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/

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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 -1 /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/

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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 -1
- 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
ср	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 04:25:28.00000000 - 0400
+++ file2
               2007-10-11 04:25:45.00000000 -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/mipsellinux-gcc -c foo.c
- Object file is created and saved in foo.c
- To create the .s file:

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

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