MCS - Data Recorder PC Assembly and Operating System Installation

Christopher Wolfe*, Steve Ellingson, Cameron Patterson

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*Bradley Dept. of Electrical & Computer Engineering, 302 Whittemore Hall, Virginia Polytechnic Institute & State University, Blacksburg VA 24061 USA. E-mail: chwolfe2@vt.edu

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1 Purpose

This document will describe the parts and required assembly of an MCS-DRPC. Additionally, this document describes the process of installing the operating system, appropriate drivers, and support software. It does not, however, cover operating software installation which is detailed elsewhere in [3]. This document supercedes the preliminary design in [2] with regard to hardware component selection.

2 Hardware Specification

The MCS-DR PC consists of a stock Dell Precision T1500, a Myricom 10 Gigabit Ethernet adapter (10G-PCI-E-8A-C+E), a LaCie eSATA adapter. The stock PC is available from Dell at `http://www.dell.com/us/en/business/desktops/precision-t1500/pd.aspx?refid=precision-t1500\&cs=04\&s=bsd`. The T1500's CPU was upgraded to Intel's Core i7 870 (2.93 GHz, 8MB cache), and the memory was upgraded to 8 GB DDR3 (four 2GB modules). The Myricom 10GbE adapter is available from Myricom at `http://www.myri.com/Myri-10G/product_list.html`. The eSATA adapter is available at `http://www.lacie.com/products/product.htm?pid=11068`. Additionally, a PNY Verto 8400 PCI VGA adapter is added since the 10GbE card occupies the system's only PCI-E 16x slot. Any PCI VGA adapter will suffice in place of the Verto, provided Ubuntu 64-bit drivers are available.

3 Assembly

The following section details the steps necessary to assemble an MCS-DRPC from stock PC and three adapter cards. Be advised that this work should be done in a static safe environment, with appropriate grounding hardware and straps. Do not plug in computer power before or while assembling the MCS-DRPC, and if PC has been previously powered, ensure that power supply capacitors are completely discharged before opening the chassis. Failure to comply with this guidance risks injury and/or equipment damage though electrical shock or ESD.

Figure 1: Removal of Chassis Side-panel

Two thumb screws secure the chassis side panel on it's rear-facing edge. Remove those two screws, and slide the side-panel towards the rear, and lift up on the rear edge of the side-panel.

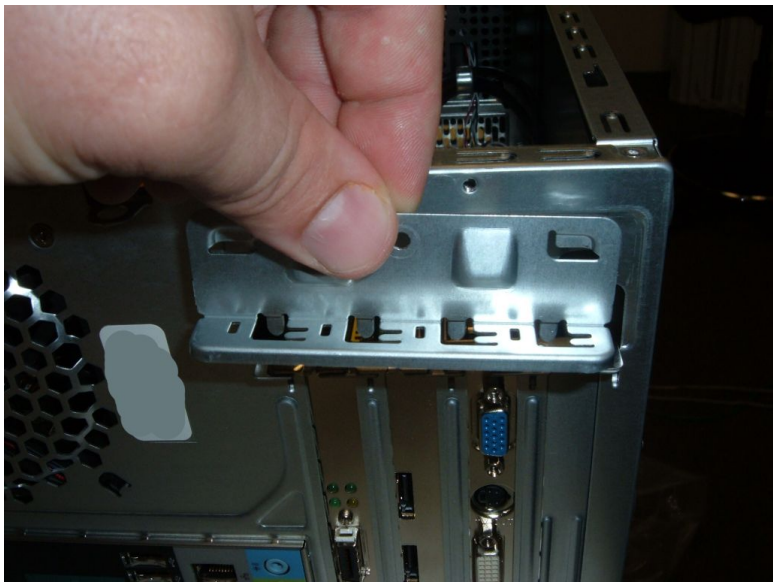

Figure 2: Card Retention Bracket Removal

Adapter cards are secured in place by a small bracket on the rear of the chassis. To install our adapters, this bracket must be removed. Remove the single screw and slide the bracket towards the chassis side with removed panel (upwards in this photo).

Figure 3: Empty Chassis

The stock PC ships with a PCI-E graphics card (not shown) that must be removed before we can install the three required adapters. On the PCI-E slot, towards the chassis' front, a small locking device holds the VGA card in the PCI-E slot. The locking mechanism may be either a simple plastic lever–as shown in this photo–or a button type. For the lever type, push the lever towards the card while simultaneously lifting the card out of the slot. For the button type, either pull from the CPU-facing side or push from the opposite side, while lifting the card out of the slot.

Figure 4: Expansion slots

From the top, the expansion slots are green: PCI-E 16x, black: PCI-E 1x, white: PCI, white: PCI. In the 16x PCI-E slot we will place the Myricom 10GbE adapter. In the 1x PCI-E slot we will install the LaCie eSATA adapter, and in one of the PCI slots, we will install the PNY VGA adapter.

Figure 5: Myricom 10GbE Adapter

This image shows the Myricom adapter. With recent a firmware update, Myricom is selling the same card under a new model number, but either model will work identically for MCS-DR. (Originally listed as 10G-PCI-E-8A-C+E, now 10G-PCI-E-8B-C+E)

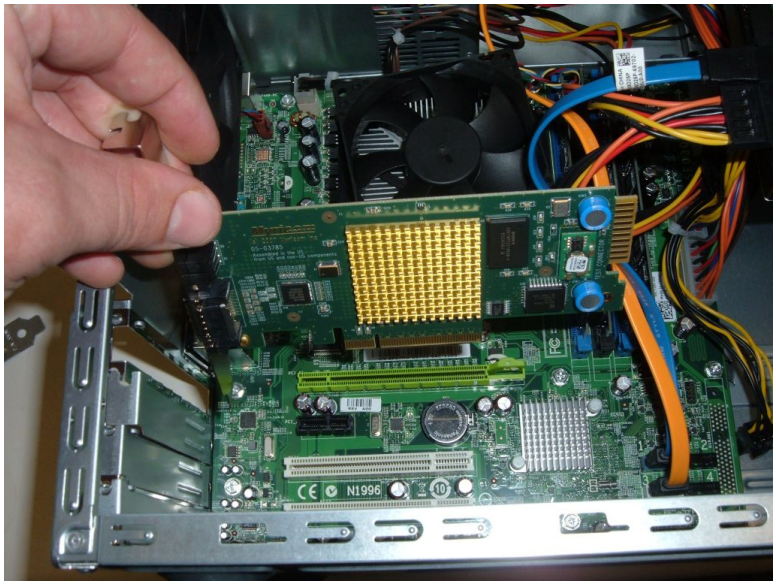

Figure 6: 10GbE Adapter Installation

Align the Myricom 10GbE adapter's PCI-E edge connector with the PCI-E slot on the motherboard, with the metal faceplate flush with the chassis rear slot panel, and press the adapter firmly into place.

Figure 7: Installed 10GbE Adapter

Shown here is a properly installed 10GbE adapter. Until the card retention bracket is reinstalled, the 10GbE adapter may be slightly loose. The important thing is to make sure the card is properly seated in the expansion slot, and is not angled, which could bridge contacts.

Figure 8: LaCie eSATA PCI-E 1x Adapter

It may be possible to replace this adapter with one from another vendor, but this is the only officially supported and tested adapter.

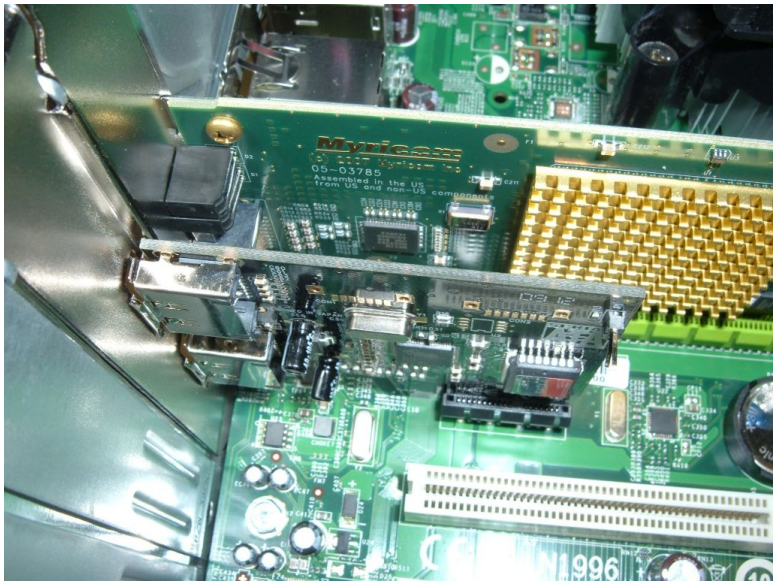

Figure 9: eSATA Adapter Installation

As before, align the adapter's PCI-E edge connector with the PCI-E 1x slot on the motherboard, and press firmly into place.

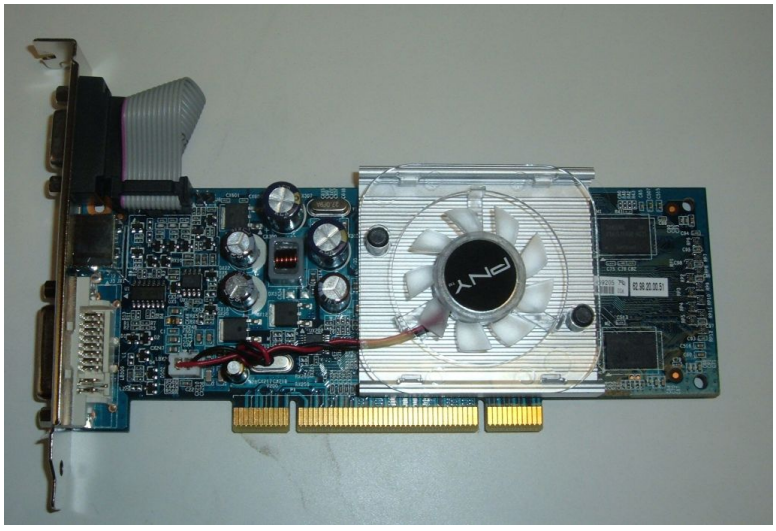

Figure 10: PNY Verto 8400 (GeForce 8400)

Dell disables "headless" operation mode in BIOS, and consequently a VGA adapter is necessary to prevent BIOS from halting due to a lack of a display adapter. Any PCI graphics adapter with Linux driver support should work, but this is the only tested and supported model.

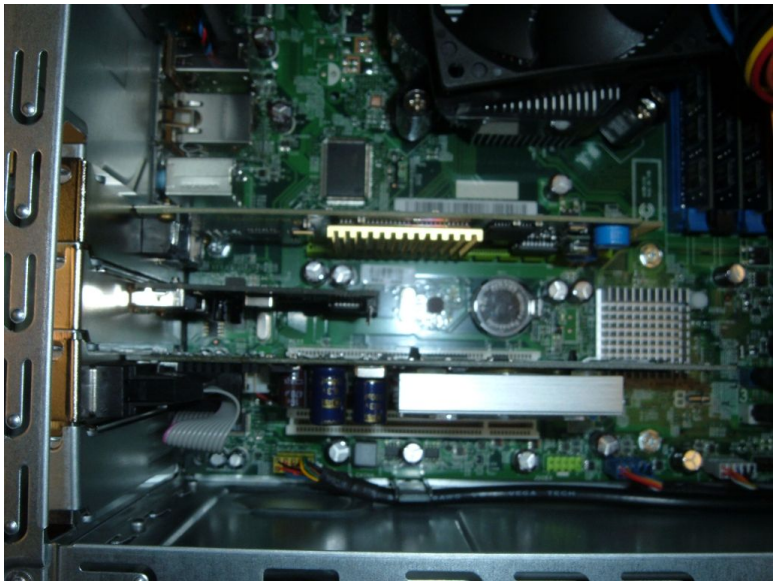

Figure 11: VGA Adapter Installation

Align the PCI edge connector with the PCI slot closest to the CPU, and press firmly into place. In this photo, all three adapters are installed.

Figure 12: Chassis Rear View with Adapters Installed

From left to right, the Dell T1500's expansion slots should contain 1) Myricom 10GbE adapter, 2) LaCie eSATA adapter, 3) PNY Verto 8400 VGA adapter, and the fourth slot should be empty.

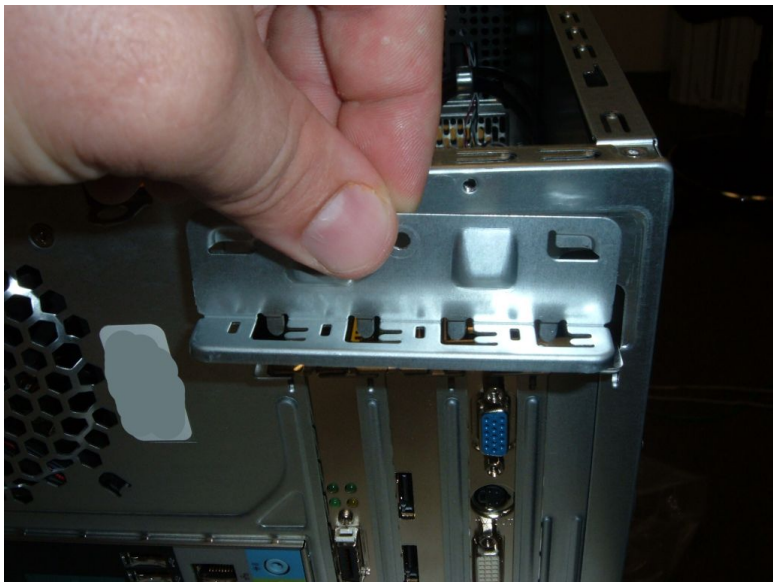

Figure 13: Card Retention Bracket Reinstallation

Align the card retention bracket's two tabs with corresponding holes in the chassis' rear panel. Slide the bracket away from the open side of the chassis (downwards in this photo). Replace the previously removed screw.

Figure 14: Rear Panel with Card Retention Bracket Reinstalled

Figure 15: Chassis Side-panel Reinstallation

Replace the side panel slightly overhanging the rear of the chassis, and slide forward until the side-panel's tabs drop into corresponding grooves on the chassis. Continue sliding forward until the panel stops, and replace the two thumb screws previously removed. Connect power, video, monitor, keyboard, and mouse cables. Press the power button, and ensure that the MCS-DRPC boots into Windows. Windows will be removed when we install Ubuntu, but for the moment it provides a quick way to verify that nothing was damaged during hardware installation.

4 Software Installation

The following section describes operating system, driver, and supporting utility installation for the MCS-DRPC.

4.1 Operating System: Ubuntu Desktop 9.04 64-bit

MCS-DRPC's operating system is Ubuntu Desktop 64-bit version 9.04. First download the ubuntu-9.04-desktop-amd64.iso file from www.ubuntu.com. Burn the .iso file to a CD or DVD, and boot the PC from the newly created disc. The installer will ask you to select a language and then take you to the main menu shown in figure 16. Select "Install Ubuntu" from the menu. The installer will then take you through several prompts to select various system configuration options. For most of these, we will leave the default settings and just click "Forward", but we will need to make changes for hard drive partitioning and username selection screens.

Proceed by clicking "Forward" until presented with the "Prepare Disk Space" options screen. The installer will, by default, recognize that Windows is installed, and avoid overwriting Windows

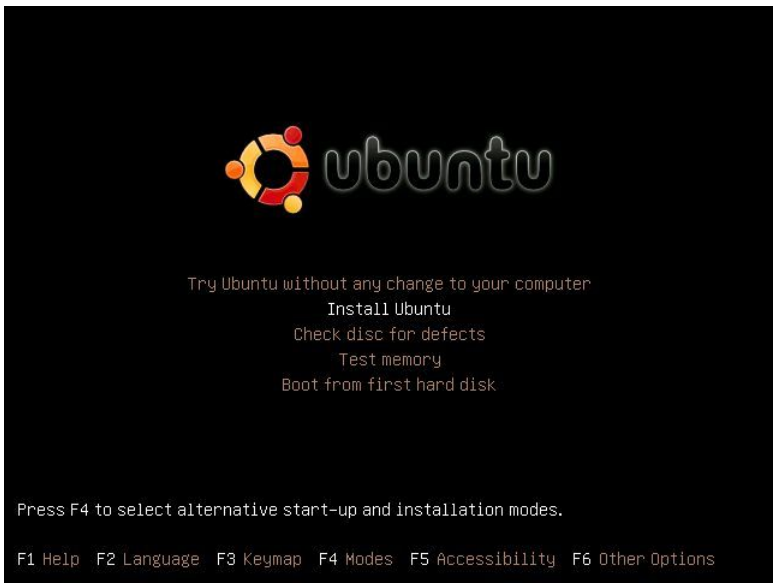

Figure 16: Ubuntu Installer Boot Menu.

partitions. Deselect "Install them side-by-side..." and select "Use the entire disk". Click "Forward" to proceed.

On the "Who are you?" screen, specify the user name as "mcsdr" and the password as "mcsdrrdscm". In the "What is the name of this computer?" field, enter xxxx-yyyy as the computer name. The letters xxxx and yyyy should be substituted with the LWA station identifier and the MCS-DRPC's assigned reference designator, respectively. Again, click "Forward" to proceed. Continue clicking forward until the "Ready to Install" screen is displayed, and then click "Install". the remainder of the installation process is automatic and should take about 15 to 30 minutes.

After the installation is complete, reboot and log in to the desktop using credentials specified on the "Who are you?" screen. Open a terminal window (Click "Applications", "Accessories", "Terminal"). Additional software installation will be performed in this terminal. These will require connection to the internet to download necessary packages. Installing the Broadcom 1GbE adapter drivers will require downloading the drivers and copying them via a USB drive.

4.2 Compilation Tools and Headers

We will now update the package registry and install C and C++ compilation tools. At the command line prompt, type `sudo apt-get update`. You will be prompted for a password. Enter "`mcsdrrdscm`". This will update Ubuntu's package manager's database. Next, type `sudo apt-get install build-essenti` This installs GNU C and C++ compilers, linkers, make, and various other utilities required to compile software. Next, we will install kernel headers required to build kernel modules (drivers). Type `sudo apt-get install Linux-headers-$(uname -r)`.

4.3 Broadcom 1GbE Adapter Driver

The driver packaged with Ubuntu for the integrated Broadcom GbE adapter does not initialize properly, and it is necessary to download the driver source, build and kernel module, and install the module so that it is loaded with each boot.

- First, download the "Linux(tg3)" driver tarball from `http://www.broadcom.com/support/ethernet_nic/netlink_k57.php` to a USB drive, and transfer it to the `/home/mcsdr` folder.

- In the terminal, type `cd ~; gunzip  Linux-3.105h`
- Type `cd ./Server/Linux/Driver`
- Type `tar -xvzf tg3-3.105h.tar.gz`
- Type `cd src`
- Type `make`
- Type `sudo make install`
- Type `sudo echo 'tg3' >> /etc/modules`

To test the driver's functionality, type `sudo modprobe tg3`, followed by `sudo services networking restart`, and finally `ifconfig -a`. An entry should be listed for the Broadcom Ethernet adapter, presumably with an IP address if on a network with a DHCP server. If the entry does not appear, refer to the README.txt file included in the tarball for complete build instructions and troubleshooting.

4.4 Myricom 10GbE Adapter Driver

- First, download the "`Myri10GE_Linux_1.5.1(source)`" package from `http://www.myri.com/scs/download-Myri10GE.html`.
- Type `tar -xvf myri10ge-Linux.1.5.1.tgz`
- Type `cd myri10ge-Linux.1.5.1/Linux`
- type `make MYRI10GE_JUMBO=1`
- type `sudo make install-only`
- Type `sudo echo 'myri10ge' >> /etc/modules`

To test the driver's functionality, type `sudo modprobe myri10ge`, followed by `sudo services networking restart`, and finally `ifconfig -a`. An entry should be listed for the Myricom 10GbE adapter, with MAC address starting with "00:60:DD". If the entry does not appear, refer to the /Linux/README.txt file included in the tarball for complete build instructions and troubleshooting.

4.5 Additional packages and libraries.

The following commands install additional packages and libraries required to build or use the MCS-DR operating software (DROS).

- First we install MDADM, the standard package for Linux software RAID
  - type `sudo apt-get install mdadm`
- Next, install lmsensors, a utility for monitoring CPU and system temperatures
  - Type `sudo apt-get install lm-sensors`
- Now add the required sensor kernel module to /etc/modules
  - type `sudo echo 'f71882fg' >> /etc/modules`
- Test sensors; a list of temperatures and voltages should be displayed.
  - type `sudo modprobe 'f71882fg'; sudo sensors`
- Install hard drive monitoring software
  - type `sudo apt-get install smartmontools`
- Test hard drive tools; a list of the hard drive's S.M.A.R.T. parameters should be displayed.
  - type `sudo smartctl -a /dev/sda`
- Install NTP time utilities
  - type `sudo apt-get install ntp ntpdate`
- Install SSH server
  - type `sudo apt-get install openssh-client openssh-server`
- Install FUSE (File Systems in User Space) library and tools
  - type `sudo apt-get install libfuse-dev fuse-utils`
- Install gdbm (GNU database) library used by DROS
  - type `sudo apt-get install libgdbm3 libgdbm-dev`

5 Summary

At this point, the MCS-DRPC is ready for DROS installation, which is covered in the Extended User's Guide in [3]. Additional configuration of network adapters will be required, but this is dependent upon deployment environment, and is not covered here. For any questions or comments, please email me directly at `chwolfe2@vt.edu`.

References

[1] S. Ellingson, "MCS Subsystem Definition," Ver. 2, Long Wavelength Array Engineering Memo MCS0004, Feb. 23, 2009. [online] http://www.ece.vt.edu/swe/lwavt/.

[2] C. Wolfe, S. Ellingson & C. Patterson, "MCS Data Recorder Preliminary Design & Verification," Long Wavelength Array Engineering Memo MCS0018, Aug. 26, 2009. [online] http://www.ece.vt.edu/swe/lwavt/.

[3] C. Wolfe, S. Ellingson & C. Patterson, "MCS Data Recorder Operating System," Ver. 1.0, Long Wavelength Array Engineering Memo MCS0027, May. 23, 2010. [online] http://www.ece.vt.edu/swe/lwavt/.