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Network and System Administration (CoSc 4036)

Chapter One: Introduction to System and Network Administration

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Introduction

- Network and Computer Systems Administrators are responsible for the day-to-day operation of an organization's computer networks.

- They organize, install, and support an organization's computer systems, including:

  - ✓ **Local area networks (LANs)**

  - ✓ **Wide area networks (WANs)**

  - ✓ **Network segments**

  - ✓ **Intranets**

  - ✓ **Data Communication Systems**

  - ✓ **Microsoft Windows Desktop**

  - ✓ **Microsoft Windows Server**

  - ✓ **Linux Workstations**

Responsibilities of system administrator

- User account management.

- Hardware management.

- Perform file system backups, restores.

- Install and configure new software and services.

- Keep systems and services operating,

- Monitor system and network

- Troubleshoot problems

- Maintain documentation

- Audit security

- Help users, performance tuning, and mor

Goals of network/system administration

- **Network Administration** means the management of network infrastructure devices (routers and switches).

- Network administration is the management of PC's in a network.

- The goal of network administration is to ensure that the users of the networks receive the information and technically serves with **quality of service** they except.

  - ✓ Put together a network of computers.

  - ✓ Get them running.

  - ✓ Keep them running (despite Users….).

  - ✓ Provide a Service to Users.

Network vs System administrator

- **Network Administrator** is a person who maintains **computer infrastructure** with more focus on **networking**.

- **System Administrator** is a person who manages daily business computer system with more focus on **multi-user computing** environment.

- **A network admin's** main responsibilities include monitoring and maintaining LAN, WAN, internet systems, installing and configuring software.

Cont …

- System administrator has full (unrestricted) access resources and performing different tasks, so he/she can do anything with system.

- For example, system administrator can remove critical system files.

- Some of the tasks accomplished by system administrators are:
  - ✓ Create new users.
  - ✓ Resetting user passwords.
  - ✓ Lock/unlock user accounts.
  - ✓ Monitor server security.
  - ✓ Monitor special services etc.

Types of administrators

- In a larger company, there are different system administrators in separate positions within a computer support or Information Services (IS) department.

- But in a smaller company or organization, all tasks and be administrated by a few system administrator, or even a single person

- The types of system administrators in different organization or company are the following:

✓ A **database administrator** (DBA) maintains a database system, and is responsible for the integrity of the data and the efficiency and performance of the system.

✓ A **network administrator** maintains network infrastructure such as switches and routers, and diagnoses problems with these or with the behavior of network-attached computers.

✓ A **security administrator** is a specialist in computer and network security, including the administration of security devices such as firewalls, as well as consulting on general security measures.

Types of administrators

✓ A **web administrator** maintains web server services (such as IIS or Apache) that allow for internal or external access to web sites. Tasks include managing multiple sites, administering security, and configuring necessary components and software. Responsibilities may also include software change management.

✓ A **computer operator (Technical support)** performs routine maintenance and upkeep, such as changing backup tapes or replacing failed drives in a RAID array. Such tasks usually require physical presence in the room with the computer; and while less skilled than system administrator tasks require a similar level of trust, since the operator has access to possibly sensitive data.

Cont …

- **Network administration compromises of 3 major groups:**

- These are **Network provisioning, Network operations, Network maintenance.**

- **Network Provisioning**: is the primary responsibility of engineering groups and its consists of **planning and design** of network which is done by engineer.

- **Network Operations**: it consists of fault, configurations, traffic, all types of management and it is done by plant facilities group.

- It is nerve center of network management operations.

- **Network Maintenance**: its consists of all types of installations and maintenance work.

The challenges of system administration

- System administration is not just about installing operating systems.

- It is about planning and designing an efficient community of computers so that real users will be able to get their jobs done.

- Some of the challenges of system administrators are the following :

✓ Designing a network which is logical and efficient.

✓ Deploying large numbers of machines which can be easily upgraded later.

✓ Deciding what services are needed.

✓ Planning and implementing adequate security.

✓ Providing a comfortable environment for users.

✓ Developing ways of fixing errors and problems which occur.

✓ Keeping track of and understanding how to use the enormous amount of knowledge which increases every year.

Cont …

The Top 6 Challenges Facing Network Management Teams

- **Poor network performance**: there's no question that poor **network** performance is a top **challenge** for **network** engineers.

- **Security**: security is another top **challenge**.

- **Configuration management**: as **networks** increase in size, overseeing the **network** configuration increases in difficulty.

- **Cost**

- **Growth**

- **Vendor lock-in**

Philosophy of System Administration

- Although the specifics of being a **system administrator** may change from platform to platform, there are underlying themes that do not.
- These **themes** make up the philosophy of system administration.
- The themes are:
  - ❖ Automate everything.
  - ❖ Document everything.
  - ❖ Communicate as much as possible.
  - ❖ Know your resources.
  - ❖ Know your users.
  - ❖ Know your business.
  - ❖ Security cannot be an afterthought.
  - ❖ Plan ahead.
  - ❖ Expect the unexpected.

Cont …

Automate everything

- Anything done more than once should be automated in order to save our **time, energy, and replace human errors**.

- Automation also gives users the extra benefit of greater predictability and consistency of service.

- Here are some commonly automated tasks:

  - ✓ Free disk space checking and reporting.

  - ✓ Backups.

  - ✓ System performance data collection.

  - ✓ Business-specific functions (pushing new data to a Web server, running monthly/quarterly/yearly reports, etc.).

Cont …

Document everything

- If given the choice between installing a **brand-new server** and writing a procedural document on performing system backups, the average system administrator would install the new server every time.

- While this is not at all unusual, you must document what you do.

- Hopefully you are now sold on the benefit of system documentation.

- That brings us to the next question:

- **What should you document? Here is a partial list:**
  - ✓ Policies
  - ✓ Procedures
  - ✓ Changes

Cont …

Communicate as Much as Possible

- The method by which you communicate with your users can vary according to your organization.

- Some organizations **use email**; others, an **internal website**.

- In any case, use whatever method(s) that work well at your organization.

- In general, it is best to follow this paraphrased approach.
  - ✓ Tell your users what you are going to do.
  - ✓ Tell your users what you are doing.
  - ✓ Tell your users what you have done.

Cont …

Know your Resources

- System administration is mostly a matter of **balancing available resources** against the **people and programs** that use those resources.

- Therefore, your career as a system administrator will be a short and stress-filled one unless you fully understand the resources you have at your disposal.

- Some of the resources are:

✓ System resources, such as available processing power, memory, and disk space.

✓ Network bandwidth.

✓ Available money in the IT budget.

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Know Your Users

- Users are those people that use the systems and resources for which you are responsible.

- As such, they are central to your ability to successfully administer your systems;

- Without understanding your users, how can you understand the system resources they require?

- A software engineer, on the other hand, may use many different applications and always welcomes more system resources (for faster build times).

- Two entirely different users with two entirely different needs.

- Make sure you learn as much **about your users** as you can.

Cont …

Know Your Business

- Whether you work for a large, multinational corporation or a small community college, you must still understand the **nature of the business** environment in which you work.

- This can be boiled down to one question; i.e. what is the purpose of the systems you administer?

- The key point here is to understand your systems' purpose in a more global sense:

  - ✓ **Applications** that must be run within certain time frames, such as at the end of a **month, quarter, or year.**

  - ✓ The times during which **system maintenance** may be done.

  - ✓ **New technologies** that could be used to resolve long-standing business problems.

- By taking into account **your organization's business**, you will find that your day-to-day decisions will be better for your users, and for you.

Cont …

Make the systems Secure

- No matter what you might think about the environment in which your systems are running.

- Even standalone systems not connected to the internet may be at risk.

- The risks will be different from a system that has **connections** to the outside world.

- It is extremely important to consider the **security implications** of everything you do.

- The following list illustrates the different kinds of issues you should consider:

  - ✓ The nature of **possible threats** to each of the systems under your care.

  - ✓ The **location, type, and value** of the data on those systems.

  - ✓ The type and frequency of **authorized access** to the systems.

Cont …

- While you are thinking about security, do not make the mistake of assuming that possible **intruders** will only attack your systems from **outside of your company**.

- Many times the perpetrator is someone within the company.

- So the next time you walk around the office, look at the people around you and ask yourself this question:

- What would happen if that person were to attempt to **subvert our security**?

Cont …

Plan ahead

- Certainly no one can predict the future with 100% accuracy.

- However, with a bit of awareness it is easy to read the signs of many changes in the future.

- So system administrator should consider **future developments or changes** when you install networks or other resources.

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Expect the Unexpected

- What would a system administrator who expects the unexpected do in this case?

- Perhaps it is possible to keep a few disk drives sitting on the shelf as spares in case of hardware problems.

- A spare of this type could be quickly deployed on a temporary basis to address the short-term need for disk space, giving time to more permanently resolve the issue.

- By trying to **anticipate problems** before they occur, you will be in a position to **respond more quickly and effectively** than if you let yourself be surprised.

Overview of Operating System

- **An operating system** is a software which performs all the basic tasks like file management, memory management, process management, handling I/O, and controlling peripheral devices such as disk drives and printers.

- **Following are some of important functions of an operating System.**
  - ✓ Memory Management
  - ✓ Processor Management
  - ✓ Device Management
  - ✓ File Management
  - ✓ Security
  - ✓ Control over system performance
  - ✓ Job accounting
  - ✓ Error detecting aids
  - ✓ Coordination between other software and users

Difference between Linux and Windows

Linux

- It provides **more security** than windows.

- It is an open source operating system.

- It facilitates the users to have access to the source code of operating system.

- It is more commonly used in servers and supercomputers.

Windows

- It has less security than Linux.

- It is a commercial operating system.

- Windows are more popular among personal computers.

- Windows is generally considered to be easier to use.

Linux distribution and UIs

- A Linux distribution often shortened to "**Linux distro**".

- It is a version of the **open source Linux operating system** that is packaged with other components, such as:

  - ✓ An installation programs

  - ✓ Management tools and

  - ✓ Additional software

Cont …

Linux distribution types

- Some distributions such as Fedora and Red Hat Enterprise Linux from **Red Hat**; openSUSE from **SUSE**; Ubuntu from **Canonical**; and Oracle Linux from **Oracle** are commercial.

- Others such as **Debian** and **Slackware** are community-developed.

- Some commercial distributions, for example those from **Red Hat and Oracle** charge users for services such as support or custom development, although **open source licensing** prohibits charging for the open source software itself.

- Romans already said: "**the more people, the more opinions**".

Linux Operations Overview

File System Hierarchy Standard (FHS)

- The File System Hierarchy Standard (FHS) defines the **directory structure** and directory contents in **Linux distributions**.

- It is a reference used to **standardize** the directory structure and directory contents on Linux systems.

- It is maintained by the Linux Foundation.

- Linux distributions (and other operating systems) can voluntarily conform to the **FHS**.

Cont …

- **FHS Organization:** the **directories** and **files** noted here are a small subset of those specified by the FHS document.

- Refer to the latest **FHS document** for the most complete information.

- In the **FHS**, all files and directories appear under the **root directory** /, even if they are stored on different physical or virtual devices.

- Most of these directories exist in all **Linux** operating systems and are generally used in much the same way;

- However, the descriptions here are those used specifically for the **FHS** and are not considered authoritative for platforms **other than Linux**.

Linux – directory

- **/(Root):** Primary hierarchy root and root directory of the entire file system hierarchy.

- **/bin :** Essential command binaries that need to be available in **single-user mode**.

- **/boot :** Boot loader files, e.g., kernels, initrd.

- **/dev :** essential device files, e.g., /dev/null.

- **/etc :** host-specific system-wide configuration files.

- **/home :** users' home directories, containing saved files, personal settings.

- **/lib :** libraries essential for the binaries in /bin/.

Linux - File Permission / Access Modes

- File ownership is an important component of Linux that provides a secure method for storing files.

- Every file in Linux has the following attributes.

- **Owner permissions** − The owner's permissions determine what actions the owner of the file can perform on the file.

- **Group permissions** − The group's permissions determine what actions a user, who is a member of the group that a file belongs to, can perform on the file.

- **Other (world) permissions** − The permissions for others indicate what action all other users can perform on the file.

File/Folder Access Modes

- The permissions of a file are the **first line of defense** in the security of a Unix system.

- The basic building blocks of Linux permissions are the **read**, **write**, and **execute** permissions, which have been described below.

- **Read:** grants the capability to read, i.e., view the contents of the file/folder.

- **Write:** grants the capability to modify, or remove the content of the file/folder.

- **Execute:** user with execute permissions can run a file/folder as a program.

Changing Permissions

- To change the file or the directory permissions, we can use the **chmod** (change mode) command.

Basic Shell Commands in Linux

- A **shell** is a special user program that provides an **interface** to the user to use operating system services.

1. Displaying the file contents on the terminal:

- **cat**: It is generally used to concatenate the files.

- **more**: It is a filter for paging through text one screenful at a time.

- **less**: It is used to viewing the files.

    Similar to *more* command but it allows **backward** as well as **forward** movement.

- **head** : Used to print the first **N lines of a file**; it accepts **N** as input and the default value of N is 10.

- It prints the first **10** lines of files.

- **tail** : Used to print the last **N-1 lines of a file**; it accepts **N** as input and the default value of N is 10.

- It prints the last **9** lines of files.

Cont …

2. File and Directory Manipulation Commands:

- **mkdir** : used to **create a directory** if not already exist.

- It accepts the directory name as an input parameter.

- **cp** : This command **will copy** the files and directories from the source path to the destination path.

- It can **copy a file/directory** with the new name to the destination path. It accepts the source file/directory and destination file/directory.

- **mv** : used to **move** the files or directories. This command's working is almost **similar to** *cp* command but it deletes a copy of the file or directory from **the source path**.

- **rm** : Used to remove files or directories.

- **touch** : Used to create or update a file.

3. Extract, sort, and filter data Commands:

- **grep** : this command is used to **search for the specified text** in a file.

- **sort** : this command is used to sort the contents of files.

- **wc** : Used to count the number of characters, words in a file.

- **cut** : Used to cut a specified part of a file.

Cont …

4. Basic Terminal Navigation Commands:

- **ls** : to get the list of all the files or folders.

- **ls -a:** Lists of all files including the **hidden files**, add **-a flag.**

- **cd**: Used to change the directory.

- **du**: Show disk usage.

- **pwd**: Show the present working directory.

- **man**: Used to show the **manual** of any command present in Linux.

- **rmdir**: It is used to delete a directory if it is empty.

- **locate:** It is used to locate a file in Linux System.

- **echo:** this command helps us **move some data**, usually text into a file.

- **df:** It is used to see the **available disk space** in each of the partitions in your system.

Cont …

5). File Permissions Commands

- The *chmod* and *chown* commands are used to control access to files in Linux systems.

- **chown**: Used to change the owner of the file.

- **chgrp**: Used to change the group owner of the file.

- **chmod**: Used to modify the access/permission of a user.

Working with disks and file systems

- **dd** – copy or securely erase disks and disk partitions.
- **fsck** – check filesystem integrity.
- **growfs** – grow filesystem.
- **mkfs** – make new filesystem.

Networking

- **iptables** – manage firewall rules on a Linux server.
- **netstat** – network statistics and network routing information.
- **traceroute** – tracing ICMP routes to a remote host.

Advanced File Manipulation Command (Init, Process & Threads)

▪ **Init**: is the parent of all processes, executed by the kernel during the booting of a system.

▪ Its principle role is to **create processes** from a script stored in the file **/etc/inittab**.

▪ It controls autonomous processes required by any particular system.

▪ **Threads in Linux** are nothing but a flow of execution of the **process**.

▪ A **process** containing multiple execution flows is known as **multi-threaded process**.

▪ For a non multi-threaded **process** there is only execution flow that is the main execution flow and hence it is also known as **single threaded process**.