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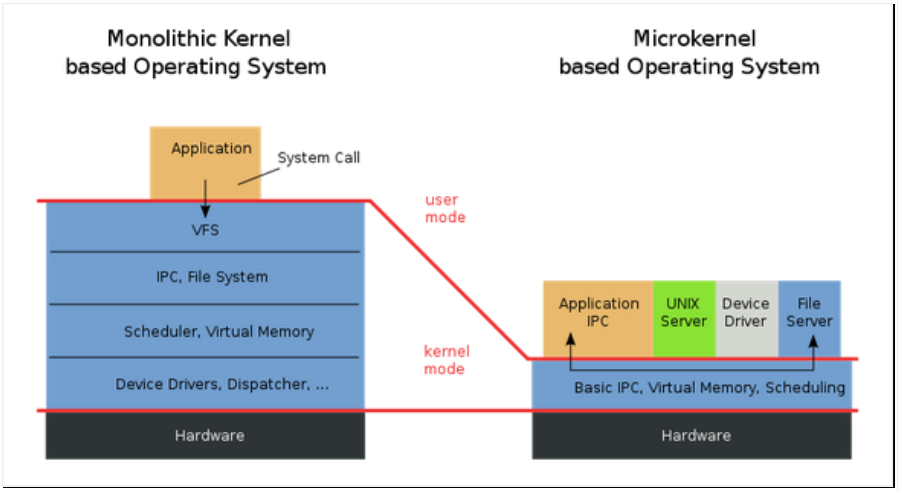
Monolithic kernel VS Micro Kernel



Monolithic kernel is a single large process running entirely in a single address space.It is a single static binary file. All kernel services exist and execute in the kernel address space. The kernel can invoke functions directly. Examples of monolithic kernel based OSs: Unix, Linux.
In **microkernels**, the kernel is broken down into separate processes, known as servers. Some of the servers run in kernel space and some run in user-space. All servers are kept separate and run in different address spaces. Servers invoke "services" from each other by sending messages via IPC (Interprocess Communication). This separation has the advantage that if one server fails, other servers can still work efficiently. Examples of microkernel based OSs: Mac OS X and Windows NT.

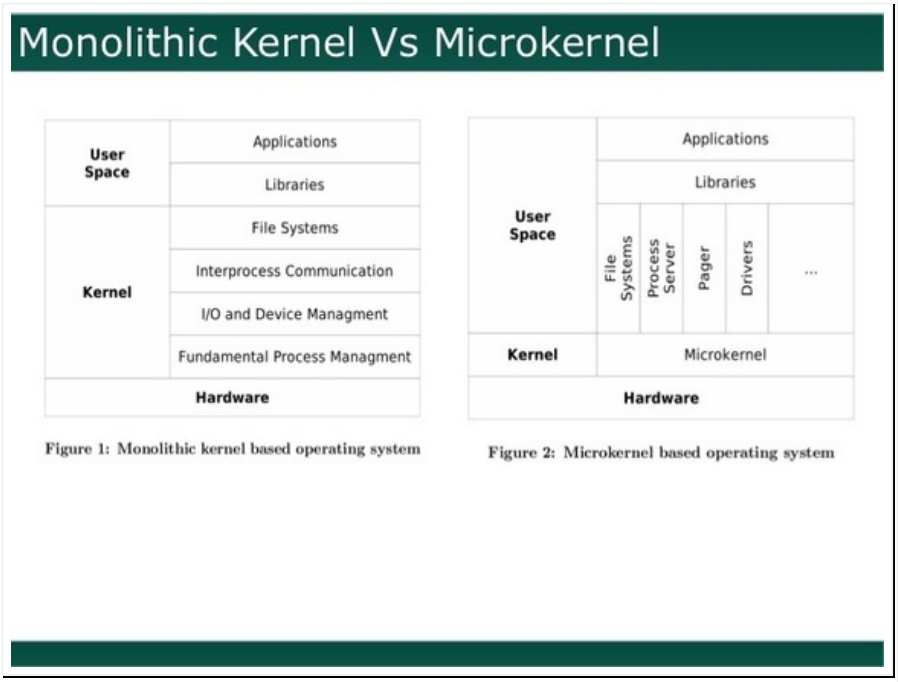


Figure 1: Monolithic kernel based operating system

Figure 2: Microkernel based operating system

1) Monolithic kernel is much older than Microkernel, the idea was conceived at the end of the 1980's.
2) Monolithic kernels are used in Unix and Linux.Microkernels are used in QNX, L4 and HURD. It was initially used in Mach (not Mac OS X) but later converted into a hybrid kernel. Even Minix is not a pure kernel because device drivers are compiled as part of the kernel .
3) Monolithic kernels are faster than microkernels.The first microkernel Mach was 50% slower

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than Monolithic kernel, while later version like L4 were only 2% or 4% slower than the Monolithic kernel .
4) Monolithic kernels generally are bulky A pure Microkernel has to be small in size, to fit into the processor's L1 cache (first generation microkernel).
5) In Monolithic kernels, the device drivers reside in the kernel space while in the Microkernel the device drivers reside in the user space.
6) Since the device driver resides in the kernel space, it makes monolithic kernel less secure than microkernel, and failure in the driver may lead to crash. Microkernels are more secure than the monolithic kernel, hence used in some military devices.
7) Monolithic kernels use signals and sockets to ensure IPC, microkernel approach uses message queues. 1st gen microkernels poorly implemented IPC so were slow on context switches.
8) Adding a new feature to a monolithic system means recompiling the whole kernel, whereas with microkernels you can add new features or patches without recompiling.

- **Monolithic kernel:**
  - It is a single static binary file.
  - All kernel services exist and execute in the kernel address space.
  - The kernel can invoke functions directly
  - Ex: **Unix, Linux - Monolithic kernel based OSs**
- **Micro kernel:**
  - It is broken down into separate processes, known as servers.
  - Some of the servers run in kernel space and some run in user-space.
  - All servers are kept separate and run in different address spaces and Servers invoke "services" from each other by sending messages via IPC (Interprocess Communication).
  - Ex: **Mac OS X and Windows NT - Micro kernel based OSs**

Posted by Prakash Arunakar at 13:10

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