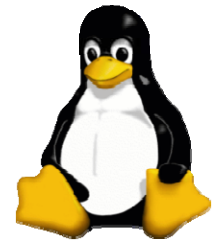




CSN-101 (Introduction to Computer Science and Engineering)

Lecture 8: Linux Operating System and Linux Administration



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Department of Computer Science and Engineering

Piazza Class Room: <https://piazza.com/iitr.ac.in/fall2019/csn101>

[Access Code: csn101@2019]

Moodle Submission Site: <https://moodle.iitr.ac.in/course/view.php?id=45>

[Enrollment Key: csn101@2019]



Plan for Lecture Classes in CSN-101 (Autumn, 2019-2020)

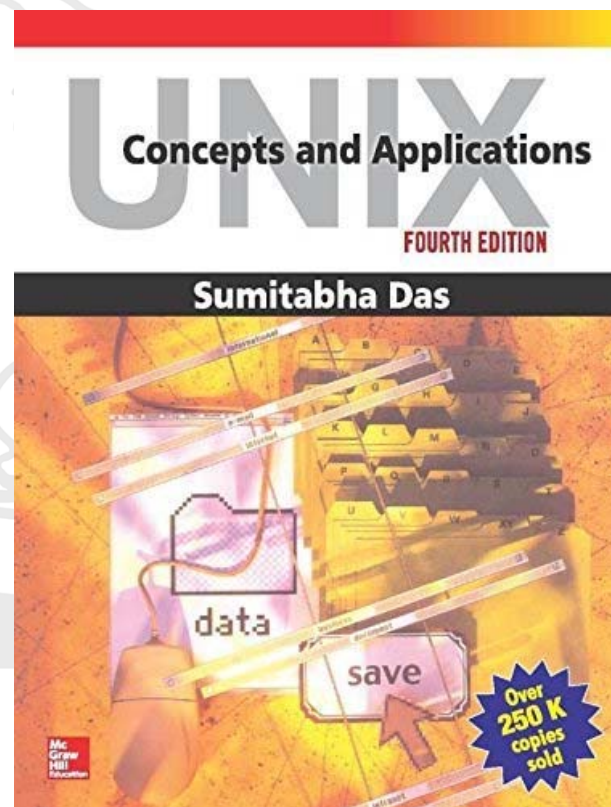


Week	Lecture 1 (Monday 4-5 PM)	Lecture 2 (Friday 5-6 PM)
1	Evolution of Computer Hardware and Moore's Law, Software and Hardware in a Computer	Computer Structure and Components, Operating Systems
2	Computer Hardware: Block Diagrams, List of Components	Computer Hardware: List of Components, Working Principles in Brief, Organization of a Computer System
3	Linux OS	Linux OS
4	Writing Pseudo-codes for Algorithms to Solve Computational Problems	Writing Pseudo-codes for Algorithms to Solve Computational Problems
5	Sorting Algorithms – Bubble sort, selection sort, and Search Algorithms	Sorting Algorithms – Bubble sort, selection sort, and Search Algorithms
6	C Programming	C Programming
7	Number Systems: Binary, Octal, Hexadecimal, Conversions among them	Number Systems: Binary, Octal, Hexadecimal, Conversions among them
8	Number Systems: Negative number representation, Fractional (Real) number representation	Boolean Logic: Boolean Logic Basics, De Morgan's Theorem, Logic Gates: AND, OR, NOT, NOR, NAND, XOR, XNOR, Truth-tables
9	Computer Networking and Web Technologies: Basic concepts of networking, bandwidth, throughput	Computer Networking and Web Technologies: Basic concepts of networking, bandwidth, throughput
10	Different layers of networking, Network components, Type of networks	Network topologies, MAC, IP Addresses, DNS, URL
11	Different fields of CSE: Computer Architecture and Chip Design	Different fields of CSE: Data Structures, Algorithms and Programming Languages
12	Different fields of CSE: Database management	Different fields of CSE: Operating systems and System softwares
13	Different fields of CSE: Computer Networking, HPCs, Web technologies	Different Applications of CSE: Image Processing, CV, ML, DL
14	Different Applications of CSE: Data mining, Computational Geometry, Cryptography, Information Security	Different Applications of CSE: Cyber-physical systems and IoTs

Up to MTE

Book to follow:

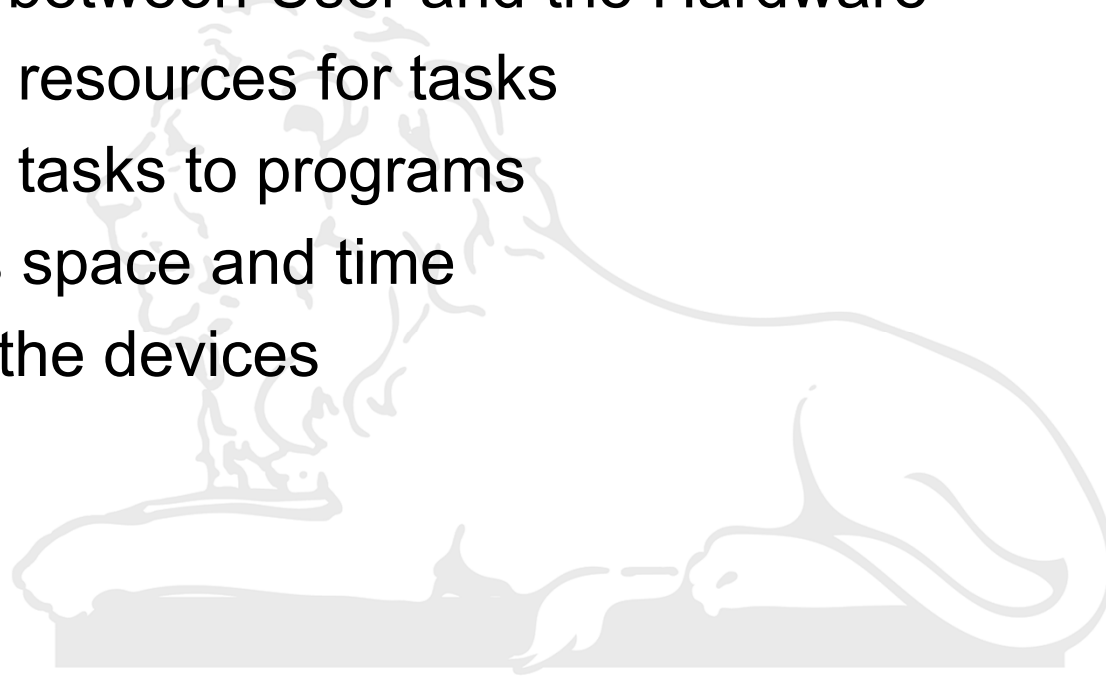
- UNIX CONCEPTS AND APPLICATIONS, by Sumitabha Das, McGraw Hill Education; 4 edition, 2017.



Operating System



- A program or a software that governs the functioning of other programs
- Interface between User and the Hardware
- Allocates resources for tasks
- Allocates tasks to programs
- Manages space and time
- Controls the devices



Types of Operating System



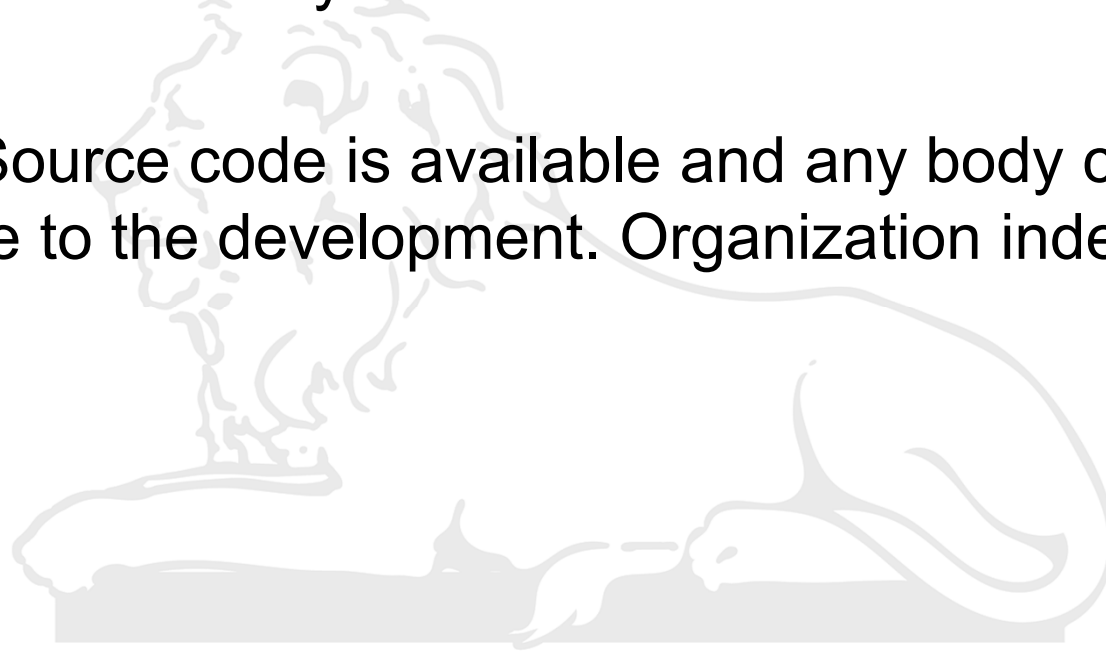
- Tasks
 - Uni tasking
 - Multi tasking
- Users
 - Single User
 - Multi User
- Processing
 - Uni processing
 - Multi processing
- Timesharing



FOSS



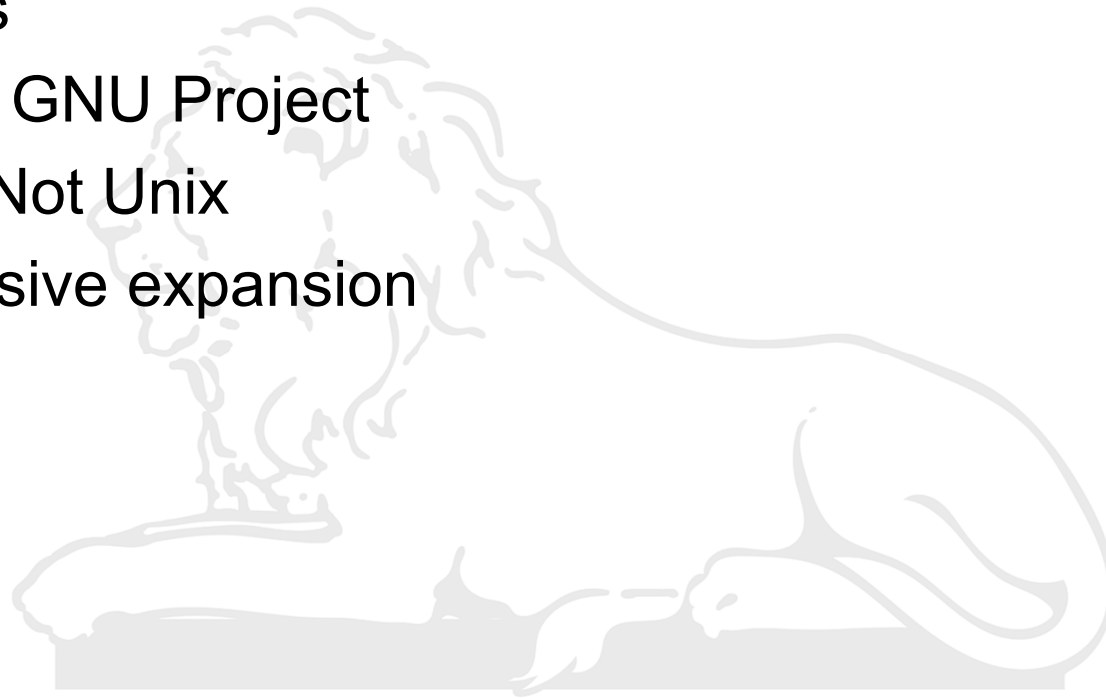
- Free Open Source Software
- Free – Means Liberty and not related to Price or cost
- Open – Source code is available and any body can contribute to the development. Organization independent



Free Software Foundation



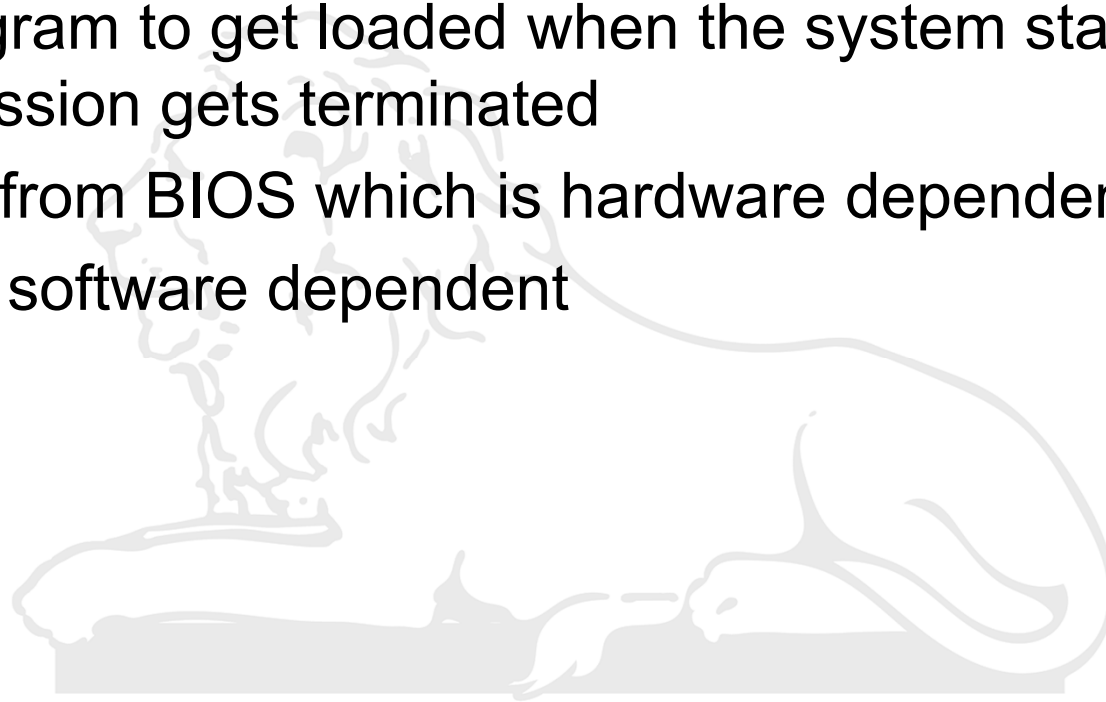
- Founded by Richard Stallman in 1983
- Organization that started developing copylefted (free) programs
- Project – GNU Project
 - GNU Not Unix
 - Recursive expansion



Kernel



- Core or nucleus of an operating system
- Interacts with the hardware
- First program to get loaded when the system starts and runs till the session gets terminated
- Different from BIOS which is hardware dependent.
- Kernel is software dependent



Kernel Types

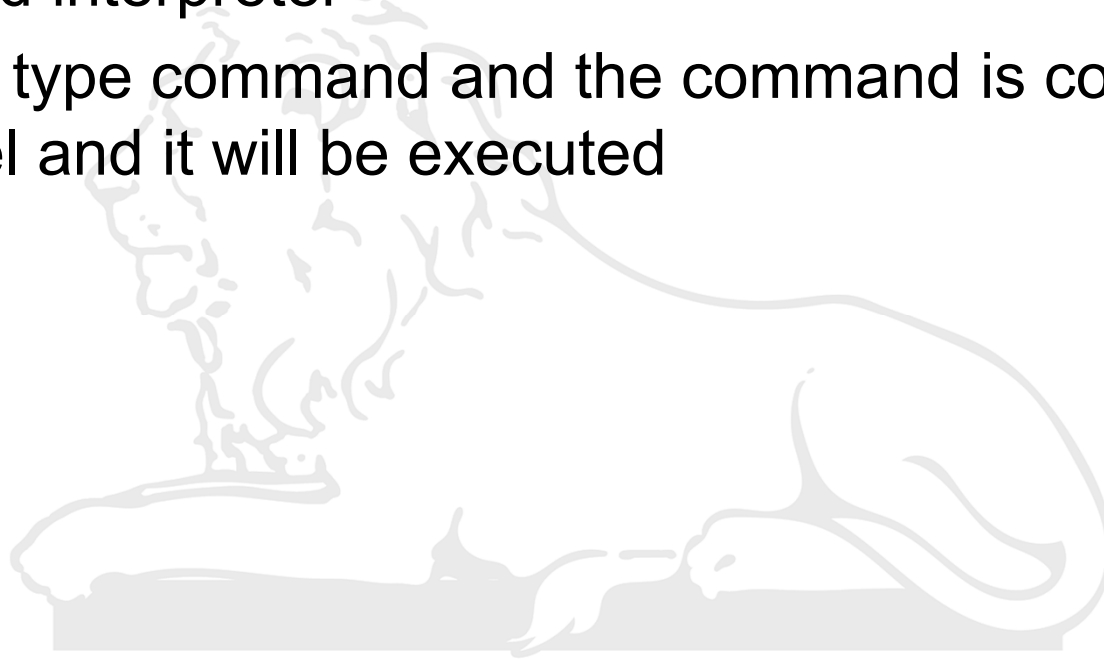


- Monolithic
 - All OS related code are stuffed in a single module
 - Available as a single file
 - Advantage: Faster functioning
- Micro
 - OS components are isolated and run in their own address space
 - Device drivers, programs and system services run outside kernel memory space
 - Supports modularity
 - Lesser in size

Shell



- Program that interacts with kernel
- Bridge between kernel and the user
- Command interpreter
- User can type command and the command is conveyed to the kernel and it will be executed



Types of Shell

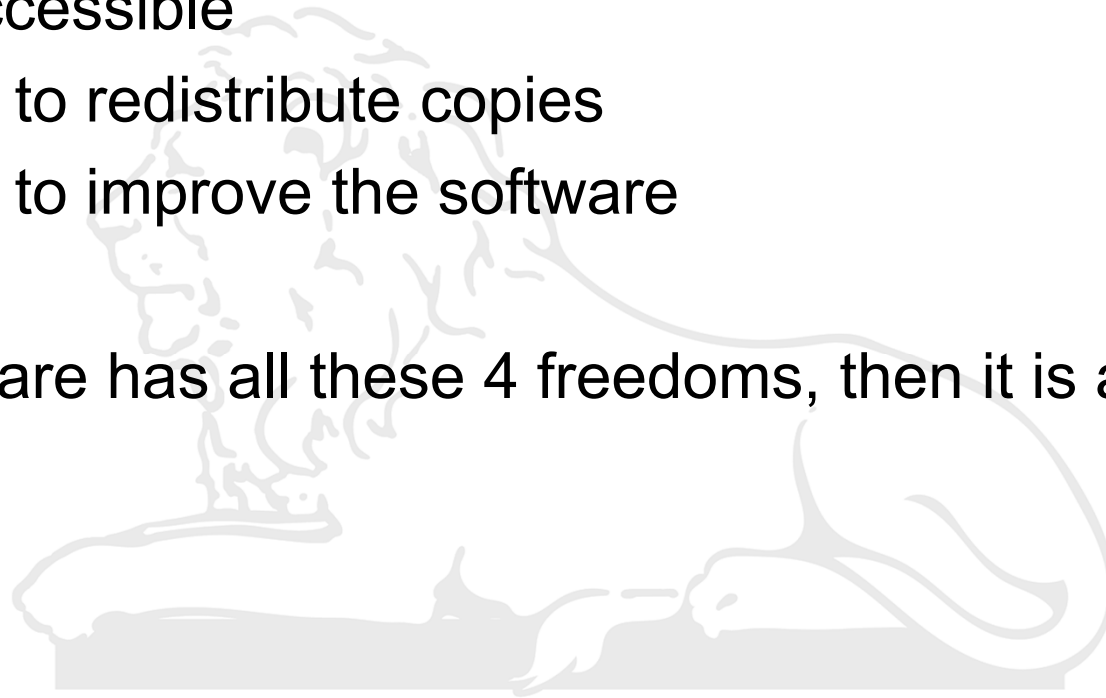


- Sh – simple shell
- BASH – Bourne Again Shell
- KSH – Korn Shell
- CSH – C Shell
- SSH – Secure Shell
- To use a particular shell type the shell name at the command prompt.
 - e.g., `$csh` – will switch the current shell to c shell
- To view the available shells in the system, type `cat /etc/shells` at the command prompt
- To view the current shell that is being used, type `echo $SHELL` at the command prompt

4 Freedoms with FOSS



- Freedom to run the software anywhere
- Freedom to study how the programs work. i.e source code will be accessible
- Freedom to redistribute copies
- Freedom to improve the software
- If a software has all these 4 freedoms, then it is a FOSS



History



- Multics – 1964
- Unics – 1969
- Minix – 1990
- Linux – 1991



History of UNIX

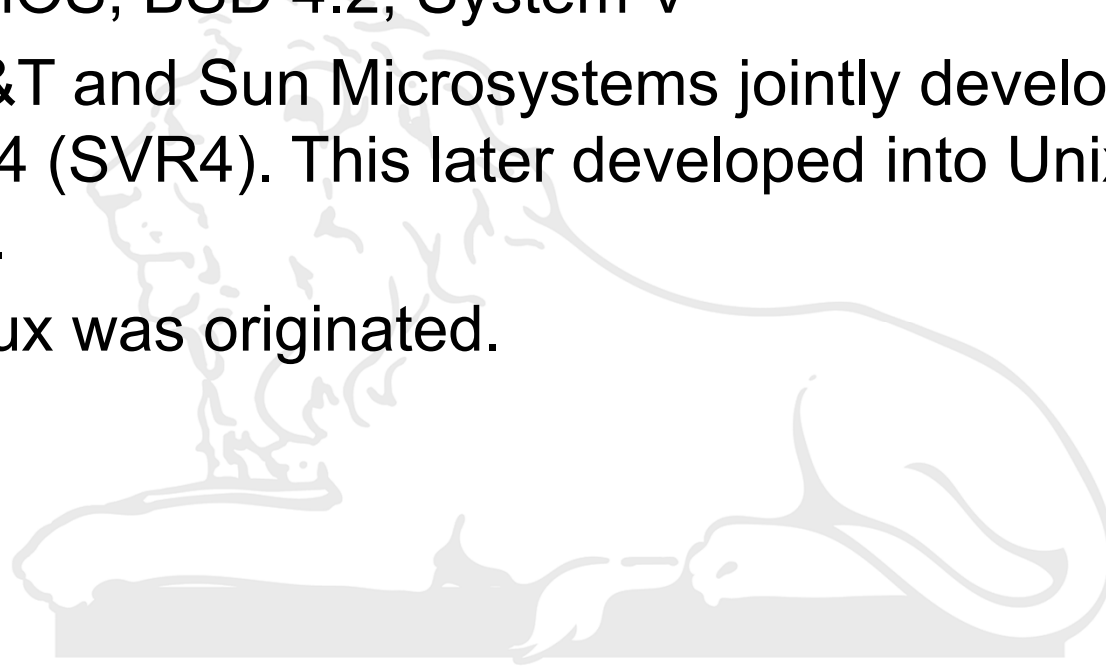


- First Version was created in Bell Labs in 1969.
- Some of the Bell Labs programmers who had worked on this project, Ken Thompson, Dennis Ritchie, Rudd Canaday, and Doug McIlroy designed and implemented the first version of the Unix File System on a PDP-7 along with a few utilities. It was given the name UNIX by Brian Kernighan.
- 00:00:00 Hours, Jan 1, 1970 is time zero for UNIX. It is also called as epoch.
- 1973 Unix is re-written mostly in C, a new language developed by Dennis Ritchie.
- Being written in this high-level language greatly decreased the effort needed to port it to new machines.

History of UNIX



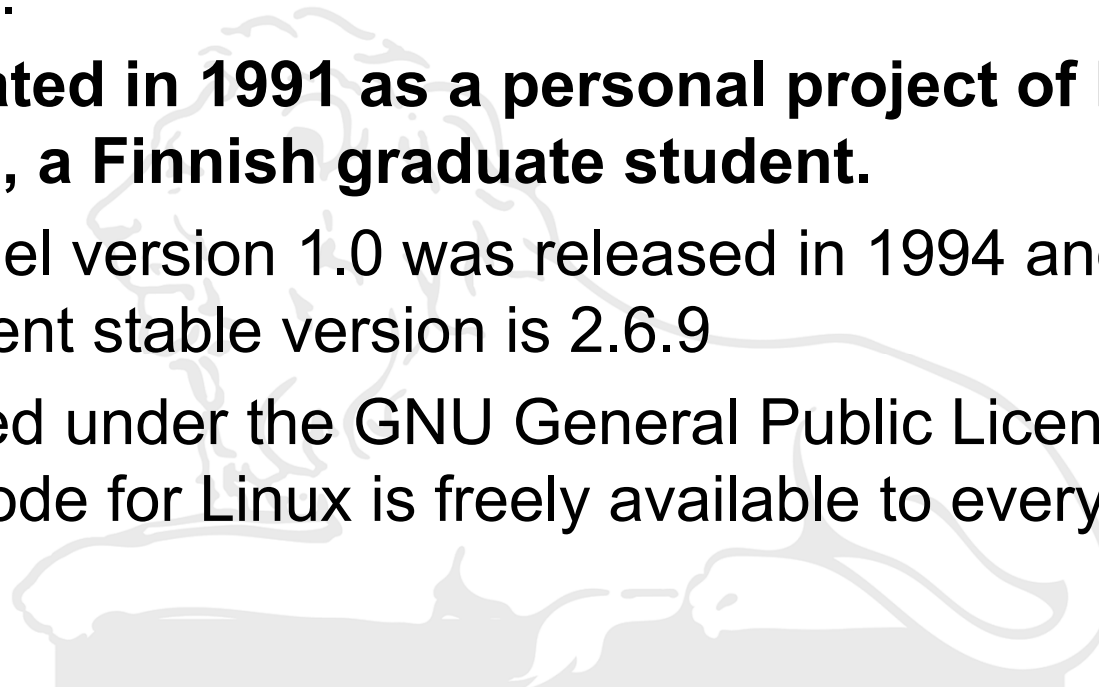
- 1977 There were about 500 Unix sites world-wide.
- 1980 BSD 4.1 (Berkeley Software Development)
- 1983 SunOS, BSD 4.2, System V
- 1988 AT&T and Sun Microsystems jointly develop System V Release 4 (SVR4). This later developed into UnixWare and Solaris 2.
- 1991 Linux was originated.



History of UNIX



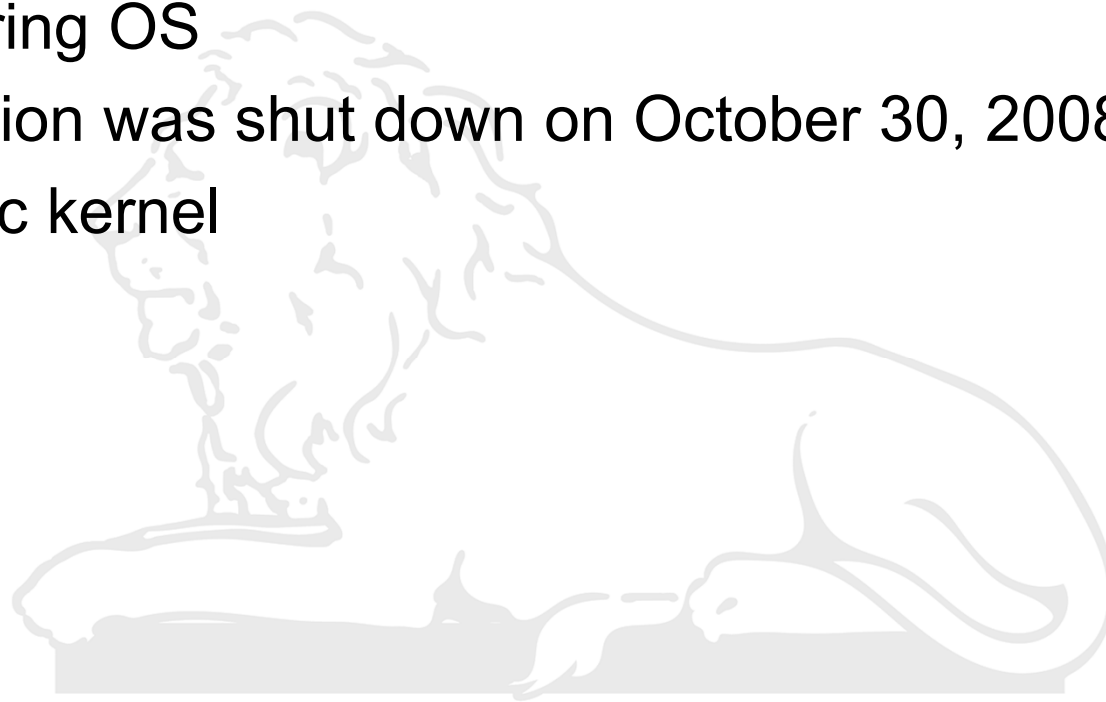
- Linux is a free Unix-type operating system originally created by Linus Torvalds with the assistance of developers around the world.
- **It originated in 1991 as a personal project of Linus Torvalds, a Finnish graduate student.**
- The Kernel version 1.0 was released in 1994 and today the most recent stable version is 2.6.9
- Developed under the GNU General Public License , the source code for Linux is freely available to everyone.



Multics



- Multiplexed Information and Computing Service
- Written in 1964
- Timesharing OS
- Last version was shut down on October 30, 2008
- Monolithic kernel



Unics



- Uniplexed Information and Computing System
- Later renamed as UNIX
- Written in 1969
- Ken Thompson, Dennis Ritchie were among the developers
- Multi user, Multi tasking and timesharing
- Monolithic kernel



Minix



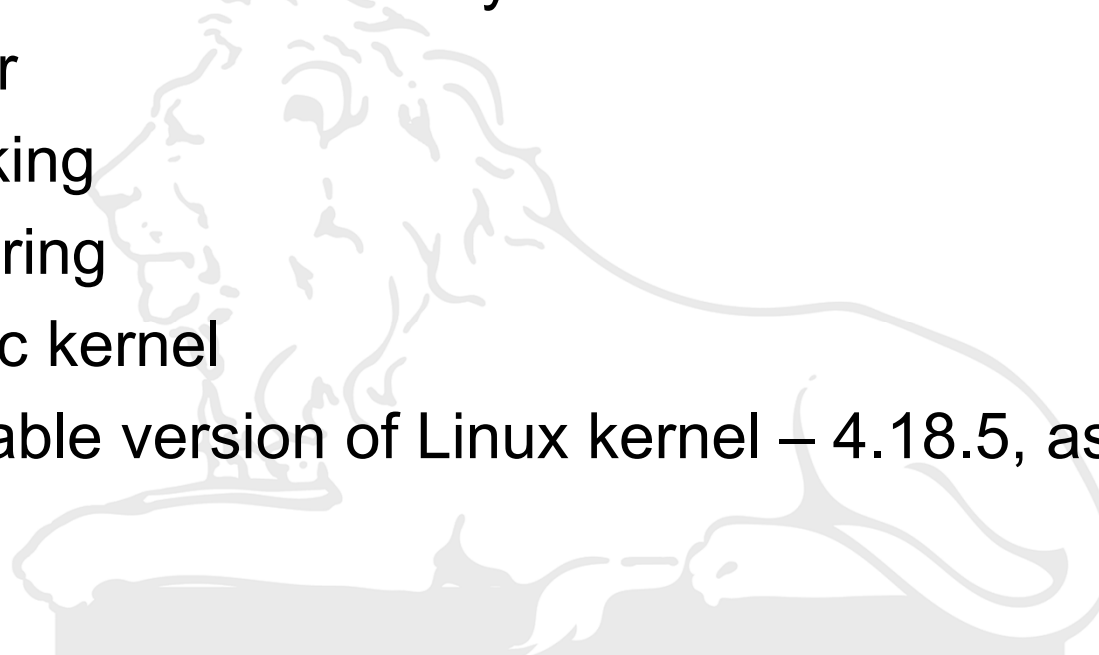
- Minimal Unix
- Tanenbaum developed this OS
- Mainly for educational purpose
- Unix like OS, implemented with Micro kernel. So the name Minix



Linux



- Developed in 1991 by Linus Torvalds
- Used in most of the computers, ranging from super computers to embedded system
- Multi user
- Multi tasking
- Time sharing
- Monolithic kernel
- Latest stable version of Linux kernel – 4.18.5, as of August 24, 2018



What is Linux?



- ❖ Linux is a true 32 bit UNIX-like OS developed originally for home PCs, but now it runs on a variety of platforms including PowerPC, Macintosh, Amiga, DEC Alpha, Sun Sparc, ARM, and many others.
- ❖ The source code for Linux is freely available to everyone.
- ❖ Linux was **created by Linus Torvalds in 1991**, and it has been developed with the help of many programmers across the Internet.
- ❖ Now it has evolved into a very functional, powerful and usable clone of Unix which has at least 10 million users worldwide.

Linux: front page of kernel.org



The Linux Kernel Archives

About Contact us FAQ Releases Signatures Site news

Protocol Location

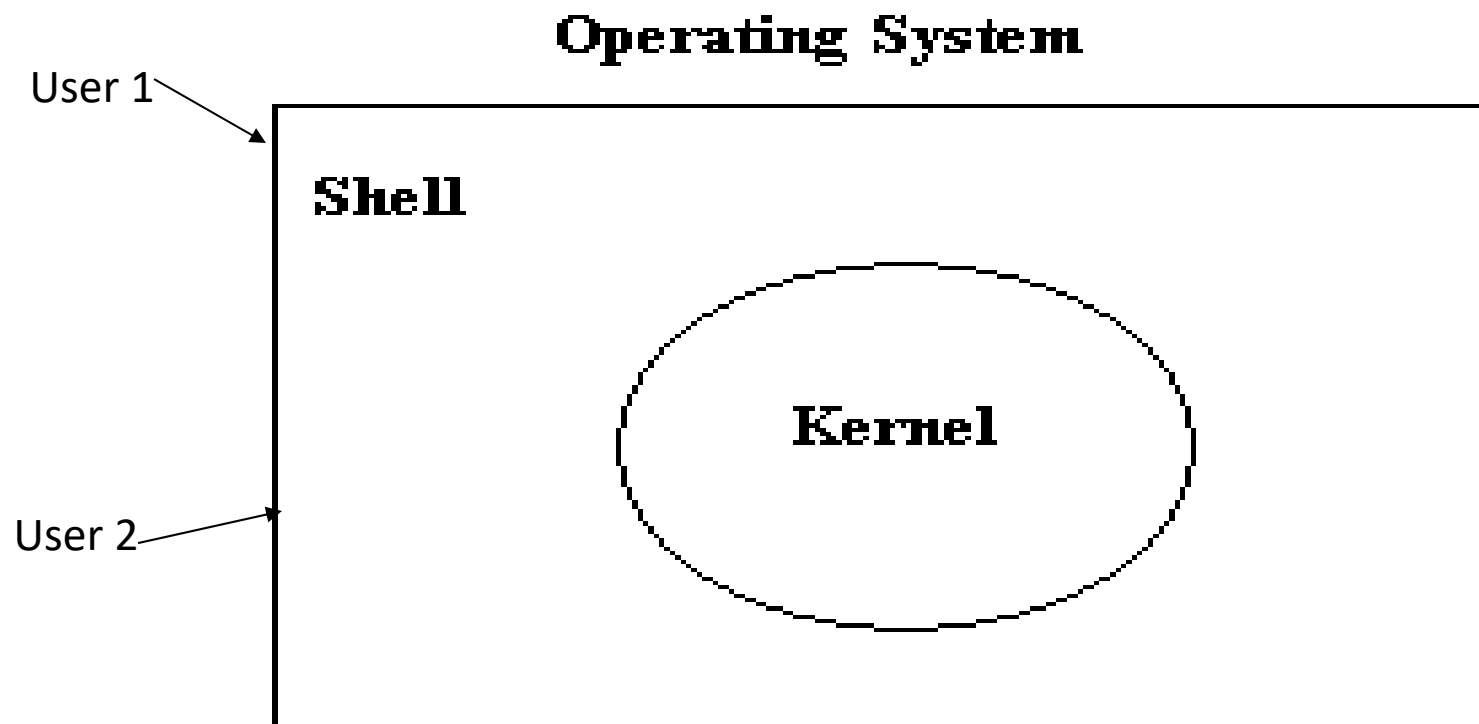
HTTP	https://www.kernel.org/pub/
GIT	https://git.kernel.org/
RSYNC	rsync://rsync.kernel.org/pub/

Latest Stable Kernel:

↓ 4.18.5

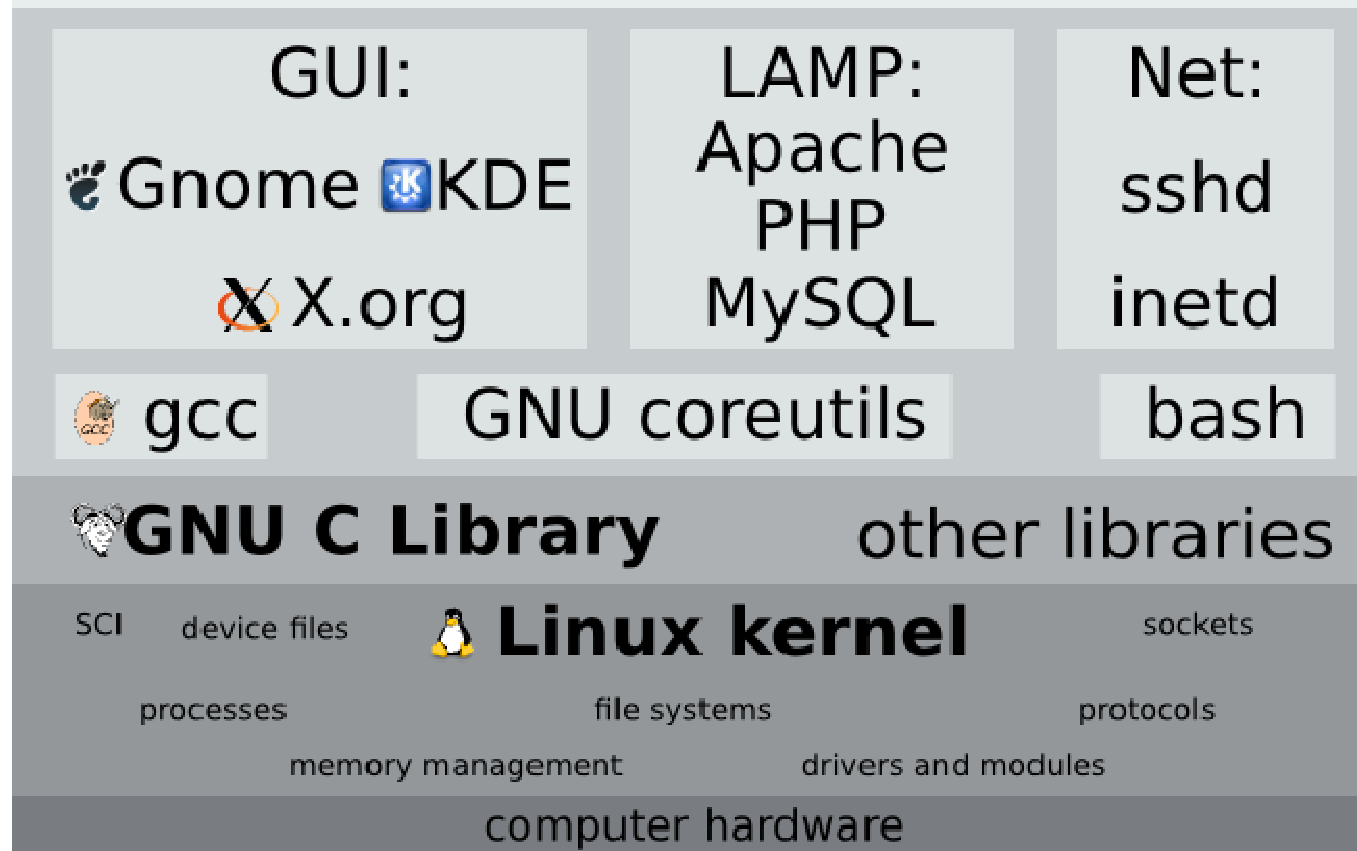
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Operating System





Main components of Linux operating system



Linux Distributions



- RedHat: <http://www.redhat.com/>
- Fedora: <http://fedora.redhat.com/>
- Debian: <http://www.debian.org/>
- SuSE/Novell: <http://www.suse.com/>
- Ubuntu: <https://ubuntu.com/>
- Mandrake: <http://www.mandrakesoft.com/>
- Live CDs – Knoppix and more



Linux Distributions



Distribution	Why To Use
Ubuntu	It works like Mac OS and easy to use.
Linux mint	It works like windows and should be use by new comers.
Debian	It provides stability but not recommended to a new user.
Fedora	If you want to use red hat and latest software.
Red hat enterprise	To be used commercially.
CentOS	If you want to use red hat but without its trademark.
OpenSUSE	It works same as Fedora but slightly older and more stable.
Arch Linux	It is not for the beginners because every package has to be installed by yourself.

GNU/Linux



- Only the kernel is called by the name Linux
- The rest are the tools developed under GNU Project
- Hence the name GNU/Linux



Continued to Next Class...
