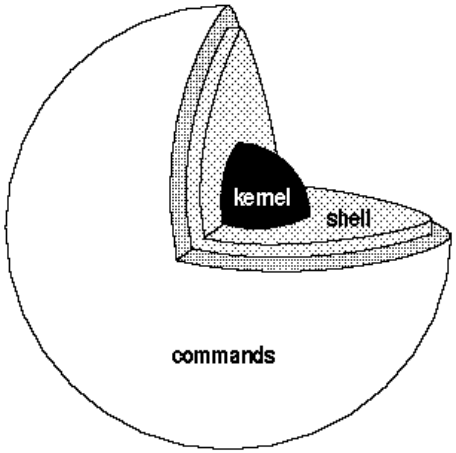
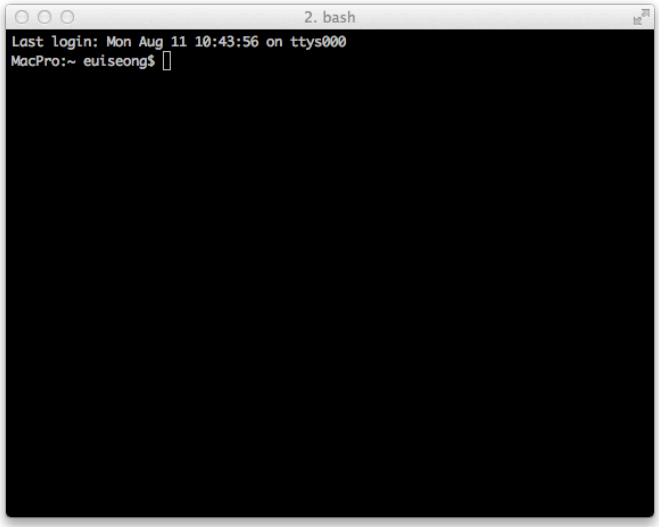
UNIX COMMANDS AND SHELLS

UNIX Programming 2014 Fall by Euiseong Seo

What is a Shell?

- A system program that allows a user to execute
  - Shell functions (internal commands)
  - Other programs (external commands)
  - Shell scripts
- A psychic between kernel and users





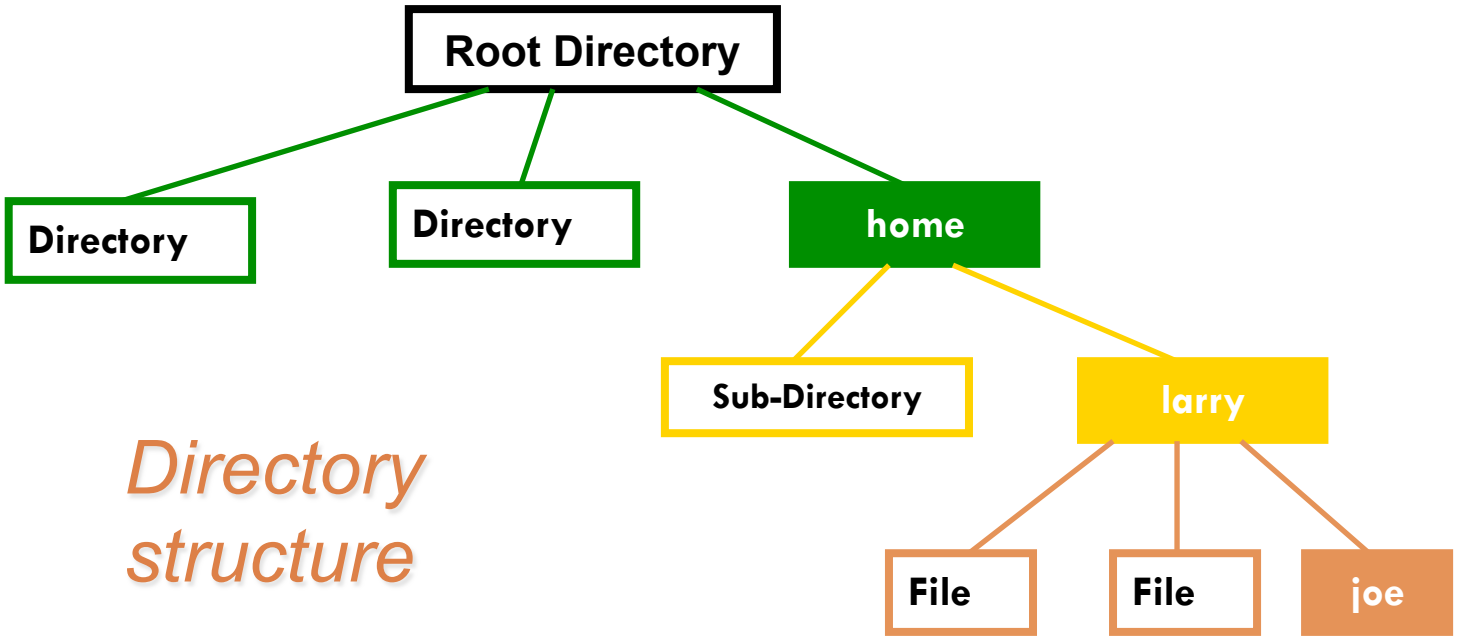
Various Shell Breeds

- Bourne shell (*sh*)
  - Written by Stephen Bourne at AT&T
  - Proposed the concept of pipe, redirection, command substitution, variables, control structures and so on
- C shell (*csh*)
  - Written by Bill Joy at UCB
  - Incorporated many new features including C-style control structure and expression grammar, history, editing, aliases, directory stack, tilde notation and so on
- TENEX C shell (*tcsh*)
- Bourne again shell (*bash*)
  - Being used by most Linux distros and Mac OS X

Command Format

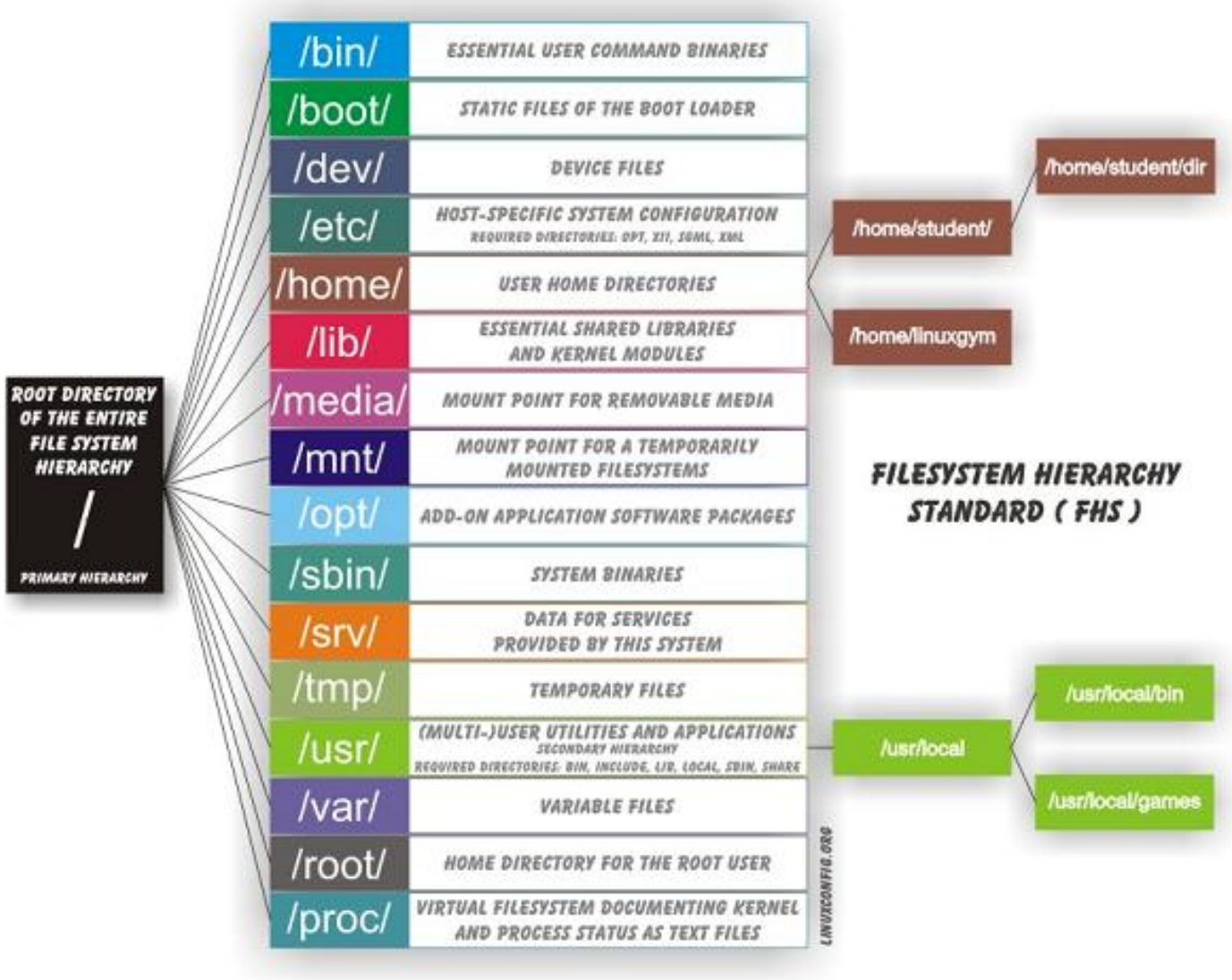
- Format principle
  - % commandname [*arg1*] … [*argN*]
  - % means prompt
- Types of arguments
  - Options
    - Indication of modes of operations
    - Prefixed with - or -- (GNU style)
  - Operands
    - Data to work with
    - Actual data or file names

UNIX Directory Structures



Directory structure

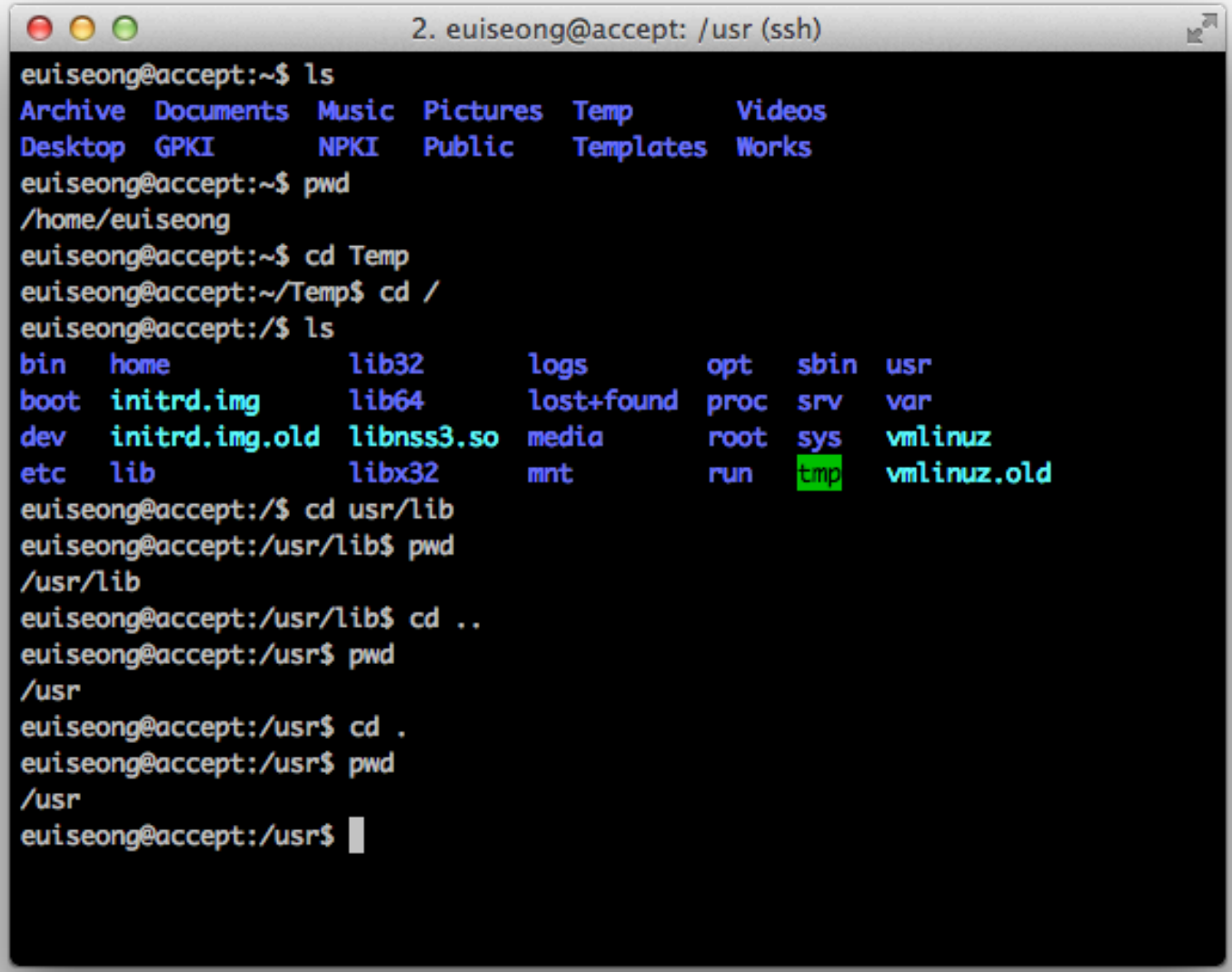
UNIX Directory Structures



UNIX Directory Structure

- Directory representation
  - Tree-like structure
  - /directory1/directory2/directory3/
- Root directory
  - Root of directory tree
  - /
- Current working directory (CWD)
  - Where you are currently working in
  - ./
- Parent directory
  - Parent of CWD
  - ../
- Home directory
  - For user's personal data
  - ~

Traversing Directories



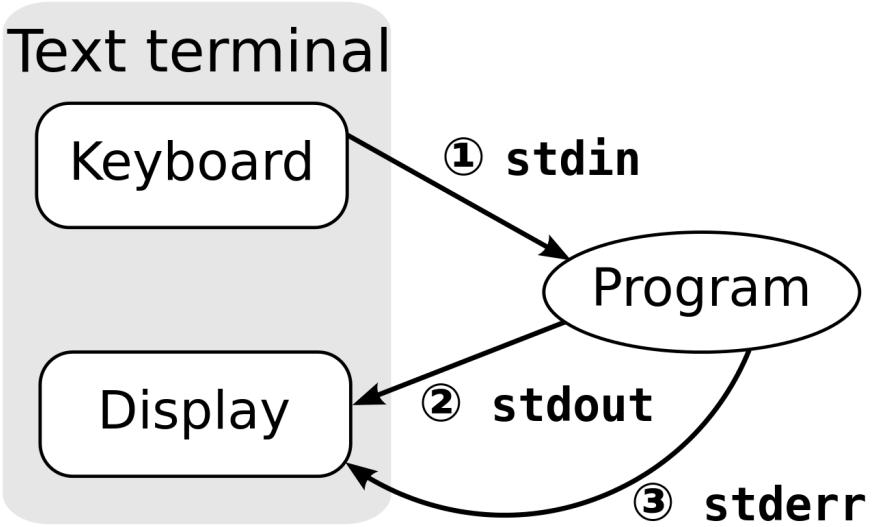
Shell Built-in Features

Help!

- help
  - Display information about built-in commands
  - help [-dms] [pattern]
  - Without options, this will display the list of built-in commands
  - Let's do help help
- "RTFM!"

Displaying Messages

- echo
  - Write arguments to standard output
  - echo [-neE] [arg ...]
  - Useful for shell scripting
  - printf of shell



Directory Traversing Again

- pwd
  - Print the name of the current working directory
- cd
  - Change CWD
  - cd [dir]
  - Default DIR is the value of HOME environment variable

Environment Variables

- A set of dynamic named values
- Affect the way running processes will behave
- A part of operating system environment
- Examples
  - HOME=/Users/euiseong
  - PWD=/Users/euiseong/Documents/Papers/vbuffer
  - PATH=/usr/bin:/bin:/usr/sbin:/sbin:/usr/local/bin:/usr/texbin

Set and Unset Environment Variables

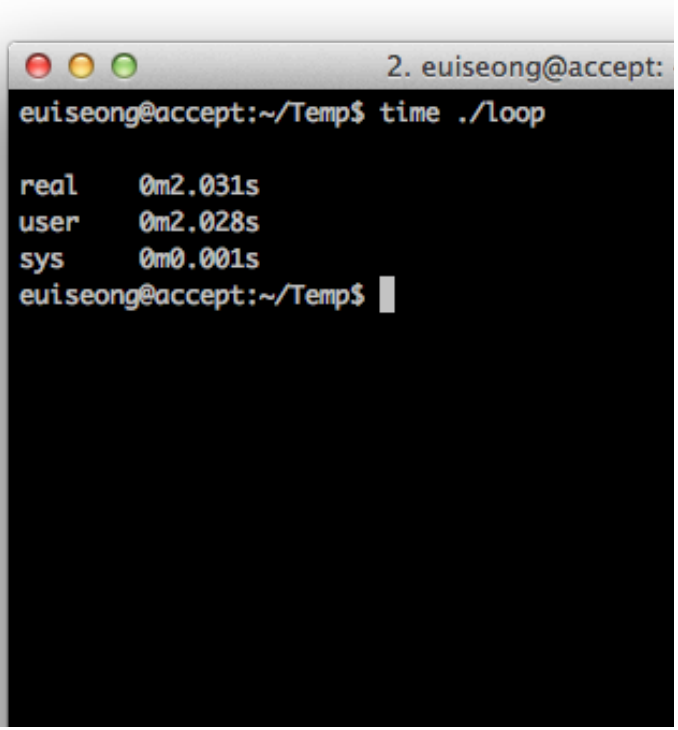
- Set an environment variable
  - export [name[=value]...] [-p]
  - Example
    - export TEMP=/tmp
    - export EMERGENCY
- Unset an environment variable
  - export -n name
  - Example
    - export -n TEMP
- Referring to an environment variable
  - $variable_name
  - Example
    - echo $PATH
    - export PATH=$PATH:./

Log In and Out

- Login shell
  - A shell obtained from a connection channel such as terminal, ssh or telnet
- logout
  - Exit a login shell
  - Returns an error if not executed in a login shell
- exit
  - Exit the shell
- Can you tell the difference between logout and exit?

Measuring Time for Processing

- time pipeline
  - Report time consumed by pipeline's execution



External Commands

Manual Pages

- man
  - Show manual pages
  - First command to remember
  - man man
- Layout
  - Name
  - Synopsis
  - Description
  - Example
  - See Also

Directory and File Management

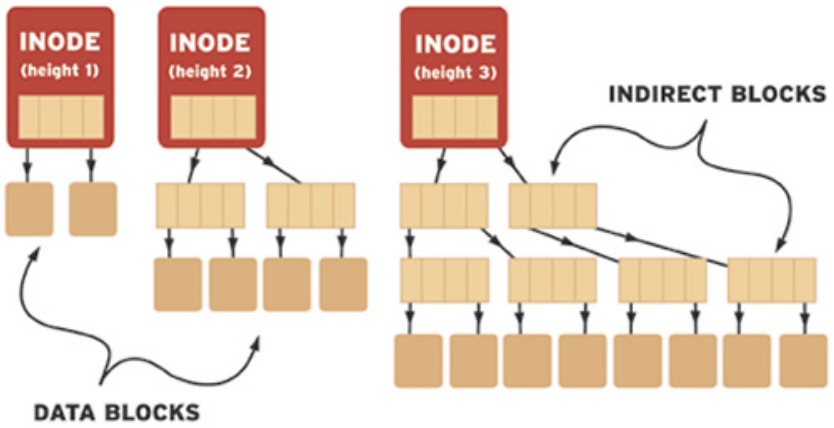
- ls [-ABCFGHLOPRSTUW@abcdefghiklmnopqrstuwx1] [file ...]
  - List of files in a directory
  - -l option shows in the long format
- cp
  - Copy files or directories
  - cp -r
    - Recursive operation (for directory copy operations)
- rm
  - Remove files or directories
  - rm -f
    - Force operation

Directory and File Management

- mkdir
  - Make a directory
- rmdir
  - Remove a directory
- file
  - Determine file type

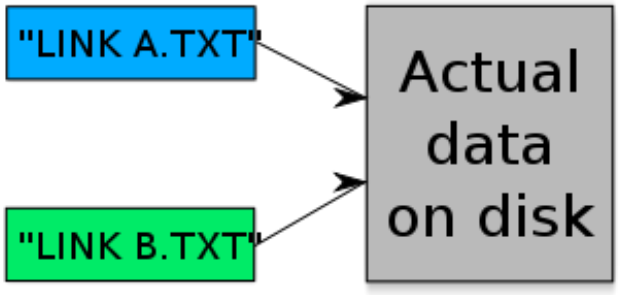
Symbolic Links and Hard Links

- Data and metadata
  - Metadata are what users see
  - In UNIX, an inode entry is a file to a user



Symbolic Links and Hard Links

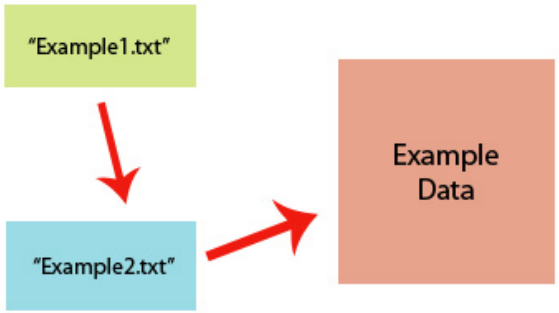
- Hard links
  - Links between i-nodes and data blocks



  - If you erase a link, the data will not be removed from disks when there is a remaining link to the data
  - An inode without a link to data is an erased file

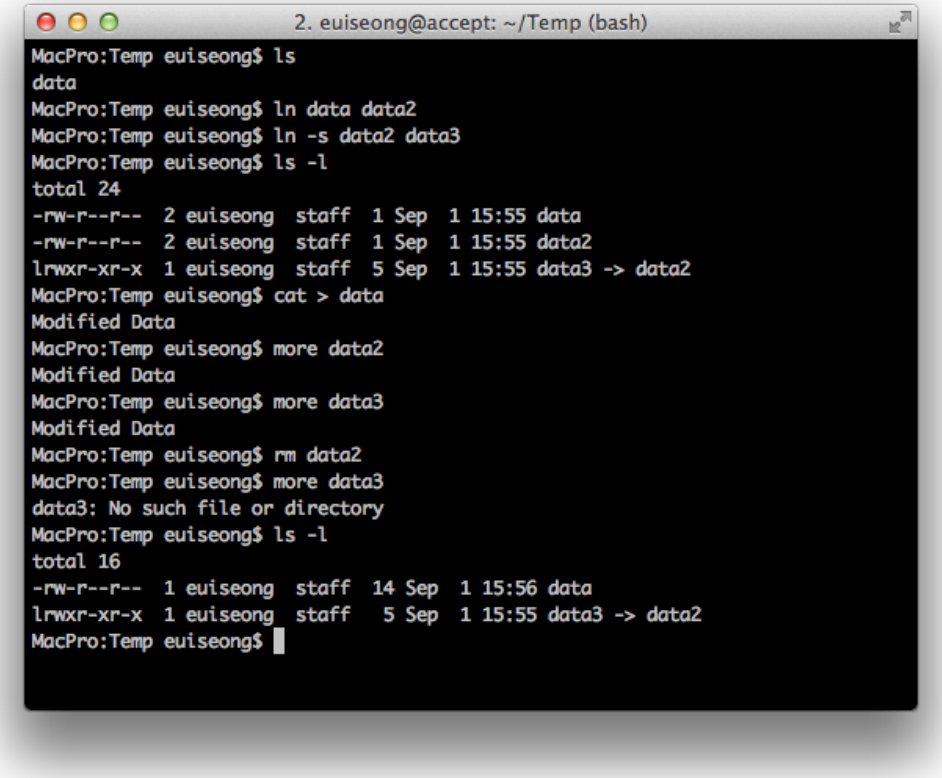
Symbolic Links and Hard Links

- Symbolic links
  - A link between an inode and another inode
    - Very much like a shortcut
    - Automatically access “Example Data” when you access “Example1.txt”
    - Useful but problematic
      - Removal of Example2.txt?
      - Removal of Example1.txt?
      - Can form a cycle!



Symbolic Links and Hard Links

- ln source_file [target_file]
  - Make links
  - -s for symbolic links



Where to Find

- which program
  - Show the location of a program
  - Search for user-specific $PATH
- whereis program
  - Show the location of a program
  - Search for hard-coded directory list

Find Files

- find [options] [-f path] path ... [expression]
  - Walk a file hierarchy
  - Example
    - find . -name "*hello*"
    - find . -newer "main.c"

User Profile Management

- chsh
  - Change user's login shell
- passwd
  - Change user's login password

Date and Calendar

- cal
  - Display a calendar and the date of easter
- date
  - Display or set date and time

Screen Clear

- clear
  - Clear screen
  - CTRL+L is an alias for clear

Alias

- alias [name[=value]]
  - A built-in command
  - Make an alias of a command
  - alias rm=“rm -rf”
- unalias
  - Erase an alias

String Operations

- wc
  - Word (or line) count of a file
- grep
  - Generalized regular expression parser
  - Search a word in a text file
  - grep -r "word" ./*
- cmp
  - Compare two files
  - Merely tells you whether two files differ
- diff
  - Compare files line by line
  - diff -rupN original/ new/ > original.patch for Linux patch creation

String Operations

- patch
  - Apply a diff file to an original
  - patch < patchfile
- cat [filename]
  - concatenate and print files
- more (or less) [filename]
  - Read a file page by page
- head and tail
  - Display first and last lines of a file, respectively

Making Things Work Together

Redirection

- Redirect standard output/error to a file or a file stream to standard input
- >
  - Redirect output to a file
  - ls > result
- >> Append redirected output to a file
  - ls >> result
- <
  - Redirect a file to a standard input
  - cat < /etc/passwd
- &>
  - Redirect both input and standard error to a file
  - ls >& /dev/null

Pipeline

- A set of processes
  - Chained by their standard streams
  - Output of a process feeds directly as input to next one
  - Denoted by symbol '|'
  - Output of a program serves as input of another
- Combination of simple utilities can do more complex tasks
  - ps A | grep 'usr/local/bin' | wc -l