Renat Norderhaug

CS 447

Take-Home Final

Final Exam

1. Components of a Virtual File System are superblock, inode, and a file. The superblock object represents a file system and is used as a mount point. The Inode is a object in the filesystem that describes the filesystem itself, and stores information about the directory. A File has many use cases, for example you can run a c++ program with a file. VFS is important because it provides a abstraction layer over the low level file system such as ext4. It allows all applications to use standard \*nix system system calls. VFS defines how to open files and what a directory is which also makes it important.
2. Filesystems permissions are managed by three distinct scopes or classes. These scopes are known as user, group, and others. When a file is created on a Unix-like system, its permissions are restricted by the umask of the process that created it. The tools used for POSIX permissions are Access control lists. Access control lists are used on Linux filesystems to set custom and more personalized permissions on files and folders. ACLs allow file owners or privileged users to grant rights to specific users or to specific groups
3. The parts of the entire linux boot process start right when you turn on your computer, the BIOS/UEFI is loaded from non volatile RAM in your computer. Most modern computers use UEFI which usually starts the machine right away without an in between menu. Then the system probes for hardware and selects a boot device, then a EFI system partition is identified, next load the boot loader which could be grub for example. GRUB is the bootloader for the operation system which is essentially the first process that is ran, then the control goes to the operating system kernel. So next a kernel is determined such as linux, so the linux data structures are loaded and next init/systemd is started as the first process and start scripts are executed. You can add your own menu entry when you start up grub. Its called a grub custom menu entry. You can make a menu entry to load the system from your usb drive for example.
4. The systemd service files can be used to provide a continuity of service, you can make a “.service” file and run it using systemctl start. The software for redundancy is RAID - an redundant array of independent disks, used to backup disk storage files and RAID is a method to combine multiple partitions on different disks into one large virtual device.
5. The role of a router and switch in a modern Ethernet network are to connect different network types and to connect to other devices. VLAN’s are virtual local area networks, which in essence is a grouping of ports belonging to the same logical segment. Vlans isolate traffic using the same switch. VLAN’s that are capable of being controlled by switch due to their description are Tagged VLAN’s, whereas Untagged VLAN’s cannot.
6. Five common application layer protocols are HTTP, FTP,DNS,SSH, DHCP. For HTTP protocol the port it uses is port 80, the debian package is https and it provides a way to get information from a server and put information to the servier, it allows you to interact with another server, for the FTP protocol the port 20 is in use. This protocol allows you to transfer file to another server and back. The DNS protocol uses port 53 and translates a hostname to an ip address, to keep track of a specific node in a network. SSH protocol is used on port 22 and used by the ssh debian package to securely connect to a remote computer. It uses the service of TCP/IP protocol and mixes in a cryptographic graph connection. DHCP uses port 67 and 68. The debian packages are called DHCP, the functionality is it assigns dynamic ip addresses to devices on a network.
7. Rule of Modularity, Rule of Clarity, Rule of Composition. A Debian package that follows the Rule of Modularity is the “0ad-data-common” package, it is a RTS game that is modular in design, the parts of the game are connected by clean interfaces. A Debian package that follows the Rule of Clarity is the “maxima” package. It is clean math code that is clearly written for developers to contribute to the code that is to be used in future releases. The Rule of Composition is shown in the debian package “gup”, which uses one program that is connected to another program. This is evident through the use of remote services.
8. DNS - domain name system is a distributed database that links a hostname to an ip. It is administered at three levels global, local, and individual. Five record types are SOA and it defines a DNS zone. Another is NS, it identifies servers. Another is type A which is name-to-address translation. PTR is address to name translation. SRV gives location of a well known service.
9. Chroot can make sort of a lightweight container. You can run the command chr = /home/rnorderhaug/testroot for example to create a directory which acts as the directory for the chroot environment. The kernel virtual file systems and configuration files have to be mounted/copied from the host to chroot.

The three linux kernel components that enabled containers are cgroups, tap networking, process namespaces.

The difference between a virtual machine and a container is:

Containers:

* Isolated group of processes managed by a shared kernel
* More Frequently dropped and replaced
* Known to be lightweight
* All the container files are in the megabytes range of size.
* There can be many

Virtual Machines:

* A Fully-fledged OS usually run by some third party software like VirtualBox
* Requires a whole boot procedure with a virtual disk
* Complete isolation
* In gigabytes