CONTROL SYSTEM CONFIGURATION MANAGEMENT AT PSI LARGE RESEARCH FACILITIES

R. Krempaská, A. Bertrand, H. Lutz, Paul Scherrer Institute, 5232 Villigen PSI, Switzerland

Abstract

At the Paul Scherrer Institute, the control system configuration is done in a uniform way for all large research facilities. To achieve this, a set of tools has been developed. This paper describes methodologies and processes used for the control system configuration management.

INTRODUCTION

The control system of the PSI accelerator facilities and their beamlines consists mainly of the so-called Input Output Controllers (IOCs) running EPICS. There are several flavours of EPICS IOCs at PSI running on different CPUs, different underlying operating systems and different EPICS versions. We have hundreds of IOCs which control the facilities at PSI. The goal of the Control system configuration management is to provide a set of tools to allow a consistent and uniform configuration for all IOCs. In this context the Oracle database contains all hardware-specific information including the CPU type, operating system or EPICS version. The installation tool connects to Oracle database. Depending on the IOC-type a set of files (or symbolic links) are created which connect to the required operating system, libraries or EPICS configuration files in the boot directory. In this way a transparent and user-friendly IOC installation is achieved. The control system expert can check the IOC installation, boot information, as well as the status of loaded EPICS process variables by using Web applications. Our implementation software runs on Scientific Linux derived from Red Hat's Enterprise Linux.

CONFIGURATION AND INSTALLATION

Configuration files and all the software needed to run an IOC are created on the file system. The configuration for specific IOC functionality, (e.g. magnet power supply control system), is defined as a project which is stored using CVS (Concurrent Versioning System). An installation tool, *swit* [1], retrieves all related data for the IOC, (such as board and CPU architecture, operating system and EPICS version, etc.) from the Hardware Inventory Database [2]. Then *swit* collects the configuration files stored in the CVS, or in a developer's directory, and installs the software needed to boot and run the IOC in its boot directory. A uniform IOC boot directory structure is used for all IOCs in large research facilities at PSI (GFA). The installation data flow can be seen in Fig. 1.

The *swit* tool allows IOC software installation for testing or production. Since one project often contains software for several IOCs, based on the naming convention of the individual IOCs, *swit* can install software for multiple IOCs. On the other hand the functionality of a particular IOC may consist of several projects with many developers. Based on the IOC naming convention, again *swit* installs the software from different projects into target IOC. All IOCs types running on GFA facilities are installed by *swit*.

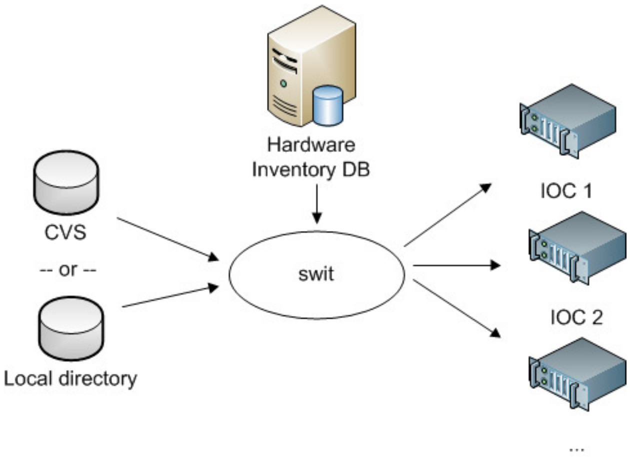


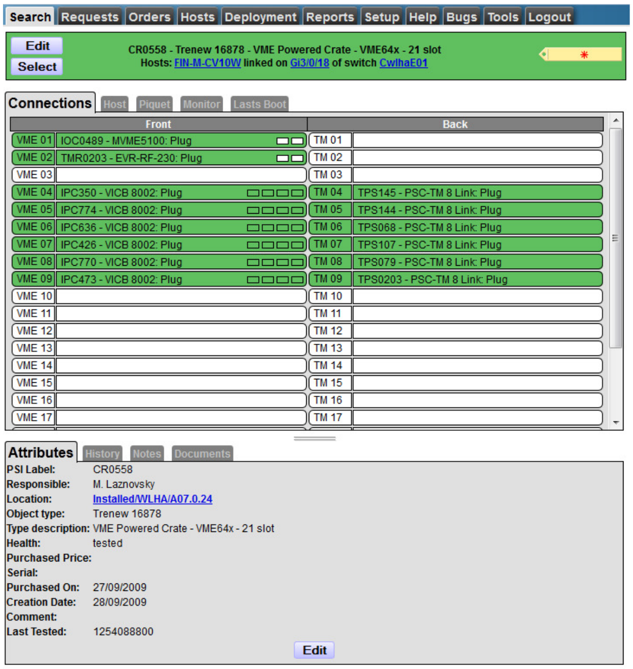
Figure 1: Configuration and IOC(s) installation data flow. *swit* gets the configuration from the file system or from the CVS repository, connects to the Hardware Inventory database for IOC's specific information and installs the software into the IOC boot directories.

HARDWARE INVENTORY DATABASE

Information about the hardware components is stored in a hierarchical way in a Hardware Inventory Database [2]. The hierarchy facilitates the work flow in which requested hardware components are ordered, labeled, delivered and finally installed. This procedure automatically keeps track of all components used. Inventory data can be modified or viewed by using a Web interface [3]. An example of a user interface representing a VME crate containing several types of cards plugged in the front- and the back-side can be seen in Fig. 2. Moreover, the system stores for each component, a set of attributes, (e.g. location, price, purchase date, test information, etc.). In the case of an IOC there is host related information, for example host name, operating system, EPICS version, as well as information about network and serial connections useful for IOC boot parameters setup and/or for IOC remote access.

The Hardware Inventory Database is to some extend managed manually by the Controls section members. On the other hand data are also automatically collected from the file system by using dedicated programs or by connecting to the standard PSI tools [4].

ISBN 978-3-95450-139-7



CR0558 - Trenew 16878 - VME Powered Crate - VME64x - 21 slot
Hosts: FIN-M-CV10W linked on Gi3/0/18 of switch CwlhaE01

Front		Back	
VME 01	IOC0489 - MVME5100: Plug	TM 01	
VME 02	TMR0203 - EVR-RF-230: Plug	TM 02	
VME 03		TM 03	
VME 04	IPC350 - VICB 8002: Plug	TM 04	TPS145 - PSC-TM 8 Link: Plug
VME 05	IPC774 - VICB 8002: Plug	TM 05	TPS144 - PSC-TM 8 Link: Plug
VME 06	IPC636 - VICB 8002: Plug	TM 06	TPS068 - PSC-TM 8 Link: Plug
VME 07	IPC426 - VICB 8002: Plug	TM 07	TPS107 - PSC-TM 8 Link: Plug
VME 08	IPC770 - VICB 8002: Plug	TM 08	TPS079 - PSC-TM 8 Link: Plug
VME 09	IPC473 - VICB 8002: Plug	TM 09	TPS0203 - PSC-TM 8 Link: Plug
VME 10		TM 10	
VME 11		TM 11	
VME 12		TM 12	
VME 13		TM 13	
VME 14		TM 14	
VME 15		TM 15	
VME 16		TM 16	
VME 17		TM 17	

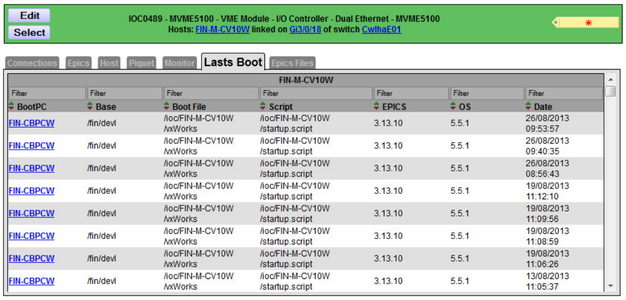
PSI Label:	CR0558
Responsible:	M. Laznovsky
Location:	Installed/WLHA/A07.0.24
Object type:	Trenew 16878
Type description:	VME Powered Crate - VME64x - 21 slot
Health:	tested
Purchased Price:	
Serial:	
Purchased On:	27/09/2009
Creation Date:	28/09/2009
Comment:	
Last Tested:	1254088800

Figure 2: An example of the Hardware Inventory Web Interface showing information about a VME crate.

INFORMATION OVERVIEW

There are several aspects of information. First, activities on the IOCs installation are automatically logged by *swit* [1] and can be visually inspected via a Web interface.

Next, during the boot process, information such as boot date, directory and boot server name, as well as operating system and EPICS version, is automatically stored in the database. Users can view the information by using the Web interface integrated into the Hardware Inventory Web application, as seen on Fig. 3. They can also use a command-line script which supplies information in a text form.



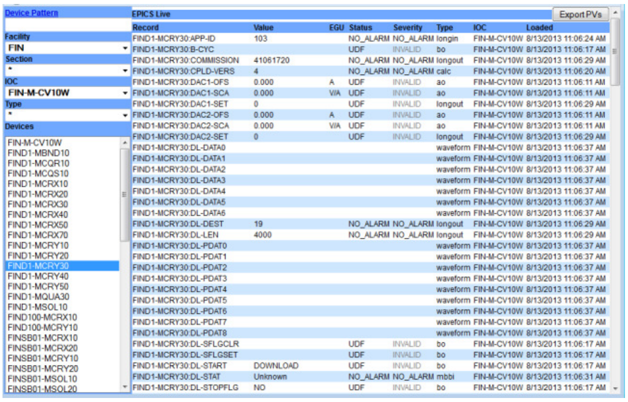
IOC0489 - MVME5100 - VME Module - I/O Controller - Dual Ethernet - MVME5100
Hosts: FIN-M-CV10W linked on Gi3/0/18 of switch CwlhaE01

FIN-M-CV10W

BootPC	Base	Boot File	Script	EPICS	OS	Date
FIN-CBPCW	/fin/devl	/ioc/FIN-M-CV10W /vxWorks	/ioc/FIN-M-CV10W /startup.script	3.13.10	5.5.1	26/08/2013 09:53:57
FIN-CBPCW	/fin/devl	/ioc/FIN-M-CV10W /vxWorks	/ioc/FIN-M-CV10W /startup.script	3.13.10	5.5.1	26/08/2013 09:40:35
FIN-CBPCW	/fin/devl	/ioc/FIN-M-CV10W /vxWorks	/ioc/FIN-M-CV10W /startup.script	3.13.10	5.5.1	26/08/2013 08:56:43
FIN-CBPCW	/fin/devl	/ioc/FIN-M-CV10W /vxWorks	/ioc/FIN-M-CV10W /startup.script	3.13.10	5.5.1	19/08/2013 11:12:10
FIN-CBPCW	/fin/devl	/ioc/FIN-M-CV10W /vxWorks	/ioc/FIN-M-CV10W /startup.script	3.13.10	5.5.1	19/08/2013 11:09:56
FIN-CBPCW	/fin/devl	/ioc/FIN-M-CV10W /vxWorks	/ioc/FIN-M-CV10W /startup.script	3.13.10	5.5.1	19/08/2013 11:08:59
FIN-CBPCW	/fin/devl	/ioc/FIN-M-CV10W /vxWorks	/ioc/FIN-M-CV10W /startup.script	3.13.10	5.5.1	19/08/2013 11:06:26
FIN-CBPCW	/fin/devl	/ioc/FIN-M-CV10W /vxWorks	/ioc/FIN-M-CV10W /startup.script	3.13.10	5.5.1	13/08/2013 11:05:37

Figure 3: IOC boot information stored in the database during the boot process.

Finally, after booting, all EPICS PVs loaded on an IOC, are stored automatically in the database. Their names, values, record types, alarm status and load date can be seen by using dedicated Web interface [5] seen in Fig. 4. In this way control system experts can check loaded EPICS PVs on all installed IOCs. Scalar values are accessible for live update as well.



Facility: FIN
Section: *
IOC: FIN-M-CV10W
Type: *

Devices:
FIN-M-CV10W
FIND1-MBND10
FIND1-MCQR10
FIND1-MCQS10
FIND1-MCRX10
FIND1-MCRX20
FIND1-MCRX30
FIND1-MCRX40
FIND1-MCRX50
FIND1-MCRX70
FIND1-MCRY10
FIND1-MCRY20
FIND1-MCRY30
FIND1-MCRY40
FIND1-MCRY50
FIND1-MQUA30
FIND1-MSOL10
FIND100-MCRX10
FIND100-MCRY10
FINSB01-MCRX10
FINSB01-MCRX20
FINSB01-MCRY10
FINSB01-MCRY20
FINSB01-MSOL10
FINSB01-MSOL20

Record	Value	EGU	Status	Severity	Type	IOC	Loaded
FIND1-MCRY30:APP-ID	103		NO_ALARM	NO_ALARM	longin	FIN-M-CV10W	8/13/2013 11:06:24 AM
FIND1-MCRY30:B-CYC			UDF	INVALID	bo	FIN-M-CV10W	8/13/2013 11:06:17 AM
FIND1-MCRY30:COMMISSION	41061720		NO_ALARM	NO_ALARM	longout	FIN-M-CV10W	8/13/2013 11:06:29 AM
FIND1-MCRY30:CPLD-VERS	4		NO_ALARM	NO_ALARM	calc	FIN-M-CV10W	8/13/2013 11:06:20 AM
FIND1-MCRY30:DAC1-OFS	0.000	A	UDF	INVALID	ao	FIN-M-CV10W	8/13/2013 11:06:11 AM
FIND1-MCRY30:DAC1-SCA	0.000	V/A	UDF	INVALID	ao	FIN-M-CV10W	8/13/2013 11:06:11 AM
FIND1-MCRY30:DAC1-SET	0		UDF	INVALID	longout	FIN-M-CV10W	8/13/2013 11:06:29 AM
FIND1-MCRY30:DAC2-OFS	0.000	A	UDF	INVALID	ao	FIN-M-CV10W	8/13/2013 11:06:11 AM
FIND1-MCRY30:DAC2-SCA	0.000	V/A	UDF	INVALID	ao	FIN-M-CV10W	8/13/2013 11:06:11 AM
FIND1-MCRY30:DAC2-SET	0		UDF	INVALID	longout	FIN-M-CV10W	8/13/2013 11:06:29 AM
FIND1-MCRY30:DL-DATA0					waveform	FIN-M-CV10W	8/13/2013 11:06:37 AM
FIND1-MCRY30:DL-DATA1					waveform	FIN-M-CV10W	8/13/2013 11:06:37 AM
FIND1-MCRY30:DL-DATA2					waveform	FIN-M-CV10W	8/13/2013 11:06:37 AM
FIND1-MCRY30:DL-DATA3					waveform	FIN-M-CV10W	8/13/2013 11:06:37 AM
FIND1-MCRY30:DL-DATA4					waveform	FIN-M-CV10W	8/13/2013 11:06:37 AM
FIND1-MCRY30:DL-DATA5					waveform	FIN-M-CV10W	8/13/2013 11:06:37 AM
FIND1-MCRY30:DL-DATA6					waveform	FIN-M-CV10W	8/13/2013 11:06:37 AM
FIND1-MCRY30:DL-DEST	19		NO_ALARM	NO_ALARM	longout	FIN-M-CV10W	8/13/2013 11:06:29 AM
FIND1-MCRY30:DL-LEN	4000		NO_ALARM	NO_ALARM	longout	FIN-M-CV10W	8/13/2013 11:06:29 AM
FIND1-MCRY30:DL-PDAT0					waveform	FIN-M-CV10W	8/13/2013 11:06:37 AM
FIND1-MCRY30:DL-PDAT1					waveform	FIN-M-CV10W	8/13/2013 11:06:37 AM
FIND1-MCRY30:DL-PDAT2					waveform	FIN-M-CV10W	8/13/2013 11:06:37 AM
FIND1-MCRY30:DL-PDAT3					waveform	FIN-M-CV10W	8/13/2013 11:06:37 AM
FIND1-MCRY30:DL-PDAT4					waveform	FIN-M-CV10W	8/13/2013 11:06:37 AM
FIND1-MCRY30:DL-PDAT5					waveform	FIN-M-CV10W	8/13/2013 11:06:37 AM
FIND1-MCRY30:DL-PDAT6					waveform	FIN-M-CV10W	8/13/2013 11:06:37 AM
FIND1-MCRY30:DL-PDAT7					waveform	FIN-M-CV10W	8/13/2013 11:06:37 AM
FIND1-MCRY30:DL-PDAT8					waveform	FIN-M-CV10W	8/13/2013 11:06:37 AM
FIND1-MCRY30:DL-SFLGCLR			UDF	INVALID	bo	FIN-M-CV10W	8/13/2013 11:06:17 AM
FIND1-MCRY30:DL-SFLGSET			UDF	INVALID	bo	FIN-M-CV10W	8/13/2013 11:06:17 AM
FIND1-MCRY30:DL-START	DOWNLOAD		UDF	INVALID	bo	FIN-M-CV10W	8/13/2013 11:06:17 AM
FIND1-MCRY30:DL-STAT	Unknown		NO_ALARM	NO_ALARM	mbbi	FIN-M-CV10W	8/13/2013 11:06:31 AM
FIND1-MCRY30:DL-STOPFLG	NO		UDF	INVALID	bo	FIN-M-CV10W	8/13/2013 11:06:17 AM

Figure 4: EPICS PVs loaded in an IOC for SwissFEL Injector Test Facility.

ACKNOWLEDGMENTS

We acknowledge our colleagues from the Controls Hardware group for maintenance of all hardware inventory data used by the control system.

REFERENCES

[1] http://gfa-it.web.psi.ch/swit.pdf
[2] http://gfa-it.web.psi.ch/i3.ppt
[3] http://gfa-it.web.psi.ch/invent_help/
[4] http://www.nedi.ch/
[5] http://epics-info.psi.ch