UNIX Basics

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What is this about?

- Brief Introduction to UNIX
  - ideas
  - basic commands
  - some examples
- For those who know MS-Windows but next-to-nothing about UNIX/Linux

Watch for advanced tips here

And watch for silly little notes here

Outline

- Background
- File System
- Shell and Basic Commands
- Shell Scripting
- Everything Else

All this and more, in one hour. Whew!

What is UNIX?

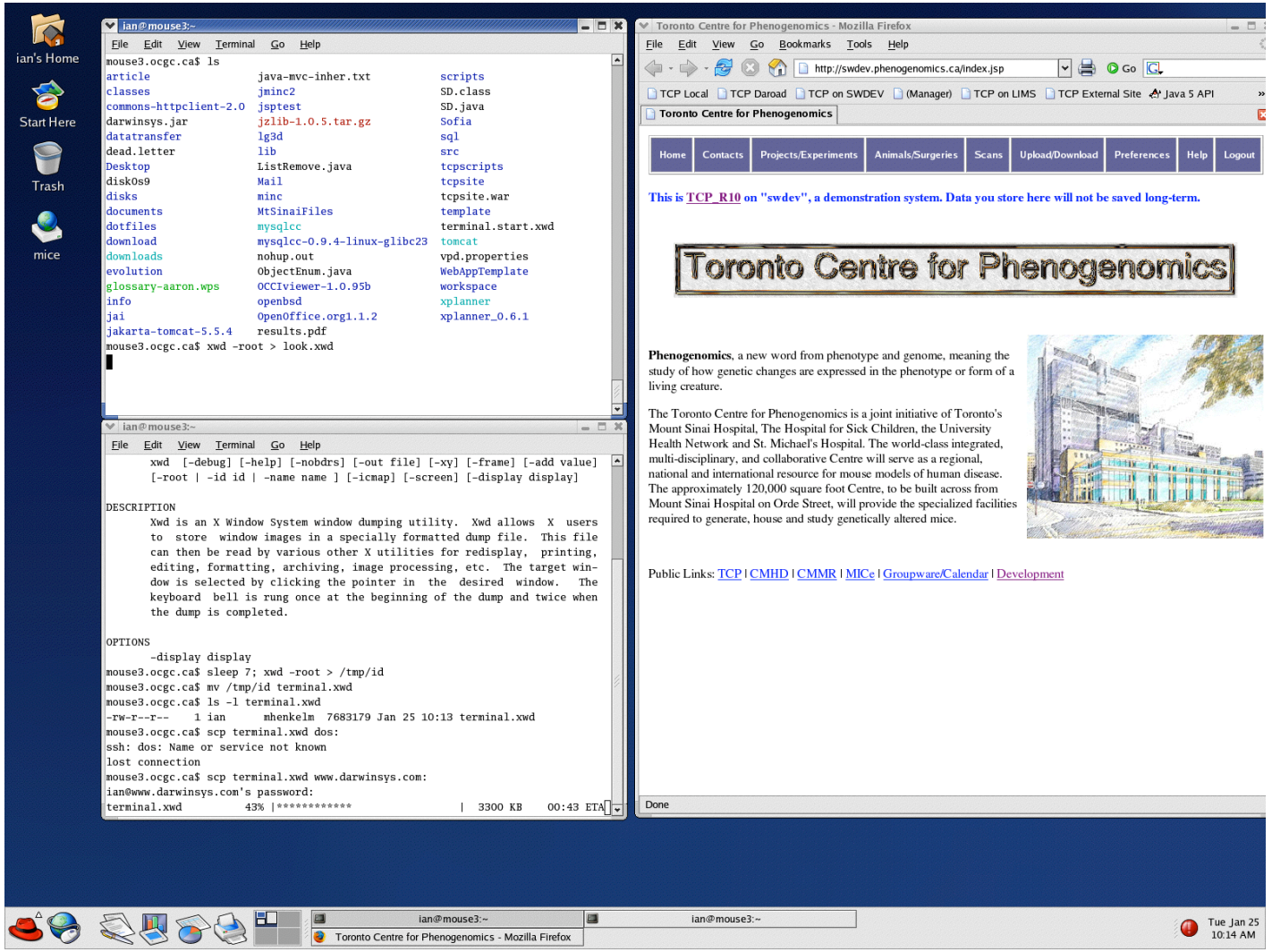
- An operating system in use for 35 years
  - Invented as a *timesharing system*, hence usable both on server machines and on desktops
  - Originally command-line based, like DOS (but smarter :-))
    - Early users logged in over *very slow* terminals
  - Now has several GUIs, like MS-Windows
    - Most based on “X Windows”, MIT’s networked window system
    - Most MICe people use one called GNOME

X Windows predates Microsoft Windows

Terminal Window

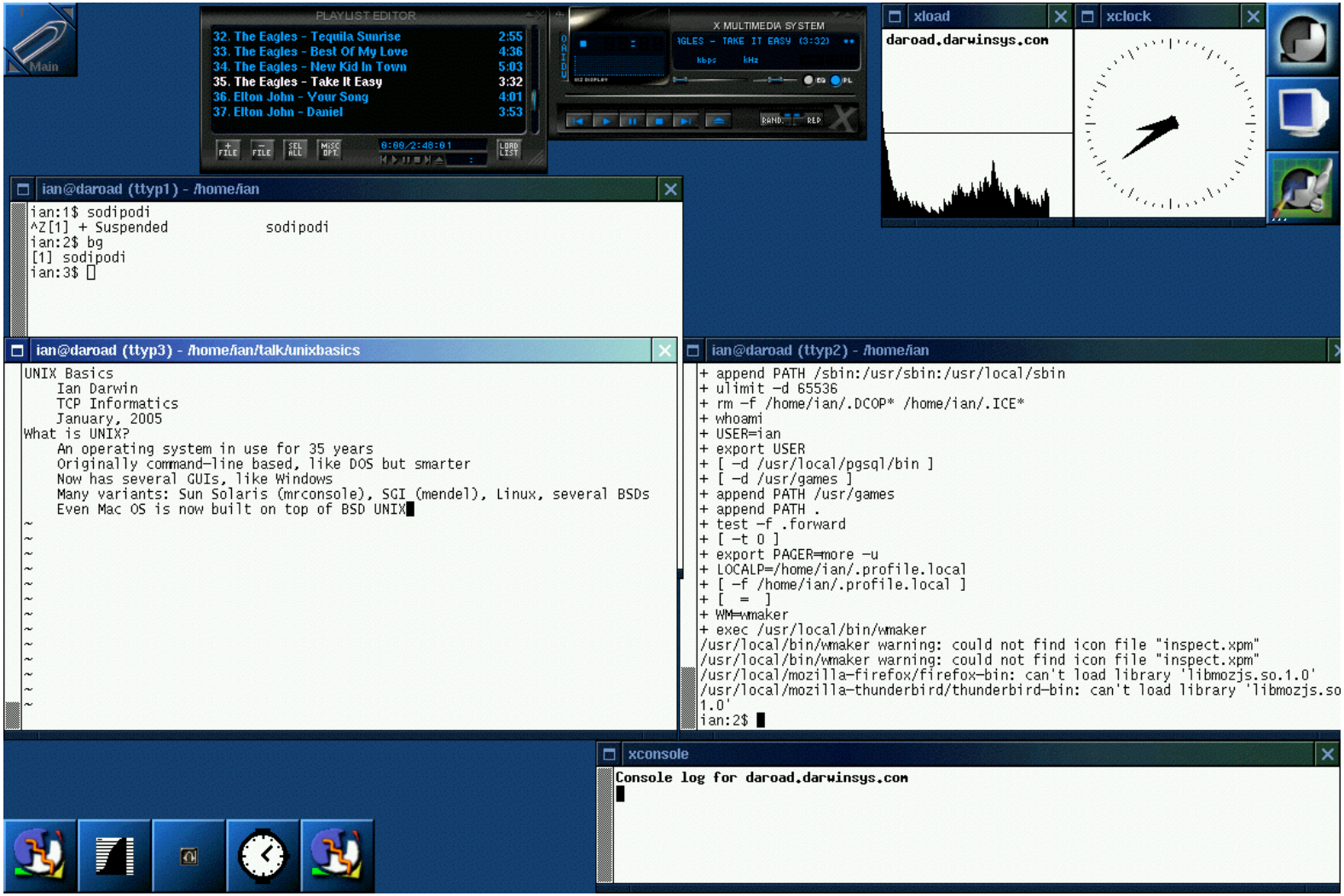
- What do I do now?
  - The subject of this talk!

GUI Our look: GNOME Blue



The first icon (here a red hat) gives you a Start Menu

“Traditional” GUI: WindowMaker



No toolbar or start menu - right click on desktop for “Root Menu”

The Many Faces of UNIX

- Variants: Sun Solaris (MRI console), SGI (miceviz), FreeBSD/NetBSD/OpenBSD
- Linux is a re-implementation of a UNIX-like system, from the ground up
- Mac OS is built on top of BSD UNIX
- "Many variants" is good for choice, but bad for consistency
  - "User" commands pretty similar, "admin" commands vary more

Where is UNIX?

- Everywhere: the Internet is run on UNIX
  - Including Microsoft Hotmail, until last year!
- Things invented on UNIX:
  - TCP/IP, Sendmail, DNS, SSH
  - Apache Web Server
  - Mosaic browser (basis of Netscape *and* IE)
  - C/C++, Perl, Python and Java programming languages
  - Tcl/TK, VTk, OpenGL

They lied about Hotmail. For years.

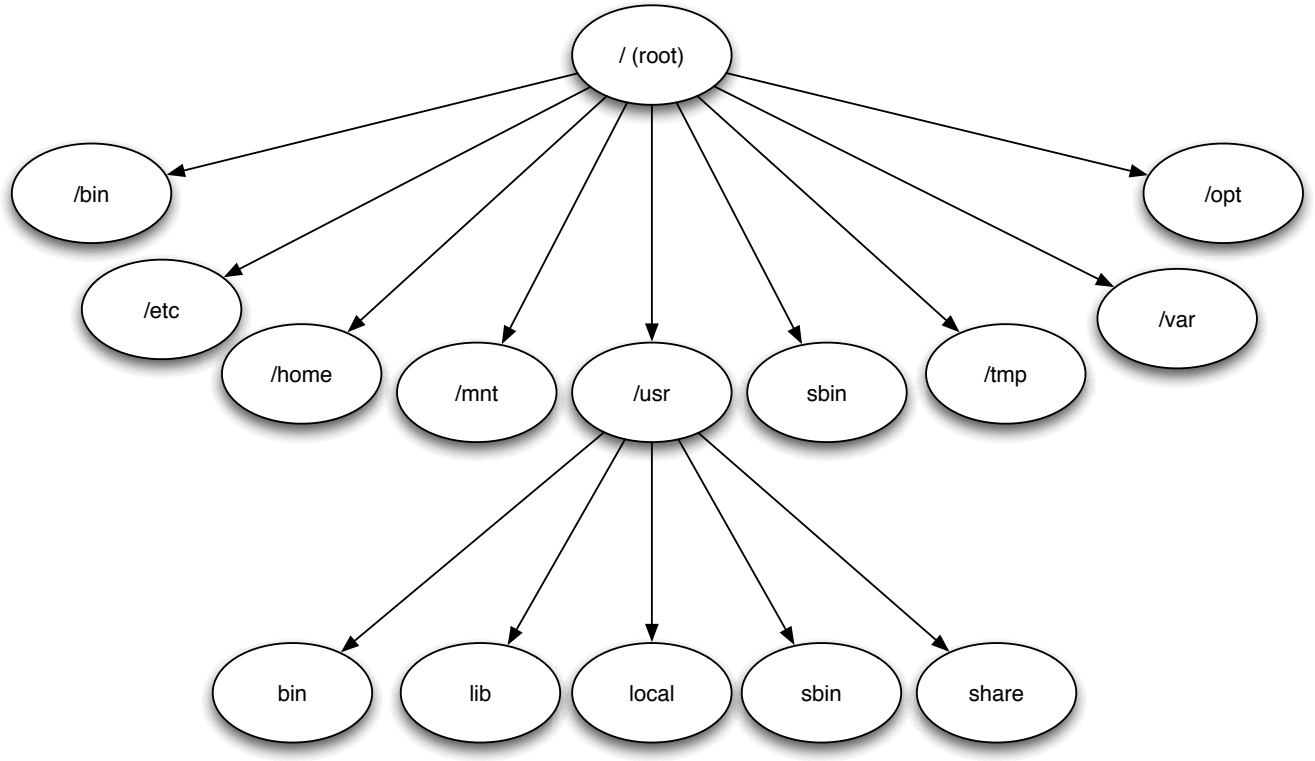
UNIX Filesystem

UNIX File System 101

- UNIX organizes files into directories
  - “Just like MS-Windows does”
  - BUT: UNIX uses the forward slash (”/”) between pathname components
- Have as many directories as you need
  - by topic, by project, etc.
- There are some “well-known” directories on most UNIX systems...

Did I mention that UNIX had this directory tree 15 years before MS-DOS?

A Typical? Unix/Linux Layout



A more typical UNIX hierarchy
Drawn by Ian Darwin (http://www.darwinsys.com)
using Graffle 3 (www.omnigroup.com) on UNIX (Mac OS X).

Networking - NFS & SaMBa

- This same “seamless” hierarchy is preserved for network filesystems (NFS)
- Most Linux boxes here have /projects/ mice as a shared filesystem via NFS
  - No special syntax or ”drive letters” to access
- Our file server also makes these files available via SMB (SAMBA) for mounting on MS-Windows desktops

Shells and Shell Windows

- Every UNIX user has a “shell” or “command interpreter” (analogous to command.com or cmd.exe)
- UNIX has many different shells
  - At this level does not matter which you use
- Reads commands, interprets special characters and built-ins, runs programs
  - Things like *, | and > are pretty much the same as on DOS and on most shells

How many special characters are special on UNIX? All of them.

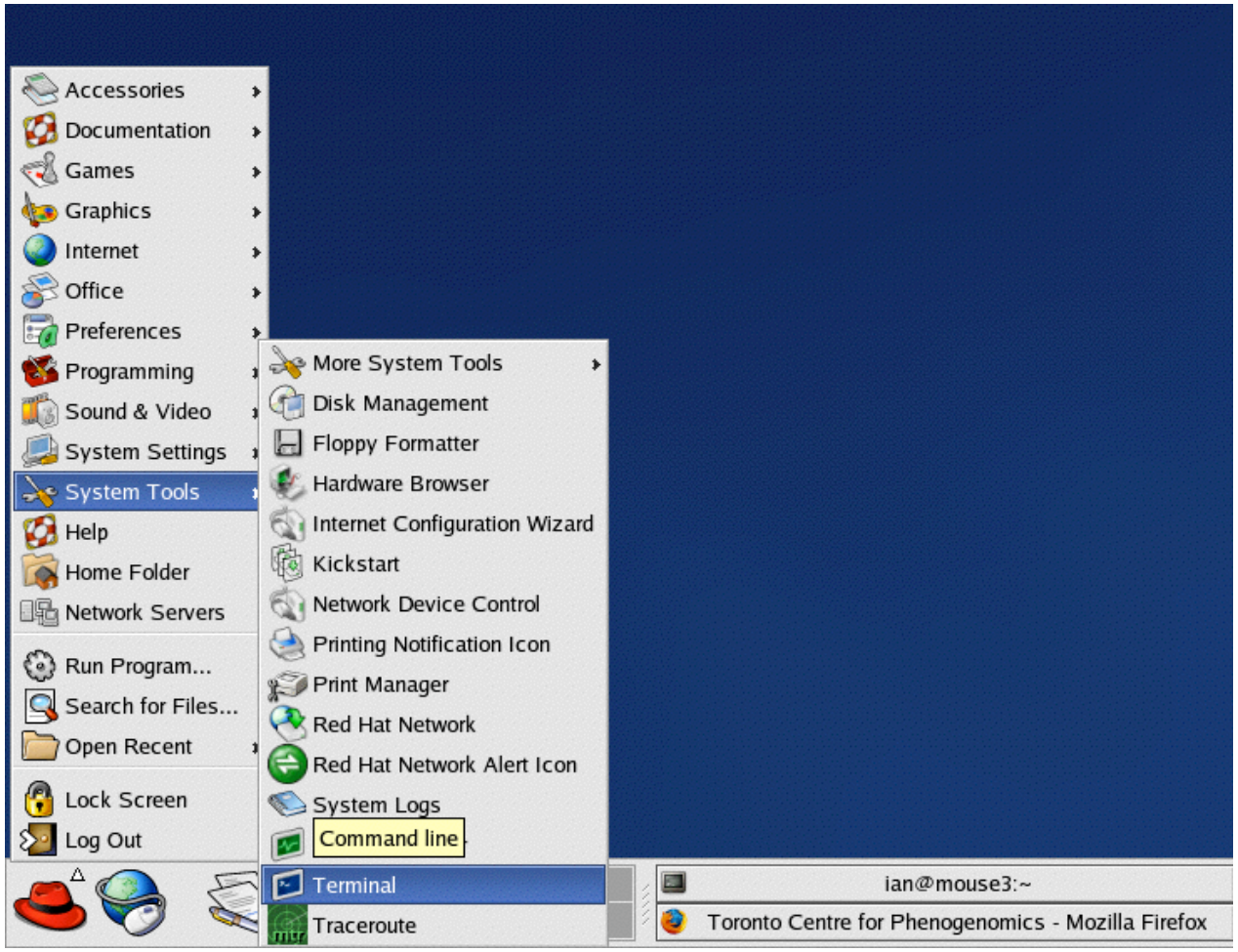
Command Format

- Most commands have this format:
  - command options filenames
  - That is, options (alterations) *before* filenames
- Options are a dash (not slash) plus a letter
  - ls -l gives **l**ong form listing
- Some options require another argument
  - sort -o newdata data
- Some commands take non-standard argument formats

The Terminal Window

- Each UNIX desktop comes with a “terminal window” program, for commands
- Right-click on the Desktop, New->Terminal
- Choose Terminal from the Utilities menu
- Click on the Terminal Icon in the toolbar
- Each of these lets you type UNIX commands...

Starting a Terminal



See? They've made it look almost "just like MS-Windows"

Remote Terminal: SSH

- SSH is a network protocol to login to a computer over the network
  - replaces rsh and telnet which are *insecure*
  - You appear to be logged in “over there”
  - SSH is both a command-line tool and (on MS-Windows) also a windowed application
- Usage: ssh user@hostname [command]
  - With no command, logs you in “over there
  - With a command, just runs it “over there”
  - If user names same on both computers, omit it

ssh to miceviz just for one command

- ssh miceviz date
- ssh miceviz ls -l | more
- ssh miceviz who

ssh to miceviz and process images

- ssh miceviz
- cd /projects/mice/YOUR_DIRECTORY
- Use any of the MINC tools on your image files, which appear in the directory

The help desk: "man" pages

- Nobody can remember all the options to all the commands
- UNIX provides the `man` command
  - prints online *man*ual pages

  `man` + name-of-command = details

  `man -k` + keyword = list of possible pages

Some UNIXes have additional tools

Linux has `info` Solaris has `answerbook`

More detailed

Top 10 Commands

- Every UNIX user needs these "top 10" commands
- cat cd date grep ls more mv ps rm who
- And one of these editors:
  - vi or emacs

UNIX people like giving stupid names to clever things

Basics: cat & more

- cat displays a file with no page breaks
  - like DOS type command
  - other advanced uses
- more displays a file a screen at a time
  - lots of flexibility: q for quit, h for help, multiple files, etc.

Basics: cd & pwd

- cd changes to a directory
  - similar to DOS
  - with no argument, to your home directory
  - with a directory name, cd's to that directory
  - directory name can be full path (starting with /) or relative
  - paths can include . or ..
- pwd = Print Working Directory

Basics: ls

- ls lists the contents of directories, that is, the details about files
- ls - short listing (like dir/w)
- ls -l - long listing (dir, explorer list view)

```
-rw-r--r-- 1 ian  wheel 9218 21 Aug 14:49 support.dat
drwxr-xr-x 4 ian  admin  136 17 Jan 16:31 talk-others
lrwxr-xr-x 1 ian  admin   16  6 Jan 19:31 w -> /shared/w
```

- Three kinds of things you'll see: files ("-"), directories ("d") and "symlinks" ("l", like Aliases or Shortcuts)

ls -h shows the sizes in "human readable", good for large image files

ls and Permissions

- UNIX has a more powerful (but complex) set of permissions than MS-Windows
- Each file or directory has user (owner), group, and “other” permissions
  - Each of which can be r, w or x in any combo
  - ls -l shows all this
- The chmod command lets a file’s owner change its permissions
- If UNIX won’t let you at a file and ls says it’s there, contact the files’ owner

Basics: cp, mv, rm

- cp is the copy command
- mv is the move/rename command
- These will normally overwrite a file without warning (on “standard” UNIX)
  - Our systems have more safety: should ask for confirmation if you try to overwrite
- rm deletes files
  - Most UNIXes do not have an undelete, so it asks first

Basics Bonus: mkdir & rmdir

- mkdir & rmdir create and remove directories
  - for mkdir, must not already exist
  - for rmdir, directory must be empty

Basics: grep

- grep finds files that contain a specified pattern
- grep Mark *.txt
- grep -i mark *.txt # -i = ignore case
- Patterns can be more complex
  - a good hour-long discussion
  - google “unix regular expressions” for detail

Basics: ps & top & kill

- System information commands, like CTRL/Alt/Delete->Process Manager
- ps lists “your” processes
  - options let you see other users’ processes
- top shows all processes, “cpu hogs” at top
- kill can terminate a program

Example: find and kill a process

$ ps -ax | grep someBadProgram

```
1868 tport      0:00 someBadProg
1971 pts02      0:00 someBadProg
1973 ?          0:09 someBadProg
```

- Assuming that you are logged in on pts02 (`who` shows that)
  - kill 1971
- If that isn't strong enough,
  - kill -KILL 1971

Basic Misc: date, who

- date command prints date & time
- ```
  $ date
  Tue Jan 25 10:56:54 EST 2005
  ```
- UNIX was originally for timesharing
  - Might have many (thousands) of users on a single server (dumb terminals)
  - who lists users logged in

```
$ who
root       ttyd1        Jan 24 12:13
baghdadi   ttyq0        Jan 24 12:29  (mouse18.phenogenomics.ca)
idarwin    ttyq1        Jan 24 19:17  (mouse12.phenogenomics.ca)
$
```

How did they get here? Answer soon
```

Basics Bonus: find & locate

- The find command goes through directories to find files by name, by age (what did I call that file I made last Thursday??), and so on
- It is probably too complex to learn today
  - Remember: man find
- The locate command tells you about files by name only
- $ locate Project42

DOS to UNIX Command Help

DOS	UNIX
attr	chmod
cd	cd, pwd
date	date
del	rm
dir	ls
dir/s	ls -R, find (locate?)
find	grep
more	more (cat?)
ren	mv

Text Editing

- Many UNIX programs are controlled by editing their “ini” files (called “dot files” on UNIX: names begin with a “.”)
- Can start by using a notepad-style editor that is included with the system
  - Start Menu->Accessories->Text Editor
- Should eventually learn to use a UNIX text editor, either vi or emacs
  - online tutorials

Shell Scripting

Saving Time and Typing

Shell Scripting

- Anything you type more than once could become a shell script
  - put the commands into a text file
  - in a directory on your PATH
  - mark it “executable” with chmod +x
  - Then run it like any other UNIX command

More on scripting

- Whole books are written on UNIX shell scripting
- Good idea to use only ksh features - most portable to other UNIX-like systems
- See the O'Reilly books *Learning the Korn shell* or *Learning the Bash shell*

Other kinds of scripting

- UNIX was written by programmers for programmers; a great development environment
- Because of this many other scripting languages have been written:
  - awk - older, simpler
  - perl - powerful, strange syntax
  - python - same power, better syntax
  - Python more used at MICe; Perl more used in BioInformatics

Everything Else

More good stuff for UNIX

Neat Stuff for UNIX

- Infinite supply of "free software"
- "Open Office": complete MS-Office-like suite
  - Writer, Presents, Calc, Draw, etc.
  - free! (http://www.openoffice.org/)
  - Reads/writes all MS-Office formats, increasingly compatible

Neat Stuff II (all free!)

- Web clients
  - Mozilla Firefox web browser
- Email clients
  - Mozilla Thunderbird email (like Netscape)
  - Evolution email (looks like MS-Outlook)
- Graphical programs
  - gimp - nice bitmap manipulation program
  - sodipodi - very nice drawing program

VNC - Virtual Network Computing

- Lets you access a machines' X Desktop remotely
  - similar to MS-Windows Terminal Server or Remote Help Access
  - Used on the MRI Scanner console

UNIX is a big subject: Where to get help?

- Ask a friend who knows
- The man command
- google
- books
- Sysadmin magazine

Q & A

1. Did I really use Unix for this talk? Yes.
2. Do I hate Microsoft? No.
3. Do I ever use MS-Windows? Yes.
4. Do I have MS-Windows on any of my own computers? No.
5. You get to ask the rest of the questions.