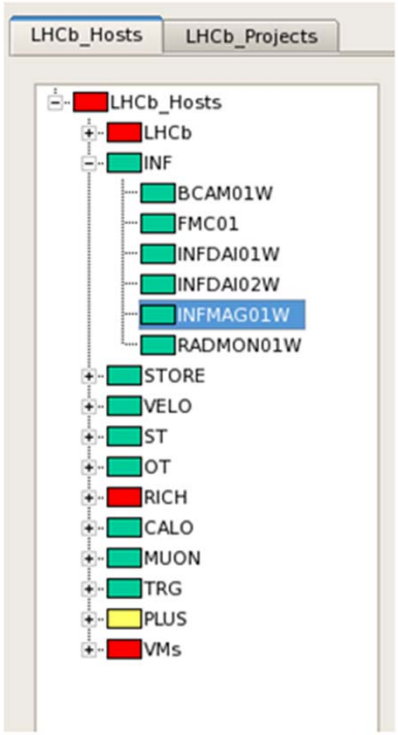
- 1747 monitored PCs:
  - 55 Windows / 1692 Linux
  - 34 are Virtual Machines
  - 1470 are for the HLT Farm
  - 167 controls PCs running PVSS Projects
  - 110 for infrastructure support, webservers, reconstruction, …
- All PCs power control available (IPMI/VM Servers)
- Memory and CPU monitoring only the most sensitive ones
- All PVSS projects and individual managers are monitored
- Processes and Task Manager Servers runnig on all the control PCs

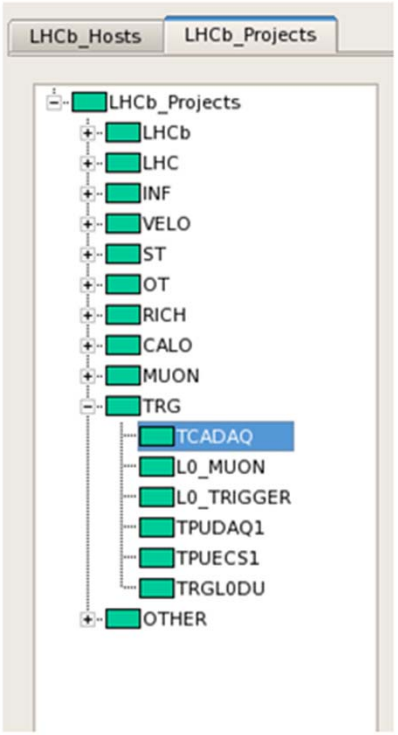
LHCb Architecture



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

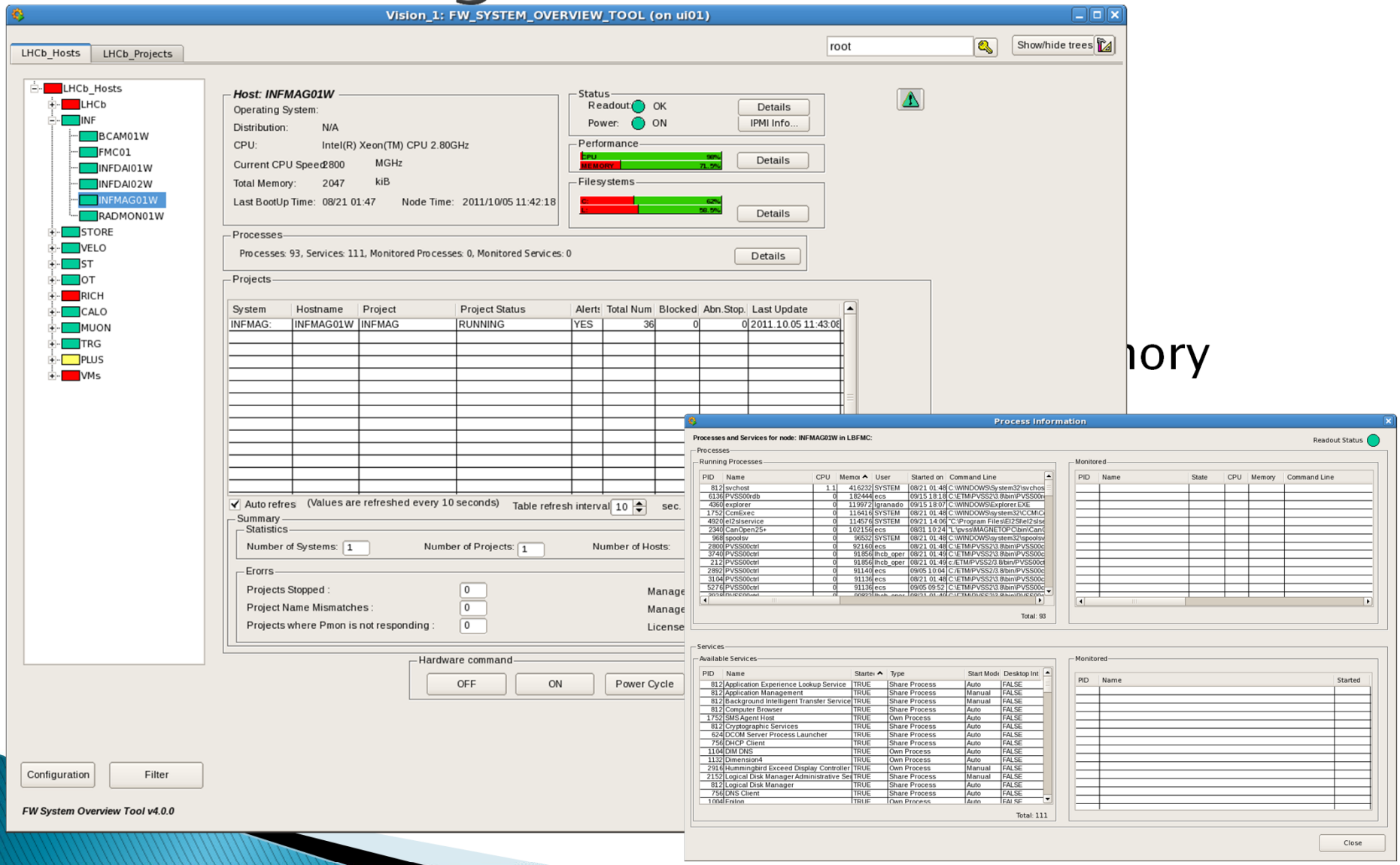




LHCb Usage

- 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!

LHCb Usage


Vision_1: FW_SYSTEM_OVERVIEW_TOOL (on ui01)
LHCb_Hosts
LHCb_Projects
root
Show/hide trees
LHCb_Hosts
LHCb
INF
BCAM01W
FMC01
INFDAI01W
INFDAI02W
INFMAG01W
RADMON01W
STORE
VELO
ST
OT
RICH
CALO
MUON
TRG
PLUS
VMs
Host: INFMAG01W
Operating System:
Distribution: N/A
CPU: Intel(R) Xeon(TM) CPU 2.80GHz
Current CPU Speed 2800 MGHz
Total Memory: 2047 kiB
Last BootUp Time: 08/21 01:47 Node Time: 2011/10/05 11:42:18
Status
Readout: OK
Power: ON
Details
IPMI Info...
Performance
Details
Filesystems
Details
Processes
Processes: 93, Services: 111, Monitored Processes: 0, Monitored Services: 0
Details
Projects
System Hostname Project Project Status Alerts Total Num Blocked Abn.Stop. Last Update
INFMAG: INFMAG01W INFMAG RUNNING YES 36 0 0 2011.10.05 11:43:08
Auto refres (Values are refreshed every 10 seconds) Table refresh interval 10 sec.
Summary
Statistics
Number of Systems: 1
Number of Projects: 1
Number of Hosts:
Erorrs
Projects Stopped : 0
Project Name Mismatches : 0
Projects where Pmon is not responding : 0
Hardware command
OFF
ON
Power Cycle
Configuration
Filter
FW System Overview Tool v4.0.0
Process Information
Processes and Services for node: INFMAG01W in LBFMC:
Readout Status
Processes
Running Processes
PID Name CPU Memo User Started on Command Line
812 svchost 1.1 416232 SYSTEM 08/21 01:48 C:\WINDOWS\System32\svchos
636 PVSS00rdb 0 182444 ecs 09/15 18:18 C:\ETM\PVSS2\3.8\bin\PVSS00r
4360 explorer 0 119972 lgranado 09/15 18:07 C:\WINDOWS\Explorer.EXE
1752 CcmExec 0 116416 SYSTEM 08/21 01:48 C:\WINDOWS\system32\CCM\C
4920 el2slservice 0 114576 SYSTEM 09/21 14:06 "C:\Program Files\El2Shel2slse
2340 CanOpen25+ 0 102156 ecs 08/31 10:24 "L:\pvss\MAGNETOP\bin\Can
968 spoolsv 0 96532 SYSTEM 08/21 01:48 C:\WINDOWS\system32\spoolsv
2800 PVSS00ctrl 0 92160 ecs 08/21 01:48 C:\ETM\PVSS2\3.8\bin\PVSS00c
3740 PVSS00ctrl 0 91856 lhcb_oper 08/21 01:49 C:\ETM\PVSS2\3.8\bin\PVSS00c
212 PVSS00ctrl 0 91856 lhcb_oper 08/21 01:49 c:/ETM/PVSS2/3.8/bin/PVSS00ct
2892 PVSS00ctrl 0 91140 ecs 09/05 10:04 C:/ETM/PVSS2/3.8/bin/PVSS00c
3104 PVSS00ctrl 0 91136 ecs 08/21 01:48 C:\ETM\PVSS2\3.8\bin\PVSS00c
5276 PVSS00ctrl 0 91136 ecs 09/05 09:52 C:\ETM\PVSS2\3.8\bin\PVSS00c
Total: 93
Monitored
PID Name State CPU Memory Command Line
Services
Available Services
PID Name Starte Type Start Mode Desktop Int
812 Application Experience Lookup Service TRUE Share Process Auto FALSE
812 Application Management TRUE Share Process Manual FALSE
812 Background Intelligent Transfer Service TRUE Share Process Manual FALSE
812 Computer Browser TRUE Share Process Auto FALSE
1752 SMS Agent Host TRUE Own Process Auto FALSE
812 Cryptographic Services TRUE Share Process Auto FALSE
624 DCOM Server Process Launcher TRUE Share Process Auto FALSE
756 DHCP Client TRUE Share Process Auto FALSE
1104 DIM DNS TRUE Own Process Auto FALSE
1132 Dimension4 TRUE Own Process Auto FALSE
2916 Hummingbird Exceed Display Controller TRUE Own Process Manual FALSE
2152 Logical Disk Manager Administrative Se TRUE Share Process Manual FALSE
812 Logical Disk Manager TRUE Share Process Auto FALSE
756 DNS Client TRUE Share Process Auto FALSE
Total: 111
Monitored
PID Name Started
Close

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/abnormaly 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)

LHCb Usage

- PVS
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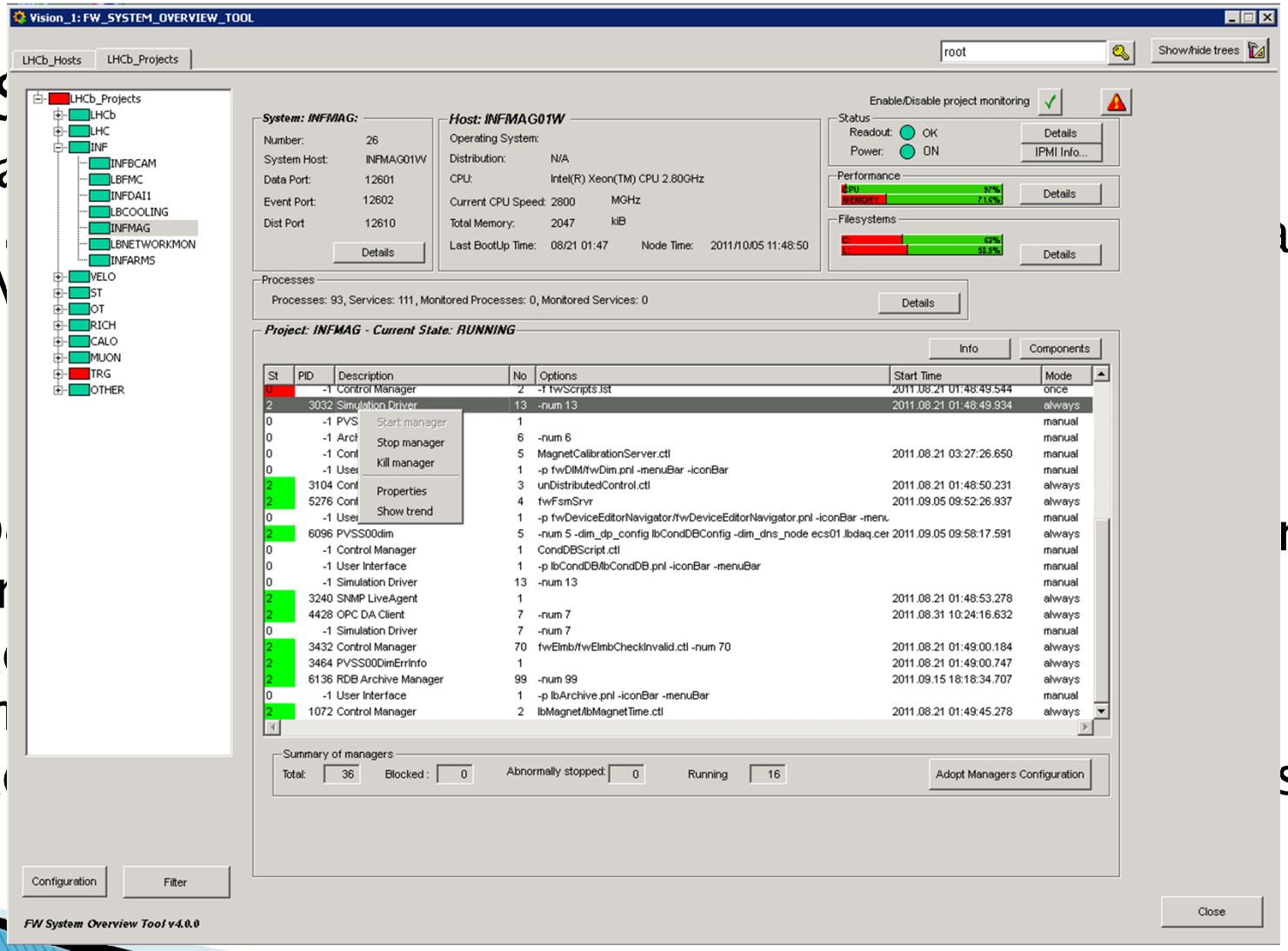
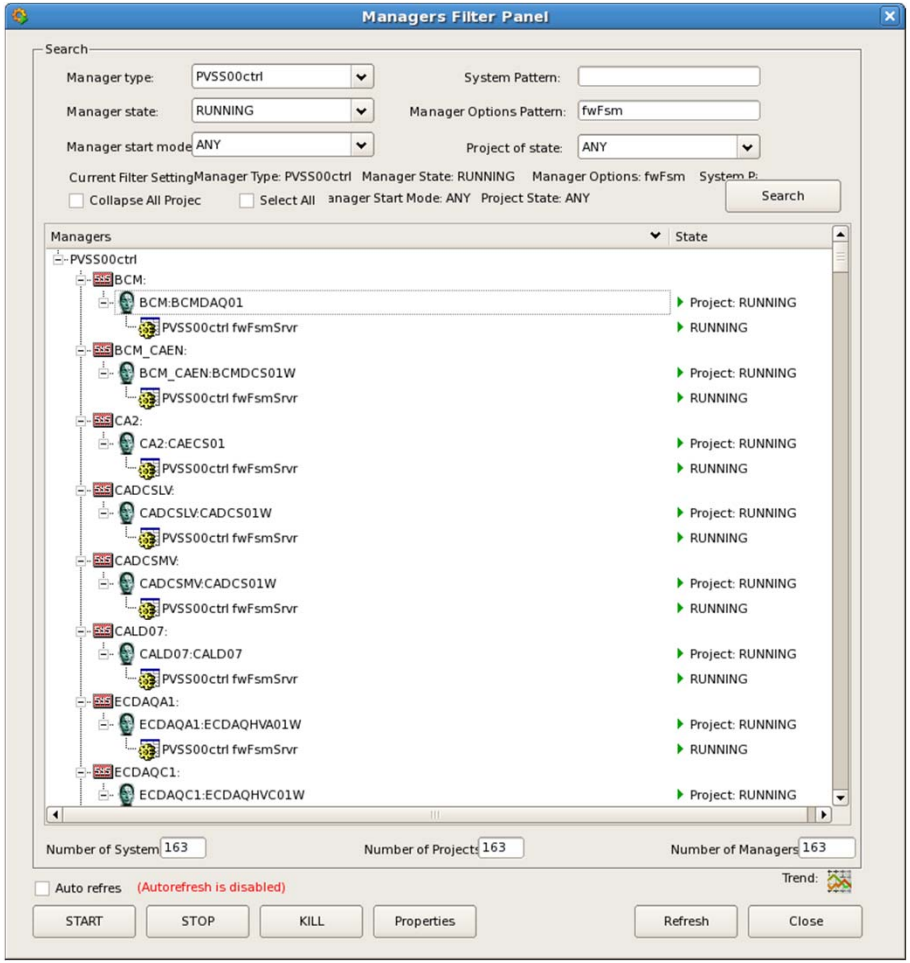


LHCb Usage

- 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