Rutgers - The State University of New Jersey
School of Engineering
Engineering Computing Services
Unisys Laboratory

650:485 Linux for Engineering and Information Technology Applications

Course Prerequisites

The course will be offered to senior level students in the Mechanical and Aerospace Engineering Department. The program of the course implies at least some basic knowledge of Unix. Interested students need to see the instructor, Alexei Kotelnikov, to ascertain if their Unix background is adequate.

Week 1: Introduction to Linux

Day 1: Basic concepts of the operating system

Kernel, shells, applications; multiuser system, users and groups; processes; file system and directories; login process and user configuration files. Demonstrations and laboratory exercises with elementary Unix commands.

Day 2: System installation and configuration

Disk partitions, fdisk and disk druid tools; workstation installation from a CD; system customization and upgrade; learning rpm for package installation, remove, upgrade and query; kickstart system installation.

Week 2: Introduction to Networking

Day 1: Basic concepts

Network packets, hardware address, protocols and TCP/IP; IP addresses and network mask; address resolution protocol (ARP); subnets and routing; configuring Linux machine on the network; `ifconfig` and `netstat` commands.

Day 2: Network ports, services and tools

Protocols (TCP, UDP, ICMP, SNMP) and ports; laboratory exercises with network services and tools: `telnet, ftp, http; inetd.conf`; opening and closing ports; packet sniffing with ethereal.

Week 3: System Security

Day 1: Securing a Linux box

Management of user accounts; changing file ownerships and permissions; TCP-wrappers, disabling vulnerable services; installing and configuring the secure shell (SSH); intrusion detection utilities, Tripwire.

Day 2: Linux firewalls

Packet filtering with `ipchains`; building a Linux firewall; NAT and DMZ firewall implementations.

Week 4: Network System Services

Day 1: Network File System (NFS)

File system sharing over the network: NFS installation and configuration; `portmap; rpc; auto-mount` configuration.

Day 2: Network Information Service (NIS)

Password/group sharing over the network: NIS installation and configuration; configuration of net-groups.

Week 5: Integrating Linux and Windows

Day 1: Dual boot

Running Windows and Linux on the same PC (dual boot); LILO and NT boot loaders; access Windows partitions from Linux and vice versa.

Day 2: Samba server

Installing and configuring Linux Samba server for network printing and file sharing; Linux NIS server for Windows domains.

Week 6: Linux Programming

Day 1: Shell scripting

Bash shell scripting; using `awk` and `grep`; interactive, batch and scheduled jobs (`at` and `cron`); job priorities.

Day 2: Code development

C and Fortran compilers; code development, compilation and debugging with `gdbx`; using `make` and `Makefiles`.

Week 7: Midterm Exam Week

Day 1: System boot-up and shutdown

System run time levels; startup services; adding and removing services from the startup.

Day 2: Midterm exam

Week 8: Linux Clustering I

Day 1: Cluster for computing

Beowulf high performance Linux clusters; cluster monitoring tools; Scheduling Systems concepts.

Day 2: Parallel programming

Programming with MPI libraries; MPI tutorial.

Week 9: Linux Clustering II

Day 1: High availability web servers

Configuration of Apache web server; concepts of high availability Linux servers.

Day 2: Linux virtual server

Server director; virtual IP address; NAT, direct routing (DR) and IP tunneling (IT) concepts of LVS; redundancy.

Week 10: Group Projects

Day 1: Project assignment and discussion

Group A) Building a Beowulf Linux cluster with Codine queue system

Group B) Building a high availability Linux Virtual Server (LVS)

Day 2: Projects (Step 1)

Group A: Building the cluster network: NAT configuration, NFS, NIS.

Group B: Setting one director with IPVS and two Apache servers with NAT.

Week 11: Group Projects

Days 1 – 2: Projects (Step 2)

Group A: Installation and configuration of Codine scheduling system

Group B: Configuration of the second server director, virtual IP address configuration.

Week 12: Group Projects

Days 1 – 2: Projects (step 3)

Group A: MPI installation on the cluster; Codine configuration for MPI.

Group B: Installation of Heart-Beat redundancy system.

Week 13: Group Projects

Days 1 – 2: Projects (step 4)

Group A: Running parallel jobs on the cluster

Group B: Testing the server for redundancy and availability.

Week 14: Final Week

Days 1 – 2: Project reports and presentation

Textbooks

The textbook is *Running Linux*, 3rd Edition, By Matt Welsh, Matthias Kalle Dalheimer & Lar Kaufman, O'Reilly Publishing.

Recommended textbooks are:

Networking Linux, A Practical Guide to TCP/IP, by Pat Eyler, New Riders.

Building Linux and OpenBSD Firewalls, by Wes Sonnenreich and Tom Yates, J. Wiley & Sons, Inc.

Integrating Linux and Windows, by Mike McCune, Prentice Hall.

Securing and Optimizing Linux: RedHat Edition, by Gerhard Mourani, Open Network Architecture and OpenDocs Publishing.