# Introduction to UNIX

(Based on slides by Michael Siegenthaler)

# Why Bother?

- Most programmers who learn UNIX end up finding it useful
- Provides powerful command-line interface
  - Many simple tasks are *easier* to accomplish
  - Possible to script repetitive operations
- Widely used in research and industry, and runs most of the servers on the Internet

# UNIX Philosophy

- Multiuser / multitasking
- Toolbox approach
  - Combine multiple simple commands instead of using a single complex application
- Designed by programmers for programmers

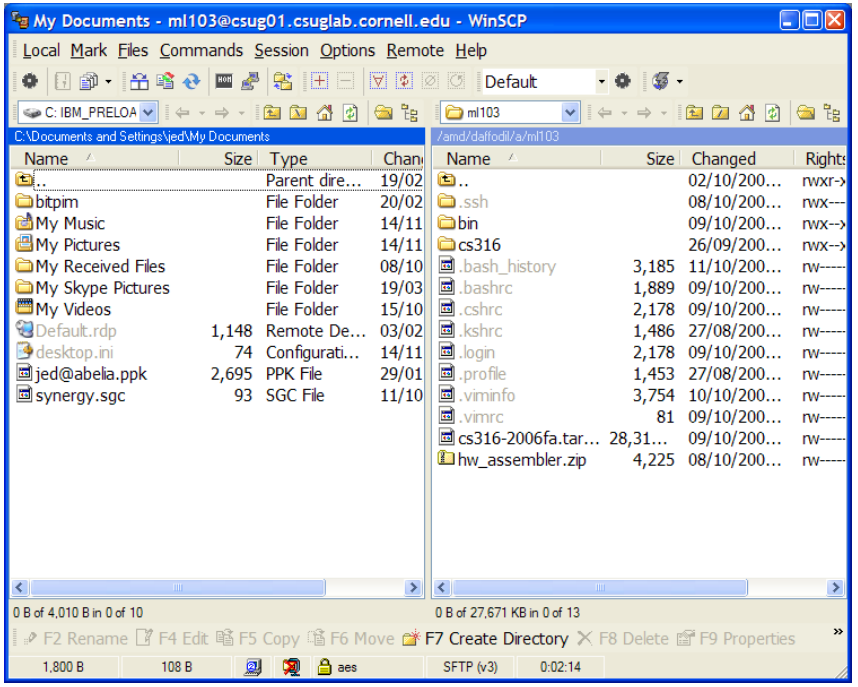
# Shelling into CSUG

- From Windows
  - PuTTY
  - Cygwin
- From MacOS, open a terminal and type
  - **`ssh netid@csug01.csuglab.cornell.edu`**

# Transferring Files

- Use WinSCP

  http://winscp.net/



# Running Commands

- Commands follow the form:
  - **`command <options> <arguments>`**
  - Options modify the command
  - Arguments indicate what file to operate on
- Get help by typing **`man command`**
- Example:

```
[msiegen@tiger ~]$ ls -l /usr
total 301
drwxr-xr-x    2 root root 69632 Oct 18 08:43 bin/
drwxr-xr-x    2 root root  4096 Aug 12  2004 etc/
drwxr-xr-x    2 root root  4096 Aug 12  2004 games/
drwxr-xr-x  117 root root 20480 Sep 12 20:40 include/
...
```

# Plumbing

- I/O Redirection
  - `>` Redirect standard output to file
  - `>>` Append standard output to file
  - `<` Get input from file
- Pipes (|) are used to take the output of one program and use it as input to another

  e.g. **`du -sk /home/* | sort -nr | head -10 > disk_hogs.txt`**

# Practical Tips

- Use **`less`** to view output that will not fit on your screen

  e.g. **`ls -lR | less`**
- Use grep to filter output, and wc to count lines

  e.g. **`ps aux | grep "vim" | wc -l`**
- Use **`&&`** to run multiple commands in sequence

  e.g. **`./configure && make && make install`**

# File System

- Case sensitive!
- Moving around, working with directories

| | |
|---|---|
| **`cd`** | Change working directory |
| **`pwd`** | Print working directory |
| **`ls -la`** | List all files in working directory |
| **`mkdir`** | Make directory |
| **`rmdir`** | Remove directory |
| **`cp`** | Copy file |
| **`mv`** | Move or rename file |
| **`rm`** | Delete a file |

- Searching

  e.g. **`find -name Makefile`**

# How to understand the File System

```
[da279@csug01 /]$ ls /
amd  bin  boot  courses  dev  etc  home  initrd  lib  lib64  localdisk  lost+found
media  misc  mnt  opt  proc  root  sbin  selinux  srv  sys  tmp  usr  var
[da279@csug01 /]$ ls /courses
cs3110  cs3410  cs3410stf  cs4411
[da279@csug01 /]$ ls /courses/cs3410
mipsel-linux  README
[da279@csug01 /]$ ls /courses/cs3410/mipsel-linux/
bin  include  info  lib  libexec  man  mipsel-linux  share

[da279@csug01 ~]$ ls /amd/daffodil/a/
ab397  al644  bc352  cek37  cs722  db493  dtt6  gey2  hs465  jjs87
js368  kk67  mjp63  ng292  pae26  rh335  rw347  sr533  tbw32  xl229...
[da279@csug01 ~]$ ls /amd/daffodil/a/da279/
for.c  for.c~  for.s  hello.c  hello.s
```

# Viewing File Contents

- Use **`cat`** or **`less`**:

```
$ cat hw1.c  # use cat for short files
#include “test-include.h”

_start() {
}

$ less hw1.s  # use less for long files
```

- You can also use vi or emacs!

# Comparing Files

- Use **`diff`**:

```
$ cat file1
Hello!
This is the contents of file1.
Goodbye.
$ cat file2
Hello!
This is the contents of file2.
Goodbye.
$ diff –u file1 file2
--- file1       2007-10-11 04:25:28.000000000 -0400
+++ file2       2007-10-11 04:25:45.000000000 -0400
@@ -1,3 +1,3 @@
Hello!
-This is the contents of file1.
+This is the contents of file2.
Goodbye.
```

# How to use gcc

```
[da279@csug01 /tmp]$ ls
hello.c
[da279@csug01 /tmp]$ gcc -o hello
hello.c
[da279@csug01 /tmp]$ ls
hello   hello.c
[da279@csug01 /tmp]$ ./hello
Hello World!
```

# How to use mipsel-linux-gcc

- **To create the .o file:**

**/courses/cs3410/mipsel-linux/bin/mipsel-linux-gcc -c foo.c**

- **Object file is created and saved in foo.c**

- **To create the .s file:**

**/courses/cs3410/mipsel-linux/bin/mipsel-linux-gcc -S foo.c**

- **MIPS Assembly Code is created and saved in foo.s**
- **You can actually run these instructions in your Processors!**