



EPICS PV Management and Method for RIBF Control System

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Abstract

For the RIKEN Radioactive Isotope Beam Factory (RIBF) project, the Experimental Physics and Industrial Control System (EPICS)-based distributed control system is utilized in Linux and vxWorks. Utilizing network attached storage (which has a high-availability system) as a shared storage, common EPICS programs (Base, Db, and so on) are shared by each EPICS Input/Output Controller (IOC). From the initial development of RIBF control system, it has continued to grow and consisted of approximately 50 EPICS IOCs and more than 100,000 EPICS records. Because RIBF has been constructed by extending RIKEN Accelerator Research Facility (RARF) in a previous project, the controllers for RARF are also utilized for RIBF control system. In this case, the dependence between the EPICS records and EPICS IOCs becomes complicated. For example, it is not easy to know the accurate EPICS record name information using only the device information. Therefore, we constructed a new management system for the RIBF control system to easily call up the detailed information. In the system, by parsing startup script files (st.cmd) to run EPICS IOCs, all EPICS records and EPICS fields are stored in the PostgreSQL-based database. By utilizing these stored data, we succeeded in developing Web-based management and search tools.

Motivation

For system maintenance and development of Channel Access client, we need to identify the IOC hostname connected to the PVs.

- RIBF control system is constructed by extending RARF control system (previous project). Relationship between controllers and IOCs is complicated.
- Not use UDP broadcast for ca_search (EPICS_CA_AUTO_ADDR_LIST=NO)

• We would like to provide efficient system environment to search IOC hostname from PV name easily for developers and operators.

Development of PV management system for EPICS-based control system (Similar concept of IRMIS@ANL[1])

Method of System Construction

By reading the startup script files and accessing the EPICS runtime database files, the program can parse the runtime database files. Therefore, we developed a program such that the information is separately stored in the PostgreSQL-based database by parsing the file.

EPICS Substitution file and macro are also available.

Startup script file #!//bin/linux-x86_64/example ## You may have to change example to som	ething else	Table Name	Information Stored in the Column	Number of Records	
## everywhere it appears in this file		iocinfo	Hostname of IOC	51	
cd \${TOP} ## Register all support components dbLoadDatabase "dbd/example.dbd" example_registerRecordDeviceDriver pdbba	se		Directory path of EPICS application		
## Load record instances dbLoadTemplate "db/userHost.su	bstitutions"		Startup script file name		
dbLoadRecords "db/dbExample.o	lb", "user=rootHost"	pvinfo	EPICS record name	110,192	
drvAsynIPPortConfigure ("network	1" , "172.23.3.221:999" ,0 ,0 ,1)		Record type		
db/dbExample.db	hostname1:999	fieldinfo	Field	3,151,383	
record(ao,"\$(user):cathodeCurrentC			Field type		
field(DESC, "set cathode current") field(DTYP, "Raw Soft Channel") field(SCAN, "1 second") field(OROC, ".5") field(PREC, "2")	rootHost:cathodeCurrentC device2ioc	device2ioc	Hostname for network-based device	432	
field(EGU,"Amps") field(DRVH,"20") field(DRVL,"0") field(HOPR,"20") field(LOPR,"0")	pvinfo Database (fieldinfo)		e Structure Used for Mana trol System (October 2015	. ,	

Stored Information Usage for Command-line Tool

It is very easy to make PV lists by a program !!

• We use this feature to make PV list for caMonitor and the electric logbook.

• Some command-line tools are developed to obtain the information from DB.

For example, making a list for all of the PVs including "psld_rp: XXXX:dac_set".

\$sql1="SELECT * from \$table where PV like psld_rp :%:dac_set and active='1' order by pv_id";



in the RIBF Control System (October 2015).



EPICS IOC Info from PV					ALL PV L	ist for IOC (rilac-dqn)		psld_rp:8SOR0:input_up			
CONTROL SYSTEM INFO		PV	psld_rp:DQN1_1:adc_h		PV ID	PV	TYPE		/		
VER. 1.1	/	EPICS IOC	rilac-dqn		100362	psld_rp:rilac_inj:byte_w2	mbboDirect		FIELD	VAL	
INDEX	/	IP Address	172.23.4.36		104	psld_rp:Speed:input	bi	1	SCAN	.01 second	
EPICS IOCs		PV val	4757		103	psld_rp:SSOR0:input_down	bi		DTYP	F3RP61	
PVs & Fields		State: conn	ected		102	psld_rp:SSOR0:input_up	bi	5	INP	@U0	
Network Devices		Data type: I	ata type: DBR_DOUBLE (native:			psld_rp:DQN2_2:input_down	bi		ONAM	On	
Help	Help DBF_DOUBL			/	100	psld_rp:DQN2_2:input_up	bi		ZNAM	Off	
Desta and d		Element co	unt: 1		99	psld_rp:DQN2_1:input_down	bi		Click this link and show fie included in selected EPICS		
PostgreSQL Autocomplete feature for					98	psld_rp:DQN2_1:input_up	bi	Ľ	icidada in Sci		
Search IOC from PV input EPICS record. IP ALIVE						psld_rp:DQN1_2:input_down	bi				
						psld_rp:DQN1_2:input_up	bi				
psld_rp:DQN1_1:adc_r psld_rp:DQN1_1:adc_cur					95	psld_rp:DQN1_1:input_down	bi	Ť			
					94	psld_rp:DQN1_1:input_up	bi				
psld_rp:DQN1_2:adc_r psld_rp:DQN1_2:adc_cur					293	psld_rp:DQN2_2:curr_ext	bi	-			
					92	psld_rp:DQN2_2:remote	bi				
psld_rp:DQN2_1:adc_r					91	psld_rp:DQN2_2:ready	bi				
psld_rp:DQN2_1:ad					90	psld_rp:DQN2_2:onoff_st	bi				
psld_rp:DQN2_2:ad					50		hi	-			
psld_rp:DQN2_2:adc_cur psld_rp:SSOR0:adc_r						his link and show recod lists	bi				
psid_ip.000ito.duc	_'				man	aged by the EPICS IOC.	bi		•		

- We can search EPICS IOC hostname from EPICS PV name. (\Rightarrow cainfo)
- Without requiring the completed EPICS record name, because of autocomplete feature.
- We can check all records and fields without source code.

Stored Information Usage for Alive Monitoring (90% complited)

Generally, alive monitoring is performed by a system that checks from the outside whether the computers continuously work.

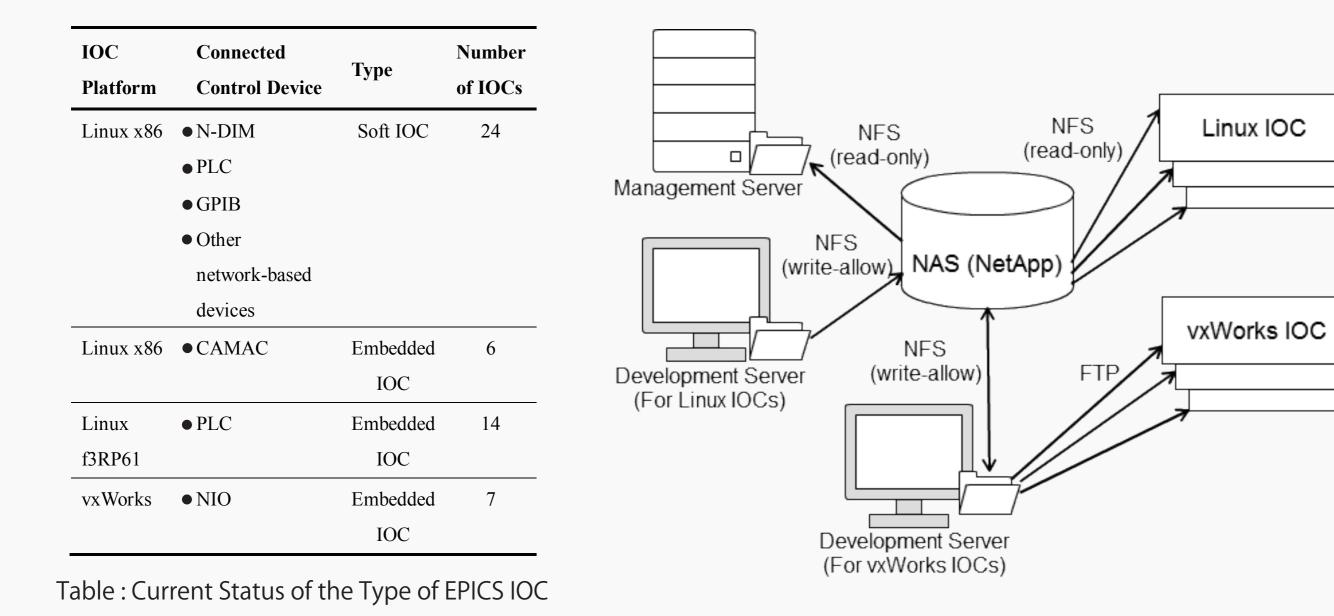
	EPICS IOC	List		PV List for IOC (18gecris)	PV List for IOC (18gecris)					
CONTROL SYSTEM INFO	EPICS IOCs	TIMESTAMP	ALIVE	EPICS PVs	TIMESTAMP	ALIVE	TIMESTAMP	STATUS		
Open/Class monitoring	18gecris	2015-10-11 19:50:30	CA OK	18gecris:peltier:set_t	2015-10-11 19:51:00	ALIVE	2015-10-11 19:50:30	СА ОК		
Open/Close monitoring	28gscecris	2015-10-11 20:38:39	CA OK	18gecris:bias_v_set	2015-10-11 19:51:00	ALIVE	2015-10-11 19:49:33	Ping OK		
for Channel Access port	28gscecris2	2015-10-11 20:38:39	CA OK	18gecris:oven_act	2015-10-11 19:51:00	ALIVE	2015-10-09 21:07:31	DEAD		
	cnsscecris	2015-10-10 13:39:30	CA OK	18gecris:oven_cur_set	2015-10-11 19:51:00	ALIVE	2015-08-17 10:32:42	CAOK		
	inj_12	2015-10-10 08:12:27	CA OK	18gecris:bias_output	2015-10-11 19:51:00	ALIVE	2015-08-17 10:31:54	DEAD		
Help	ioc1alarm	2015-08-31 11:29:25	CA OK	18gecris:oven_output	2015-10-11 19:51:00	ALIVE	2015-08-16 17:37:21	Ping OK		
	ioc1rilac	2015-08-24 11:16:52	CA OK	18gecris:oven_cc	2015-10-11 19:51:00	C · · · ·				
EPICS record monitoring	ioc1rilac2	2015-08-24 11:16:52	CA OK	18gecris:oven_cv	2015-10-11 19:51:00	Status log. If CA port is NOT opene the system try to check using Pin				
J	ioc2ribf1	2015-08-26 10:41:53	CAOK	18gecris:oven_err	2015-10-11 19:51:00					
using caMonitor	ioc2ribf2	2015-08-26 10:14:50	CAOK	psId_rp:18gecris_sol2:curr_ext	2015-10-11 19:51:00					
	ioc2rilac	2015-08-29 19:52:24	CA OK	psld_rp:18gecris_sol2:onoff_st	2015-10-11 19:51:00	ALIVE	2015-05-13 13:50:56	DEAD		
	ioc2rilac2	2015-09-15 11:49:25	CAOK	psId_rp:18gecris_sol2:fault	2015-10-11 19:51:00	ALIVE	2015-05-13 13:42:01	СА ОК		
	ioc2rrc1	2015-08-26 10:41:52	CAOK	psId_rp:18gecris_sol2:ext_int	2015-10-11 19:51:00	ALIVE	2015-05-13 13:41:01	Ping OK		
	ioc2rrc2	2015-10-09 15:48:20	CA OK	psld_rp:18gecris_sol2:dac_set	2015-10-11 19:51:00	ALIVE	2015-03-02 18:45:06	СА ОК		
	ioc2seq	2015-10-12 10:10:18	CA OK	psId_rp:18gecris_sol1:curr_ext	2015-10-11 19:51:00	ALIVE	2015-03-02 18:44:07	Ping OK		
	ioc3ribf	2015-08-26 10:38:34	CA OK	psld_rp:18gecris_sol1:onoff_st	2015-10-11 19:51:00	ALIVE	2015-02-25 17:17:03	СА ОК		
	ioc3rilac	2015-08-24 11:18:56	CAOK	psId_rp:18gecris_sol1:fault	2015-10-11 19:51:00	ALIVE	2015-02-25 17:16:01	Ping OK		
	ioc3rrc	2015-08-26 10:40:50	CAOK	psId_rp:18gecris_sol1:ext_int	2015-10-11 19:51:00	ALIVE	2015-02-25 16:45:02	СА ОК		
	ioc3rrc2	2015-08-31 09:12:40	CAOK	psId_rp:18gecris_sol1:dac_set	2015-10-11 19:51:00	ALIVE	2015-02-25 16:44:15	DEAD		
	ioc4ribf	2015-08-26 10:39:24	CAOK	nsld mi18decris RFQsolicum ext	2015-10-11 19:55:29	ALIVE	2015-02-10 11:22:20	CAOK		
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Alive monitoring for EPICS IOCs and records.

	EPICS IOC	List		Device Connected by EPICS IOC (ioc2rrc2)			Connection Log (at_ll		
CONTROL SYSTEM INFO	EPICS IOCs	TIMESTAMP	ALIVE	Device Name	TIMESTAMP	Connection	TIMESTAMP	Connection	
VER. 1.1	18gecris	2015-10-11 19:50:30	CA OK	at_IH10	2015-10-11 20:39:01	Socket OK	2015-10-11 20:39:01	Socket OK	
)pop/Close monit	oring	2015-10-11 20:38:39	CA OK	at_I10	2015-10-11 20:39:01	Socket OK	2015-10-11 20:34:03	DEAD	
Open/Close monito for used port of	onng –	2015-10-11 20:38:39	CAOK	at_S1	2015-10-11 07:39:01	Socket OK	2015-10-10 08:11:06	Socket OK	
for used port o	r – 1	2015-10-10 13:39:30	CA OK	vac_M11	2015-10-15 06:54:01		2015-10-10 07:56:16	DEAD	
network-based de	evice	2015-10-10 08:12:27	CA OK	fc_B12	2015-10-15 06:46:01		2015-10-08 10:10:02	Socket OK	
	ive reserved	2015-08-31 11:29:25	CA OK	fc_B20	2015-10-10 08:11:10	Socket OK	2015-10-08 10:09:03	DEAD	
PostgreSQL	ioc1rilac	2015-08-24 11:16:52	CA OK	vac_AA6	2015-10-10 08:06:27	Socket OK	2015-09-27 02:30:03	Socket OK	
	ioc1rilac2	2015-08-24 11:16:52	CA OK	fc_F51fRC	2015-10-10 08:06:2	Status la	rt ic NOT	onon	
	ioc2ribf1	2015-08-26 10:41:53	CA OK	vac_S64	2015-10-10 08:06:4		g. If used po		opene
	ioc2ribf2	2015-08-26 10:14:50	CA OK	fc_S64INJ	2015-10-10 08:06:4	the sys	heck using	g Ping	
	ioc2rilac	2015-08-29 19:52:24	CA OK	fc_B40	2015-10-10 08:10:5	-			
	ioc2rilac2	2015-09-15 11:49:25	CA OK	vac_C01	2015-10-10 08:10:50	Socket OK	2015-08-16 08:12:15	DEAD	
	ioc2rrc1	2015-08-26 10:41:52	CA OK	vac_F41	2015-10-10 08:06:22	Socket OK	2015-08-15 10:12:01	Socket OK	
	ioc2rrc2	2015-10-09 15:48:20	CA OK	fcb_a	2015-10-09 13:58:07	Socket OK	2015-08-15 09:53:02	DEAD	
	ioc2seq	2015-10-12 10:10:18	CA OK	fc_D16aD17	2015-10-10 08:06:22	Socket OK	2015-07-16 17:57:08	Socket OK	
	ioc3ribf	2015-08-26 10:38:34	CA OK	at_C22S22	2015-10-10 08:06:29	Socket OK	2015-07-16 17:52:58	PING OK	
	ioc3rilac	2015-08-24 11:18:56	CA OK	rarfndimrf1	2015-10-04 09:49:09	Socket OK	2015-07-16 17:52:58	PING OK	
	ioc3rrc	2015-08-26 10:40:50	CA OK	fc_B50	2015-10-10 08:10:55	Socket OK	2015-07-16 17:52:58	PING OK	
	ioc3rrc2	2015-08-31 09:12:40	CA OK	fcb_F51	2015-10-10 08:06:30	Socket OK	2015-07-16 17:52:58	Socket OK	
	ioc4ribf	2015-08-26 10:39:24	CA OK	vac_D11	2015-10-10 08:06:30	Socket OK	2015-07-16 17:52:58	PING OK	
	ioc4rilac	2015-08-24 11:22:52	CA OK	rarfndimrfc1	2015-08-23 03:46:11	Socket OK	2015-07-16 17:52:58	Socket OK	
	ioc4rilac2	2015-08-25 11:46:27	CA OK	fc_DA1aDA2	2015-10-10 08:06:30	Socket OK	2015-07-16 17:52:58		
	ioc4rrc	2015-09-01 14:21:24	CA OK	sl_C01aC21aC22	2015-10-15 07:56:08		2015-07-16 17:52:57	Socket OK	
	ioc4scecr	2015-08-24 11:21:56	CA OK	fc_D18	2014-04-28 16:34:11	DEAD	2015-07-16 17:52:57		
	ioc4utility-gw	2015-08-24 11:22:58	CA OK	vac_B12	2015-10-10 08:11:00	Socket OK	2015-07-16 17:52:57	Socket OK	

RIBF Control System and Shared Storage

Common EPICS programs (EPICS-base, application programs, runtime database, and additional extensions programs) are stored in the NAS, and they are shared by all EPICS IOCs using the NFS or FTP.



Alive monitoring for network-based devices.

Not only IOCs but also all network-based devices will be monitored using the IP address and port number in this system. Therefore, we will be able to check both the port open/close and the ping states.

[1] D. A. Dohan et al., Proc. ICALEPCS2007, Knoxville, Tennessee, USA (2007), p. 82.

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