CHAPTER 5

Systems and Network Administration

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Systems and Network Administration

- It is a branch of engineering that concerns the operational management of human-computer systems

- It addresses both the technology of computer systems and the users of the technology

- It is about putting together a network of computers, getting and keeping them running in spite of the activities of users who tend to cause the systems to fail.

System and Network Administration

- System and network administration involves the design, installation, configuration, troubleshooting, and maintenance of computing infrastructures

- It is about hardware, software, user support, diagnosis, repair and prevention

- System and network administration is an extremely demanding engineer's job

System and Network Administration

- Network and systems administrators are responsible for the day-to-day operation of these networks.

- They organize, install, and support an organization's computer **systems**, including local area networks (LANs), wide area networks (WANs), network segments, intranets, and other data communication systems

- System and network administrators need to be good at technical, administrative and socio-psychological skills.

System Administration

- System administration entails
  - knowledge of operating system and applications
  - hardware and software troubleshooting
  - knowledge of the purposes for which people in the organization use the computers.
- Problem solving is the most important skill of System administration.
- A person specialized in maintaining and operating a computer system is called system administrator (Sysadmin)

Tasks of System and Network Administrator

A system and network administrator's responsibilities might include:

- Applying operating system updates, patches, and configuration changes.
- Installing and configuring new hardware and software.
- Adding, removing, or updating user account information, resetting passwords, etc.
- Supporting and maintain servers
- System performance tuning
- Train users on software and security.

Tasks of System and Network Administrator

- Responsibility for documenting the configuration of the system.
- Responsibility for security.
- Performing backups.
- Analyzing system logs and identifying potential issues with computer systems.
- Troubleshooting any reported problems.
- Introducing and integrating new technologies into existing data center environments.
- Answering technical queries.
- Insuring that the network infrastructure is up and running
- Hardware configurations
- Software configurations

Network configuration tools

Based on command line Interface (CLI)

- **ipconfig** – network configuration to display Interface Settings
  - Ipconfig or ipconfig /all
- **Ping** –requests echo reply from a computer/Destination reachability
  - Ping hostname or IP address
  - Sends an ICMP echo request and responds an ICMP echo reply
- **traceroute** – show path taken by IP packets through a network
  - Router hops to destination
  - Traceroute [-n] hostname or IP
- T**cpdump-**show network traffic on the wire/Packet sniffing
  - Tcpdump [-e] [-n] –i fa0/0

Network configuration tools

- **Netstat**-show routing entries and listening/active sockets
  - Network performance status
  - Netstat [-n] -a
- **Arp**-show/modify IP→MAC address lookup table

  - arp -a
- **Ndp**-Show debug
- **Route**- is used to show/modify the routing table
        -Set/Display gateway
  - route [-n] get default
- **Mtr**-combines ping and traceroute
  - Mtr [hostname or IP]
- **nslookup** – DNS lookups/DNS Queries
- **netsh** – Change Interface Settings

Types of Administrations

- In a larger company, the following types of administrations may all be in separate positions within Information Services department.
- In a smaller group, they may be shared by a few sysadmins, or even a single person.

- Network Administration
- User administration
- Mail administration
- Web administration
- FTP administration
- Database systems administration
- Remote access administration
- Backup administration
- DNS/DHCP administration
- Proxy server administration

Network Administration

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

- A person who is involved in computer network and that carry out network administration is called network administrator or network specialist or network analyst.

- Network administration normally includes the deployment, configuration, maintenance and monitoring of active network gears:
  - Switches
  - Routers
  - Firewalls
  - Other network infrastructures…

Network Administration

Network administration includes activities such as

- Network address assignment
- Assignment of routing protocols and routing table configuration
- Configuration of authentication and authorization
- Maintenance of personal computers, printers, etc.
- Maintenance of network servers such as file server, VPN gateways, intrusion detection system, etc
- Network design and security
- Troubleshooting and debugging network related problems.

Directory Service (User Administration)

- Directory Service - is a software application that stores and organizes information about a computer network's users and network resources, and that allows network administrators to manage users' access to the resources.

  - LDAP (Lightweight Directory Access Protocol) is the directory service for Unix.

  - Active Directory (AD) is the directory service for Windows Server. It stores information about objects on the network and makes this information easy for administrators and users to find and use.

Directory Service (User Administration)

- With a single network logon, administrators can manage directory data and organization throughout their network, and authorized network users can access resources anywhere on the network.

- Server-client architecture

User Account management

- Accounting and restrictions

- User IDs

- Home directories (Quotas, Drive capacities)

- Permission, group membership

- Disabling/ removing user accounts

Mail Administration

- Install/configure/manage e-mail software
  - mail transfer agents.
  - mail readers.

- Managing E-mail servers
  - Email servers are open by design to accept email from anyone
  - Spam can be a problem to manage
    - Specific utilities can be used to help minimize spam
  - Viruses are commonly sent by email
    - Use virus detection software and keep it updated

Web Administrators

- Systems administrators may specialize in maintaining websites, which requires constant observation and maintenance.

- These administrators monitor the speed of the website and approve all content before it is published.

- As part of their mission to constantly improve the website, web administrators analyze data regarding the site's traffic patterns and may implement changes based on user feedback

- A web administrator maintains web server services that allow for internal or external access to web sites.

- Web server administrators focus on the internet
  - Need to work with ISPs and web page developers

Web Administration

- Web server provides information to anyone who requests it over the internet
- Tasks include
  - managing multiple sites
  - administering security
  - Control access to webpages
  - configuring necessary components and software.
  - Responsibilities include software change management.

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Web

- Hypertext Transfer Protocol (HTTP) works with the World Wide Web. A Web browser is a client-server application

- A Web browser presents data in multimedia formats on Web pages that use text, graphics, sound, and video. The Web pages are created with a format language called Hypertext Markup Language (HTML). HTML specifies locations for the placement of text, files, and objects that are to be transferred from the Web server to the Web browser.

- Hyperlinks make the World Wide Web easy to navigate

- A hyperlink is an object, word, phrase, or picture, on a Web page

Web

- When that hyperlink is clicked, it directs the browser to a new Web page

- The Web page contains, often hidden within its HTML description, an address location known as a Uniform Resource Locator (URL)

- In the URL http://www.cisco.com/edu/, the "http://" tells the browser which protocol to use. The second part, "www", is the hostname or name of a specific machine with a specific IP address. The last part, /edu identifies the specific folder location on the server that contains the default web page.

FTP Administration

- FTP is a commonly used protocol for exchanging files over any network that supports the TCP/IP protocol (such as the Internet or an intranet).

- There are two computers involved in an FTP transfer: a server and a client.

- client can do a number of file manipulation operations (if he has the authority) such as uploading files to the server, download files from the server, rename or delete files on the server and so on.

FTP Administration

- Usually users are asked to enter a username and password to access an FTP site.

- Many sites that run FTP servers enable so called "anonymous ftp". Under this arrangement, users do not need an account on the server.

- As a system and network administrator you are required to Install Internet Information Services (IIS) and Configure it for accessibility

Database Administration

- Maintaining a database system and insuring the integrity of the data and the efficiency and performance of the system is called database administration

- A person who is responsible for the environmental aspect of a database is called a database administrator (DBA)

- The duties of DBA vary and depend on the job description, corporate and IT policies and the technical features and capability of the DBMS being administered.

Database Administration

The roles of DBA include
- disaster recovery (backup)
- performance analysis and tuning
- installation of database software
- configuration of hardware and software with the system administrator
- secure the database
- data analysis, database design and data modeling and optimization

Security Administration

- Security administration needs a person who is specialist (security administrator) in computer and network security including the administration of security devices such as firewall as well as consulting on general security measures.

- Ensures that the organization's systems are secure and very difficult to hack.

- protecting security breaches.

- Becoming a very big deal!

Security Administration

- May keep watch over employees for inappropriate network usage.

- Dealing with viruses that threaten core equipment.

- In-depth firewall knowledge is required, as well as a solid understanding of system hacking.

- In case a security breach could not be averted, it is the security administrator's responsibility to close the systems, determine damages, trace the culprit and ensure that it doesn't happen again.

DNS/DHCP Administration

<u>DHCP (Port 67/68):</u>

- DHCP stands for Dynamic Host Configuration Protocol

- It is an Internet protocol for automating the configuration of computers that use TCP/IP

- DHCP can be used to automatically assign IP addresses, to deliver TCP/IP stack configuration parameters such as the subnet mask and default router, and to provide other configuration information such as the addresses for printer, time and news servers.

DHCP Administration

- Under DHCP, a computer is designated as the DHCP server. All of the other computers on the network that need an IP address - will be DHCP clients (computers that already have a permanently set IP address don't need to participate).

- The network administrator needs to initially configure the DHCP server.

- Part of that configuration process involves assigning the DHCP server a block of IP address numbers that it can dispense to nodes that need IP addresses.

DNS Administration

- When a new node comes onto the network assuming it is capable of being a DHCP client, it will broadcast a request for an IP address.

- The DHCP server will respond by checking its table of address assignments, selecting the next available address, and sending a response back to the requesting node.

- The requesting node sends acknowledgement to the server hose offer is accepted.
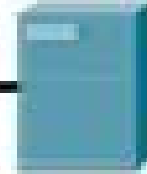
DHCP clients obtain a DHCP lease for an IP address, a subnet mask, and various DHCP options from DHCP servers in a four-step process:

DHCPDISCOVER: The client broadcasts a request for a DHCP server.

DHCPOFFER: DHCP servers on the network offer an address to the client.

DHCPREQUEST: …

DHCPACK:

DNS Administration

<u>DNS (port 53)</u>:

- DNS stands for Domain Name System

- It helps users to find their way around the Internet

- Every computer on the Internet has a unique address –"IP address". But it is hard to remember everyone's IP address

- The DNS makes it easier by allowing a familiar string of letters (the "domain name") to be used instead of the arcane IP address

- So instead of typing 192.0.34.65, you can type *www.icann.org.* It is a "mnemonic" device that makes addresses easier to remember

DNS Administration

- Translating the name into the IP address is called "resolving the domain name."

- The goal of the DNS is for any Internet user any place in the world to reach a specific website IP address by entering its domain name

- These logical names are connected to their IP address.

- The logical name that is associated to an IP address is also referred to as the *domain name*.

DNS Administration

- When a client computer wishes to communicate with the host computer, it must translate its logical name into its IP address

- It does this via a domain name lookup query, which asks a *domain name server (DNS)* the IP address of the destination host given the domain name.

- The domain name server has a set of static tables that it uses to find the IP address associated with a domain name.

Remote Access Administration

- **Remote administration** refers to any method of controlling a computer from a remote location.

- Software that allows remote administration is becoming increasingly common and is often used when it is difficult or impractical to be physically near a system in order to use it.

- A remote location may refer to a computer in the next room or one on the other side of the world. It may also refer to both legal and illegal (i.e. hacking) remote administration.

Remote Access Administration

- Any computer with an Internet connection, TCP/IP or on a Local Area Network can be remotely administered.

- For non-malicious administration, the user must install or enable server software on the host system in order to be viewed. Then the user/client can access the host system from another computer using the installed software.

- Usually, both systems should be connected to the internet, and the IP address of the host/server system must be known.

Proxy Server Administration

- A proxy server is a server that acts as an intermediary between a workstation user and the Internet so that the enterprise can ensure security, administrative control, and caching service.

- By using the proxy server you can hide, conceal and make your network id anonymous by hiding your IP address.

- A server that sits between a client application, such as a Web browser, and a real server

Proxy Server Administration

- A Proxy server administration is to configure a proxy server on Windows, and Windows applications so that the network traffic will pass through the proxy server.

You   Proxy Server   Internet
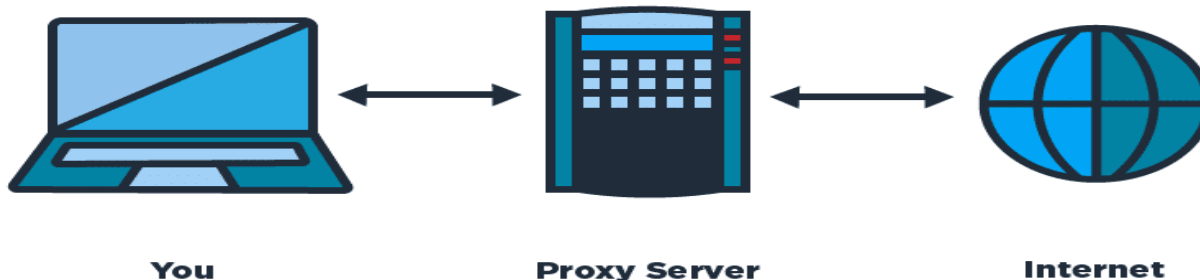
Backup Administration

- In information technology, a **backup**, or the process of backing up, refers to the copying into an archive file of computer data so it may be used to restore the original after a data loss even

- The primary purpose is to recover data after its loss, be it by data deletion or corruption.

Backup Administration

- The Backup Administrator is responsible for installing, configuring and managing data on disk storage devices and magnetic tape and associated libraries.

- They are also responsible for ensuring that the data is accessible and recoverable, ensuring that there is available capacity for allocation of new data and archiving or removing obsolete data from the system, performance using appropriate reporting & monitoring tools.

Challenges of System/Network Administration

- Systems or Network Administration is more than just installing computers or networks.

- It is about planning and designing an efficient community of computers that allow users to get their jobs done.

Challenges of Administration

- Design Logical, Efficient networks
- Easily deploy & update many machines
- Decide what services are needed
  - know the business tasks & customers
- Plan and implement adequate security
- Provide comfortable User environment
- Be able to fix errors and problems
- Keep track of & be able to use knowledge

Ethics for system and network administrators

- The task of systems and network administration is a balancing act. It requires patience, understanding, knowledge and experience.
- Codes of ethics for systems and network admin
  - Professionalism- Treat people professionally
  - Personal integrity- be honest, unbiased
  - Privacy- protect the confidentiality of any information
  - Laws and policies

Ethics for system and network administrators

- Communication

- System integrity- available the system

- Education

- Responsibility to computing community

- Social responsibility

- Ethical responsibility

Ethics for system and network administrators

- A Sysadmin is a customer service agent!
- The Sysadmin must be able to communicate with technical and non-technical users.
- The Sysadmin should be patient, and have a sense of humor.
- The Sysadmin must be able to solve difficult technical problems.
- The Sysadmin must be able to work in a group setting.
- The Sysadmin must document activities in order to reproduce the results.

Network Certifications

levels of Cisco network certification:

- Entry
- Associate
- Professional
- Expert
- Architect

Entry

- Both the CCENT and the CCT certifications serve as starting points for individuals interested in starting a career as a networking professional.
  - CCENT- **Cisco Certified Entry Networking Technician**
  - CCT- **Cisco Certified Technician**

Associate

- The Associate level of Cisco Certifications can begin directly with
  - CCNA (**Cisco Certified Network Associate**) for network installation, operations and troubleshooting or
  - CCDA (**Cisco Certified Design Associate)** for network design.
- Think of the Associate Level as the foundation level of networking certification.
  - CCDA
  - CCNA Cloud
  - CCNA Collaboration
  - CCNA Cyber Ops
  - CCNA Data Center
  - CCNA Industrial
  - CCNA Routing and Switching
  - CCNA Security
  - CCNA Service Provider
  - CCNA Wireless

Professional

The **Cisco Certified Network Professional (CCNP)** level is an advanced level of certification that shows more expertise with networking skills. Each certification covers a different technology to meet the needs of varying job roles.

- CCDP- **Cisco Certified Design Professional**

- CCNP Cloud

- CCNP Collaboration

- CCNP Data Center

- CCNP Routing and Switching

- CCNP Security

- CCNP Service Provider

- CCNP Wireless

Expert

The Cisco Certified Internetwork Expert (CCIE) certification is accepted worldwide as the most prestigious networking certification in the industry.

- CCDE- Cisco Certified Design Expert
- CCIE Collaboration
- CCIE Data Center
- CCIE Routing and Switching
- CCIE Security
- CCIE Service Provider
- CCIE Wireless

Architect

Cisco Certified Architect is the highest level of accreditation achievable and recognizes the architectural expertise of network designers who can support the increasingly complex networks of global organizations and effectively translate business strategies into evolutionary technical strategies.

- **CCAr –** Cisco Certified Architect