

Surviving Robotics with a Facilitised Machine

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Robotics Immigration Course 2002.

Assembled by Nick Roy (nickr@ri.cmu.edu) from years of screwing up his (and other) workstations. No guarantees are made regarding the soundness or completeness of this document, and the expected value of this document is not defined.

This document can be found at <http://www.ri.cmu.edu/roboorg/computing.html> in both postscript and PDF form.

1 Preamble

This document focuses almost exclusively on operating Linux machines. If you use Windows, I can't really help you. But some tips:

- The windows software repository is at `\\monolith\PC_DIST`
- There is an NT FAQ at http://www-2.cs.cmu.edu/~pdinda/nt_scs.html.
- Another NT FAQ can be found at <http://www.ntfaq.com/>.
- Facilities has licences for an X Server (xwin32) and an AFS client.

Throughout the rest of this document, wherever you would type your userid, ie. `nickr`, I will specify `myid`.

2 Getting help

- <http://vasc.ri.cmu.edu/intranet/resources.html>.

A very good superset of this document can be found in the VASC intranet, especially for application-specific information. Had I known about the VASC help pages (courtesy of Danny Huber) before I started writing this document, this document would probably be a lot better organised. And possibly unnecessary.

- <http://www.ri.cmu.edu/roboorg/index.html>
Rudimentary help, some links to more help.
- <http://www-2.cs.cmu.edu/~help/>
Facilities help.
- `man -k <subject>`
For finding a man page about some command. Reading cryptic man pages is something of a black art.
- <http://www-2.cs.cmu.edu/~fzq/>
More than just facilities help. Also a lot of random information. Quite helpful often.
- <http://zarchive.srv.cs.cmu.edu/prog/zquery>
Searching the zephyr archives is also quite helpful often. Reading and understanding the zephyr archives is also something of black art.

- mail gripe@cs - 'No hurry, but ...'
Good for specific hardware issues. Not so good for software issues. Latency can sometimes be months.
- Call help desk 8-4231 - 'How do I ...?'
Essentially a (sometimes) faster version of gripe. If you have just removed `/lib/libc.so`, then they'll help pretty quickly. (Naturally, I can attest to this.) But, oftentimes boils down the person on the other end sending mail to gripe. On call 9-5, M-F.
- Call operations at 8-2607 - 'Something is down ...'
If the network just went away, or the printer's on fire. On call 24/7.
- This document liberally borrows from
<http://www-2.cs.cmu.edu/~jcl/presentation/ic01/frame.html>.

3 Logging in

- Your password is (usually) the same for all facilitated machines, and is served by a kerberos ticket server.
- A local password can be generated using

```
% password -l
```

which can be used for login using

```
% login: myid:local
```

as opposed to

```
% login: myid
```

4 E-Mail

4.1 Reading Mail

- Many ways to read mail: elm, pine, netscape, evolution, etc. Read the facilities help page at http://www-2.cs.cmu.edu/afs/cs.cmu.edu/help/www/mail_news/ for how to set these up.
 - POP: Mail is read using pine, netscape, evolution. Advantage: More clients support POP.
Disadvantage: Pretty much the only way to read mail remotely is to ssh to your mail server (one of the `ux{1-9}` machines) and `cat /usr/spool/mail/myid`
 - IMAP: Mail is read using pine, evolution.
Advantage: Easier to read remotely.
Disadvantage: You have to manage your server-side storage carefully. If you don't download soon enough, your IMAP storage fills up and mail starts to bounce.
 - MMDF: Mail is delivered to some local file (perhaps in AFS space), and read using pine, elm, mail, mush, xmush, etc.
Advantage: Easiest to read remotely.
Disadvantage: You lose the pretty readers like netscape and evolution, and attachments can sometimes be tricky to handle.
- You can get mail to a plethora of accounts:
 - `nickr@cs.cmu.edu`
 - `nickr+@ri.cmu.edu`
 - `nicholas.roy@cs.cmu.edu`
 - `nicholas_roy@cs.cmu.edu`

The plus means that no smart matching needs to be done on the address: e.g., `nick.roy@ri.cmu.edu` vs. `nick.roy+@ri.cmu.edu`.

You can use anything after the plus to sort your mail, e.g., `nickr+spam@ri.cmu.edu`, `nickr+hockey@spam.ri.cmu.edu`, `nickr+canadians@ri.cmu.edu`. All of these would be delivered to `nickr`, and then my mailer could sort them into appropriate folders for reading.

4.2 Mailing lists

Robotics has three e-mail lists that you can use:

- `ri-people`
- `robotics-students`
- `robotics-students-verbose`

Use `ri-people` very, very sparingly since it goes to EVERYONE.

You can set up your own mailing lists by contacting facilities, and there's a help page at http://www-2.cs.cmu.edu/afs/cs.cmu.edu/help/www/mail_news/list.html.

4.3 Mailing lists

If you want to check to see if you have an email address correct, you can either `finger address`, or you can `checkaddr address`. If you use `checkaddr -w address`, you can also see how the mail is handled. This is more in the way of a stupid computer trick than useful information.

5 AFS

Everyone in SCS gets an AFS (or Andrew File System) account. Good for providing access everywhere in SCS. Many people make this their home directory.

Common commands:

- `pts examine myid` tells you about yourself from AFS's point of view. UID, groups, etc.
- `fs la dir` examines the permissions on a directory. (In AFS land, file permissions are ignored, and everything is controlled using access control lists on a per-directory basis.)
- `fs sa dir -acl rlidwka yourid` changes the access control list for directory `dir` to allow read, write, list, insert, delete, and administer privileges for user `yourid`.
- `man fs (1)` for more info.

6 Web sites

- Setting up a web-site can be found at <http://www-2.cs.cmu.edu/webhelp/howto.html>
- Key steps:
 - Create `/afs/cs/user/myid/www`
 - Insert html documents here.
 - `fs sa /afs/cs/user/myid -acl www.srv:http-ftp rl`
 - `fs sa /afs/cs/user/myid/www -acl www.srv:http-ftp rl`
 - telnet jeeves
 - Select Perform WWW related operation

- Select **Create a personal web link**
- Set it to `/afs/cs/user/myid/www`.
- SCS web server does not allow server-side includes or CGI scripts. But, you can always install apache on your local machine and enable these permissions for your own machine.

7 Writing papers

- Editors: emacs, xemacs, vi, pico, etc. If you use emacs or xemacs, add this line to your `.emacs` file now: `(global-set-key "^H" 'delete-backward-char)`
You'll thank me later.
- L^AT_EX– the document language everyone loves to hate.
`latex paper.tex` converts a latex file to a dvi file.
`xdvi paper` to view your paper.
`dvips -o paper.ps paper` to turn it to a postscript file, or
`dvips -f paper | lpr -Prader` to print to radar.
- Lyx is not installed by facilities, but it can be had at <http://www.lyx.org>. If I were learning L^AT_EX for the first time, I would use Lyx. Lyx is a nice graphical front end to latex, and kind of approximates a WYSIWYG editor.
- Emacs tries to give you WYSIWYG in latex mode, but it's kind of pathetic. It tries so hard, and fails so miserably, that you end up wanting to emacs out for a beer to suggest it find a new line of work. A better WYSIWYG mode for emacs editing latex is XSymbol, <http://x-symbol.sourceforge.net/>.
- Making PDFs in latex:
`dvips -Ppdf -G0 -t letter -f paper.dvi > paper.ps`
This step creates a ps file that has the fonts included (-Ppdf), and eliminates weird ligatures (-G0). (Note G-Zero, not G-Capital-O).
`ps2pdf paper.ps paper.pdf` creates the pdf.
- Including images in latex
The standard approach to including graphics in a latex document is to turn your gif/jpeg/png/etc into an EPS using xv/gimp/xfig/etc., and then include the EPS using epsfig or graphicx. These packages do a TERRIBLE job of rendering postscript.
Get the img2ps package from Chuck Rosenberg (<http://www-2.cs.cmu.edu/~chuck/softpg/index.html>), and use this program to generate PS images. You'll thank me (and most especially, Chuck), because your latex documents will generate postscript files that are 1/10th the size (in megabytes) of what they would otherwise be.
- Getting Latex help (because you'll need it).
The best LaTeX reference: *A Guide to L^AT_EX: Document Preparation for Beginners and Advanced Users (3rd Edition)* by Helmut Kopka, Patrick W. Daly.
Lamport's book *LaTeX: A Document Preparation System (2nd Edition)* is the canonical reference, but sucks.
<http://www.ctan.org>
<http://www.giss.nasa.gov/latex/>
and for a list of symbols: <http://www.ri.cmu.edu/roboorg/computing.html>.
- Open Office
Reads/writes MS Office documents (mostly) transparently, can be downloaded for free from Sun.
- Printing
<http://www-2.cs.cmu.edu/afs/cs.cmu.edu/help/www/printing/Printer-By-Special.html>

8 Working with Math

- Facilities has licences for both Mathematica and Matlab. Drew says “Mathematica will dramatically ease your workload in, e.g. Al’s class, where otherwise you are handling huge symbolic matrices by hand. Mathematica also make awesome postscript plots.” However, other people swear by Matlab, although it doesn’t do symbolic manipulation.
- Gnuplot is a very good quick-and-dirty plotting program. And it generates human-readable postscript, so if you need to edit your graph after you’ve long since lost the original data set, you can.

9 Networking

9.1 Remote access

ALWAYS, ALWAYS SSH!

- Every facilitised machine has ssh installed.
- You can set it up to let you ssh and scp between machines without typing your password:

```
- mkdir .ssh
- ssh-keygen -t rsa -b 1024 -f .ssh/identity
- cp .ssh/identity.pub .ssh/authorized_keys2
```

or, if the remote machine does not (yet) have ssh2 working (as many facilitised machines don’t, which is less secure, bastards):

```
- ssh-keygen -t rsa1 -b 1024 -f .ssh/identity
- cp .ssh/identity.pub .ssh/authorized_keys
```

- At this point, you have a passphrase, which you can associate with an **ssh-agent**. I do the following: startx using ssh-agent, as in:

```
% ssh-agent startx.
```

And then, once X is started, set up the agent to store the passphrase key by running, in an xterm:

```
% ssh-add
% Enter passphrase for /homes/home4/nickr/.ssh/identity:
%
```

At this point, any terminal started inside X will know the passphrase, and I can connect to any other machine without having to type my password or passphrase.

- If you must access using ftp, you need to create an ftp instance for yourself by telnetting to jeeves.

10 Miscellany

10.0.1 Accessing dos floppies

- Use mtools
mdir a:
mcopy a:word.doc .

10.0.2 Programming languages

- Be aware that there are two different Perl installations on every facilitised machines: the RedHat installed version (`/usr/bin/perl`), and the “latest” facilities install (`/usr/local/bin/perl`). I always use `#!/usr/bin/perl`, because a) I can install extra packages against it, and b) it used to be that the facilitised version was way out of date, but the facilitised version actually seems to be up-to-date at the moment.

- The latest java release installed is (I think) kaffe 1.0.2. You will need to install a 21st century version.
- Python on the standard distribution is ridiculously ancient as well, and does not seem to be installed by facilities by default, even though there is a depot collection (more about depot below). It is apparently used in install scripts for red-hat/facilitized linux. You should either upgrade the local copy (in /usr/bin) or add python to your depot.pref.local to get the latest version installed in /usr/local/bin.

10.0.3 Debugging

- Facilities has licences for CodeWarrior (which is kind of lame), and Insure (thanks Danny Huber), which is fantastic for memory management debugging.
- I also like Electric Fence (3) (link with -lefence) for quick and dirty seg fault finding.

10.0.4 Dealing with Spam

- Use spamassassin+maildelivery (5) to tag your mail as spam and filter it. This is the contents of my .maildelivery file, which resides in my AFS home directory.

```
# Let me know spam arrived using zephyr
addr nickr+spam | R /usr/local/bin/zwrite -q -d nickr -m caught spam
# Store spam in spam folder
addr nickr+spam > ? /afs/cs/user/nickr/Mail/spam
# Let me know regular mail arrived (who its from, subject, etc.)
addr nickr+nonspam pipe R /usr/local/bin/zrcvalert $(size)
# Store regular mail in my mailbox
addr nickr+nonspam file R /afs/cs/user/nickr/Mail/mailbox
# Anything not already handled by spamassassin, pass to spamassassin.
default - | ? /usr/local/bin/spamassassin-maildelivery -S nickr+spam@cs.cmu.edu -N \
nickr+nonspam@cs.cmu.edu
```

Note that I have my mail delivered into a directory in AFS, which means I can read it anywhere that elm is installed; I don't have to ssh to ux4 (which is my maildrop machine). If you read mail using POP or IMAP, then you replace the above references to AFS with /usr/spool/mail/myid.

10.0.5 Time Wasting – Zephyr

- Kind of like a SCS Instant Messenger + IRC
- Can use it to get mail notification
- Can modify zephyr using a .zphyr.vars file.
- Also control your zephyr subscriptions using zctl (1).
- See <http://www-2.cs.cmu.edu/~fzq/>

10.0.6 Time Wasting – News

Readers: rn, trn, xrn, emacs, netscape.

- % setenv NNTPSERVER localhost
- % trn

Facilities has directions on how to set it up:

http://www-2.cs.cmu.edu/afs/cs.cmu.edu/help/www/mail_news/netscapenews.html

Useful newsgroups: cmu.cs.robotics, cmu.cs.robotics.students, cmu.cs.scs, cmu.cs.general, cmu.cs.facilities

10.0.7 The Dark Side

- Facilities has licences for vmware. If you install it, you never need to reboot to launch windows!

11 Maintaining Your Machine

Most of the following section requires root access.

11.1 Root

- It's a good idea to get the root password to your machine. Get this by mailing facilities. Facilities will give you access to a kerberos-root instance, e.g., `myid.root`. You will need to first create such an instance using `jeeves`.
- This kerberos instance will be USELESS to you in the event of a boot failure, or even the network going away. Create a local root password for yourself too. (See section 1). You will need to become root first to change the root password (ie., through the kerberised root instance facilities).

- If you totally screw up your root password, you can recover from this by rebooting your machine. At the lilo prompt, type
`lilo: linux single`
as opposed to the usual
`lilo: linux`

This will dump you into run-level 1, with write access to the `/` partition, which is where `/etc/password` resides. At this point you have no networking (and are root), so it's trivial to change the password with:

```
% passwd
```

11.2 Kernel Messages

- Facilitised machines log kernel messages in `/usr/adm/messages`, not `/var/log/messages` as you might expect. No one knows why.

11.3 Depot

- Facilities updates installed packages in `/usr/local` every night using a mechanism called depot. Check out `/usr/local/depot` for logs and package maintenance. As a consequence `/usr/local` is overwritten EVERY NIGHT. So NEVER install anything into `/usr/local`. Happily, 99% of all tarballs install into `/usr/local`, so it's quite easy to get this wrong.
- The source for the package updates resides in `/afs/cs/local/<package>`, so you can often poke around there to see what you're actually getting. 90% of the depot packages are student maintained, and so are frequently broken or out of date. If CVS or matlab stop working one morning, you can bet that you got a little present from depot the night before.
- Most things in `/usr/local` actually come across the network over AFS, which can be slow (or broken). Make important packages local by editing `/usr/local/depot/depot.pref.local` (not one of the others – these are over-written every night), e.g.:

```
target.installmethod copy bin/emacs
target.installmethod copy lib/texmf
```

This makes the emacs binary and the latex libraries local, making emacs and latex run much faster.

- If you *must* install into `/usr/local`, you can compile your binary into some other location on your machine, and have depot update it from there every night. Consult your manual.

11.4 RPMS

- RPMS for supported RedHat versions can be found at `/afs/cs/archive/redhat/redhat-5.2,6.2,7.1/etc`.

11.5 Security

- First things first, make sure your machine is locked down somewhat reasonably by modifying `/etc/hosts.allow` and `/etc/hosts.deny`.

My `hosts.deny` contains:

```
ALL : ALL
```

My `hosts.allow` contains:

```
ALL: localhost , .CS.CMU.EDU , .cs.cmu.edu , 128.2.0.0/255.255.0.0 , 127.0.0.1
```

This prevents access to most listening servers from any domain except SCS. If you have DSL, you'll need to add your DSL IP address, but you should only need to add this IP address for ssh and (maybe) ssh-x11 access. Letting an outside machine have access to all ports is in general a bad idea.

- If you're a little paranoid (and you should be), you should disable nfs. NFS is the hole for most exploits, and although facilities does a good job of keeping nfs up-to-date, NFS is totally unnecessary and should be disabled by default. That is, unless you know you need it.

```
% /etc/rc.d/init.d/portmap stop
```

```
% /etc/rc.d/init.d/nfs stop
```

```
% rpm -e nfs-utils
```

```
% rpm -e portmap
```

- If you're really paranoid (and you definitely should be):

Disable telnet and ftp. Since you're always going to use ssh and scp from now on, you won't ever need telnet and ftp again.

Remove from `/etc/inetd.conf` the lines:

```
ftp stream tcp nowait root /usr/sbin/tcpd /usr/local/etc/ftpd -a
telnet stream tcp nowait root /usr/sbin/tcpd /usr/local/etc/telnetd
```

and then restart inetd using:

```
/etc/rc.d/init.d/xinetd restart
```

- In a weird fit of paranoia, facilities does NOT turn on X forwarding or agent forwarding via ssh by default. This can be easily fixed by editing `/etc/ssh_config` and `/etc/sshd_config`.

- Your machine may not allow ssh2 by default. This can be verified in the following manner:

```
% ssh -2 <your machine name>
```

If the connection fails, you may want to enable ssh2, since this is a more secure protocol:

```
% ssh-keygen -b 1024 -t rsa -f /etc/ssh_host_rsa_key
<hit return, no passphrase>
```

edit `sshd_config` to have the following lines:

```
include HostKey /etc/ssh_host_rsa_key
Protocol 2,1
```

and then restart sshd using

```
/usr/local/etc/nanny -restart sshd
```

- `/usr/local/etc/nanny` is a watchdog that makes sure essential services are always running, and restarts any that crash. `/usr/local/etc/nanny -list` gives a list of other nanny-managed services.

11.6 I/O Devices

- Permissions on audio devices, the joystick, cdrom drive, etc. are controlled by `pam`, and change depending on who is logged in to the console. If you wish to change the file permissions on `/dev/dsp`, for example, you can, but be aware that when you log out, the permissions will revert back to root. This is (in general) secure behaviour.
- If you want to permanently modify the permissions on IO devices managed by `verb!pam!`, you need to wrest control from `pam`. The first step is to edit `/etc/security/console.perms` to remove references for any devices you want to remove from `pam` control.

However, this is not the final step. Facilities has modified `pam` to *actually* read `/etc/fstab`, and you need to update `/etc/fstab` by running `/usr/adm/fac/bin/mkfstab`, which reads `/etc/console.perms` and re-creates `/etc/fstab`. You can, of course edit `/etc/fstab`, but some time during the night your change will be over-written. Naturally.

11.7 Audio drivers

- Facilitised machines come with the OSS/Free audio driver. However, this driver sometimes does not work well. The ALSA driver is usually much more stable. It can be found at <http://www.alsa-project.org>.

11.8 Desktops

- The default linux X windows manager is `fvwm2`. If you want a prettier desktop, Ximian Gnome seems to play nicely with facilitised machines, although I have not tried KDE. Ximian Gnome can be installed by going to the website <http://www.gnome.com>, clicking the download link and following the instructions.

You get a prettified installation application that manages the install for you. One warning: you are asked to choose a download mirror. I have had little success choosing the canonical `ximian.com` mirror, and a lot of success using the Duke University mirror. *Caveat emptor*.

12 Ergonomics

CMU (happily for us) takes our physical discomfort seriously, at least, so long as it's work-related. If you have any wrist pain, run (don't walk) to Jim Skees (skees@cmu.edu).

13 Contributors

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