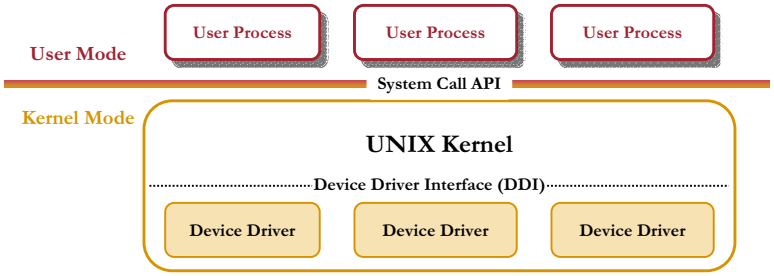
Kernel & Device Drivers Installation & Configuration

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 that '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!