Linux® Installation for VnmrJ

Varian, Inc. NMR and MRI Systems

Pub. No. 01-999268-00, Rev. D1005

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Applicability of manual:
64 bit version of Red Hat Enterprise WS V4, Dell 380N, and VnmrJ 2.1A or later.

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Linux Installation and Administration

Varian, Inc. NMR spectrometers use VnmrJ as the data acquisition and processing software. This manual describes how to prepare a Linux workstation to run VnmrJ.

These instructions apply to Red Hat Enterprise Linux Version 4.

- "Getting Started" on this page
- "Verifying Requirements" on this page
- "Collecting Network Information" on page 6
- "Connecting the Linux Workstation to the Console and Network" on page 6

Getting Started

The general installation steps are as follows:

Task	*More Information*
Collect network information.	"Collecting Network Information" on page 6
Install Linux.	Chapter 1, "Installing Red Hat® Linux®," page 7
Install VnmrJ	Chapter 2, "VnmrJ Installation," page 15 or *VnmrJ Installation and Administration*

Verifying Requirements

Note: Only Dell system with two network interface ports purchased from Varian, Inc. is supported.

VnmrJ on a Linux workstation requires the following:

Computer	Dell Precision Workstation 380N, 3.4 GHz, P4
RAM	1 GB, non-ECC, 533MHz DDR2 SRAM, 2 x 512, GX270(311-2865)
Graphics	64 MB nVidia Quadro NVS 280
Hard disk	80 GB SATA, 7200 RPM
CD drive	DVD/CD-RW drive
Second network interface card	installed
Mouse	wheel mouse
Linux	64 bit version of Red Hat Enterprise Linux WS v. 4 with patch, supplied
VnmrJ	VnmrJ 2.1A or newer

Before you begin any of the procedures in this manual, you should be comfortable working with Linux, computer hardware, and Ethernet networks.

Collecting Network Information

Use the "Network Information Worksheet" on page 6 to collect your network information. You will use this information when installing Linux. The network administrator for your site should be able to provide this, or any additional, network information needed.

Network Information Worksheet

Network	*Comments*	*Your Configuration*
Host Name	The host name of the host computer. **DO NOT USE** names listed in Table 1	
Network Device	The network interface (Ethernet board) installed in the computer. Linux systems show **`eth1`** for the primary (on board) interface and **`eth0`** as the secondary (card slot) interface.	
IP Address (**`eth1`**)	The network IP number for the Ethernet board connected to the NMR console. IP addresses, select one: 172.16.0.1 or 10.0.0.1.	
IP Address (**`eth0`**)	The network IP number for the Ethernet board connected to the network — supplied by the local network administrator.	
Netmask	The associated netmask or subnet mask number. Typically, this number is 255.255.255.0.	
Gateway	For or the secondary network card — supplied by the local network administrator.	
Name Service	Depends on the local network setup. NIS+, NIS, DNS, DCE, or similar.	
Domain Name	Your network domain name; for example: `our.domain` — supplied by the local network administrator.	
Name Server	Your network name server and IP address — supplied by the local network administrator.	
Proxy Server (Optional)	Proxy server name, e.g., `proxy.`*`domain`*`.com` — supplied by the local network administrator. To find the proxy server, open Netscape and look under Edit->Preferences->Advanced->Proxies	

.

Table 1. Reserved System Names

`inova, inovaauto, gemcon, or wormhole, master1, rf1, rf2, rf3, rf4, rf5, rf6, rf7, rf8, lock1, lock2, grad1, grad2, pfg1, pfg2, ddr1, ddr2, ddr3, ddr4, ddr5, ddr6, ddr7, ddr8`

Connecting the Linux Workstation to the Console and Network

1. Connect the on board network interface card, **eth1**, to the NMR console.
2. Connect the card slot network interface card, **eth0**, to the local network.

Chapter 1. Installing Red Hat® Linux®

Sections in this chapter:

- 1.1, “Booting from the Installation CD,” this page
- 1.2 “Installing the 64 bit Version of Linux,” on page 8
- 1.3 “Configuring the Network Settings,” on page 11

This chapter describes how to install Red Hat Linux so that it is compatible with VnmrJ. The instructions are based on the Red Hat Enterprise Linux Version 4.

1.1 Booting from the Installation CD

Use the 64 bit version of Linux for this installation. During the installation process use the arrow keys (up, down, left, or right) or the mouse to select options. The instruction to **Restart** the computer requires powering down the computer and powering it back up. Rebooting the computer is automatic in some cases or requires a user action at a prompt to select or accept a restart.

1. Start the computer.
2. Press F2 during the start-up process and access the BIOS settings.

   If the screen passes before F2 is pressed, restart the computer and try again.
3. Insert the first of the Linux installation CDs into the CD/DVD drive.
4. Change **Boot Sequence** in the **BIOS settings**.
   a. Go to the **Boot Sequence** section after entering the BIOS setup window and press Enter.

      Boot options:

      onboard or USB floppy drive
      onboard SATA hard drive
      onboard IDE hard drive
      onboard or USB CD-ROM

   b. Change this sequence so that the CD-ROM is first in boot order.

      The computer first looks at the CD-ROM drive for bootable media; if it does not find bootable media on the CD-ROM drive, it will then check the hard drive or diskette drive.
   c. Follow the on screen instructions and press enter to save the changes.
5. Set SATA Operation to **Combination** as follows:
   a. Select Drives

b. Select Enter

c. Select **SATA Operation**.

d. Select Enter.

e. Select **Combination**.

f. Select Enter.

Ignore the popup window. The system saves changes to the BIOS settings and automatically reboots the computer. For more information, refer to the documentation that came with the system, or the *Red Hat Linux Installation* manual.

g. Select ESC to exit.

h. Select **Save / Exit**.

i. Select Enter.

6. If asked, select the **CD-ROM** option from the boot loader screen and click **OK**.

7. Select the **Graphical Mode** (software will automatically default to graphic mode if no action is taken) for the Red Hat installation — press enter.

1.2 Installing the 64 bit Version of Linux

The Red Hat Linux installation Welcome screen should appear on the display. Click **Next** to begin setting up the installation. A series of screens appear that require making a selection and clicking the Next button. The table in the *Quick Install Information* section outlines the responses to enter at the prompt. The *Detailed Installation* section provides step-by-step details for the relevant screens.

- "Responding to Options Presented During Installation" on this page
- section "Installing Linux" on page 9
- section "Setting up Linux" on page 11

Responding to Options Presented During Installation

The following table summarizes the suggested responses to various prompts presented during the installation process and is provided as a guide and reference. Follow in installation procedure in section "Installing Linux" on page 9.

Screen	*Selection*
Test CD Media	**Skip**
Language Selection	**English**
Keyboard Configuration	**U.S. English**
Installation Type (full)	**Install** Red Hat Enterprise Linux workstation (do not upgrade)
Disk Partitioning Setup	**Automatically Partition** See step 2 in section "Installing Linux" on page 9.
Boot Loader Configuration	GRUB (default)
Network Configuration for **eth1**	edit **eth1**; *uncheck* **Configure using DHCP**; check **Activate on Boot**; IP Address = see section "Specifying IP Addresses" on page 12 Netmask = **255.255.255.0**

Screen	*Selection*
Network Configuration for **eth0**	edit **eth0**; *uncheck* **Configure using DHCP**; check **Activate on Boot**; IP Address = see section "Network Information Worksheet" on page 6 Netmask = **255.255.255.0** Hostname->Set the hostname:->**manually**: enter a hostname Miscellaneous Settings -> Gateway = see section "Network Information Worksheet" on page 6
Firewall Configuration	select **No firewall**.
Additional Language Support	select **English (USA)** as the default; select other languages you wish to install.
Time Zone Configuration	select your local time zone
Set Root Password	enter a root password.
Package Installation Defaults	select **Customize the set of packages to be installed**
Package Group Selection	select **Everything** .

Installing Linux

Use the selections listed in section "Responding to Options Presented During Installation" on page 8, to complete the next series of steps. Refer to the Red Hat manuals for more detailed information, if needed.

1. Click on the Next button to begin. Upon completion of each screen the **Next** button must be click to proceed to the next step. The **Back** button steps the process backward.
2. When the *Disk Partitioning Setup* screens do the following:
   a. Select **Automatically Partition**
   b. Select **Remove all Partitions**
   c. Verify that the option: **Review (and modify if needed) the partition created** is checked.
   d. Select **Yes …** in popup window.
3. Add the `/home` partition is as follows.
   a. Select the **/** partition.
   b. Click **New**. The Add Partition screen appears.
   c. **Mount Point** — Enter **/home** .
   d. **File System Type** — Select **ext3** for **/home** .
   e. **Size (MB)** — Enter the following value: original size of root (/) - 10 GB.

      Example: if the original size of the root partition (/) is 74000 Mb the size of the **/home** partition is 64000 Mb.
   f. Select fixed size.
   g. Click **OK** after the **/home** partition is set up.
4. Click **Next** to accept the changes and continue.
5. The boot loader in the *Boot Loader Configuration* screen is displayed. Keep the GRUB boot loader, which is the default.

6. Select devices — configure the Network device, eth0.
   a. Select **eth0**
   b. Click Edit.
   c. Configure eth0 using the section “Network Information Worksheet” on page 6.
   d. Ignore DNS warnings if the network does not use DNS.
   e. Do not configure eth1, configuration of this port is part of section “Configuring the Workstation Ethernet Ports” on page 12.
7. Configure the Firewall in the *Firewall Configuration* screen — Select **No firewall** and **Enable SELinux active**.
8. Click on **Proceed** in the *Warning No Firewall* popup window.
9. For *Additional Language Support* — Select **English (USA)** as the default. Select other languages you wish to install.
10. Enter the *time zone* information.
11. Set the *root password* as appropriate.
12. In the *Package Installation Defaults* screen — Select **Customize the set of packages to be installed**.

    The *Package Group Selection* screen appears – scroll to the bottom and check the **Everything** box, which is at the end of the list.
13. Click **Next** to start the software installation.
14. Click on **Continue** in the information window that says CDs 1 to 5 are will be required.

    The Installing Packages screen appears with a progress bar. The software begins installing. This can take about an hour or more to finish. Switch CDs as instructed.
15. Click on **Reboot** when the last CD has loaded.

    The installation of the patch for 64 bit operation will fix any graphics issues that appear after the computer reboots.
    a. **Restart** the computer.
    b. Press **Enter** when the Booting Red Hat Graphics Linux screen appears (screen will disappear quickly). Restart the computer after the startup has completed if you miss the Loading Red Hat screen.
    c. **Highlight** the first entry (do not press Enter):

       Red Hat Enterprise Linux WS (2.6.9-5.ELsmp)
    d. Press the **a** key to modify the Kernel.
    e. Wait for the following line to be displayed and the Linux kernel to load:

       ```
       greb append>ro root=/dev/VolGroup00/LogVoL00 rhgb quiet
       ```
    f. Append a `-s` to the end of the line that is displayed and press enter.
    g. Insert the Supplement for DELL 380N CD into the CDROM drive.
    h. At the `sh-3.00#` prompt, enter:

       ```
       mount /dev/cdrom /media
       cd media
       ls
       ```

```
./pkgsetup
```

i. Wait for the patches to install.

j. Enter the following at the `sh-3.00#` prompt:

```
cd
umount media
eject
reboot
```

Setting up Linux

Complete the setup information requested in the following screens. VnmrJ requires a generic (user01) user account.

- Click **Next** in the *Welcome* screen.
- *License Agreement* -- Read the license agreement and click **Yes, I agree to the License Agreement**. Click **Next**.
- *Date and Time* -- Set the appropriate date and time and ***disable*** **Network Time Protocol**.
- *Graphics and Monitor* -- Select configure.
  - **Select** the appropriate monitor (**Dell 1901 FP (digital)**) by clicking on the **triangle symbol** next to DELL In the *Monitor Configuration* screen.
- In the Customize Graphics Configuration screen, set the following:
  - Color Depth: **Millions of Colors**
  - Screen Resolution: **1280x1024** and click **next.**
- Click on the message **Tell me why … and provide Red Hat login** then click on **Next**.
- Choose not to register now and click on Next.
- *User Account* -- Enter **`user01`** or something else appropriate for your site.
  a. Click **Use Network Login** to configure your name server and authentication.
  b. Click the **User Information** tab and configure your name server as appropriate for your site. Refer to the Network Information Worksheet on page 6 and your network administrator.
  c. Click the **Authentication** tab and ***disable*** **Use MD5 Passwords**.
- *Additional CDs* -- Install any of the additional CDs listed. These might be useful, but are not required by VnmrJ.
- *Finish Setup* -- Click **Next**.
- Login as root.

Linux is now installed.

1.3 Configuring the Network Settings

Configure the network in the *Network Configuration* screen. Each workstation ethernet port must be configured. Systems not connected to a network require only one ethernet port (on board port) and systems connected to a network require two ethernet ports (one on board and one card).

Specifying IP Addresses

Select a system IP address for the system that does not conflict with the network at the site and corresponds to the NMR console to which the is connected, refer to Table 2.

Table 2. Assignment of IP Addresses

System	*IP Address*
All Varian NMR System	172.16.0.1 or 10.0.0.1

For DNS IP numbers, refer to the Network Information Worksheet, or ask you network administrator for assistance.

Configuring the Workstation Ethernet Ports

1. Log in as root and start the **Network Configuration Tool**.

   From the **Main Menu** (Red Hat icon in upper left of screen), select:
   System Settings -> **Network**

2. Click the **Devices** tab.

3. Configure eth1 (port connected to the NMR console).

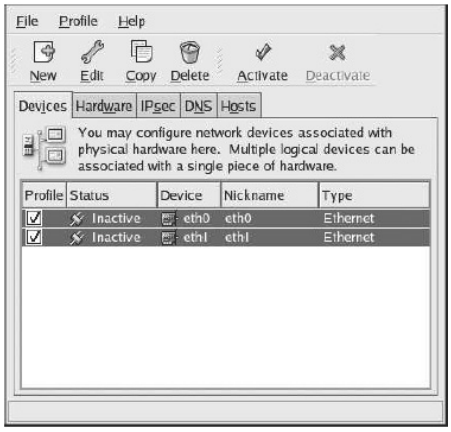
   a. Select **eth1** from the **Device Type** list, and click **Edit**.

   b. In the *Configure Network Settings* screen:

   — Select **Activate device when computer starts** (must be selected or port will not be active after reboot)
   — Select **Statically set IP addresses –** required for Varian NMR Systems

   — **IP Address** – see Table 2
   — **Netmask** enter **255.255.255.0**
   — **Default Gateway Address** – leave empty
   — **Host name** – delete any host name and leave the field empty.

   c. Click **OK**.



Network Administration Tool

4. Do one of the following:

   - Workstations connected to the local area network — continue with step 5.
   - Workstations not connected to the local area network — continue with step 6.

5. Configure the **eth0** connection:

   Consult your network administrator for any network information specific to the network at your site.

   The local network administrator must set up the connection between the workstation and the local network. The local network is connected to eth0. Configure the network interface card as follows:

   a. Select **Ethernet connection** (**eth0**) from the **Device Type** list, and click **Edit**.

   b. In the *Configure Network Settings* screen:

— Select **Activate device when computer starts** (must be selected or port will not be active after reboot)

c. Click **File, Save** and Save the changes.

d. Click **Quit** to exit the Network Configuration Tool.

6. Reboot the workstation.

7. Continue with section “VnmrJ Installation” on page 15.

Chapter 2. VnmrJ Installation

Sections in this chapter:

- 2.1 “Installing VnmrJ,” this page
- 2.3 “Adjusting the Linux OS for VnmrJ,” on page 16
- 2.4 “Setting Up Acquisition Communications,” this page
- 2.6 “Configuring VnmrJ,” this page
- 2.7 “Working with the File Browser,” this page
- 2.8 “Logging in Remotely to a Linux Workstation,” this page

This chapter provides a quick installation procedure for VnmrJ. Refer to the *VnmrJ Installation and Administration* manual for more information on installing, configure, and creating user accounts in VnmrJ.

2.1 Installing VnmrJ

1. Log in as root.
2. Open a terminal or command window.
3. Change to the VnmrJ CD and enter the load.nmr command:

   ```
   # mount /dev/cdrom /media
   # cd media
   # ./load.nmr
   ```

   The Load VnmrJ Software screen appears.
4. Select the options to install.
5. Click **Install**.

   The Installation Progress window appears.
6. Click **Done** after the installation is finished.
7. Enter **`cd`**
8. Eject the VnmrJ CD.
9. Continue with section “Installing Required VnmrJ Patches” on page 15.

2.2 Installing Required VnmrJ Patches

1. Log in as `vnmr1`.
2. Install all current Linux related patches for VnmrJ.

3. Continue with section “Adjusting the Linux OS for VnmrJ” on page 16.

2.3 Adjusting the Linux OS for VnmrJ

The default mouse click interval in Red Hat Linux must be optimized for VnmrJ.

1. Click the **Applications Menu** (Red Hat icon) on the top left of the screen.
2. Select **Preferences** -> **Mouse**.
3. Change the **Double-click Time Out** from 0.4 to **0.5** sec.
4. Continue with section “Setting Up Acquisition Communications” on page 16.

2.4 Setting Up Acquisition Communications

Use the `setacq` command to set up host to acquisition communications.

1. Open a terminal or command window.
2. Enter the setacq command:
   `# /vnmr/bin/setacq`
3. Reboot the NMR console as directed.
4. Reboot Linux as directed.
5. Continue with section “Configuring VnmrJ” on page 16.

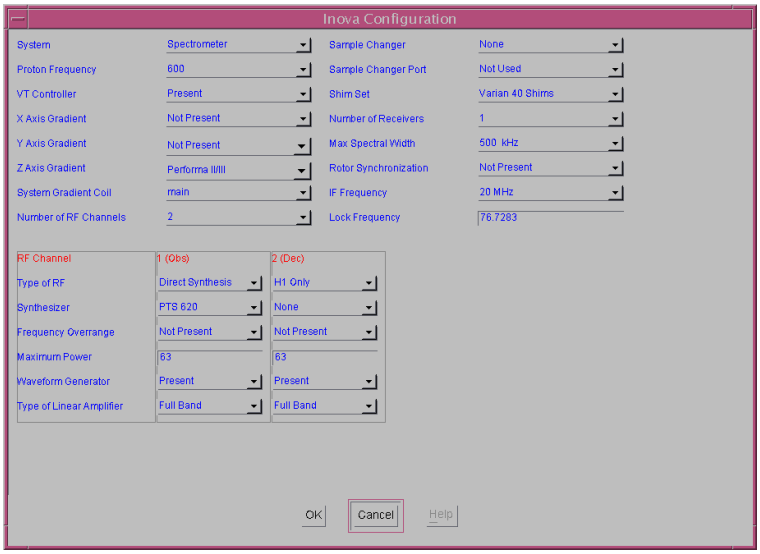
2.5 Creating `su acqproc`

1. Login as root.
2. Open a terminal window.
3. Enter **`/vnmr/bin/makesuacqproc`**
4. Close the terminal.
5. Logout.

2.6 Configuring VnmrJ

1. Log in as **vnmr1**.
2. Start VnmrJ by entering **`vnmrj`** in a terminal window.

   To open a terminal window, right-click somewhere in the screen and select Open Terminal.
3. Open the System Configuration window and configure VnmrJ for your spectrometer.
   a. Click on **Utilities**
   b. Select **System Settings**
   c. Click on **System Config**



d. Enter system settings.

e. Click on **OK**.

4. Enter **`fixpar`** on the VnmrJ command line.

2.7 Working with the File Browser

The File Browser operates in conjunction with the Locator.

- section “Using the File Browser” on page 17
- section “Entering a Directory Path Directly” on page 18

Using the File Browser

When the file browser panel is open, the Locator limits its scope to only files and directories at the current file browser level or below. Closing the file browser by clicking the arrows or dragging the border, causes the Locator to go back to an unlimited display of items.

Drag & drop from Locator to the File Browser sets the File Browser to the director where the dragged item resides.

File browser buttons and controls:

^	click to go up one level
Home	click to go to the current users home data directory
CD/DVD	click to go to the currently open CD or DVD directory
+	(or double clicking a directory)— to open that directory and make it the top level currently in the file browser and also the Locator

Double clicking on a file or directory— operate on that file or directory as the Locator does. That is, double clicking on an NMR data file loads it just as double clicking on the same data file in the Locator does.

Drag a file and directory from file browser — operate on that file or directory as the Locator does when dragging to other windows including the graphics canvas and the study queue.

Entering a Directory Path Directly

The top level of the file browser is editable.

1. Click on the top item to select it.
2. Click again to get the editing cursor.
3. After editing, hit the **Return** key to display the new directory.

2.8 Logging in Remotely to a Linux Workstation

Because of the security features incorporated into Linux, you must use **ssh** (Secure Shell) instead of `rlogin` to remotely login to a Linux workstation.

The typical syntax for the `ssh` command is:

`ssh [-l login_name] [host_name]`

Chapter 3. Linux Administration Notes

Sections in this chapter:

- 3.1 “Understanding User Accounts,” on page 19
- 3.2 “Transferring Data from a Sun to a Linux PC,” on page 20

This chapter provides some additional information about Linux administration as it relates to VnmrJ.

3.1 Understanding User Accounts

One method of creating user accounts for VnmrJ LX is to let the VnmrJ LX installation software use the “VnmrJ master user” (vnmr1), and to then use vnmrj adm (the VnmrJ Administrative interface) to create any additional users (vnmrj adm calls makeuser internally; calling makeuser in a UNIX shell should also be OK).

The one drawback with this method is that makeuser automatically selects a user-ID (UID) for new users, and if you define multiple users, their user-ID will depend on the sequence in which they are defined. On a single / stand-alone Linux / VnmrJ LX installation this is perfectly OK – the user actually never needs to know what his/her user-ID is. However, in networked installations with multiple Linux / VnmrJ LX installations you may experience problems if the user-ID for a given user name is not the same across all workstations, in that (for example) on NFS-mounted partitions you may not be able to read what you think are your files on the remote system, because these files may have an unexpected UID.

The proper solution for networked systems (apart from using NIS or similar means of sharing user definitions, password information etc.) would be to define all users before starting the VnmrJ LX installation. This way you (or the system administrator) can decide what the user-ID for a given user name should be on all systems, and the user definitions can be made consistent across the network.

Note that makeuser allocates UIDs starting and incrementing from the value 500. Many UNIX system administration handbooks actually recommend the following:

- Not using UIDs below 100 at all (these should be reserved for internal use).
- Using UIDs between 100 and 1000 for administrative accounts only.
- Allocating UIDs from 1001 (or 1000) up for ordinary users.

Note that under Solaris, makeuser allocates UIDs starting at value 72 – we strongly recommend not propagating this to the Linux systems.

The real pitfall with a manual user account definition under Linux is in the choice of user shell: by default, under RedHat Linux, user accounts are set up with “bash” as the default user shell. You will not be able to start VnmrJ with this setting. You must make sure you specify **tcsh** (`/bin/tcsh`) as the user's default shell on Linux platforms.

3.2 Transferring Data from a Sun to a Linux PC

This section (adapted from *Varian NMR News 2005-02-13*) describes transferring data from a Sun workstation to a Linux workstation. You may want to transfer files if you are considering upgrading a NMR spectrometer host from a Sun workstation to a PC running RedHat Linux and VnmrJ LX 1.1D, VnmrJ 2.1A or newer.

- section “Single-User Data Transfer” on page 20
- section “Multiple-User Data Transfer” on page 21

Single-User Data Transfer

The most generic solution certainly is to use NFS mounting for temporary access to the Sun disk from the PC. This involves the following steps:

1. Make sure both systems are on the same network branch and can access each other.

   It is convenient if the systems know each other through entries in `etc/hosts` (then you can use host names), but that's not a requirement; the minimal condition is that the two systems can reach each other by IP address - you can test this by using `ping` *`ip_address`* e.g.:

   ```
   # ping 123.45.67.89
   ```

   which should report:

   ```
   host 123.45.67.89 is alive
   ```

   Make sure you try this from both sides.

2. On the Sun, edit the file `/etc/dfs/dfstab` as root, adding a line such as

   ```
   share -F nfs /export/home
   ```

   then (still as root) enter:

   ```
   /etc/init.d/nfs.server start
   ```

   which initiates the sharing and starts the necessary NFS daemon copies. The command `share` without argument should now report the shared file system.

3. On the Linux PC, as root, make sure you have a mount point that you can use, e.g.:

   ```
   mkdir /mnt/sundisk
   ```

   Mount the Sun file system with

   ```
   mount host_name:/export/home /mnt/sundisk
   ```

   or, if the Sun workstation is not listed in `/etc/hosts`:

   ```
   mount ip_address:/export/home /mnt/sundisk
   ```

4. As a VnmrJ user, you should be able to transfer your files, e.g., with

   ```
   cp -r /mnt/sundisk/vnmr1/vnmrsys/data/* ~/vnmrsys/data
   ```

   – OR –

   ```
   cp -r /mnt/sundisk/vnmr1/data/* ~/data
   ```

   (This command will not work if you are logged in as root)

   This works as expected, under two conditions:

   - There are no symbolic links involved (`cp -r` would replace such links by the files they are pointing to). If you want symbolic links to be copied as such, then rather use a command such as:

     ```
     cd /mnt/sundisk/vnmr1/data
     tar cf - . | (cd ~/data; tar xfBp -)
     ```

- All files to be copied are “world-readable”, i.e., have read permission for everybody (and directories must have “execute” permission for everybody). The problem with the last point is that in all likelihood (at least, if you simply used `makeuser` to define the VNMR / VnmrJ users on the two systems), users may have identical names on both systems, but they will have different UIDs (see also Varian NMR News 2005-02-05). If the copying fails, you can alter the permissions first: log into the Sun, then (as VNMR / VnmrJ user) use the following command:

  ```
  chmod -R +r ~
  ```

  and in the case of problems with directory access use

  ```
  find ~ -type d -exec chmod +x {} \;
  ```

It may be necessary for every VnmrJ user to perform these steps. While basic FTP is OK for simple, plain files, it is tedious to use for transferring nested directories - but alternatively, you may user GUI-based, easy-to-use FTP utilities such as gFTP under Linux to do the data transfer.

This should avoid permission issues, as on the remote system you act as a local user.

Note: Beware of transferred binary executables! Compiled programs ONLY work on the architecture for which they have been compiled. Files (other than shell scripts) in `~/bin` or `/vnmr/bin` are suspicious under that aspect.

Multiple-User Data Transfer

With many users a managed data transfer as root might be more efficient than the single-user procedure described above. To do this, you must export the Sun file system(s) *with root permission*. This is achieved by changing the file sharing command in `/etc/dfs/dfstab`, for example:

```
share -F nfs -o root=host1:host2 /export/home
```

where *host1* and *host2* would be potential NFS clients with root access. Now, after mounting, root retains root access even on the NFS-mounted file system, and a global data transfer can be done with the following commands, for example:

```
mkdir /home/import
cd /export/home
tar cf - vnmr1 vnmr2 user3 user4 ... | (cd /home/import; tar xvfBp -)
```

where `/home/import` is a directory on the Linux system that receives all Sun files. In this case, the transferred files will retain the UID and the GID that they had in the Sun and Solaris environment. Due to the potential discrepancy in the UID and GID assignment, you will need to correct the ownership of the transferred files. You can do this by file or directory name, for example:

```
cd /home/import
chown -Rh vnmr1:nmr vnmr1
chown -Rh vnmr2:nmr vnmr2
...
```

Alternatively, if you have directory trees with mixed ownership, you can change the ownership by UID, for example, if vnmr1 in Solaris had UID 72, you can catch all files with that UID by entering:

```
find /home/import -user 72 -exec chown -h vnmr1:nmr {} \;
```

In this case, the recursion is achieved with the `find` command. The `-h` option causes `chown` to change the ownership of a symbolic link rather than trying to change it on the file the link points at.