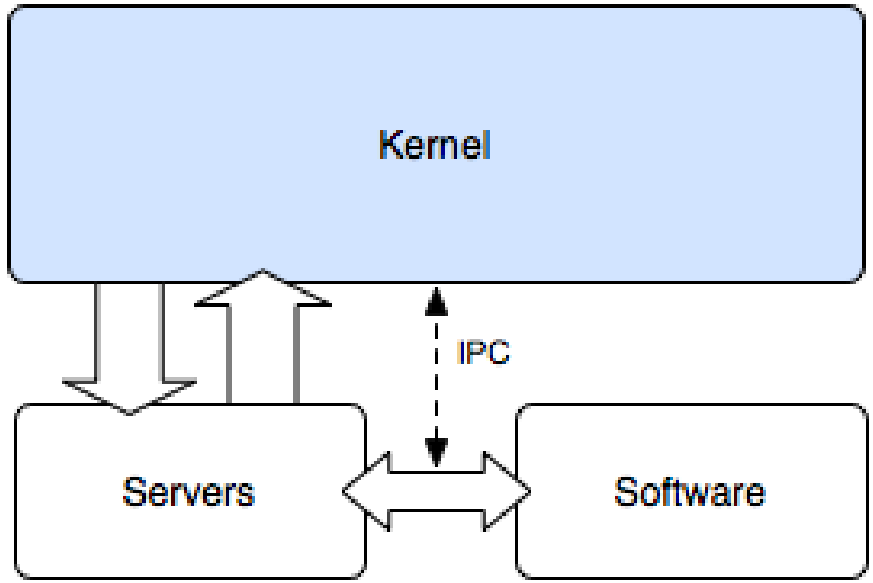
Mach Microkernel

presented by

Ercan Ucan

Microkernels



Mach Introduction

- Developed at Carnegie Mellon University
- One of the earliest examples of a microkernel, still the standard
- Ran from 85 to 94, ending with Mach 3.0
- Logical successor of CMU's Accent kernel.
- An effort to produce cleanly-defined, Unix-based, highly portable Accent.

Mach Concepts

- a "task" is a set of resources that enable "threads" to run
- a "thread" is a single unit of code running on a processor
- a "port" defines a secure pipe for IPC between tasks
- "messages" are passed between programs on ports

Mach Concepts

- Based on Accent's IPC, but much more Unix-like
- Ports have security and rights like Unix.
- Under Mach, OS = collection of utilities
- A task can consist of a number of threads. (first system to define this)
- Kernel = utility maintainer and scheduler

Mach Concepts

- Ports and IPC, the most fundamental difference from traditional kernels
- Trap system = IPC system
- Actual request taken care of by some other program.
- Use of IPC has huge benefit in allowing the system to be distributed over multiprocessors

Mach Concepts

- Performance of IPC and copy-on-write
- Messages are checked for validity
- Quote on Mach:
  - Unlike UNIX, which was developed without regard for multiprocessing, Mach incorporates multiprocessing support throughout. Its multiprocessing support is also exceedingly flexible, ranging from shared memory systems to systems with no memory shared between processors. Mach is designed to run on computer systems ranging from one to thousands of processors. In addition, Mach is easily ported to many varied computer architectures. A key goal of Mach is to be a distributed system capable of functioning on heterogeneous hardware.

Disadvantages

- Major problem was obvious with Mach 3
- As the OS is attempted to move to user-space, overhead became overwhelming. IPC calls
- Syscall performance in BSD and Mach is 20 vs. 114 microseconds.
- Overall performance was degraded by up to 66%

Disadvantages

- Memory management issues. Kernel had no real idea of what the OS consisted of.
- Simple pager proposed in Mach 3. Still all benefits were killed by expensive IPC.
- IPC performance was found to be the main contributor to the problem, accounting for about 73% of the lost cycles

OSs using Mach

- GNU Hurd/GNU Mach
- MkLinux
- Mach386
- MachTen
- MacMach
- Mac OS X
- NEXTSTEP
- OSF/1
- Workplace OS