

# **GL615 "Linux for UNIX Administrators"**

Intended for administrators proficient in Unix environments, this course helps administrators transition their Unix skills to the Linux environment. This accelerated fast track course concentrates on the popular Red Hat Enterprise Linux distribution, and covers subjects ranging from initial installation of Linux to day-to-day administrative tasks such as management of user accounts and disk space. Also covered is setup and maintenance of many of the most popular network services available for Linux, including servers for DNS, SMB, e-mail servers, FTP, web, and caching proxy. Special attention is paid to the concepts needed to implement these services securely, and to the trouble-shooting skills which will be necessary for real-world administration of network and system services.

Individuals wishing to take this class should already have a solid grounding in UNIX administration concepts. Fundamentals such as an understanding of the Linux filesystem, process management, and the ability to manipulate and edit files is considered a must and will not be covered in class. An understanding of network concepts, and the TCP/IP protocol suite is helpful.

This course is intended to be taught as a five day 40 hour course. However the content supplied could span more than seven days in length. To keep the course within a targeted 40 hour time frame a consensus between the student and instructor must be made on which topics and labs not to cover. The remaining topics not targeted for exclusion should be covered at an accelerated pace.

*Courseware supports latest versions of Red Hat Enterprise Linux, Fedora Core, SUSE LINUX Professional, and SUSE LINUX Enterprise Server.*

*Suggested course duration: 5 days.*

## **Detailed Course Outline**

### **Section 1 Linux Installation**

- Pre-Installation Considerations
- Partition Considerations
- Partition Planning
- Filesystem Considerations
- Journalled Filesystems
- Installation Choices
- CD-ROM Installation
- Network Installation
- Local Hard Drive Installation
- FC Personal Desktop Class
- FC Workstation Class
- FC Server Class
- FC Custom Class
- Install Program Interface
- Installation Diagnostics
- Language Selection
- Keyboard Configuration
- Mouse Configuration

- Fedora Install Options
- Automatic Partitioning
- Partitioning with Disk Druid
- Installing a Boot Loader
- Network Configuration
- Security Configuration
- Language Support Selection
- Root Password Configuration
- Time Zone Configuration
- Package Group Selection
- Installing Packages
- Install Finished
- Firstboot
- Finalizing GUI Configuration
- Video Card Configuration
- Monitor Configuration
- Authentication Configuration

### **Lab 1 - Installation**

- Perform a GUI network NFS based workstation install
- Configure LVM and Software RAID at installation time

## **Section 2 Post-Install System Configuration**

- Configuration Utilities
- Configuration Files
- Network Services
- Managing System Time
- Managing Network-Wide Time
- Continual Time Sync - NTP
- Configuring NTP Clients
- Managing Software
- RPM Features, Architecture, and Package Files
- Working With RPMs
- Querying and Verifying with rpm
- Package Dependencies
- Intro to YUM
- Using the YUM command
- Configuring YUM
- YUM Repositories
- YUM Resources
- Common UNIX Printing System
- Defining a Printer
- Kickstart
- Creating Kickstart Files
- Using Kickstart files

### **Lab 2 - Post-Install Config**

- Answer some questions about the system using RPM queries
- Install zsh using RPM
- Troubleshoot and repair a package using RPM verification
- Upgrade the kernel using RPM

- Install the XFCE desktop environment using YUM
- Create and test a custom YUM repository
- Create a custom YUM repository for installing software
- Setup CUPS print queues using: system-config-printer, lpadmin, and the CUPS web interface
- Modify a kickstart file using a text editor
- Create a kickstart file using ksconfig
- Start an install using a pre made kickstart file

### **Section 3 Boot Process and SysV Init**

- Booting Linux on PCs
- GRUB Configuration
- Kernel Boot Parameters
- /sbin/init
- System init Styles
- /etc/inittab
- rc.sysinit
- /etc/init.d and /etc/rcX.d
- rc
- Typical SysV Init Script
- The rc.local file
- Managing Daemons
- Controlling Startup Services
- Shutdown and Reboot

#### **Lab 3 - Boot Process**

- Use GRUB to boot into single user mode
- Modify kernel/init parameters in GRUB
- Explore the GRUB interface
- Attach to the /boot filesystem and display the contents of the grub/grub.conf file
- Set a GRUB password
- Modify the lilo.conf creating a new stanza that passes kernel parameters

### **Section 4 User/Group Administration and NFS**

- User Private Group Scheme
- User Administration
- Modifying Accounts
- Group Administration
- Password Aging
- Default User Files
- Controlling Logins
- PAM, PAM Services, and PAM Control Statements
- su, Wheel, and sudo
- DS Client Configuration
- NFS Server Configuration and NFS Clients
- Automounting Filesystems

#### **Lab 4 - User Admin**

- Learn to customize /etc/skel
- Learn to add new users and manage password aging
- Practice setting up wheel group behavior for su

- Configure a project directory to take advantage of the user private group scheme
- Configure autofs to access an NFS export
- Configure NIS client as part of the EXAMPLE.COM domain
- Configure autofs to mount home directories
- Switch to using LDAP for authentication
- Setup an NFS server and export directories

## **Section 5 Filesystem Administration**

- Partition Tables
- File System Creation
- Mounting File Systems
- Filesystem Maintenance
- Persistent Block Devices
- udev
- Resizing Filesystems
- File Deletion and Undeletion
- Swap
- Disk Usage
- Configuring Disk Quotas
- Checking Disk Quotas
- Filesystem Attributes
- File Access Control Lists
- Manipulating ACLs
- Viewing ACLs
- Backing Up ACLs
- Backup Hardware
- Tape Libraries
- Backup Software
- Backup Examples

### **Lab 5 - Filesystem Admin**

- Create and activate additional swap space
- Configure and test disk quotas on the /tmp filesystem
- Backup files using tar and cpio over ssh
- Backup files using rsync over ssh
- Backup and restore files with dump and restore
- Create and test an ISO9660 image

## **Section 6 LVM and RAID**

- Logical Volume Management
- Implementing LVM
- Manipulating VGs and LVs
- Advanced LVM Concepts
- Graphical LVM Tool
- RAID Concepts, Tools, Implementation, and Monitoring/Control

### **Lab 6 - RAID and LVM**

- Use command line tools to partition free space
- Configure software RAID-5 with a hot-spare
- Fail a member device of the array, examine the automatic recovery using the hot-spare
- Fail another member device testing RAID-5

Remove failed member devices, add new devices to array examine the recovery of array  
Partition the drive and create LVM Physical Volumes  
Create a LVM Volume Group and Logical Volume to hold website content  
Verify the operation of LVM snapshots  
Extend and grow the Logical Volume and the ext3 filesystem

## **Section 7 Task Automation & Process Accounting**

Automating Tasks  
at Access Control  
crontab  
/etc/cron.\* Directories  
anacron  
Viewing Processes  
Managing Processes  
System Logging  
/etc/syslog.conf  
Log Management  
Log Anomaly Detector  
Process Accounting  
Using Process Accounting  
Limiting System Resources  
System Status - Memory, I/O, and, CPU  
sar

### **Lab 7 - Cron & Process Admin**

Create and edit user cron jobs  
Add a system-wide cron task to /etc/cron.hourly  
Install and configure process accounting  
Enable and set process limits  
Remove cron jobs

## **Section 8 Client Networking**

Linux Network Interfaces  
Ethernet Hardware Tools  
Runtime configuration change  
Configuring Routing Tables  
Advanced Configuration  
Starting and Stopping Interfaces  
Virtual IP Interfaces  
Enabling IPv6  
Interface Bonding  
802q VLANs  
IP Stack Configuration  
DNS Clients  
DHCP Clients  
Red Hat Configuration Tools  
Network Diagnostics

### **Lab 8 - Client Networking**

Enable static configuration  
Configure a virtual interface and verify connectivity through the new interface

Verify Link-Local IPv6 Connectivity  
Configure and Test Site-Local Connectivity

## **Section 9 The X Window System**

The X Window System  
Xorg  
Configuring X  
X Fonts  
Using Fonts  
Display Manager Selection  
XDMCP  
Specialized X Servers  
Starting X Apps Automatically

### **Lab 9 - X**

Change the display manager to gdm  
Enable XDMCP to support remote desktop login  
Configure VNC to accept incoming connections  
Launch a program by creating a script in the /etc/X11/xinit/xinitrc.d/ directory  
Start a custom X session by modifying the ~/.xinitrc file.  
Secure X for use in a public kiosk  
Test and verify that the special key sequences are disabled

## **Section 10 Security Concepts**

Tightening Default Security  
Staying Current  
Using up2date  
Security Advisories  
SELinux Security Framework  
Choosing a SELinux Policy  
SELinux Commands  
Booleans  
Graphical Policy Tools  
inetd / xinetd  
Xinetd Features  
TCP Wrappers  
hosts.allow & hosts.deny  
hosts.\* Syntax Shortcuts  
Basic Firewall Activation  
Stateful Packet Filter: iptables  
Netfilter Concepts  
Using the iptables Command  
Netfilter Rule Syntax  
Targets  
Common match\_specs  
Stateless Firewall Example  
Connection Tracking  
Stateful Firewall Example

### **Lab 10 - Security Lab**

Examine current system

- Configure Xinetd to provide a variety of limits for connecting to services
- Configure a sensor to log connection attempts
- Use TCP Wrappers to secure various services
- Use the Netfilter stateful packet filtering to protect the system-

## **Section 11 Linux Kernel Compilation**

- Why Compile?
- Getting Kernel Source
- Preparing to Compile
- Configuring the Kernel
- General Options
- Disk Configuration
- Network Configuration
- Expansion Port Configuration
- Multimedia Configuration
- Kernel Documentation
- RH 2.6 Kernel Extensions
- Compiling the Kernel
- Compile and Install Modules
- Installing the Kernel
- Tips and Tricks

### **Lab 11 - Kernel Compilation**

- Compile and install a new driver for the running kernel
- Patch the Linux kernel source to add support
- Compile and install a custom Linux kernel

## **Section 12 DNS Concepts**

- Naming Services and A Better Way
- The Domain Name Space
- Delegation and Zones
- Server Roles
- Resolving Names and IP Addresses
- BIND Administration
- rndc key configuration
- Configuring the Resolver
- Testing Resolution

### **Lab 12 - Configure BIND**

- Install the BIND name server on the system and configure it to act as a slave for the classroom domains
- Configure the name server to support the rndc command.

## **Section 13 Configuring Bind**

- BIND Configuration Files
- named.conf Syntax and Options Block
- Creating a Site-Wide Cache
- Zones in named.conf
- Zone Database File Syntax
- SOA - Start of Authority

A -Address / PTR-Pointer  
NS - Name Server  
CNAME -Alias / MX-Mail Host  
Abbreviations and Shortcuts  
\$GENERATE

### **Lab 13 - Configure BIND**

Configure the name server as the primary master name server for a new domain and it's corresponding id-addr.arpa domain

## **Section 14 OpenLDAP Servers**

OpenLDAP Components  
Configuring slapd  
Global Parameters  
Schema Definition  
Access Control  
Backend Types  
Backend Configuration  
Database Configuration  
Indexes  
Replicas and Replica Configuration

### **Lab 14 - Configure LDAP**

Configure the LDAP server  
Create a new directory  
Add, modify, and delete entries in the LDAP server

## **Section 15 Using OpenLDAP**

Managing slapd  
Online and Offline Data Manipulation  
Native LDAP authentication and Client Config

### **Lab 15 - Configure LDAP**

Create self-signed x509 certificate for LDAP server use  
Configure LDAP server to enable secure connections  
Configure LDAP server with baseDN and rootDN settings  
Install Perl Libraries needed by ldapmigrate  
Add three UNIX users  
Use ldapmigrate to import the /etc files  
Setup LDAP client to use native LDAP authentication

## **Section 16 Using Apache**

Apache History, Status, and Architecture  
SSL / HTTPS and Apache  
Apache Configuration Files  
httpd.conf  
Dynamic Shared Objects  
Adding Modules to Apache  
Apache Logging  
Log Analysis

### **Lab 16 - Configure Apache**

Configure the ServerName directive

Optimize Apache by turning off unneeded modules  
Create an index.html file

### **Section 17 Virtual Hosting with Apache**

HTTP Virtual Servers  
DNS Implications  
Security Implications  
IP-based Virtual Host  
Name-based Virtual Host  
Port-based Virtual Host

#### **Lab 17 - Configure Apache**

Configure Apache Virtual Hosts  
Use the "Main" server for global settings

### **Section 18 Apache Security**

Delegating Administration  
Directory Protection  
Common Uses for .htaccess  
SSL Using mod\_ssl

#### **Lab 18 - Configure Apache**

Password protect a directory  
Override MIME types for a single directory  
Redirect traffic to a different URL  
Create a test SSL certificate  
Use Apache and SSL to setup an SSL-enabled site

### **Section 19 Implementing an FTP Server**

WU-FTPD  
vsftpd  
Configuring vsftpd  
Anonymous FTP with vsftpd

#### **Lab 19 Configure VSFTPD**

Install and configure vsftpd for basic authenticated access  
Configure vsftpd for anonymous uploads

### **Section 20 The SQUID proxy server**

Squid Overview, Layout, Access Control Lists, and ACL application  
Tuning Squid / Hierarchies  
Bandwidth Metering and Monitoring of Squid  
Proxy Client Configuration

#### **Lab 20 - Configure SQUID**

Define an ACL for authorized IP networks  
Apply the ACL using http\_access  
Enable the Squid cachmgr.cgi program  
View Squid statistics  
Create a Proxy Auto Configuration file  
Change the mime-type in Apache for the PAC file  
Configure the web browser to use the PAC file  
Create an ICP proxy mesh

Secure the default ICP permissions

## **Section 21 Samba Concepts**

- SMB Network Protocol
- NetBIOS and NetBEUI
- NetBIOS Naming
- Introducing Samba
- Samba Daemons, Clients, Utilities, and Configuration Files
- The smb.conf File

### **Lab 21 - Configure Samba**

- Install the Samba server and configure it to share the /tmp directory.
- Use smbclient and smbfs to access SMB shares

## **Section 22 Using Samba**

- Unix and DOS Permissions
- Unix and Windows Concepts
- Name and Case Mangling
- Sharing [homes] and Printers
- Restricting Access
- Share-Level Access and User-Level Access
- Mapping Users
- SMB and Passwords
- The smbpasswd Database
- User Share Restrictions

### **Lab 22 - Configure Samba**

- Examine Samba's behavior when handling symbolic links and file permissions
- Configure the Samba server to use share-level access and user-level access
- Compare encrypted user-level access with unencrypted user-level access
- Configure Samba to share users home directories on demand
- Configure a new group and add the user to the group
- Create a directory for use by the group
- Configure the share to support the group that is read only for some users and read write for others

## **Section 23 Sendmail**

- sendmail Features, Process, Architecture, Components, and Configuration
- Configuration Files
- Databases
- Text Files
- Network Access
- Masquerading Sendmail
- Controlling access
- Configuring SMTP AUTH and SMTP STARTTLS

### **Lab 23 - Configure Sendmail**

- Install the Sendmail SMTP server on the system and configure it to serve domains
- Configure Sendmail to accept remote network connections
- Configure virtual hosts on Sendmail
- Configure Sendmail to support STARTTLS

## **Section 24 Postfix**

- Postfix Features, Architecture, Components, and Configuration
- master.cf and main.cf
- Postfix Map Types and Pattern Matching
- Advanced Options
- Virtual Domains
- Mail Filtering
- Configuration and Management Commands
- Postfix Logging and Logfile Analysis
- chroot'ing Postfix
- Postfix and SMTP AUTH
- SMTP AUTH Server and Clients
- Postfix Extensions
- Postfix/TLS
- TLS Server Configuration
- Postfix Client Configuration
- Other TLS Clients and Ensuring TLS Security

### **Lab 24 - Configure Postfix**

- Install the Postfix SMTP server on the system and configure it to serve domains
- Configure Postfix to accept network connections
- Configure virtual hosts on Postfix
- Configure Postfix to use SMTP AUTH for secure relaying
- Configure Postfix too support STARTTLS to secure SMTP AUTH

## **Section 25 IMAP, POP, Spam Filtering and Web Mail**

- Filtering Email
- procmail
- SpamAssassin
- Sendmail Mail Filter (milter)
- Amavisd-new Mail Filtering
- Accessing Email
- The POP3 and IMAP4 Protocol
- Dovecot POP3/IMAP Server
- Cyrus IMAP/POP3 Server
- Cyrus IMAP MTA integration
- Cyrus Mailbox Admin
- Fetchmail and SquirrelMail

### **Lab 25 - Filtering/Web Mail**

- Install the procmail mail-filtering software and configure it as the default MDA on the server
- Install SpamAssassin and configure it to flag spam on the server
- Install and configure Cyrus IMAP
- Enable POP3 and IMAP over SSL
- Install and configure the SquirrelMail web email client

## **Section 26 Troubleshooting**

- Basic Troubleshooting
- Gathering Information
- Information from df,and mount

- Information from Log Files
- Information Regarding Network Settings
- Information from ps, chkconfig, dmesg, w, and netstat
- Useful Debugging Aids
- Common Problems
- Incorrect File Permissions
- Inability To Boot
- Corrupt File Systems
- Typos in Configuration Files
- Disks Full?
- Runaway Processes
- Shared Libraries
- The Rescue Environment

### **Lab 26 - Troubleshooting**

- Explore troubleshooting and disaster recovery on non-mission-critical machines
- Practice troubleshooting common system and daemon errors

### **Appendix 1 - Using NIS**

- NIS History, Overview, Limitations, Advantages, and Implementation
- Creating a NIS Master Server
- NIS Client Configuration
- Slave Server Configuration
- Troubleshooting Aids

### **Appendix NIS - Lab 1**

- Configure a NIS master server and NIS client
- Configure a NIS slave server
- Enable ypxfird for high-performance database transfers between master and slave NIS servers
- Configure a NIS client system
- Observe client usage of a NIS slave server when a NIS master server fails