LASER INTERFEROMETER GRAVITATIONAL WAVE
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Proposal for Reorganization of 40m Computing

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file /home/ajw/Docs/T000057-00.pdf

Proposal for Reorganization of 40m Computing

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1 PURPOSE

The purpose of this document is to outline a proposed rearrangement of the 40m computer network and software. The goals of this reorganization are:

- To collect and organize all critical 40m software in a cvs repository, maintaining the current and all older releases of the code,
- To collect all of the software into one straightforward directory structure under a single username, and
- To limit network contact with the outside world to a single gateway machine, which can download new software releases from the common repository.

2 OUTLINE OF CURRENT SYSTEM

2.1 Hardware

The 40m lab contains the following computers and attached devices:

- Two SUN SparcStation 10 (eltanin, suhail) and two SparcStation 5 (syrma, zaurak) machines for use as personal workstations.
- Three SUN Ultra Enterprise 2 computers, each with a designated purpose:
  - EPICS (cdssol6)
  - Data acquisition (cdssol9/albireo)
  - Dataviewer (cdssol4)
- Two SUN SparcStation 1 machines, one for running the LabView routines (soon to be obsolete) which control the vacuum system (tigress) and one for fetching and plotting the vacuum system log files (gib).

- One Gateway P5-166 PC, with no specific purpose and rarely used.
- Six VME CPU's (both Heurikon Baja and MVME 162), each labelled as "scipeXX", where XX is a number below 100.
- One 44GB RAID array for storing frame data.

All of these devices are currently functioning except gib, which is irreparably down. In addition, tigress is non-Y2K compliant, and has displayed strange behavior after its date was rolled back one year to prevent a crash. And cdssol9/albireo has been subject to attack from hackers, leaving its operating system partially corrupted but still usable.

2.2 Network Setup

Figure 1 shows the current network connections in the 40m lab. The IP addresses fall into four subnets: 113, 114, 115, and 122. The 115 subnet is reserved for the printers and personal workstations in the lab; users can telnet into these machines from elsewhere in the LIGO cluster. The DAQ machine, cdssol9, also has a subnet 115 interface (albireo) to allow users to remotely access the frame data. The three cdssol machines make up the 114 subnet. While part of the same subdomain as 115 (due to the netmask of 255.255.254.0), outside connections to these machines are restricted.

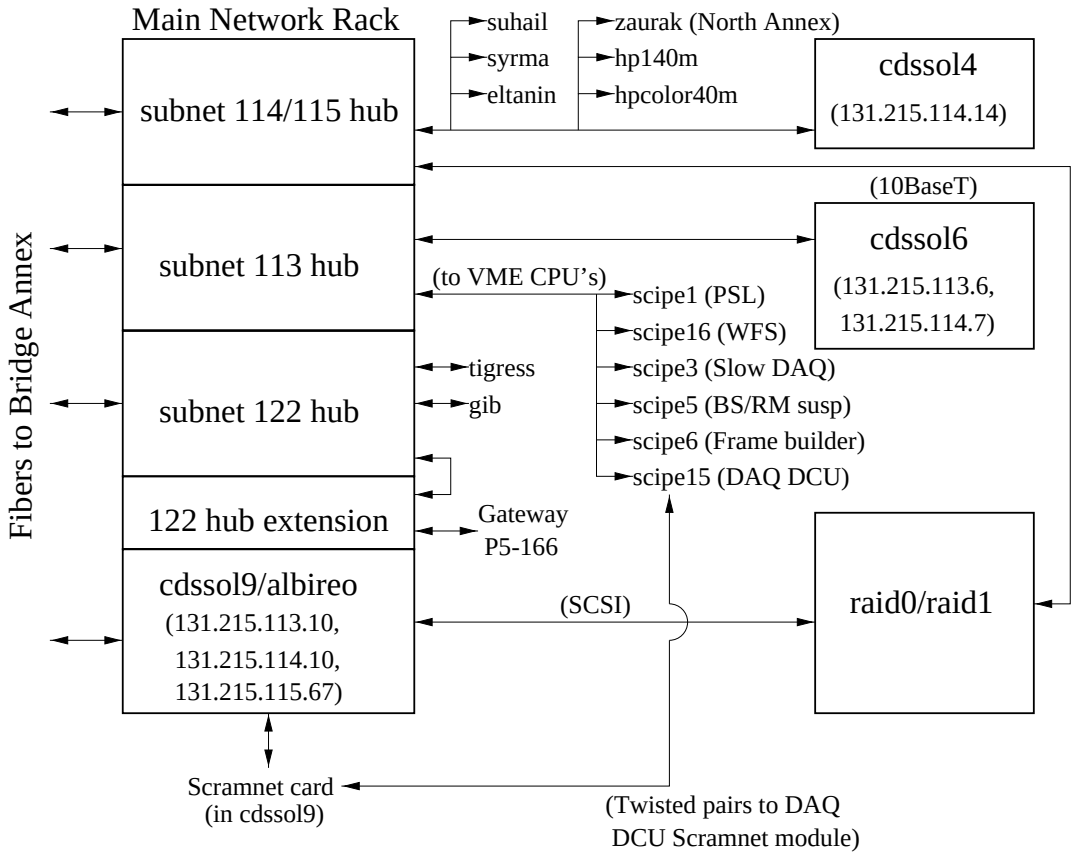
The 113 subnet is exclusively for EPICS machines which need to access software on kater. This includes cdssol6 and the six VME CPU modules. Finally, the 122 subnet consists of tigress, gib, and the rarely-used Gateway PC. Originally tigress was designed to accept no connections except from gib. The pressure gauge and residual gas analyzer log files would be downloaded to gib, which had routines on its hard drive for translating and plotting the logged data. However, gib is now permanently out of service, and tigress is accessible by telnet.

2.3 Software

Most of the EPICS code necessary to control the six VME CPU's in the 40m laboratory is centralized on kater in the Wilson House, which can be nfs-mounted by cdssol6. Figure 2 shows an example directory structure, in this case for the beam splitter and recycling mirror suspension controls. The programmer should have previously placed all database code in directory (c), written and compiled state code in directory (d), and placed the

Dennis Ugolini 3/9/00
/home/dugolini/40m_network.fig

40m Networking Diagram



Note: The IP address for scipe(x) is 131.215.113.(50+x)
(i.e., the address for scipe15 is 131.215.113.65)

Figure 1: Current network arrangement of 40m laboratory.

state code object files in directory (e). Upon reboot the CPU modules load VxWorks (b) and execute *startup.cmd* (a). This is one of four standard routines written by CDS, each designed for a specific CPU processor model (in this case, the Motorola MVME-162). *startup.cmd* calls all executables in directory (f); in this case, *database.load* grabs the database files in (c), while *seq.load* selects all object files in (e).

The exceptions to this arrangement are the *.adl* files for the graphical user interfaces. These files are located under /export/home/controls on cdssol6. The user must login to cdssol6 as "controls" to execute these GUI's.

The data acquisition software can be found on cdssol9 in the directory /usr/avi/core3.d. The user first instructs scipe15 (the main DAQ crate CPU module) via telnet to begin frame-building, then executes *start_daqd* on cdssol9. This routine grabs frames from scipe15 through the Scramnet shared memory module and deposits them onto the RAID array. The DAQ software was written by Alex Ivanov and most of the files have permissions set exclusively to him, so the user must login to cdssol9 as "avi" to execute *start_daqd.*

The Data Viewer software can be found both in the /opt/CDS directories on the LIGO cluster. The program also calls the display routine *xmgr*, which currently only functions on an X-terminal with SunOS 5.6 or greater. This unfortunately excludes cdssol4, which was originally assigned as the Data Viewer terminal. The personal workstations suhail and syrma have SunOS 5.6, however, and the user can log remotely into sirius or canopus from other machines.

There is currently no data analysis software (GRASP, for example) installed on any of the 40m laboratory computers. Matlab can be run from any of the LIGO cluster workstations, but is not installed on the cdssol machines.

3 PROPOSED SYSTEM

3.1 Network and Hardware Setup

Figure 3 shows the proposed rearrangement of the 40m network setup. Much of the system remains unchanged; the personal workstations are still connected to the LIGO cluster through subnet 115, and the scipes continue to communicate with cdssol6. Tigress and gib have been removed, however, as

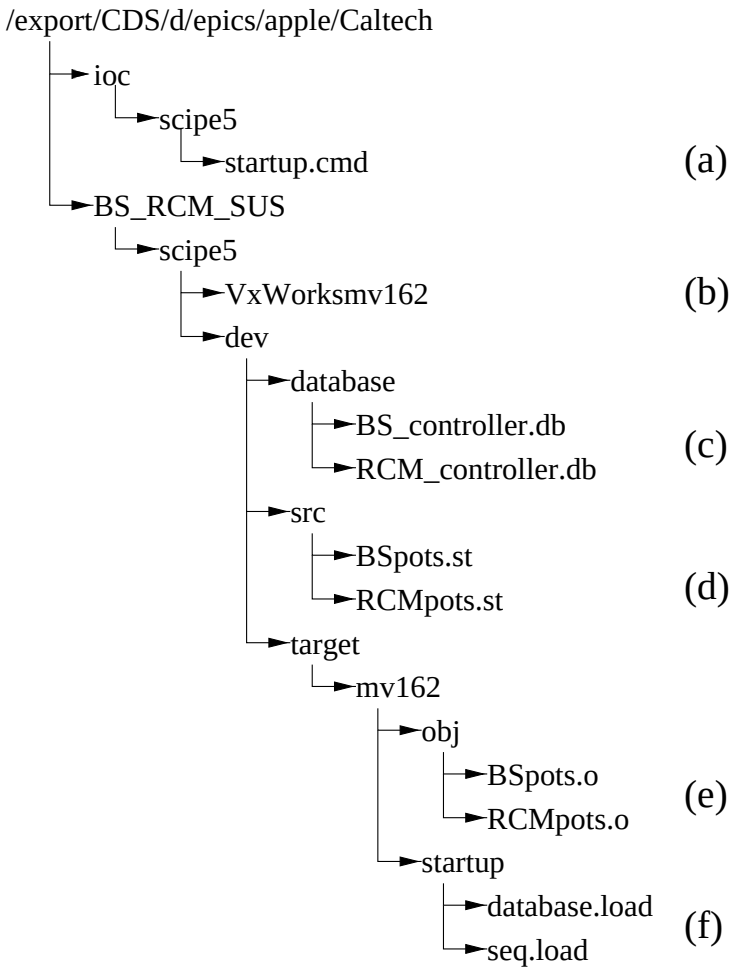


Figure 2: Directory structure for the BS/RM suspension controller EPICS software. "mv162" refers to the MVME-162 processor module.

they will be unnecessary with the new EPICS-based vacuum control system.

The major changes involve the cdssol machines. For security and efficiency, the 40m will be its own private network, with cdssol4 designated as the local server for the 40m. The network will be designed such that if cdssol4 or the LIGO cluster fail, the 40m can continue to function. Any software necessary for running the 40m will be installed on cdssol4, which can then be nfs-mounted and copied over by cdssol6 or cdssol9. The albireo interface to cdssol9 will be removed, and cdssol6 will no longer mount kater to access the startup files for the VME crates (more on software in the next section). All of the cdssol machines will operate under a single username, "40m", rather than the hodgepodge of "controls", "avi", and user identities currently used.

cdssol6 will continue to be designated solely EPICS, and should not require a significant upgrade. cdssol9 will be used for both DAQ and real-time data viewing (in case cdssol4 fails); its hardware should be sufficient, but an upgrade to Solaris 5.6 is necessary. cdssol4 will be hosting all of the 40m applications, and be responsible for downloading new software releases from the LIGO cluster. Thus cdssol4 should be upgraded to a speed and disk space appropriate to its role. In addition, cdssol4 must be able to mount the RAID disks, and a script must be written to serve this frame data to CACR or other remote users.

3.2 Software Directory Structure

Two new directories will be built on cdssol4. One directory, /40m, will be used for code specific to operation of the 40m interferometer:

- /40m/epics_apps – *.adl* files for EPICS GUI's
- /40m/scipe_code – contains a subdirectory with startup code, databases, and state code for each VME processor, much like what now exists on kater
- /40m/daqd – all of the DAQ code currently residing on cdssol9 in /usr/avi/core3.d, with the permissions reset to the "40m" userid
- /40m/dataviewer – current release of the Data Viewer software
- /40m/docs – outlines the directory structure given here, and procedures for updating the software when new releases are made available

Dennis Ugolini 3/9/00
/home/dugolini/40m_newnet.fig

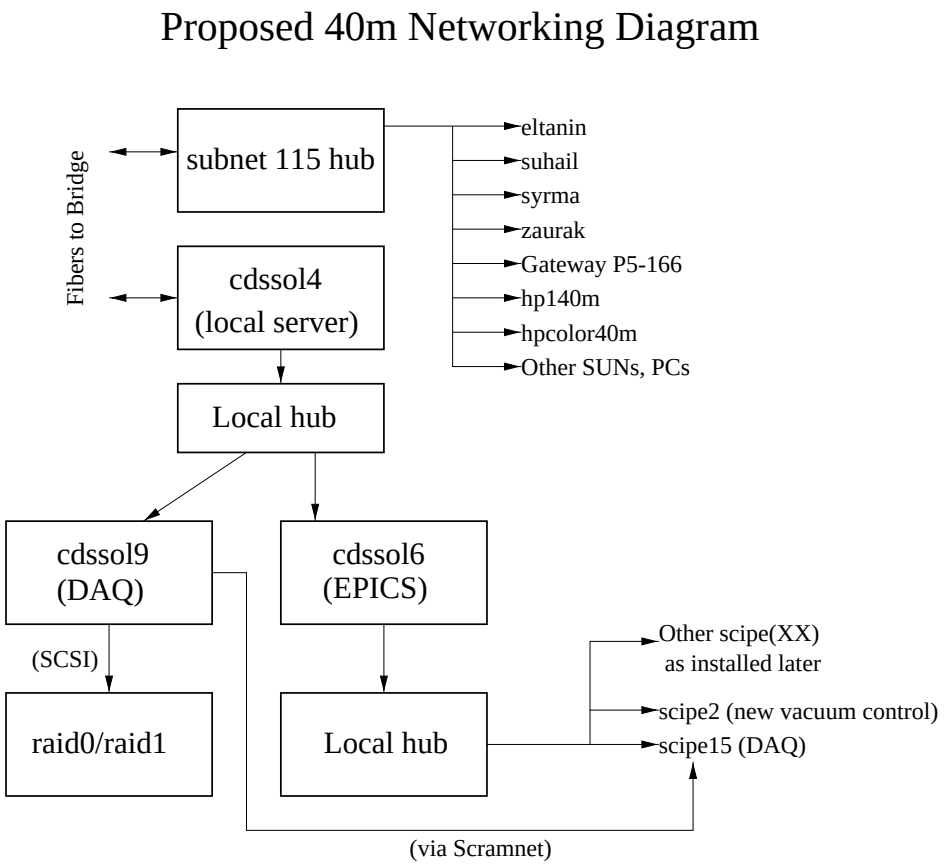


Figure 3: Proposed network setup for 40m laboratory

The second directory, /generic, will include software used throughout the LIGO collaboration:

- /generic/epics – the basic EPICS code, rather than the 40m-specific applications
- /generic/frame – code defining the frame datatype
- /generic/grasp – GRASP data analysis package
- /generic/gds – real-time data analysis software for the Global Diagnostics System (GDS)
- /generic/xmgr – plotting program for Data Viewer
- /generic/matlab

Both cdssol6 and cdssol9 will be able to mount the cdssol4 disk and execute the software from these directories.

In order to continually supply current software releases to the 40m, a cvs repository should be created on one of the networked disks in the LIGO cluster. The directory structure will parallel the one given above for cdssol4, with a /src (source code), /dev (development, or object files for testing), and /rel (release) subdirectory for each software package. cdssol4 could then regularly check the /rel subdirectory for updates and download the software as necessary.

4 COMMISSIONING PLAN

Work is beginning immediately on creating a sample software directory structure on cdssol4. Setting up a cvs repository will require cooperation with the various software authors (Alex Ivanov, Hongyu Ding, CDS, etc.). Rearrangement of the network setup is on hold until two tasks are completed: measurements of the seismic stack transfer functions with the DAQ system, and conversion of the vacuum controls to the new EPICS-based system. Both of these tasks should be completed by Summer 2000.

5 SUMMARY

We have proposed rearranging the 40m computing and network setup such that one machine (cdssol4) acts as the local server and sole connection to

the rest of the LIGO network. This machine would host production versions of all software necessary to run the interferometer, eliminating dependence on other computers and usernames. A cvs repository on the LIGO cluster would contain current releases of all software, which cdssol4 could download as necessary.

We welcome comments on the appropriateness of this solution, and on the specific hardware requirements that may be necessary for the upgrade of cdssol4.