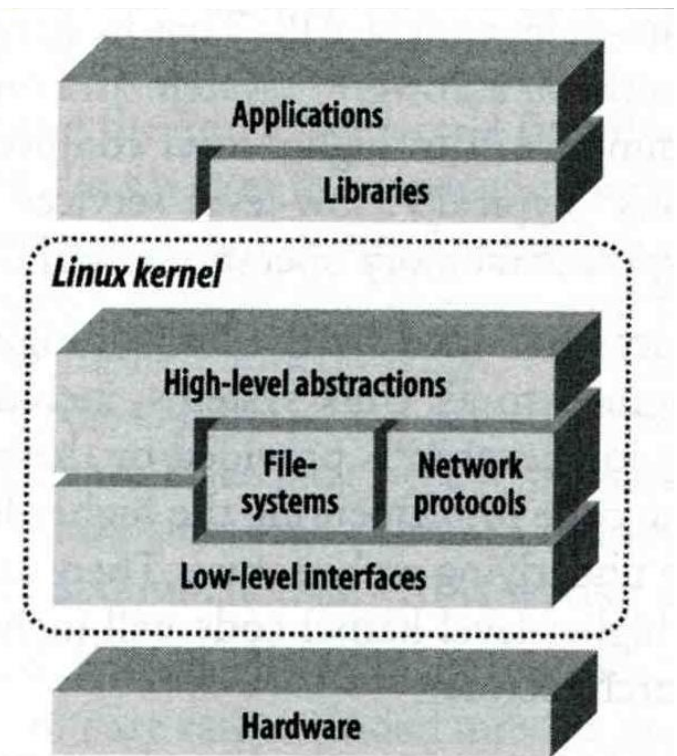


# Chapter 12

## Drivers and the Kernel

# Roles of Kernel

- Components of a UNIX System
  - > User-level programs
  - > Kernel
  - > Hardware
- Two roles of kernel
  - > High-level abstractions
    - Process managements
    - File system management
    - Memory management
    - I/O management
  - > Low-level interface
    - drivers



# Kernel Types

- Two extreme types
  - > **Micro kernel**
    - Provide only necessarily, compact and small functionalities
    - Other functions is added via well-defined interface
  - > **Monolithic kernel (龐大的)**
    - Whole functionalities in one kernel
- Modern OS
  - > Solaris
    - **Completely modular kernel**
    - **Load necessarily module when it is needed**
  - > BSD-derived system
    - **Explicitly specify the devices on kernel compile process**
  - > Linux
    - **Between BSD and Solaris System**

# Kernel related directory

- Build directory and location

System	Build Directory	Kernel file
FreeBSD	/usr/src/sys	/boot/kernel
Red Hat	/usr/src/linux	/vmlinuz or /boot/vmlinuz
Solaris	-	/kernel/unix
SunOS	/usr/kvm/sys	/vmunix

# Why configure the kernel?

- ◉ The native kernel is often big and common
- ◉ Tailoring kernel to match site situation
  - > Purge unnecessary kernel devices and options
  - > Add functionalities that you want
- ◉ OS patch
  - > Remedy security hole of kernel implementation
- ◉ Fine-tune system performance
  - > Such as adjusting important system parameters
- ◉ Adding device drivers

# Building a FreeBSD Kernel

- ◉ Kernel source
  - > /usr/src/sys
- ◉ Kernel configuration file
  - > /usr/src/sys/<ARCH>/conf
- ◉ Sample Kernel configurations
  - > GENERIC
  - > LINT (use "make LINT")
  - > NOTES
- ◉ Steps to build a new kernel
  - > Edit /usr/src/sys/<ARCH>/conf/<KERNCONF>
  - > # cd /usr/src
  - > # make KERNCONF=KERNCONF buildkernel [-j parallel count]
  - > # make KERNCONF=KERNCONF installkernel

# Building a FreeBSD Kernel – Configuration file

- Each line is a control phrase

<http://www.freebsd.org/doc/en/books/handbook/kernelconfig-config.html>

- > Keyword + arguments

Keyword	Function	Example
machine	Sets the machine type	i386 amd64
cpu	Sets the CPU type	I586_CPU HAMMER
ident	Sets the name of the kernel	SYSADM
maxusers	Sets the kernel's table sizes	0
options	Sets various compile-time options	INET or INET6
device	Declares devices	fxp
makeoptions	Building parameters	DEBUG=-g
hints	kernel boot information for device configuration	hint.sio.1.port="0x2F8"

# Tuning the FreeBSD Kernel

- ◉ `sysctl` command
  - > Dynamically set or get kernel parameters
  - > All changes made by `sysctl` will be lost across reboot
  - > Use `sysctl` to tune the kernel and test it, then recompile the kernel
  - > Format:

```
# sysctl [options] name[=value] ...
```

Ex:

```
# sysctl -a                list all kernel variables
```

```
# sysctl -d kern.maxfiles  print the description of the variable
```

```
# sysctl kern.maxfiles    print the value of the variable
```

```
# sysctl kern.maxfiles=2048
```

- > `/etc/sysctl.conf`
  - `security.bsd.see_other_uids=0`