Introduction to Linux

Week 1 - Monday

A Brief History of Operating Systems

- · The Dark Ages
 - No OS until 1960s
 - Manually loaded programs
 - Reboot after each program
- Batch OS
 - Unified application development across systems
 - Output via printer, later via monitor
 - I/O via magnetic tape or disk
 - Written in assembler (e.g., OS/360)
 - Multiprocess

A Brief History of Operating Systems

- Timesharing OS
 - Multiuse
 - Multiuser
 Multics (1964)
 Segmented memory
 Paged virtual memory
 Applications written in many languages
 Shared multiprocess memory

- Shared multiprocess memory
 Personal Computer
 Single machine for single user
 OS must manage screen and input devices
 Window, Icon, Menu, Pointing Device (WIMP, e.g., MacOS, 1984)
 Cutting-Edge OS
- - High performance computer (HPC) clusters (e.g., BlueGene/L at LLNL rated at 280.6 teraFLOPS)
- Cell phones, video
 Video games
 Browsers

Why Knoppix?

- Multics (1964) → Unix (1970) → Minix (1987) → GNU/Linux (1991) → Knoppix (2003)
- · Free software package via GNU
- · Linux kernel (Unix-like OS)
- LiveCD Linux distribution
- · Allows us to understand the workings of Unix
- Practice software construction via command line interface (CLI)

CLI vs. GUI

- Steep learning curve
- Pure control (e.g., scripting)
- Cumbersome multitasking
- Speed: Hack away at
- Convenient remote access

GUI

- Intuitive
- Limited Control
- · Easy multitasking
- · Limited by pointing
- · Bulky remote access

Unix File System Layout

- · Everything is a file (including devices)
- Tree structured hierarchy (with some exceptions)
- · Lost?
 - man: get manual or man pages

The Basics: Moving Around

- · pwd: print working directory
- · cd: change working directory
- ~: home directory
- · .: current directory
- /: root directory, or directory separator
- · ..: parent directory

The Basics: Dealing with Files

- The basics continued...
 - mv: move a file (no "undo")
 - cp: copy a file
 - rm: remove a file
 - mkdir: make a directory
 - rmdir: remove a directory
 - Is: list contents of a directory

 - -d: list only directories
 -a: list all files including hidden ones
 - -I: show long listing including permission info
 - · -s: show size of each file, in blocks

The Basics: File Name Matching

- ?: matches any single character in a filename
- *: matches one or more characters in a filename
- []: matches any one of the characters between the brackets. Use '-' to separate a range of consecutive characters.

The Basics: History

- · <up arrow>: previous command
- <tab>: auto-complete (tab twice to enumerate completions)
- !!: replace with previous command
- ![str]: refer to previous command with str
- ^[str]: replace with command referred to as str

The Basics: Look These Up

- cat
- head
- tail
- du
- ps
- kill
- diff cmp
- wc
- sort

The Basics: Redirection

- > file: write stdout to a file
- >> file: append stdout to a file
- < file: use contents of a file as stdin

The Basics: Changing File Attributes

- In: create a link
 - Hard links: points to physical data
 - Soft links aka symbolic links (-s): points to a file
- touch: update access & modification time to current time
- chmod
 - read (r), write (w), executable (x)
 - User, group, others

The Basics: find

- -type: type of a file (e.g,, directory, symbolic link)
- -perm: permission of a file
- -name: name of a file
- -prune: don't descend into a directory
- -o: or
- · -ls: list current file

vi

- Modes:
 - Normal: Enter commands
 - Insert: Insert text
 - Visual: Like normal, but you can highlight
 - Replace: Like insert, but you replace characters as you type
 - Recording: Record a sequence of keys

	VI "Cheat" Sheet	Deletion com	u ande	Many test for	m file old to file new	
vi Editor "Che Invoking vi: vi filename Forman of vi connatata: [consoft connents] Command mode versus input mode	February 1995	di ernidi div div div di di di Di X	Delete is lines to present buffer Delete word to present buffer Delete words Delete to words Delete to send of sustance Delete previous word Delete to send of the Delete chances	vi old "oldyy se senev "op :30,60w new	yank 30 lines to buffer a write work buffer and the set of per test from a silver cursor Write lines 10 to 60 in file new ossions (soperch strings)	
Vi sterts in commend mode. The positioning commends opened only while it is in commend mode. You switch it to imput mode by eastening any one of several it input commends. (We not section.) Clean in input mode, and the section.) Clean in input mode, any character you type is taken to be text and in added to the file. You cannot execute any commended using the section of the commended of the com	w name Wipe edit buffer to file name wq Wipe to file and quit up Quit without saving changes ZZ Same as up th Execute shell communits (*cml*d)	Undo comma	Put pepend buffer after curser Put pepend buffer before curser	ŝ	Matches beginning of line Matches and of line Matches my stagle character Matches my previous character Matches my character Matches my character	
To exit apper acode, press the excepte (Euro) key. Input commands (end with Eac) a Appeal after careo i Loave testers careo o Open line testers Open line testers Jille Danet testers Appeal the store Jille Sanet companies to the store Jille Sanet testers Loave tipe after careo than Any of these commands leaves it to apper pode sucti too	Window motions control control scrall dears (Mail screen) control control control specific s	Rearrangemen yy or Y "16yy yw "3066 "4944	Undo all changes on line If commands Yank (copy) line to general buffer Yank or to general buffer Yank word to general buffer Delete 9 lines to buffer a Delete 9 lines to buffer a	Search and replace commands Syntax: Geddmans x / old_bean/new_beart / Address components: Current lise Lise seable 1		
pois Bao. Privileg the ESTORY key will not take you get of input mode. Change commands (Input mode) cw Change word (Exc) cc Change ing (Exc) - Maks line	Display Critical tax common and file authorization in Engages search in Signature of the Common and the Common	Parameters	Part and from buffer a after cursor Par general buffer after cursor Par general buffer before cursor Join lines Show turnishin characters.	Jezingi 94 [add:1][add:2] Examples: The following on	A line that countin "string" Entire file Specifies a range sample replaces only the first occur- with Kunners in each of 11 lines	
ci Change to said of line not Replace Chances with c R. Replace (Six) - opposite s Substance (Six) - these with saving S Substance (Six) - these with saving S Substance (Six) - Rest of line with next Repeat last change	E Reposition window: cursor in middle Exposition window: cursor in middle Cursor motions H Upper left camer (home) M Middle line	set probet set prophet set prophet set prototoplest set prototoplest set showwards	Doe's show accoulds characters Show line numbers Doe's show has rembers Does and contains a second Time off accounted a Show matching one of paramaters on they are treed	strong with the current last () and containing for the 10 that follow (~10).		
Changes during insert mode -cathal Seck are duscret -cathar Seck are sward -cathar Seck are ward -cathar Seck are haven	L Lewel left conset b Rod a character j Devra a late character j Levra a late character w One word Consend b Rod cone word c Paul c Romen c	set showmode	Time of shewmanh Displey mode on lost line of screen. Time off showards Show values of all possible parameters	every line in the with "M as the	or/gener/g semple removes the last character from afte. Use it if every lass is the Sie state create of a flat musical Evecuse it is on the flow last of the file.	

Emacs

- Almost like a Windows text editor, but much more powerful
- Usually easier to pick up
- Lots of extensions! The core of emacs contains a LISP interpreter

GNU Emacs Reference Card		Motion			Multiple Windows		
(for version 20)		entity to more over budgered forward			When two commands are shown, the second is for "other frame		
l .		character	Coh	Cuf	delete all other windows	O-w 1	
Starting Emacs		word	N-6	M-E	split window, above and below C-:	9 Dec 5 9	
		line	C-p	C-m	delete this window Dr		
To enter GNU Emacs 20, just type its name:	essos	go to line beginning (or end)	0-a	One Man	split window, side by side	0-x 3	
lo read in a file to edit, see Files, below.		sentence paragraph	H-a H-(H-0	arroll other window	O-E-v	
		page	0-4 [0-x 1	switch cursor to another window C-s		
Leaving Emacs		avogo	C-85-b	C-M-f	select buffer in other window Co	45 0:55	
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uspend Emacs (or soundy it under A) xit Emacs permanently	0-x 0-c	go to buffer beginning (or end)	M-<			4 0 0 0 5 1	
All makes perameters	0-2 0-0	acroll to next across	O-			44 0-154	
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rnes		acroll right			error window taller	0.4	
rod a file into Emacs	0-x 0-f	scroll current line to center of screen	0-1	0-1	shrink window norrower	0-x {	
rave a file back to disk	One One				grow window widor	0-x)	
ove all files	0-ж в	Killing and Deleting					
	One Cone				Formatting		
write buffer to a specified file	Drx Ore	entity to kill	backward		indest current line (mode-dependent)	TAB	
renios control checkin/checkont	0-x 0-a	character (delete, not kill)	DEL	O-d Mod	indext region (mode-dependent)	C-8-\	
		line (to end of)	M-O CH	D-Sr	indext sexp (mode-dependent)	C-8-q	
Getting Help		sentence	C-x 161.	H-k	indent region rigidly are columns	C-x TAB	
		могр	H C-M-k	C-M-k	insert newline after point	0-o 0-#-o	
The help system is simple. Type 0-h (or F1) a	ad follow the di-	kill region	0~	,	move rest of line vertically down delete blank lines around point	Crar Cro	
octions. If you are a first-time user, type C-L		copy region to kill ring	H-		ioin line with previous (with arg, next)	8-1	
emove help window	0-x 1	kill through next occurrence of shor		t cher	delete all white space around point	H-\	
croll help window	0-M-v	yank back last thing killed	0-		per exactly one space at point	M-SPC	
propos show commands matching a string how the function a low rum	C-b a C-b c	replace last yank with provious kill	N-	,	fII paragraph	N-q Ora f	
lescribe a function	C-h f				set fill column set prefix each line starts with	O-x f	
pt mode-specific information	0-b m	Marking			net face	fire .	
		eet mark here		Bur Outst	PET LIKE		
Error Recovery		enthance point and mark		6 G-X	Case Change		
		set mark are words away	н-		0		
sbort partially typed or executing command		mork poragraph	8-1		appercase word lowecome word	Mrs.	
recover a file lost by a system crush — But indo as unwanted chance	recover-file C-x u or C-	merk page	0-	0-p	capitalize word	M-c	
vetore a buffer to its original contents Neg		mark sexp		6-0	uppercase region	0-8 0-9	
edraw garbaged screen	0-1	mark function		t-1.	lowercase region	0-2 0-1	
		man tanto trans	-				
Incremental Search		Query Replace			The Minibuffer		
	0-9	equally respinee			The following leve are defined in the mini	la dia	
earch forward	C-s	interactively replace a text string	840		complete as much as possible	TAR	
varies expension search	C-M-se	using regular expressions N	z query-rep	lace-regexp	complete up to one word	SEC	
overse regular expression search	C-H-r	Valid responses in query-replace mo-	le are		complete and execute	BET	
elect previous search string	N-p	replace this one, go on to next	57		show possible completions Setch previous minibuffer input	7 H-0	
elect pext later search strips	N-m	replace this one, don't move	- 7		fetch previous minibuffer input fetch later minibuffer input or default	H-p H-r	
xit incremental search ado effect of last character	RET DEL	skip to next without replacing	000		resect search backward through history	N-z	
ndo effect of last character bort current search	DEL C-se	replace all remaining matches back up to the previous match			report search forward through history	N-a	
loor current search. See C-s or C-r again to repeat the search in		exit onerwordsce	88	r	abort commond	0-6	
Joe C-s or C-r again to repeat the search in Y Ernacs is still searching. C-r cancels only th	enuer carection.	enter recursive edit (C-M-c to exit)	0-0		Type C-z ESC ESC to edit and repeat the		
					med the minibuffer. Type P10 to activate		
© 1997 Free Submary Franchiston, Inc. Promptoto	or on back, with				the minihaffer		

GNU Emacs Reference Card		Regular Expressions		Registers		
Buffers		any single character except a nowline zero or more repeats	(dot)	sore region in register insert register contents into buffer	Ours Ours	
wheet proother heffer	Or h	one or more repeats	*	sove value of point in register	0-x r 890	
elect another buffer let all buffee	0-x b 0-x 0-b	zero or one repeat	7	jump to point saved in register	0 x r 1	
oll a berfer	0-2 0-6 0-2 k	quote regular expression special character alternative ("or")				
OH A BURNE	UX E		M	Keyboard Macros		
		grouping	V V	Keyboard Macros		
Transposing		same text on 6th group at word break	//			
		not at word break	VR	start defining a keyboard macro	0-2 (
ranspose characters	C-t			end keyboard macro definition	0-x)	
rampose words	m-t	entity match start	match end	execute hat-defined keyboard macro	0-x e	
rampose lines	0-x 0-6	line	4	append to last keyboard macro	Ora Ora (
rampose sexps	0-x-t	word \<	10		namo-loot-kbd-mac N-w insert-kbd-mac	
		class of characters match these	match others	insert Liep delimbon in buller	N-E TREALF-EDS-BYC	
Spelling Check						
spening Check		explicit set []	f* 1	Commands Dealing with	Emacs Lisn	
		word-syntax character \w character with syntax c \nc	\V Vs.			
check spelling of current word	M-S M-x isrell-region	character with system c \ac	/aic	enal sexts before point	0-x 0-e	
				eral cerrent define	0.11	
thock spelling of entire buffer	M-x impell-buffer	International Character Sc	ds.	eval region	Mrx eval-region	
		International Character Deto		road and roal minibaffor	No.	
Tags		specify principal language N-x set-lan	mage-environment	load from standard system directory	M-x load-library	
Lugo .		show all input methods N-x 1	at-input-methods			
find a tag (a definition)	W-	enable or disable input method	Co)			
find next occurrence of the	0-x 8	set coding system for next command	C-x MET o	Simple Customization		
	g visit-tage-table	show all coding systems Hrg 11	t-codiag-gratems			
			er-coding-system	customize variables and faces	M·x customize	
	M-x tags-search			Making global key bindings in Emacs L	ion (communical):	
run query-replace on all the files W-z tage-query-replace continue het tage search or overy-replace W		Info		(global-net-key "\C-og" 'goto-line)		
continue met tage search or query-repeace	м-,	inio		(global-set-key "W-S" 'query-replo	(or-reserve)	
Shells		enter the lafe documentation reader	60.5			
Sneus		find specified function or variable in Info	00.04	777 141 CT 1		
			U-R U-1	Writing Commands		
execute a shell command	H-1	Moving within a node:				
ren a shell command on the region	M-1	scroll forward	SPC	(defun command-name (ergs)		
filter region through a shell command	C-4 H-1	scroll reverse	DEL	"documentation" (interactive "ten	spiate")	
start a shell in window *shell*	M-x shell	beginning of node	. (dot)	body)		
		Moving between nodes:		An example:		
Rectangles		ment node		(defun this-line-to-top-of-window)	The same of the sa	
		next node previous node	1	"Reposition line point is on to t	anne)	
copy rectangle to register	C-x r r	previous aode	7	With ANG, pet point on line ANG."	op or emesor.	
kill rectangle	O'x r k	select mens item by name	:	(interactive 'P')		
youk rectangle	0-x r y	select menu stem by name select ath menu item by number (1-9)		(recenter (if (mull line)		
open rectangle, shifting text right	Our ro	follow cross reference (seturn with 1)	7	German (11 Gall 1114)		
blank out rectangle	C-x r c	return to last node you saw	i	(prefix-mameric-value	lime(1)))	
prefix each line with a string	Ourt	return to directory node	â	The interactive spot sors low to re		
		go to any node by name	*	The interactive spec says how to re tivels. Type C-h f interactive for mo	on organizate intere	
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ADDIEVS						
uld clobal abbrev		run lafo tutorial	h .	Connectable (I) 1997 Pres Submary F	bandatha for	
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and mode-some expansion for this abtrover applicitly expand abbrev	C-x a i l C-x a e				in notice are preserved	
				all cuptes.		
espead previous word dynamically	8-/			Fer copies of the GNU Emacs montal, write t	o the Free Software For	
				datton, Inc., 59 Temple Place, Suite 200, Box	on, MA SZIII-ESST US	