



Kernel & Device Drivers

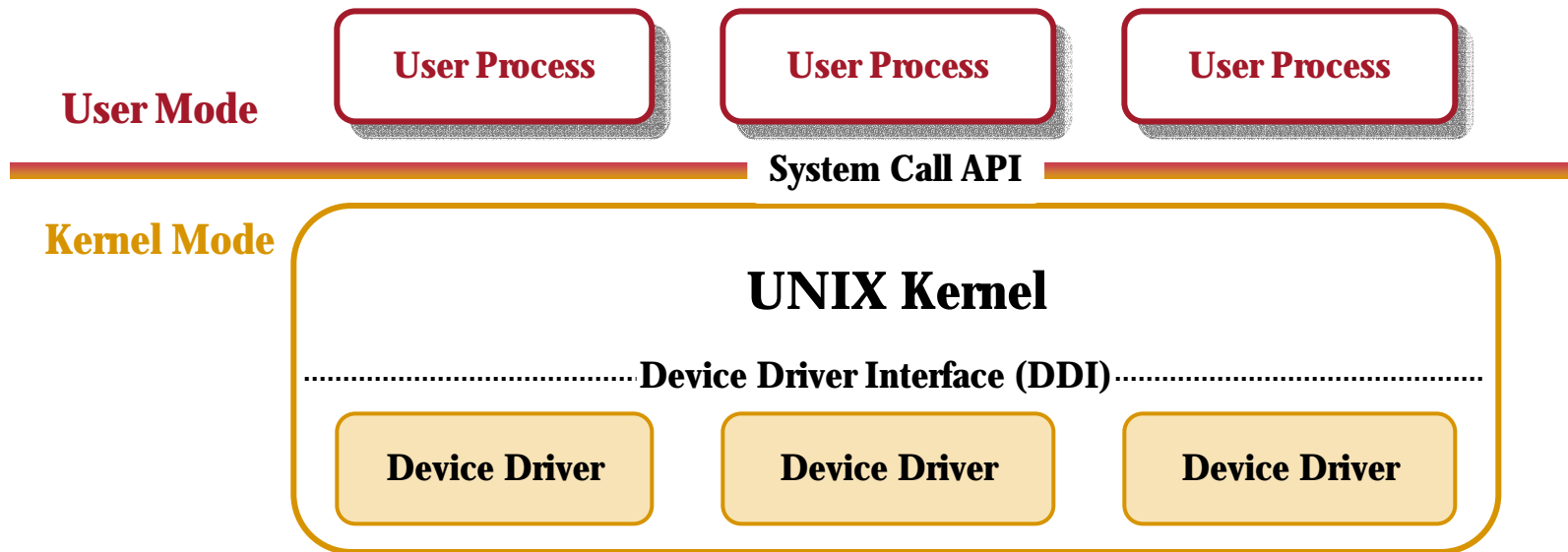
Installation & Configuration

CIS 68C1

UNIX System Administration

The Kernel & Device Drivers

- What are Device Drivers?
 - ✗ Small kernel software modules that control and operate specific devices
 - ✗ Interface between kernel and device driver is similar to interface between a user process and the kernel



The Kernel & Device Drivers

- Why are they needed?
 - ✗ Kernel does not speak a device's language
 - ✗ Kernel uses device drivers to talk to these devices
 - ✗ Kernel and device drivers communicate via a protocol
 - ✗ A Device Driver Interface – DDI
 - ✗ Too many devices, manufacturer's and variations
 - ✗ 200 network interfaces, 30 SCSI chipsets, dozens of controllers
 - ✗ Red Hat 7.0 comes with 570 different drivers!
 - ✗ Allows modularization
 - ✗ Don't have to re-work entire kernel for a new device

The Kernel & Device Drivers

- Where are they located?
 - ✗ Built-in drivers
 - ✗ Statically linked into the kernel when kernel was built
 - ✗ Cannot be removed without rebuilding the kernel
 - ✗ Loadable Kernel Modules – LKMs
 - ✗ Available in the filesystem
 - ✗ `/lib/modules/kernel-version`
 - ✗ List of modules:
 - ✗ `/lib/modules/kernel-version/modules.dep`

The Kernel & Device Drivers

- When are they used?
 - ✗ To use a device, its driver must be **loaded**
 - ✗ Built-in drivers are loaded when the kernel is loaded
 - ✗ LKMs are dynamically loaded by the kernel when needed
 - ✗ A device in **/dev** generally can't be used until its driver is loaded
 - ✗ A Linux system can be setup to automatically load LKMs upon referencing a **/dev** entry

The Kernel & Device Drivers

- How are they loaded?
 - ✗ The **insmod** and **modprobe** commands
 - ✗ **insmod *module*** loads a module
 - ✗ Does not resolve dependent modules
 - ✗ Some modules have dependencies, others do not
 - ✗ Eg. *moduleB* requires *moduleA*, therefore *moduleA* must be loaded before *moduleB* can be used
 - ✗ **modprobe *module*** loads *module* and its dependencies
 - ✗ Resolves all dependencies
 - ✗ Dependency list: `/lib/modules/kernel-version/modules.dep`
 - ✗ Also uses `/etc/modules.conf`

The Kernel & Device Drivers

- How are they loaded?
 - ✗ **kerneld** is the LKM loader daemon
 - ✗ Works on behalf of the kernel
 - ✗ When a device with an unregistered major number is used, kernel asks **kerneld** to load that device driver
 - ✗ Loads module associated with a major device number
 - ✗ Files used for module definitions
 - ✗ /etc/modules.conf
 - ✗ /lib/modules/*kernel-version*/modules.dep

The Kernel & Device Drivers

- Other module commands and files
 - ✗ **lsmod** command lists all loaded modules
 - ✗ **rmmod** command removes loaded modules
 - ✗ **/etc/modules.conf**
 - ✗ Configuration file used during load
 - ✗ Defines per module variables, names, & load options
 - ✗ Used to give an alias name to a module
 - ✗ Deprecated name: /etc/conf.modules

UNIX Installation

- Overview of UNIX Installation Procedures
 1. Boot mini-UNIX from boot floppy or CD-ROM
 2. An installer runs
 3. Hard disk is prepared
 4. UNIX software copied to hard disk
 5. Reboot into newly installed UNIX
 6. Complete any post-installation steps and configuration

UNIX Installation

□ Boot mini-UNIX

✗ Boot from installer CD

- ✗ Configure BIOS to boot from CD

- ✗ BIOS older than '97 may not support CD booting

✗ Boot from boot floppy

- ✗ If you don't have boot floppies, make them

- ✗ Images are available via Windows on Linux installer CD

- ✗ Need **rawrite** utility (available on CD)

- ✗ Also can be created via UNIX **dd** command

UNIX Installation

□ mini-UNIX

- ✗ Loaded from the boot floppy or CD-ROM
 - ✗ Loaded into RAM-based filesystem called a **ramdisk**
- ✗ Why does UNIX need to run?
 - ✗ UNIX installers are generally UNIX programs
 - ✗ Software to be installed is in the native UNIX format
 - ✗ Eg. Red Hat Linux packages software in RPM packages
 - ✗ Gives access to the CD-ROM and other devices
 - ✗ To create the root partition as a native UNIX filesystem
 - ✗ Eg. ext2 or ext3 in Linux
 - ✗ Device detection

UNIX Installation

□ mini-UNIX

- ✗ Load supplementary device-support floppies
 - ✗ Provides a way to add additional device support
 - ✗ May need to obtain drivers or host bus adapters
 - ✗ Check vendor's website, or elsewhere on the web
 - ✗ The boot loader program will ask for additional device floppies
- ✗ Primary causes of boot failures
 - ✗ Unsupported or unknown devices
 - ✗ Device not detected
 - ✗ Device I/O or IRQ conflicts
 - ✗ Device driver support incomplete
 - ✗ Kernel support incomplete or nonexistent

UNIX Installation

□ mini-UNIX

✗ Resolving boot failures

✗ Boot in text mode

- ✗ Graphical installers hide much valuable diagnostic information

- ✗ Pay close attention to all messages on the screen

- ✗ Need to supply boot loader with options to override defaults

- ✗ These are *very* specific to your hardware

- ✗ Eg. LILO

- ✗ Interrupt LILO - hold down Shift or Control during boot

- ✗ Boot with required options

- ✗ Example: **boot: linux nousb cdrom=nodma**

UNIX Installation

□ Installer

- ✗ Graphical Installer drives installation process
 - ✗ Vendor Specific
 - ✗ Red Hat's **anaconda**
- ✗ May be used in text mode for further debugging
- ✗ Asks series of configuration questions
- ✗ Runs program to partition the disk
 - ✗ Eg. **fdisk** or Red Hat's **Disk Druid**
 - ✗ Required partitions: root (/), swap (/swap)
 - ✗ Optional partitions home (/home), usr (/usr), var (/var), etc.

UNIX Installation

□ Installer

- ✗ Creates initial UNIX accounts (root and user accounts)
- ✗ Creates bootable root filesystem
 - ✗ **ext2** or **ext3** on Linux
- ✗ Initializes swap partitions
- ✗ Creates additional filesystems as requested
- ✗ Asks which software packages should be installed
 - ✗ Or simplified choices such as **workstation**, **server**, or **custom**
- ✗ Installs operating system and selected packages from CD-ROM to the newly created UNIX filesystem(s)

UNIX Installation

□ Installer

- ✗ Installer can install a boot loader for you
 - ✗ Red Hat asks to install LILO or Grub
 - ✗ Install in **partition boot record** if dual booting
 - ✗ Requires capable boot loader or Linux boot diskette
 - ✗ Install in **master boot record** (MBR) otherwise
- ✗ Reboots when package installation is complete
 - ✗ Remove boot floppy (and CD as requested)
 - ✗ Otherwise, the mini-UNIX will load and run again

UNIX Installation

□ First Boot

- ✗ Supply boot loader with any required settings
 - ✗ Use same procedure required to boot mini-UNIX
- ✗ Login as root
 - ✗ Reconfigure boot loader permanently as needed
 - ✗ Eg: LILO
 - ✗ Add options required to boot in **/etc/lilo.conf**
 - ✗ Must run **lilo** utility to reconfigure boot record
 - ✗ Begin basic system administration and setup
 - ✗ Configure X Windows, user accounts, setup networking, etc.

UNIX Installation

□ Additional Help

✗ Linux LKMs

✗ <http://www.linuxdoc.org/HOWTO/Module-HOWTO/index.html>

✗ Installation Links

✗ <http://www.linuxdoc.org/HOWTO/Installation-HOWTO/index.html>

✗ <http://www.redhat.com/docs/manuals/linux/RHL-7-Manual/install-guide/>

✗ <http://www.linuxdoc.org/HOWTO/HOWTO-INDEX/howtos.html>

✗ Class website FAQ and UNIX Forum

✗ Start searching the web

✗ Review Q&A's on various websites and forums

✗ Ask a friend!