

1. Kernel in Operating Systems

NOTE: THIS NOTE IS CREATED TO GIVE YOU A MORE ADVANCED AND COMPREHENSIVE EXPLANATION COMPARED TO QUT's LECTURE NOTES

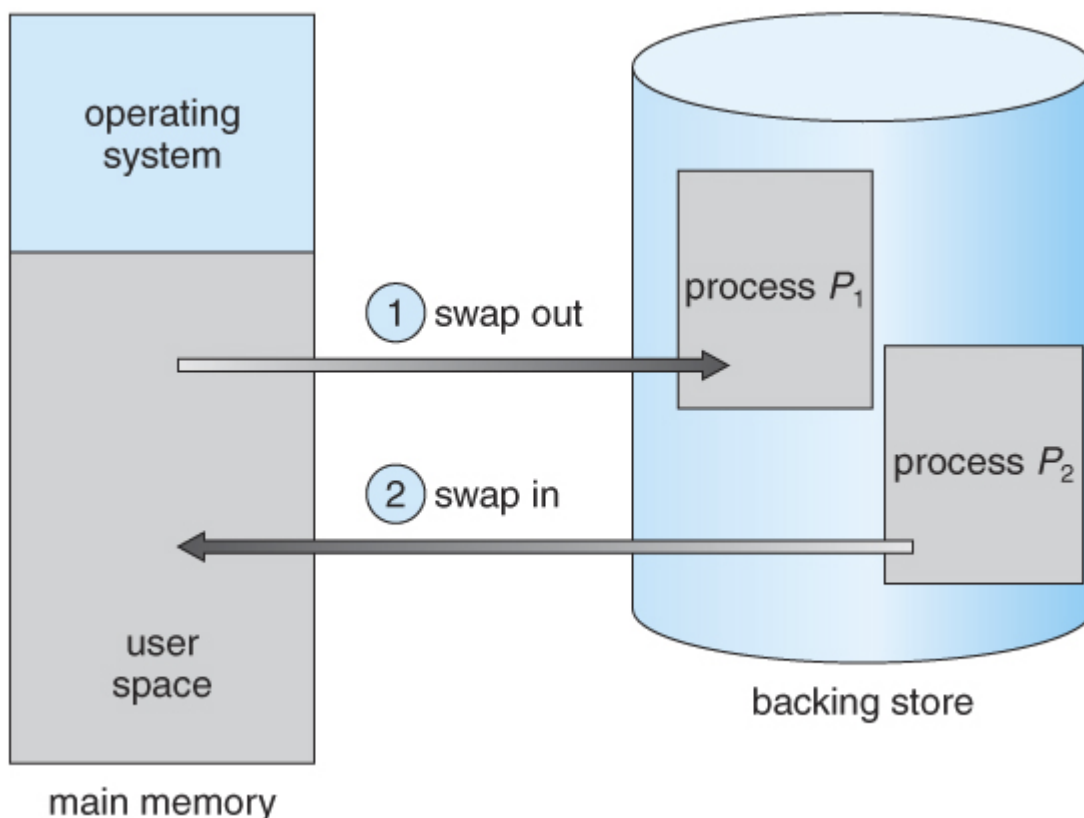
The kernel is the core component of an operating system (OS) that acts as a bridge between the computer's hardware and the software applications running on it. It is responsible for managing system resources, such as memory, CPU time, and input/output (I/O) operations, and providing an interface for user programs to interact with the hardware securely and efficiently.

Functions of the Kernel

The kernel performs several essential functions in an operating system:

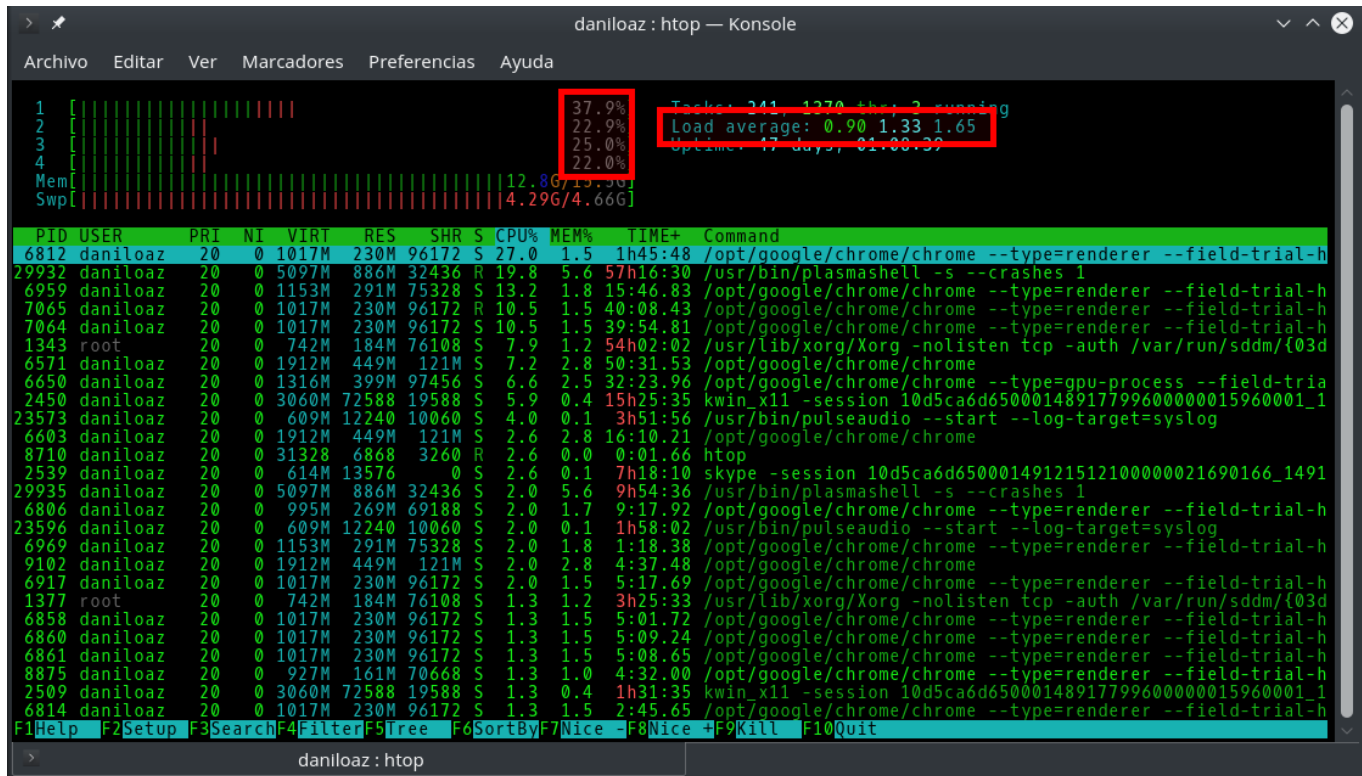
1. Memory Management:

The kernel manages the allocation and deallocation of memory to various processes running on the system. It ensures that each process has access to its own memory space and prevents unauthorized access to memory allocated to other processes.



2. Process Management:

The kernel is responsible for creating, scheduling, and terminating processes. It assigns CPU time to processes based on their priority and ensures that each process gets a fair share of the system's resources.

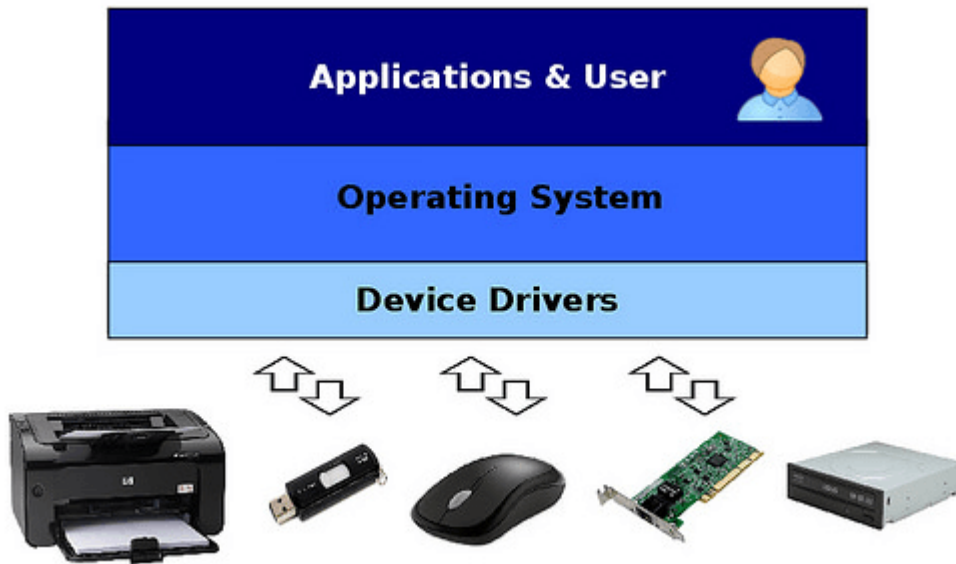


The screenshot shows a terminal window titled "daniiloaz : http — Konsole". The top section displays system statistics: CPU usage (37.9%, 22.9%, 25.0%, 22.0%), Load average (0.90, 1.33, 1.65), Uptime (17 days, 01:00:32), Memory (12.86/19.30), and Swap (4.296/4.66G). Below this is a table of running processes. The table has columns: PID, USER, PRI, NI, VIRT, RES, SHR, S, CPU%, MEM%, TIME+, and Command. The processes listed include various instances of chrome, plasmashell, xorg, pulseaudio, and skype. At the bottom, there is a navigation bar with function keys F1 through F10.

PID	USER	PRI	NI	VIRT	RES	SHR	S	CPU%	MEM%	TIME+	Command
6812	daniiloaz	20	0	1017M	230M	96172	S	27.0	1.5	1h45:48	/opt/google/chrome/chrome --type=renderer --field-trial-h
29932	daniiloaz	20	0	5097M	886M	32436	R	19.8	5.6	57h16:30	/usr/bin/plasmashell -s --crashes 1
6959	daniiloaz	20	0	1153M	291M	75328	S	13.2	1.8	15:46:83	/opt/google/chrome/chrome --type=renderer --field-trial-h
7065	daniiloaz	20	0	1017M	230M	96172	R	10.5	1.5	40:08.43	/opt/google/chrome/chrome --type=renderer --field-trial-h
7064	daniiloaz	20	0	1017M	230M	96172	S	10.5	1.5	39:54.81	/opt/google/chrome/chrome --type=renderer --field-trial-h
1343	root	20	0	742M	184M	76108	S	7.9	1.2	54h02:02	/usr/lib/xorg/Xorg -nolisten tcp -auth /var/run/sddm/{03d
6571	daniiloaz	20	0	1912M	449M	121M	S	7.2	2.8	50:31.53	/opt/google/chrome/chrome
6650	daniiloaz	20	0	1316M	399M	97456	S	6.6	2.5	32:23.96	/opt/google/chrome/chrome --type=gpu-process --field-tria
2450	daniiloaz	20	0	3060M	72588	19588	S	5.9	0.4	15h25:35	kwin_x11 -session 10d5ca6d6500014891779960000015960001_1
23573	daniiloaz	20	0	609M	12240	10060	S	4.0	0.1	3h51:56	/usr/bin/pulseaudio --start --log-target=syslog
6603	daniiloaz	20	0	1912M	449M	121M	S	2.6	2.8	16:10.21	/opt/google/chrome/chrome
8710	daniiloaz	20	0	31328	6868	3260	R	2.6	0.0	0:01.66	htop
2539	daniiloaz	20	0	614M	13576	0	S	2.6	0.1	7h18:10	skype -session 10d5ca6d65000149121512100000021690166_1491
29935	daniiloaz	20	0	5097M	886M	32436	S	2.0	5.6	9h54:36	/usr/bin/plasmashell -s --crashes 1
6806	daniiloaz	20	0	995M	269M	69188	S	2.0	1.7	9:17.92	/opt/google/chrome/chrome --type=renderer --field-trial-h
23596	daniiloaz	20	0	609M	12240	10060	S	2.0	0.1	1h58:02	/usr/bin/pulseaudio --start --log-target=syslog
6969	daniiloaz	20	0	1153M	291M	75328	S	2.0	1.8	1:18.38	/opt/google/chrome/chrome --type=renderer --field-trial-h
9102	daniiloaz	20	0	1912M	449M	121M	S	2.0	2.8	4:37.48	/opt/google/chrome/chrome
6917	daniiloaz	20	0	1017M	230M	96172	S	2.0	1.5	5:17.69	/opt/google/chrome/chrome --type=renderer --field-trial-h
1377	root	20	0	742M	184M	76108	S	1.3	1.2	3h25:33	/usr/lib/xorg/Xorg -nolisten tcp -auth /var/run/sddm/{03d
6858	daniiloaz	20	0	1017M	230M	96172	S	1.3	1.5	5:01.72	/opt/google/chrome/chrome --type=renderer --field-trial-h
6860	daniiloaz	20	0	1017M	230M	96172	S	1.3	1.5	5:09.24	/opt/google/chrome/chrome --type=renderer --field-trial-h
6861	daniiloaz	20	0	1017M	230M	96172	S	1.3	1.5	5:08.65	/opt/google/chrome/chrome --type=renderer --field-trial-h
8875	daniiloaz	20	0	927M	161M	70668	S	1.3	1.0	4:32.00	/opt/google/chrome/chrome --type=renderer --field-trial-h
2509	daniiloaz	20	0	3060M	72588	19588	S	1.3	0.4	1h31:35	kwin_x11 -session 10d5ca6d6500014891779960000015960001_1
6814	daniiloaz	20	0	1017M	230M	96172	S	1.3	1.5	2:45.65	/opt/google/chrome/chrome --type=renderer --field-trial-h

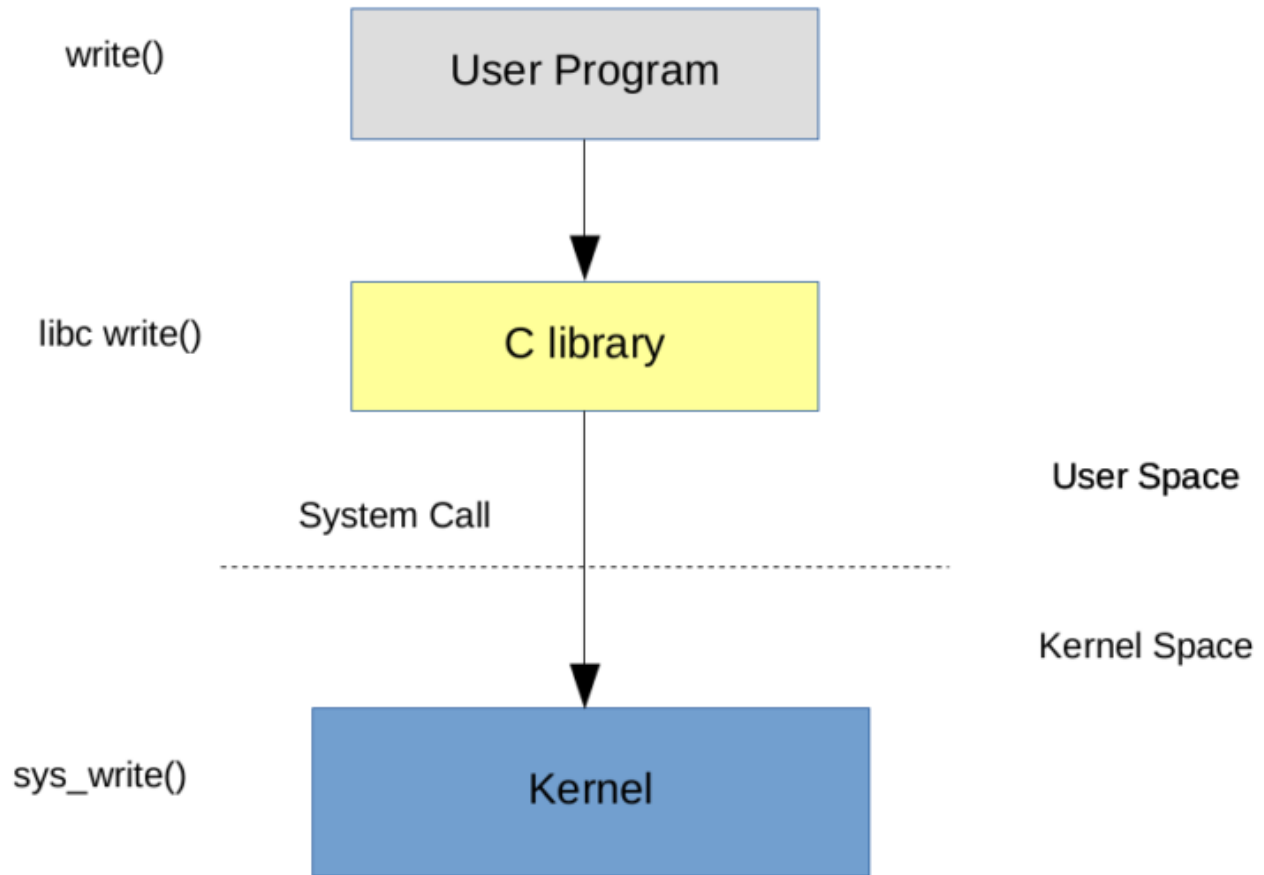
3. Device Drivers:

The kernel contains device drivers that allow it to communicate with various hardware devices, such as keyboards, mice, printers, and storage devices. Device drivers act as translators between the hardware and the software, enabling the OS to interact with the hardware seamlessly.



4. System Calls:

The kernel provides a set of system calls that allow user programs to request services from the OS. These system calls act as an interface between the user space and the kernel space, enabling processes to perform tasks such as file I/O, process creation, and inter-process communication.



Types of Kernels

There are two main types of kernels:

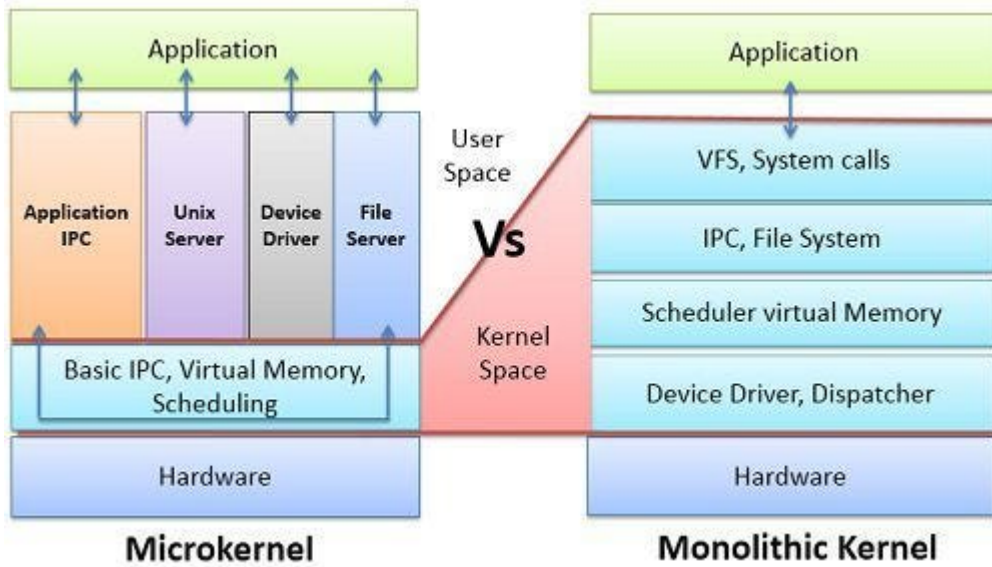
1. Monolithic Kernel:

In a monolithic kernel, all the OS services, such as memory management, process management, and device drivers, are implemented within the kernel itself. This approach provides better performance but results in a larger kernel size and reduced modularity.

2. Microkernel:

In a microkernel architecture, the kernel is minimized, and most of the OS services are implemented as user-space processes. The kernel only provides the most essential services, such as process management and inter-process communication. This approach improves modularity and security but may result in reduced performance due to increased communication.

overhead between user-space processes and the kernel.



See Also [2. File systems in Operating Systems](#)