Unix and the Shell

Comp-206 : Introduction to Software Systems
Lecture 2

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Your main source of information

- All information about the course ...
  - Notes
  - Assignments
  - Midterm Info
  - Last minute announcements
- ... will be posted on the course website:
  - http://www.cs.mcgill.ca/~cs206/

To 5th edition, or not to 5th edition

- For the two books, you can buy any editions.
- The books are a recommended alternate source of information.
- I will never directly reference a specific page in either book.
- For the C book, I highly recommend the 2nd edition.

1ˢᵗ Teacher's Assistant

- There should be 3 teacher's assistant for this course.
- Currently, 1 teacher's assistant has been confirmed: Robert Kaplow
- He is available on Wednesday (exact time to be determined now)
    - 10h00 – 12h00
    - 12h00 – 2h00
    - 1h00 - 3h00

Questions?

Any questions on last class?
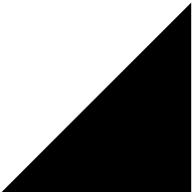
The Quiz

1. What is a library?
2. Name 2 open and 2 closed operating systems.
3. Name 4 services that an operating system provides?
4. How is an operating system able to run multiple process at the same time.
5. When the operating system runs out of memory, where does it store data?
6. What is the most common network protocol?
7. What does a device driver do?
8. How do you call a visual component of a GUI?
9. What is the difference between a BSD Unix and a System V Unix?
10. Why is Linux not Unix?
11. What does POSIX mean?

- Historically, UNIX has been a client/server platform.
  - Companies(universities) would buy one huge machine (server) and several small terminals (client).
- You can terminal into a Socs machine using SSH.
- Its not surprising to see the same architecture in the GUI system.
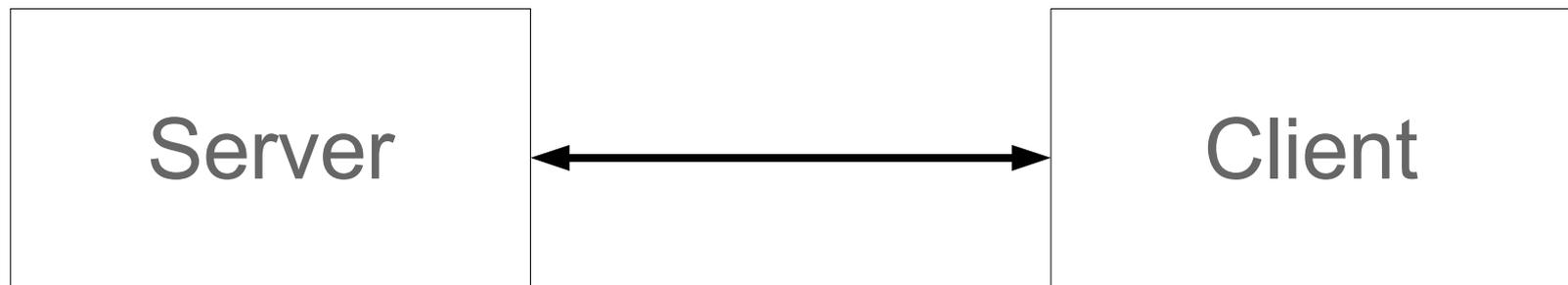
| Server | | Client |

Client / Server GUI

- Given the popularity of client/server setups for Unix environments, it's not surprising for the GUI to also be client server.

- On the client side, you have an X client and the window manager

- Applications run on the server side.

- On a normal Unix desktop, the server and the client are on the same machine.

- However, you can redirect an X session to a client on another machine.

| X Server | ←——————→ | X Client |
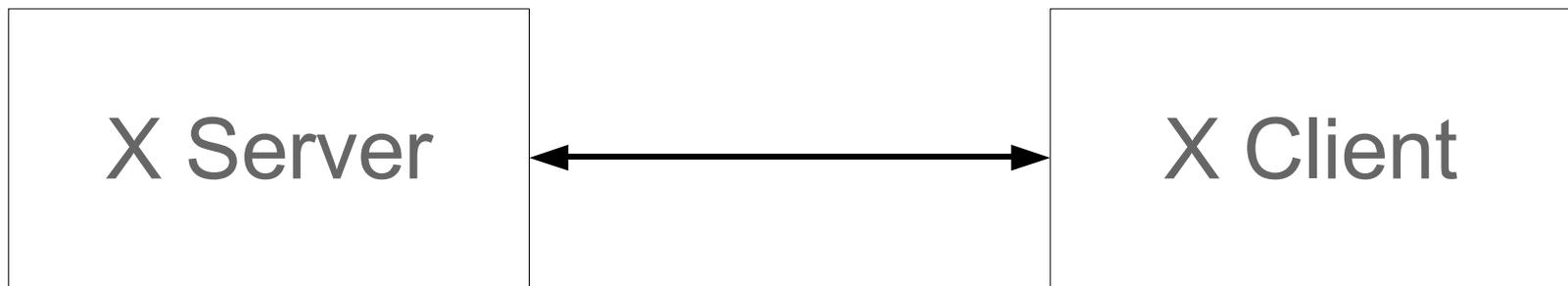
Window Manager

- The X Window systems only allows you to create different windows for application.

- The Window Manager provides the interface to manipulate those windows.

  - Moving, resizing, hiding windows

  - Button system to launch applications

- Traditionally, people would use simple window managers (twm, fvwm, Modif, etc).

- Nowadays, we use desktop environments such as Gnome or KDE.

Your favorite Windows Manager

- Gnome
- KDE
- Fluxbox
- CDE
- Xfwm
- FVWM
- and so on ...

- When an application launches, it creates a process. The process is the instance of that running application.
  - If you launch an application twice, then two processes get created.
- That process is then assigned a unique id, known as it's pid (process id).
  - When a process is created, it also records the pid of its parent, the process that created it.
- The process is also allocated a fixed block of memory. A process can increase that block by asking the operating system.
- A process also has a priority level, which indicates how much CPU time a process will get.

Multithreading

- Unix is a multi threading operating system. Several process can run simultaneously

- However, most computer are only equipped with one processor.

- Thus, Unix is also known as a time sharing operating system.

- All the processes share the CPU in turn. Each turn is called a time slice

- The priority level of process determines how many time slice a process gets.

Multithreading Demonstration

- Frisbee Demo

- The UNIX file system is composed of files and directories.

- Files are organized in a tree structure.

  - Directories are the branches of the tree.

  - Files are the leaves of the tree.

- In UNIX, external devices, such as printers or scanners, are represented as files. This allows us to read and write to them as if they were files.

- UNIX file systems also provide link files. These files simply point to another file or directory. You can think of them as alternate names for files or directories.

Types of files

- Text or ASCII : These files are used to store text using the ASCII character encoding. Each byte of the file represents a character.
  - Special control characters are used to represent an end of line (015) or an end of file (003).
  - There is a total of 256 different characters in an Ascii file.
- Binary : All files that use an encoding scheme other that ASCII are considered binary. The include image files, music files and PDF documents.
  - Each byte has a special meaning for that file.
  - The meaning of that byte is defined by the encoding format.

ASCII Table

Dec	Hx	Oct	Char		Dec	Hx	Oct	Html	Chr	Dec	Hx	Oct	Html	Chr	Dec	Hx	Oct	Html	Chr
0	0	000	NUL	(null)	32	20	040	 	Space	64	40	100	@	@	96	60	140	`	`
1	1	001	SOH	(start of heading)	33	21	041	!	!	65	41	101	A	A	97	61	141	a	a
2	2	002	STX	(start of text)	34	22	042	"	"	66	42	102	B	B	98	62	142	b	b
3	3	003	ETX	(end of text)	35	23	043	#	#	67	43	103	C	C	99	63	143	c	c
4	4	004	EOT	(end of transmission)	36	24	044	$	$	68	44	104	D	D	100	64	144	d	d
5	5	005	ENQ	(enquiry)	37	25	045	%	%	69	45	105	E	E	101	65	145	e	e
6	6	006	ACK	(acknowledge)	38	26	046	&	&	70	46	106	F	F	102	66	146	f	f
7	7	007	BEL	(bell)	39	27	047	'	'	71	47	107	G	G	103	67	147	g	g
8	8	010	BS	(backspace)	40	28	050	(	(	72	48	110	H	H	104	68	150	h	h
9	9	011	TAB	(horizontal tab)	41	29	051	)	)	73	49	111	I	I	105	69	151	i	i
10	A	012	LF	(NL line feed, new line)	42	2A	052	*	*	74	4A	112	J	J	106	6A	152	j	j
11	B	013	VT	(vertical tab)	43	2B	053	+	+	75	4B	113	K	K	107	6B	153	k	k
12	C	014	FF	(NP form feed, new page)	44	2C	054	,	,	76	4C	114	L	L	108	6C	154	l	l
13	D	015	CR	(carriage return)	45	2D	055	-	-	77	4D	115	M	M	109	6D	155	m	m
14	E	016	SO	(shift out)	46	2E	056	.	.	78	4E	116	N	N	110	6E	156	n	n
15	F	017	SI	(shift in)	47	2F	057	/	/	79	4F	117	O	O	111	6F	157	o	o
16	10	020	DLE	(data link escape)	48	30	060	0	0	80	50	120	P	P	112	70	160	p	p
17	11	021	DC1	(device control 1)	49	31	061	1	1	81	51	121	Q	Q	113	71	161	q	q
18	12	022	DC2	(device control 2)	50	32	062	2	2	82	52	122	R	R	114	72	162	r	r
19	13	023	DC3	(device control 3)	51	33	063	3	3	83	53	123	S	S	115	73	163	s	s
20	14	024	DC4	(device control 4)	52	34	064	4	4	84	54	124	T	T	116	74	164	t	t
21	15	025	NAK	(negative acknowledge)	53	35	065	5	5	85	55	125	U	U	117	75	165	u	u
22	16	026	SYN	(synchronous idle)	54	36	066	6	6	86	56	126	V	V	118	76	166	v	v
23	17	027	ETB	(end of trans. block)	55	37	067	7	7	87	57	127	W	W	119	77	167	w	w
24	18	030	CAN	(cancel)	56	38	070	8	8	88	58	130	X	X	120	78	170	x	x
25	19	031	EM	(end of medium)	57	39	071	9	9	89	59	131	Y	Y	121	79	171	y	y
26	1A	032	SUB	(substitute)	58	3A	072	:	:	90	5A	132	Z	Z	122	7A	172	z	z
27	1B	033	ESC	(escape)	59	3B	073	;	;	91	5B	133	[	[	123	7B	173	{	{
28	1C	034	FS	(file separator)	60	3C	074	<	<	92	5C	134	\	\	124	7C	174	|		
29	1D	035	GS	(group separator)	61	3D	075	=	=	93	5D	135	]	]	125	7D	175	}	}
30	1E	036	RS	(record separator)	62	3E	076	>	>	94	5E	136	^	^	126	7E	176	~	~
31	1F	037	US	(unit separator)	63	3F	077	?	?	95	5F	137	_	_	127	7F	177	&#127;	DEL

UNIX Users

- To use a UNIX machine, you must have an account on that machine.
- An account consist of a user name and a password.
- When created, a user also gets a home directory (denoted by a tild ˜).
- An account always a member of at least one group. These groups of users are used for permission purposes.
- On every Unix machine, there exist a special administration account (root) which has all the permissions.

Password Security

- Choosing a correct password is critical for the security of your account.
- If someone discovers your password, the UNIX system cannot prevent him from login in.
  - Most password attack are dictionary-based.
  - Don't use a dictionary word (or something common).
- If a dictionary attack doesn't work, then the second alternative is brute force.
  - A brute force attack is not feasible if the number of different possible character is very high.
  - This is why we suggest a good mix of lower/upper case letters, numbers and punctuation.

Characteristics of a good password

- Good mix of upper and lower case letters, numbers and punctuation.
- Do not use dictionary words.
- Do not use a dictionary word with a number appended to it.
- Do not use 1337 (leet) speak.

Permissions on the File Systems

- All files are owned by a user and a group.
  - Usually, this owner is the user that created the file.
- Permissions on files exists at three level: user, group and all.
- Three types of rights can be given: read, write and execute.
- Any combination of these rights must be given to these three levels.

Permissions (cont.)

- Permissions are often displayed as a string of 10 characters: -rwxr-xr-x

  - The first character indicates if the file is a directory.

  - The second character indicates if the owner has read access to the file.

  - The third character indicates if the owner has write access to the file.

  - The fourth character indicates if the owner has execute access to the file.

  - The fifth, sixth and seventh characters indicates if the group owner has read, write or execute access to the file.

  - The eight, ninth and tenth characters indicates if all other users have read, write or execute access to the file.