

System Programming and Administration (SPA)

Higher Diploma in Computing and Information Technology - CS, SE

Asia Pacific Institute of Information Technology

Intakes:


Lecturer:

E-mail:

Start Week:

End Week:

SPA-01-PREVIEW AND INTRODUCTION
25-10-1999
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SYSTEM PROGRAMMING & ADMINISTRATION

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AIMS

- To provide the 'selected few', the 'priceless insight' into the tasks, responsibilities, 'power' and long term benefits of System Administration.
- Provide effective methodical training to inculcate 'instinctive' skills to deal with common Operating System problems.
- To make the professional aware of the techniques to implement System Programming solutions.
- To effectively 'equip' professionals with the ability to perform System Administration tasks.

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OBJECTIVES

On the successful completion of this module, the IT Professional should be able to:

- Identify the tasks and responsibilities involved in System Administration;
- Implement System operation and usage procedures;
- Manage users and groups effectively on the System;
- Identify the importance of taking System Backups;
- Identify the need for Securing the System;
- Implement Programming solutions using System tools;
- Analyse System statistics to make relevant decisions;
- Administer and Maintain a System effectively.

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PRE-REQUISITES

- I. Strong Foundation in C Programming Language.**
- II. Familiarity with vi editor and other basic commands and utilities of the UNIX System.** [Hands-on experience at APIIT-HP Labs]
- III. In-depth understanding of Computer Architecture and Operating Systems.** [Module offered in Year-1, APIIT-Higher Dip]

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SYSTEM PROGRAMMING & ADMINISTRATION SPA SYLLABUS

- This subject will expose the IT Professional to the fundamentals of System Administration and Programming.
- The practical approaches and solutions to the problems facing Systems Administrators will be presented ...
- ... as well as discussing the underlying concepts of the UNIX Operating System, with the aim to provide an efficient and secure operating environment.

- This course will emphasize on the AT&T's System V.4 version of the UNIX Operating System and a vast variety of topics will be covered.


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SPA SYLLABUS (CONT..)

- Security issues that Users, Programmers & Administrators must address and solve are presented.
- Professionals gain more complete understanding of the UNIX System Files and Utilities ...
- ...as well as System Accounting and Management.
- An in-depth exposure will also be provided in the areas of Shell Programming and Inter-Process Communications using Sockets.

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SYSTEM PROGRAMMING & ADMINISTRATION SPA

BREAKDOWN OF ASSESSMENTS

No.	Description	% of Marks
1.	In-Course Assessment	40 %
2.	Final Examination	60 %
	TOTAL	100 %


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SYSTEM PROGRAMMING & ADMINISTRATION SPA INCOURSE ASSESSMENTS

No.	Description	% of Marks
1.	Assignment-1	10 %
2.	Assignment-2	10 %
3.	Test	30 %
4.	Project	40 %
5.	Attendance & Conduct	10 %
	TOTAL	100 %

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REFERENCES & RESOURCES

- UNIX SYSTEM V - A PRACTICAL GUIDE - MARK G. SOBELL
- UNIX ADMINISTRATION GUIDE FOR SYSTEM V- THOMAS & FARROW
- UNIX NETWORK PROGRAMMING - W.RICHARD STEVENS
- APIIT SPA COURSE NOTES
- APIIT SPA HAND-OUTS
- LINUX Installation on PC (Recommended!)

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System Administration

What is UNIX System Administration?

- System Administration is the installation and maintenance of the UNIX Computer system.
- The **System Administrator** requires to add new users, maintain the software and hardware for the system.
- The issues include hardware configuration, software installation, reconfiguration of the kernel, networking, maintain security and integrity of the system work and keep it running in a satisfactory manner.
- To do this the System Administrator can assume 'super-user', or root, privileges to perform many tasks not normal available to average users of the system.

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Daily Tasks of a System Administrator


Good News!

-You don't have to be a UNIX fanatic, adept in the arcane arts of alchemy and magical C language, spoken only by programmers and gold-hoarding dragons in deep, dark caves ..."

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Daily Tasks of a System Administrator

Just perform these more humane deeds!

- **1. Manage user logins**


To add accounts by assigning login id's, groups, user id numbers, group id numbers, login directories, and set-up the users' login environments.

To balance the needs of various users, e.g. with quotas on disk space or limits on simultaneous processes.

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Daily Tasks of a System Administrator

- 2. Monitor system activity and security**
Monitor disk status, system processes, user process activity, system security, and system log files to make sure that your resources are available and that only valid users have access to them.
- 3. Administer file systems, devices and network services**
To manage disk space usage, tape and CDROM devices and network services to make sure that these resources are available.
- 4. Startup and Shutdown**
Startup is to boot the system from the ROM. The shutdown programs, shutdown/reboot/halt, allow you to close down the system in an orderly fashion.


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Managing File Systems

- 1. File System Backups**
Backup and restore procedures are need to insure data integrity against disk crashes, users accidently deleting files, for the removal of seldom used programs to free up disk space, etc. You can usually automate this task.
- 2. Disk space quotas**
Quotas restrict users to a finite disk space and can be set individually. This insures that individual users don't hog the available disk space.
To provide access to disk space,CPU cycles, data integrity,operating system software updates, install necessary software, mail and network access,system security

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Responsibilities to the users

Hardware responsibilities

You are responsible for keeping the system running and maintaining it, adding new hardware, and making sure that everything is working properly.

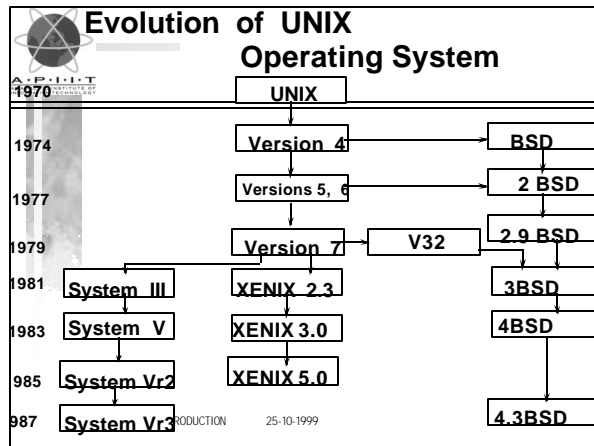
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Evolution of UNIX Operating System

- **MULTICS** was a joint project of MIT, AT&T Bell Labs and GE,developed for **GE 635 MainFrame**.
- Ken Thompson of AT&T Bell Labs created the first version of **UNIX** in1969, to support a video game he was building on a **DEC PDP-7** computer.
- Dennis Ritchie invented **C** Language in early 70's.
C was created from B which originated from BCPL.
- **UNIX** was rewritten in **C** by Thompson and Ritchie in 1973, and was the first OS to be written in a **HLL**!
- **Version 4** was developed in 1974.
- Later developments resulted in **Versions 5 ,6 and 7**.

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History of Unix

- Bell labs originally gave free source code to Universities
 - They used it for further research and enhancement
 - Students became familiar with it, and they wanted to use it in industry
 - University of California, Berkeley made significant additions and changes
 - BSD (Berkeley Software Distribution) version of Unix
- Open Software Foundation (OSF) (IBM, Digital)
- Sun's Solaris is based on BSD Unix
- POSIX (Portable Operating System Interface)

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Overview of UNIX OS Features

- Developed using H.L.L (C Language)
- Open Systems Portability
- Multitasking
- Multi-user
- System Kernel
- Programmable Shells
- Device Independence
- Security
- Inter-process Communication


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UNIX Environment

- File is a collection of data usually stored on disk
 - peripherals (terminals, printers etc.) are considered as special files.
- A program is a collection of bytes representing -code and data which is stored as a file
- A program when it is running is called a process.

The program is loaded from the disk to the RAM .


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UNIX Environment

- Most processes read and write data from files
- Processes and files have an owner
 - May be protected against unauthorized access.
- Files are arranged in a hierarchical directory structure.
 - The top most directory is called root (/)
 - Root is owned by the *super-user*
- Unix provides services for the creation, modification and destruction of programs, processes and files.


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UNIX Philosophy

- The prompt you see when you log on is displayed by a program called *shell*
 - Shell is a middleman between you and the Unix kernel
 - Each session is handled by a shell process
- The shell process lets you
 - run (multiple) programs
 - build pipelines
 - save output to files etc.
- Three popular shells
 - Bourne shell
 - C shell
 - Korn shell



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...Other basic UNIX terminology

- System Call
- File
- I-Node
- Directory
- Device file
- Device driver
- Major device number
- Minor device number
- Block devices
- Character devices

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Daemon Processes

Daemons provide a lot of comfort and assistance...

“Contrary to the more popular connotation of the word ‘demon’ as a ‘devilish spirit’, a more practical and less demoralizing definition is a ‘guardian spirit’”

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Daemon Processes

Daemons are processes that run unattended within the UNIX system and perform routine tasks that do not require supervision.

- init**
 - The init process starts during System Start-up, and continues until the UNIX system is halted.
 - The PID of init process is 1.
 - The init process is responsible for initiating user log-in processes and launching the other daemons.


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Daemon Processes (Cont..)

- cron**
 - The cron daemon is the clock watcher or timer process.
 - The cron daemon starts when the system goes multiuser
 - cron 'wakes' up every once a minute, checks the time, and starts processes
 - cron's configuration file lists the order of processes.
- lpsched**
 - This is the Line Printer Scheduler Daemon.
 - The daemon 'sleeps' until a user makes a request for printing with the **lp** command.
 - Then it 'wakes' up and starts an interface program to handle the print request, and continues to schedule printing requests until the last one.
 - It then goes back to 'sleep'.


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Daemon Processes (Cont..)

- errdemon**
 - records system-wide errors.
 - gets launched when the system goes multiuser.
 - it waits for the kernel to write error messages to **/dev/error**, then copies the messages to **/usr/adm/errfile**.
- uucico**
 - UNIX to UNIX copy-in copy-out daemon 'wakes' up when one user sends mail to another on a remote machine.
 - events include commands like **uucp uux**, or **uuto** to request file transfers.
 - cron daemon may start uucico periodically.
 - uucico terminates after processing pending UUCP requests.


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Daemon Processes (Cont..)

- sendmail**
 - A BSD daemon that listens to a socket connected to Ethernet and handles incoming mail messages.
- From the above, it can be clearly seen that daemons are event-driven, activated by timers (**cron**), user requests(**lpsched** and **uucico**), or other system events (**errdemon**).

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SYSTEM ADMINISTRATION DUTIES

- System start-up and shut-down.
- File Systems Architecture
- File System Back-up and File Recovery.
- Maintenance of File System integrity and free space
- Changing configuration files for:
 - Adding or removing user accounts
 - Activating/deactivating access ports
 - Setting up and maintaining communication
 - Start-up and Shut-down scripts
 - Setting up files to selectively run commands

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SYSTEM ADMINISTRATION DUTIES

- Account Management
- Monitoring System Accounting and Activity.
- Balancing users' needs
- Reading root's mail
- Teaching users UNIX basics
- Establishing and maintaining Security
- Installing Hardware and Software
- Purchasing supplies and new equipment
- Correcting errors and problems.

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