

*Suggested Teaching Guidelines for **Linux Programming and Cloud Computing** PG-DBDA Aug 19*

Duration: 42 class room hours + 38 Lab hours

Objective: To introduce Linux environment and hands on Linux commands.

Prerequisites: Knowledge of Computer Fundamentals

Evaluation method: Theory exam– 40% weightage

Lab exam – 40% weightage

Internal exam – 20% weightage

List of Books / Other training material

Text Book:

1. Linux: The Complete Reference – Petersen/ TMH 6th Edition

Reference:

1. The Linux Programming Interface: Linux and UNIX System Programming Handbook
2. Pro Bash Programming: Scripting the GNU/Linux Shell, Second Edition
3. Beginning Unix – Joe Marilino (Wrox Publication)
4. Linux Command Line And Shell Scripting Bible – Blum (Wiley – India)

Linux Programming

Session 1

Lecture:

Linux History and Operation

- The Evolution of Linux
- The GNU Movement and the GPL
- Linux Operations as a Server
- The Architecture and Structure of Linux

Installing and Configuring Linux

- Introduction to Installation and Media Types
- Performing a Custom Linux Server Installation
- Run Levels and the Startup/Shutdown Sequence
- Logging In and Out of a Linux System

Basic Commands

(ls, cp, mv, sort, grep, cat, head, tail, man, locate, find, diff, file, rm, mkdir, rmdir, cd, pwd, ln and ln – s, gzip and gunzip, zip and unzip, tar and its variants, touch, echo, who, whoami, ps, kill, makefile, etc.)

Assignment –Lab:

Getting Acquainted with the Linux Environment
Use various commands in Linux system.

Session 2

Lecture:

Gaining confidence with Linux

- Access control list and chmod command
- chown and chgrp commands
- Commands like telnet, ftp, ssh, and sftp
- Basic of I/O system with mount and unmount.

vi editor

- Features and different modes of vi editor
- Editing using vi editor
- Find and replace commands
- cut-copy-paste commands
- The set command

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- Other related commands of vi

Assignment –Lab:

Review Exercises

Session 3 & 4

Lecture:

Users and Groups

- Introduction to Users and Groups
- Essentials of Effective User, Group, and Password Management

The Ext2 Filesystem

- Introduction to the Second Extended (Ext2) Filesystem
- Partitioning and Formatting
- Mounting and Configuring Filesystems
- Administering Ext2 Filesystems
- Understanding Permissions

Session 5 & 6

Lecture: Linux shell programming

- Introduction to Shells
 - What is shell?
 - Different types of Linux shells
 - Bourne Again Shell (BASH)
 - Shell variables (environment and user defined)
 - Shell files (.bashrc, .profile, .bash_profile, .bash_logout)
 - Positional parameters
- Get start with simple scripts (User variable, expr, multiple command)
- Wild cards (* and ?)
- Command line arguments
- Arithmetic in shell scripts

Assignment –Lab:

Review Exercises

Session 7 & 8

Lecture:

Linux shell programming (Contd.)

- Read* and *echo* commands in shell scripts
- The *tput* command
- Taking decisions:
 - if-then-fi
 - if-then-else-fi
 - The test command (file tests, string tests)
 - Nested if-elses
 - The case control structure

Assignment –Lab:

Review Exercises

Session 9 & 10

Lecture:

Linux shell programming (Contd.)

- The loop control structure
 - The while, until and for loop structures
 - The break and continue statements

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- ° Shell metacharacters
- ° Command line expansion
- ° Directory stacks manipulation
- ° Job control, history and processes
- ° Builtins and functions
- ° Shell Files

Assignment –Lab:

Review Exercises

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Cloud Computing

Reference:

1. Cloud Computing Black Book by Kailash Jayaswal, Dreamtech
2. Mastering Cloud Computing by Rajkumar/ McGraw Hill Education
3. Cloud Computing a practical Approach by AnthonyT Velte/ McGraw Hill Education
4. Architecting the Cloud: Design Decisions for Cloud Computing Service Models (SaaS, PaaS, and IaaS)
5. Cloud Computing
6. An Introduction to Parallel Computing : Design and Analysis of Algorithms (Authors: Vipin Kumar, Ananth Grama, Anshul Gupta, George Karypis)
7. High Performance Cluster Computing: Architectures & Systems (Volume-1) by Rajkumar Buyya, Pearson
8. Parallel Programming in C with MPI and Open MPI, Michael, TMH
9. High-Performance Computing on Complex Environments

Sessions 11:

Lecture

- Introduction to cloud
- What computing paradigms are there?
- Characteristics and benefits

Lab Assignments:

- Study about cloud and other similar configuration

Session 12:

Lecture

- Cloud Infrastructure and Deployment
- Main aspects of a cloud system
- Key properties of cloud computing

Lab Assignments:

- Explore available solutions
- Cloud Architecture

Session 13:

Lecture

- Introduction to SaaS
- Pros and Cons of SaaS Model
- Traditional Packaged software Vs SaaS
- SaaS examples

Lab Assignments:

- Provide a solution on cloud as SAAS using available systems.

Session 14:

Lecture

- Introduction to IaaS
- Examples
- Reference Model of AWS
- Amazon computes cloud services

Lab Assignments:

- Install Red hat all in one

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Sessions 15:**Lecture**

- Introduction to virtualization
- Types and Uses of Virtualization
- Virtual Machine Provisioning
- Virtual Machine Migration Services
- Private Cloud Computing Deployment

Lab Assignments:

- Install VM on a physical host machine through which every I/O or network communication must pass.
- Explore Xen Architecture
- Implement security mechanism for private cloud(Hardened OS, Role based access etc).
- Implement virtual machine provisioning

Sessions 16:**Lecture**

- Introduction to PaaS
- Storage as Service(RAID)
- Challenges of cloud environment
- Hypervisor
- Comparisons of web services

Lab Assignments:

- Install open shift binary on Cent OS.

Session 17 & 18:**Lecture**

- Cloud Computing and big data
- How does Bigdata relate to Cloud
- Cloud Services for Big Data

Lab Assignments:

- Study about cloud and other similar configuration
- Exposure to big data technologies on cloud

Session 19:**Parallel Processing Concepts (2 Hrs Theory)****Lecture:**

- Physical Organization and building blocks of High Performance Computing Systems,
- Processors and Multi-Core Architectures
- Vector processing,
- Super-scalar,
- In-order execution,
- Instruction-Level Parallelism etc.,
- FMA, 32 and 64 bit types,
- ISA, Accelerators such as GPGPUs and Xeon Phi
- Threads and Processes,
- Multi-processing OS,
- Data and flow dependence,
- Race conditions,
- Synchronization and communication fundamentals,
- Concurrency control,
- Parallel I/O,
- General concepts

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Parallel Programming Models and Parallel Algorithms Design (4 Hrs Theory and 4 Hrs Labs)

Session 20 & 21:

Lecture:

- Application domains of HPC,
- Decomposition Techniques:
- Data parallelism,
- Functional parallelism,
- Divide and Conquer etc.,
- Characteristics of Tasks and Interactions,
- Mapping Techniques for Load Balancing,
- Methods for Containing Interaction Overheads,
- Granularity of parallelism
- Programming with OpenMP

Assignment –Lab:

- Installation of OpenMP
- Programming with OpenMP