

SNS Control Systems



EPICS

R3.14 Software Migration Plan

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OUTLINE



- Introduction/Motivation
- Migration Plan/Schedule/Status
- Drivers and Shared software modules that need conversion.
- Standardized R3.14 build templates
- Standardized R3.14 layout and IOC boot scheme
- Standardized R3.14 Software versioning and Release scheme.
- IOC Rollback Scheme
- R3.14 testing and Q/A scheme

Introduction – Reasons for migration



- **Operating System Independence (OSI) from VxWorks real-time operating system. Now also RTEMS, Lynx, Blue Kat, Linux, Windows**
- **Accommodates use of large arrays to store and display waveforms**
- **Support for setting channel access priorities**
- **Simpler set of configuration files to maintain (important for use of Oracle database)**
- **Important progression to version of EPICS needed to operate SNS (EPICS R3.15)**

Migration Sequence/Schedule (Proposed)

- **Make sure that all control systems used for the last commissioning run have been tagged in CVS (must have a snapshot of successfully operating system) and use one or two subsystems to test roll-back to be sure it can be done reliably**
- **Finish migration to R3.14.4 on Hot Spare Ion Source**
- **BNL Partner can start R3.14 work now.**
- **LANL Partner can help with R3.14 drivers if schedule permits**
- **Migrate each subsystem to R3.14.4 on ics-srv02 and test in stand-alone mode to the extent possible**
 - » **Example: MPS Test Stand**
- **Once R3.14.4 version of application works in stand-alone mode on ics-srv02, then migrate it to the production server, still working in stand-alone mode for testing**
- **Operate accelerator with a couple of subsystems (e.g., vacuum and cooling) to get experience with long-term reliability**
 - » **Test interoperability of IOCs running R3.13 with those running R3.14**
- **Integrate RF sub-systems with vacuum and cooling, all these using R3.14.4.**
- **Integrate remaining sub-systems**
- **Other subsystems/applications targeted for conversion: Magnet Test Stand, HEFT, Ring, RTBT, Target**

The transition from R3.13 to R3.14



How do I start?

- **Before starting the conversion process be sure that you have a production Release tag for the current running system. This is the place to clean up directories for the current working R3.13 version, e.g., rename top directory to give a release name (e.g. R1-8-1) before tagging.**
 - » Example: Need to be able to do “cvs tag R1-8-1”
- **Rollback depends on a good Production Release Tag.**
- **The Production Release Tag will also be required to place any software on the production server in the future.**
- **Before starting the conversion process be sure that you have a solid tag at your starting point. This is what is sometimes referred to as the root or start tag.**
 - » `cd <your R3.13 working directory>`
 - » `cvs commit -m "End of 3.13"`
 - » `cvs tag epics314-root`
- **Now create a branch tag for maintenance of the 3.13 versions. In your development directory:**
 - » `cvs tag -b epics313-maint-branch`
- **Now: get rid of any “Development”, “current” or “working” directories. If you have been following the ADE then you won’t need the working directory anymore and leaving these files lying around will cause an accident later. There should be no CVS directories left in your 3.13 working area!**

The transition from R3.13 to R3.14



Let the R3.14 transformation begin!!

- Use the snsTemplates to guide your conversion
- Use conversion scripts provided by snsTemplates
- To start the conversion in place:
 - » `cd <your R3.14 working directory>`
 - » `cvs get -d Development <your module name>`
 - » `cd Development`
 - » Type the following:
 - » `cvstrm(){ rm -f $* ; cvs remove $* ; }`
 - » Use this new shell command later for cleaning up obsolete files like this:
 - » `cvstrm Makefile.Host`
- Lastly, commit and tag the work at the end of the conversion process.

The transition from R3.13 to R3.14



Working with the maintenance branch

- **Systems still using R3.13 will require you to perform software maintenance (e.g. for bug fixes). This will be the case until all systems have move to R3.14.**
 - » An example, the LLRF system will need to use the R3.13 version of the utility module driver. Software fixes/patches will have to be applied to the R3.14 trunk as well as the R3.13 maintenance branch.
- **To start or continue a maintenance project:**
 - » `cd $IOC_TOP/<machine-section>`
 - » `cvs get -r "epics313-maint-branch" -d "epics-313-maint-branch" <your module name>`
- **You can commit/tag and operate from here, it will not affect the main CVS trunk.**

The transition from R3.13 to R3.14



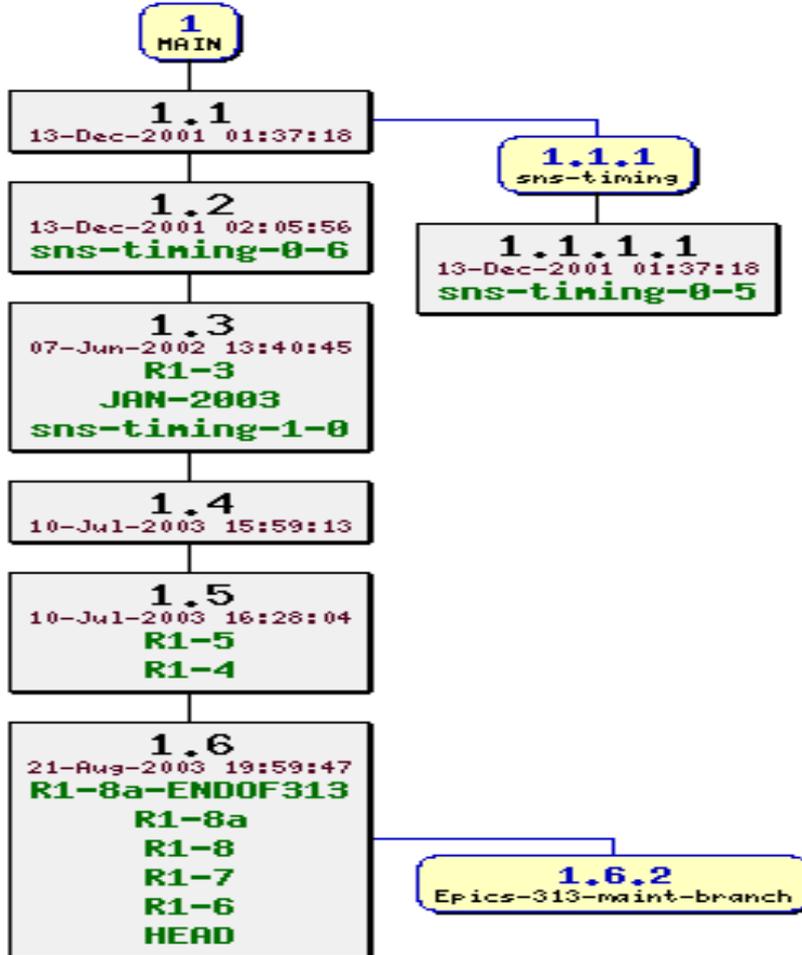
Advanced CVS --- Merging Changes (Don't try this at home)

- If you made changes to the epics313-maint-branch that you now want to merge in, do the following:
- Commit and tag as usual in the 313 working area, remember that you need to plan the 313 tags so they don't conflict with the 314 ones. Be sure your 314 working area is committed as well.
- In the 314 working area:
 - » `cv s update -r <the 313 tag>` (First time)
- Or for the second to Nth time:
 - » `cv s update -r <nth-1 313 tag> -r <nth 313 tag>`
- After all merges do this after conflicts are resolved.
 - » `cv s commit; cv s tag <nth tag>_merged`

The transition from R3.13 to R3.14



/sns/ADE/cvsroot: epics/supTop/timing/timingApp/src/Makefile.Ho:
Revisions: 7, Branches: 3



Required Drivers and Shared software



R3.14.4 Conversion Status

- **Common to most IOCs**

- » vxStats -- module maintainer – Carl Lionberger **(Done)**
- » genSubRecord – module maintainer – Carl Lionberger **(Done)**
- » timestampRecord – module maintainer – Carl Lionberger **(Done)**
- » autoSaveRestore – module maintainer – Carl Lionberger **(Done)**
- » seq – module maintainer – Ernest L. Williams **(Done)**
- » snsTemplates – module maintainer – Ernest L. Williams **(Done)**
- » utility – module maintainer – Dave Thompson **(Done)**
- » timing – module maintainer – Dave Thompson **(Done)**
- » snsMachines – module maintainer – John Munro **(not ready)**
- » opStats – module maintainer – Pam Gurd **(not ready)**



R3.14.4 Conversion Status

- **Additional Drivers used by many IOCs**
 - » **ether_ip** -- module maintainer – Kay Kasemir **(Done)**
 - » **mps** – module maintainer – Dave Thompson **(Done)**
 - » **pciDirect** – module maintainer – Dave Thompson **(Done)**
 - » **motor** – module maintainer – Ernest L. Williams **(Done)**
 - » **cpidRecord** – module maintainer – Pam Gurd **(Done)**
 - » **drvAscii** – module maintainer – Carl Lionberger **(not ready)**



R3.14.4 Conversion Status

● Drivers/Shared Components by Subsystem

» IonSource/LEBT

- group3 – module maintainer – Carl Lionberger (Done)
- scope – module maintainer – Carl Lionberger (Done)
- cpidRecord – module maintainer – Pam Gurd (Done)
- ab -- module maintainer – Carl Lionberger (not ready)

» Vacuum

- ab -- module maintainer – Carl Lionberger (not ready)
- serialHytec – module maintainer – Johnny Tang (not ready)
- rga0dy – module maintainer – Pilar Marroquin (not ready)

» RCCS

- beckhoff – module maintainer – Richard Dabney (not ready)

Required Drivers and Shared software (Cont'd)



R3.14.4 Conversion Status

- **Drivers/Shared Components by Subsystem**
 - » **Timing Master System**
 - V112S -- module maintainer – Larry Hoff (**not ready**)
 - VS64 -- module maintainer – Dave Thompson (**not ready**)
 - V123S -- module maintainer – Dave Thompson (**not ready**)
 - SG2 – module maintainer – Dave Thompson (**not ready**)
 - V105 -- module maintainer – Dave Thompson (**not ready**)
 - » **Magnet Power Supply System**
 - group3 – module maintainer – Carl Lionberger (**Done**)
 - psc – module maintainer – Sheng Peng (**not ready**)
 - beckhoff – module maintainer – Richard Dabney (**not ready**)
 - » **Diagnostics (VME-based) System**
 - vmic2510 – module maintainer – Larry Hoff (**not ready**)
 - hytec – module maintainer – Carl Lionberger (**not ready**)
 - ics110 – module maintainer – Larry Hoff (**not ready**)
 - vhq – module maintainer – Larry Hoff (**not ready**)

Required Drivers and Shared software (Cont'd)



R3.14.4 Conversion Status

- **Drivers/Shared Components by Subsystem**
 - » **HPRF System**
 - vmi4145 – module maintainer – Ernest L. Williams **(not ready)**
 - RFUtil -- module maintainer – Kay Kasemir **(not ready)**
 - beckhoff – module maintainer – Richard Dabney **(not ready)**
 - » **LLRF System**
 - cdm -- module maintainer – Kay Kasemir **(not ready)**
 - hpm -- module maintainer – Kay Kasemir **(not ready)**
 - fcm -- module maintainer – Kay Kasemir **(not ready)**
 - mux -- module maintainer – Kay Kasemir **(not ready)**
 - vxi -- module maintainer – Kay Kasemir **(not ready)**
 - » **PPS**
 - ether_ip -- module maintainer – Kay Kasemir **(done)**
 - » **CF**
 - ether_ip -- module maintainer – Kay Kasemir **(done)**



R3.14.4 Conversion Status

- **Drivers/Shared Components by Subsystem**
 - » **Cryogenic Systems**
 - ether_ip -- module maintainer – Kay Kasemir **(done)**
 - lvdt -- module maintainer – Pam Gurd **(not ready)**
 - v460 -- module maintainer – Pam Gurd **(not ready)**
 - cpidRecord -- module maintainer – Pam Gurd **(not ready)**
 - » **Target Systems**
 - ether_ip -- module maintainer – Kay Kasemir **(done)**

Get R3.14.4 going on the Test Facilities Systems



Hot Spare Ion Source Test Facility Drivers Done!!

- **HOT Spare Ion Source**
 - » autoSaveRestore (C. Lionberger)
 - » Ether_ip (K. Kasemir)
 - » genSub (C. Lionberger)
 - » Group3 (C. Lionberger)
 - » opStats (P. Gurd)
 - » Scope (C. Lionberger)
 - » Seq-2.0.x (E. Williams)
 - » snsTemplates (E. Williams)
 - » timestampRecord (C. Lionberger)
 - » Timing (D. Thompson)
 - » Utility (D. Thompson)
 - » vxStats (C. Lionberger)
- **Magnet Test Facility (Well, how about it??)**
- **RF Test Facility (Well, how about it??)**

Standardized R3.14 layout and IOC boot scheme



- **`${IOCS}=/ade/epics/iocCommon`**
 - » **Members of the parent directory**
 - `<iocNetName>` SNS IOC network names
 - `<All>` common start-up config based on boot server
 - `<errorLogs>` location of IOC error logs from `iocLogServer`
- **`${VX_RELEASE}=/ade/vxWorks`**
- **`${SUPTOP}=/ade/epics/supTop`**
 - » **Members of the parent directory**
 - `<base>` releases of the EPICS kernel live here.
 - `<extensions>` releases of the channel access client apps and EPICS tools
 - `<vdct>` graphical database configuration editor
 - `<share>` Software drivers and other software components common to multiple IOC application trees
- **`${SHARE}=${SUPTOP}/share/<epics-Release>`**
 - » **Members of the parent directory**
 - Home to `drivers/device/record` support common across IOC application areas
 - Home to generic software common across IOC application areas
- **`${IOCTOP}=/ade/epics/iocTop/<epics-Release>`**
 - » **Members of the parent directory**
 - IOC applications that run the accelerator.
 - Broken down by machine and/or subsystem

Standardized R3.14 build templates



snsTemplates

- **SNS driver/device/record support Build Template**
 - » **Template Name – snsShare**
 - makeBaseApp.pl -T \$TEMPLATE_TOP -t snsShare <name>
 - makeBaseApp.pl -T \$TEMPLATE_TOP -i -t snsVx <iocname>
 - Where <name> is the driverApp's name for example
 - Where <iocname> is the IOC's SNS network name for example
- **SNS softIOC support Build Template**
 - » **Template Name – snsSoft**
 - makeBaseApp.pl -T \$TEMPLATE_TOP -t snsSoft <name>
 - makeBaseApp.pl -T \$TEMPLATE_TOP -t snsSoft <iocname>_<port>
 - Where <name> is the App's name for example
 - Where <iocname>_port is the IOC's name and procServ port.
- **SNS VxWorks support Build Template**
 - » **Template Name – snsVx**
 - makeBaseApp.pl -T \$TEMPLATE_TOP -t snsVx <name>
 - makeBaseApp.pl -T \$TEMPLATE_TOP -i -t snsVx <iocname>
 - Where <name> is the App's name for example
 - Where <iocname> is the IOC's SNS network name for example

Converting shared and iocTop Apps 1



- **Make sure the app is a cvs module**
- **Set up conversion environment**
 - » Working directory has snsTemplates checked out in it
 - » convApp, makeRegistrar, convShare, srcMakeCon on path
- **If shared module:**
 - » convShare <module name>
- **If iocTop module:**
 - » convApp <module name>

Converting Shared and iocTop Apps 2



- **Look in “working” subdirectory**
 - » Any old working dir renamed..
 - » <module> and <module314> directories
 - » Only makefiles and configure directory changed, no source file changes so far.
- **Review the Makefiles a little, try building if you want, tweak**
- **Make changes to source**
 - » Registering of rsets, dsets, drsets, subroutine functions
 - » locsh registering
 - » OSI calls

Changes to App source code 1



- For subroutine func, dset, rset, drset registration follow Janet Anderson's guide for upgrading from R3.14.1 to R3.14.2
- For iocsh registration, use the makeRegistrar script
 - » Prepare a file <fname> with ansi function prototypes of the desired functions
 - » makeRegistrar < fname > outfile
 - » Modify registrar function name in outfile ("xxx" in two places)
 - » Paste outfile into c source code.
 - » Insert "registrar(registrarName)" in dbd file
 - Apps that didn't need dbd files before may now.
- OSI conversion not covered here.

Put converted App in CVS <method a>



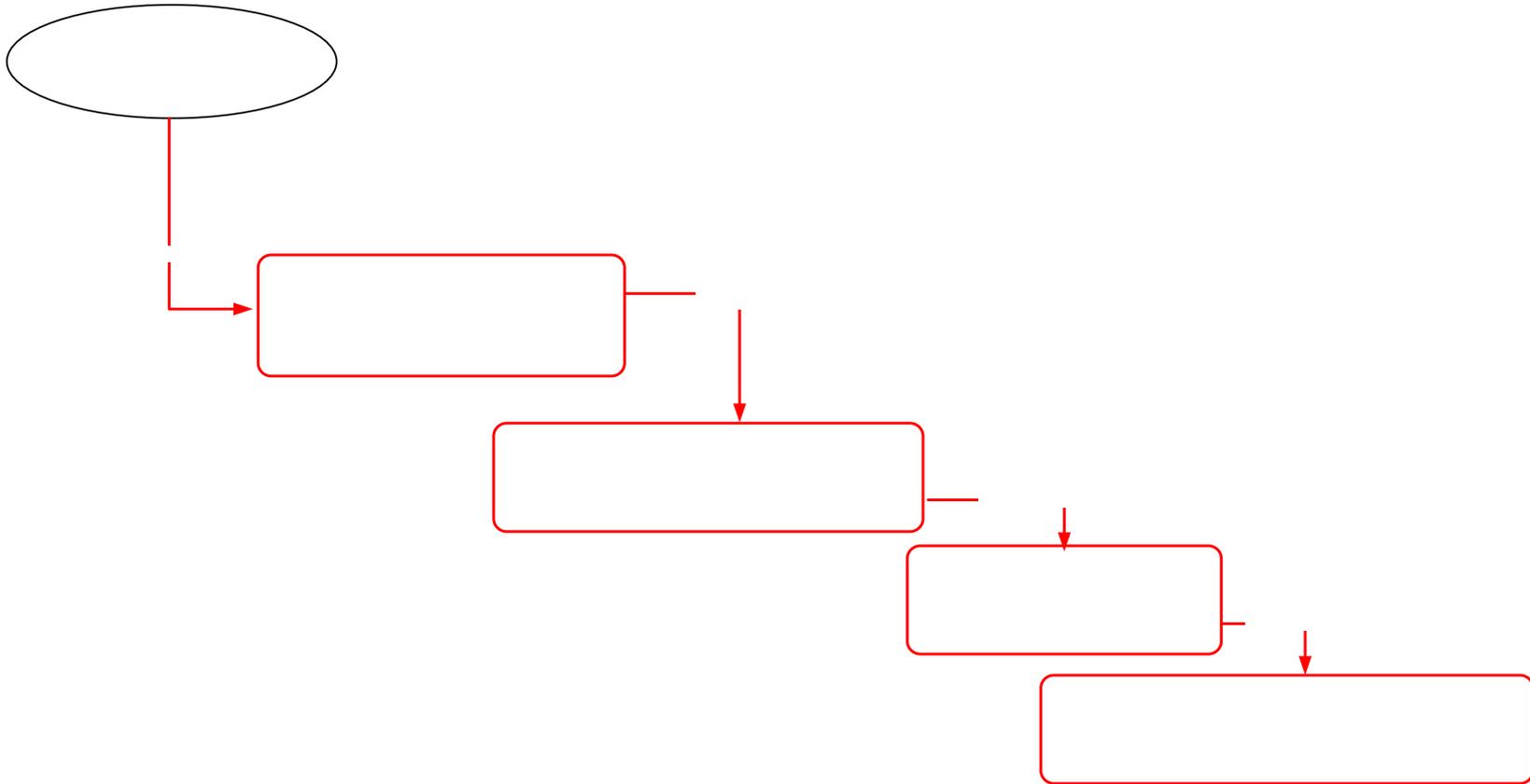
- Do a “make realclean” and finish job by hand
- Check out current head (R3.13 version)
 - » Cvs tag R3-13Version
 - » Cvs tag -b R3-13Branch
- Cvs remove config dir and contents
- Cvs remove Makefile.Vx's and Makefile.Host's
- Copy over files and configure dir from “module314” in working directory
- CVS commit and add as necessary
 - » Head is now 3.14 version

Put converted App in CVS <method b>



- Do a “make realclean” and finish cleanup by hand
- Check out current head (R3.13 version)
 - » Cvs tag R3-13Version
 - » Cvs tag -b R3-13Branch
- Go into module314 in work directory
- CVS import -m “R3.14 upgrade” <repository path> <original vendor tag> <new release>
- Check out a new copy to merge: CVS checkout -j<new release> <repository path>
 - » This causes a merge between the current head and the imported code to be checked out.
 - » If conflicts are generated (check messages) they need to be fixed. Simply delete the first section (from head) of each conflict set.
 - » Remove and cvs remove contents of config directory (and commit) then cvs remove and remove config directory.
 - » Cvs commit entire app – its now on the head
 - » Cvs tag R3_14Version

Flow of the standardized IOC Boot process



SNS IOC Boot Process

Boot process user interface



- All IOCs start from `$IOCS/<iocName>`
- The sys admin is responsible for creating the IOC directories under `iocCommon` and ensuring the proper UID,GID and permissions.
- Place vxWorks kernel version in your RELEASE file from `/ade/vxWorks/ioc/<VERSION>`
- Include vxStats information in the `iocBoot/ioc<iocNAME>/Makefile`
- Install IOC's startup script by typing the following in the `iocBoot/ioc<iocNAME>` directory.

```
make ST=st.cmd
```

- » Creates/updates `$IOCS/<iocname>/startup.cmd`
- » Creates/updates `$IOCS/<iocname>/vxWorksV`
- » Appends info to `$IOCS/<iocname>/log`
- » Creates convenience script `setup.rc` in the in `$IOCS`
Source `$IOCS/<iocName>/setup.rc ; cd $STARTUP`

Do not do this unless you are going to reboot the IOC immediately!

Standardized R3.14 Software versioning and Release scheme.



- **Use release names with syntax following a standard convention: RI-J-K or <cvsmoduleName>-I-J-K**
 - » I = Major release number (major software change was made or hardware changes occurred)
 - » J = Minor release number (minor software changes or feature additions)
 - » K = Software patch sequence number
- **Major and minor releases are usually required when software is modified because changes were made to functional requirements**
- **New patches are generated as result of fixing software bugs.**
- **Note Applications that move to EPICS 3.14 deserve a major release number increment**

IOC Rollback Scheme



- **Versions used during last commissioning run must be tagged in CVS. Use command**
 - » Cvs tag [example of arguments to use given in a related presentation]
- **Perform a rollback for at least one subsystem to make sure the rollback process is well-understood**
- **Now here is how one rolls back quickly:**
 - » First thank Dave Thompson for the scheme.
 - » Second thank Johnny Tang for insisting on quick rollback.
 - » `cd $IOCTOP/<TOP>/<Release>/iocBoot/iocName`
 - » `make ST=st.cmd`
 - This will point the IOC to the selected release. Check this by investigating `$IOCS/<iocName>`. There is even a log file with release history being tracked.

R3.14.4 Testing and Q/A Procedure



- Demonstrate successful build for each subsystem from scratch beginning with CVS checkout
- Demonstrate successful IOC loading of modules and databases (clean boot required)
- Demonstrate successful subsystem control using **EDM** screens
- Document IOC performance baseline in test mode
- Check operation of **StripTool**, **Archiver**, **autoSaveRestore** and **Alarm Handler**
 - » Does not matter how well your IOC runs if the above apps are not working!!

R3.14.4 Testing and Q/A Procedure



- **Test software/hardware upgrades thoroughly before deployment to operations.**
- **Coordinate a phased testing scheme for new hardware/software or upgrades in the real operating environment.**

References



- <http://ics-web1.sns.ornl.gov/ADE/index.html>
- <http://www.aps.anl.gov/epics/modules/base/R3-14/4.php>