UNIT I

What is a System Administrator?

System Administrator

A system administrator (sysadmin) is an information technology professional who supports a multiuser computing environment and ensures continuous, optimal performance of IT services and support systems.

Sysadmins are responsible for ensuring the uptime of their companies' computers, servers, and internet -- basically "keeping the lights on" to limit work disruptions. This includes system maintenance and configuration, such as installing and troubleshooting hardware and software and assessing new technologies for their companies.

Depending upon an organization's specialty, information system administrator job titles may include a data center administrator, computer network administrator, virtualization administrator, server administrator, or database administrator.

Depending upon the organization's culture, a system administrator may also be referred to as a system operator or application support engineer.

Why System Administration?

- Great starting point in IT
- In-demand with fantastic pay
- Learning on the job is the job
- It's satisfying and rewarding

Roles of a System Administrator

- Sysadmins must be comfortable working with applications and file servers, desktops, routers, wide area networks, databases, information security systems cybersecurity protocols, and storage.

- Should be skilled at problem-solving in multiple operating systems, such as Linux, Microsoft, and others.

- Should be familiar with tasks related to scripting, automation, and programming. Increasingly, virtualization and cloud computing skills have also become essential to the job.

Responsibilities of a System Administrator

- Applying Operating System Updates
- Configuring Systems and Software
- Securing Access to Systems and Data
- Performing Backups and Restores

- Analyzing and Troubleshooting
- Assisting Users and Team Members

Reminders for being a SysAdmin…

However, the ability to troubleshoot, manage firewalls, and provide technical support aren't the only skills required for sysadmins. (people skills) are just as necessary as sysadmins because they interact with people in so many areas of IT and business. When IT services are slow or down entirely, a system administrator must be able to work under pressure, read a situation as it unfolds, and quickly decide on a response that yields the best result for all involved.

Training and Certifications needed

Computer system administrators – and most IT professionals for that matter – are expected to have at least one, but preferably multiple, certifications for the job.

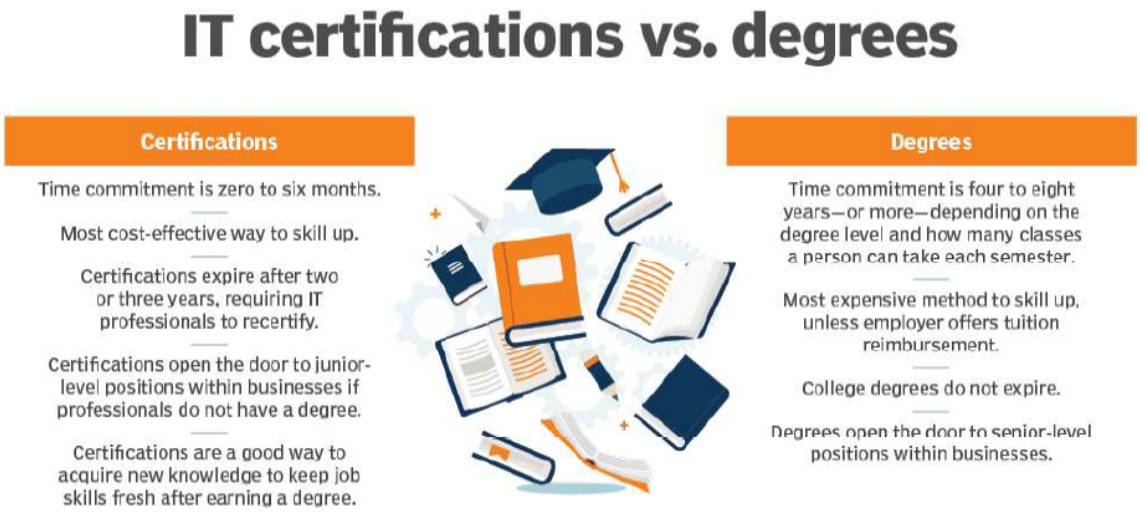
Depending on the technologies used within the enterprise, common certifications in demand include:

- Microsoft Certified Solutions Associate
- CompTIA Server +
- Cisco Certified Network Associate
- Red Hat Certified SystemAdministrator

Vendor Neutral Certifications

Certifications that DO NOT TARGET specific technology, platform or vendors like Google, Apple, or Microsoft. These are baseline certifications that apply to all vendors and technologies.

Example: CompTIA



UNIT II

What is a Server?

A server is a computer program or device that provides a service to another computer program and its user, also known as the client.

In a data center, the physical computer that a server program runs on is also frequently referred to as a server. That machine might be a dedicated server, or it might be used for other purposes.

A server program awaits and fulfills requests from client programs, which might be running in the same, or other computers. A given application in a computer might function as a client with requests for services from other programs and as a server of requests from other programs.

Types of Servers

Web server

A computer program that serves requested HTML pages or files. In this case, a web browser acts as the client.

Application Server

A program in a computer in a distributed network that provides the business logic for an application program.

Proxy Server

Software that acts as an intermediary between an endpoint device, such as a computer, and another server from which a user or client is requesting a service.

Mail Server

An application that receives incoming emails from local users -- people within the
same domain -- and remote senders and forward outgoing emails for delivery.

Virtual Server

A program running on a shared server that is configured in such a way that it seems to each user that they have complete control of a server.

File Server

A computer is responsible for the central storage and management of data files so that other computers on the same network can access them.

Database Server

This server is responsible for hosting one or more databases. Client applications perform database queries that retrieve data from or write data to the database that is hosted on the server.

Print Server

This server provides users with access to one or more network-attached printers – or print devices as some server vendors call them.

The print server acts as a queue for the print jobs that users submit. Some print servers can prioritize the jobs in the print queue based on the job type or on who submitted the print job.

Types of Server Machines

Tower Server

Tower servers are the most basic types of servers and are often mistaken to be the traditional CPU of a desktop computer. On the outside, a tower server looks and feels much like a traditional tower PC. These servers are designed to offer a basic level of performance and are therefore on a lower-end even in terms of price. However, there is currently a wide range of tower servers that can be very costly and can handle large and multiple tasks.

Tower servers can consume a good amount of physical space to be installed and used. Due to their big and bulky form factor (most of the time), it becomes difficult to physically manage them. Also, due to size, stacking them on top of one another or rearranging them from place to place is difficult.

Each and every individual tower server consumes a good amount of office space and also needs an individual KVM (Keyboard, Video, and Mouse) switch in order to be managed; otherwise, you'd have to unplug each to control each device. Moreover, if you have a lot of network devices or peripherals that connect to servers, then dealing with the cabling is not an easy affair, especially with tower servers.

Tower servers usually don't come pre-installed with any additional features such as an advanced graphic card, a dedicated fan for cooling, dedicated higher memory, KVM kits, and more. However, this makes it an ideal choice for the business or organization, which has a plan to upgrade its servers in the near future. Having that said, upgrading the tower servers is easy and cost-effective.

Tower Server (Interface)

Rack / Rackmount Server

This server is responsible for hosting one or more databases. Client applications perform database queries that retrieve data from or write data to the database that is hosted on the server.

Rack servers are smaller than that of tower servers and are mounted inside a rack. These racks are similar to that of a normal rack, which we use to stack up a set of files and folders. A rack server is designed to be positioned in a bay, by vertically stacking servers one over the other along with other devices such as storage units, cooling systems, SAN devices, network peripherals, and batteries.

The racks used for mounting these rack servers adhere to IEEE standards and are typically measured in rack units, or “U’s”. Each U is around 19” wide and 1.5-1.75” tall. The advantage of using these racks is that it allows the user to stack up other electronic devices along with the servers. A single rack can contain multiple servers along with additional devices as mentioned above. Therefore, these rack servers are pretty much convenient to use and consume less space than that of a tower server.

Since a rack is housed with all the devices together, the cable management becomes a little cleaner as they are relatively easy to organize due to the presence of management tools in the rack. However, you'd still have to deal with a lot of cabling in
a rack server.

Like the tower servers, most of the rack servers also need to be connected with KVM switches to operate. Rack servers are expandable in terms of processors, RAM, and storage. However, you'd need to arrange the space in the rack to accommodate the upgrades.

Rack / Rackmount Server (Interface)

Blade Server

A blade server is a modular server that allows multiple servers to be housed in a smaller area. These servers are physically thin and typically only have CPUs, memory, integrated network controllers, and sometimes storage drives built in. Any video cards or other components that are needed will be facilitated by the server chassis which is where the blades slide into.

Blade servers are often seen in large data centers. Due to their ability to fit so many servers into one single rack and their ability to provide a high processing power.

Blade servers are generally used when there is a high computing requirement with some type of Enterprise Storage System: Network Attached Storage (NAS) or a Storage Area Network (SAN). They maximize available space by providing the highest processor per RU availability. Blade Servers also provide rapid serviceability by allowing components to be swapped out without taking the machine offline. You will be able to scale to a much higher processor density using the Blade architecture. The facility will need to support a much higher thermal and electrical load per square foot.

Blade Server (Interface)

Server Operating Systems

Windows Server

Is a brand name for a group of server operating systems released by Microsoft since 2003. The first Windows server edition to be released under that brand was Windows Server 2003. However, the first server edition of Windows was Windows NT 3.1 Advanced Server, followed by Windows NT 3.5 Server, Windows NT 3.51 Server, Windows NT 4.0 Server, and Windows 2000 Server. Windows 2000 Server was the first server edition to include Active Directory, DNS Server, DHCP Server, Group Policy, as well as many other popular features used today.

Linux Server

A Linux server is a variant of the Linux operating system that is designed to handle more intense storage and operational needs of larger organizations and their software. Linux servers are widely used today and considered amongst the most popular due to their stability, security, and flexibility, which outstrip standard Windows servers.

Additionally, Linux Servers are generally lighter to run on both physical and cloud servers because they don't require a graphics interface.

Redundant Array of Independent Disks

RAID

Redundant Array of Independent/Inexpensive Disks (RAID) is a technology that allows storing data across multiple hard drives. The purpose of RAID is to achieve data redundancy to reduce data loss and, in a lot of cases, improve performance.

The best way to get in on the RAID action is with a NAS.

Key Terminologies in RAID

Striping

Splitting the flow of data into blocks of a certain size (called "block size") and then writing these blocks across the RAID one by one. This way of data storage affects the performance.

Mirroring

Is a storage technique in which identical copies of data are stored on the RAID members simultaneously. This type of data placement affects the fault tolerance as well as the performance.

Parity

Is a storage technique that utilizes striping and checksum methods. In the parity technique, a certain parity function is calculated for the data blocks. If a drive fails, the missing block is recalculated from the checksum, providing the RAID fault tolerance.

Fault Tolerance

Which is the ability to survive one or several disk failures.

Performance

Which shows the change in the read and write speed of the entire array as compared to a single disk.

RAID Configuration

RAID 0 - Striping

System data are split up into blocks that get written across all the drives in the array. By using multiple disks (at least 2) at the same time, this offers superior I/O performance.

Advantages of RAID 0

- RAID 0 offers great performance, both in read and write operations. There is no overhead caused by parity controls.
- All storage capacity is used, and there is no overhead.
- The technology is easy to implement.

Disadvantages of RAID 0

- RAID 0 is not fault-tolerant. If one drive fails, all data in the
- RAID 0 arrays are lost. It should not be used for mission-critical systems.

RAID 1 - Mirroring

Data are stored twice by writing them to both the data drive (or set of data drives) and a mirror drive (or set of drives). If a drive fails, the controller uses either the data drive or the mirror drive for data recovery and continuous operation. You need at least 2 drives for a RAID 1 array.

Advantages of RAID 1

- RAID 1 offers excellent read speed and a write speed that is comparable to that of a single drive.
- In case a drive fails, data do not have to be rebuilt, they just have to be copied to the replacement drive.
- RAID 1 is a very simple technology.

Disadvantages of RAID 1

- The main disadvantage is that the effective storage capacity is only half of the total drive capacity because all data gets written twice.
- Software RAID 1 solutions do not always allow a hot swap of a failed drive. That means the failed drive can only be replaced after powering down the computer it is attached to. For servers that are used simultaneously by many people, this may not be acceptable. Such systems typically use hardware controllers that support hot Swapping.

RAID 5 – Striping with Parity

RAID 5 is the most common secure RAID level. It requires at least 3 drives but can work with up to 16. Data blocks are striped across the drives and on one drive a parity checksum of all the block data is written. The parity data are not written to a fixed drive, they are spread across all drives, as the drawing below shows. Using the parity data, the computer can recalculate the data of one of the other data blocks, should those data no longer be available. That means a RAID 5 array can withstand a single drive failure without losing data or access to data.

Advantages of RAID 5

- Read data transactions are very fast while write data transactions are somewhat slower (due to the parity that has to be calculated).
- If a drive fails, you still have access to all data, even while the failed drive is being replaced and the storage controller rebuilds the data on the new drive.

Disadvantages of RAID 5

- Drive failures have an effect on throughput, although this is still acceptable.
- This is complex technology. If one of the disks in an array using 4TB disks fails and is replaced, restoring the data (the rebuild time) may take a day or longer, depending on the load on the array and the speed of the controller. If another disk goes bad during that time, data are lost forever.

RAID 6 – Striping with Double Parity

RAID 6 is like RAID 5, but the parity data are written to two drives. That means it
requires at least 4 drives and can withstand 2 drives dying simultaneously. The chances that two drives break down at exactly the same moment are of course very small.

However, if a drive in a RAID 5 system dies and is replaced by a new drive, it takes hours or even more than a day to rebuild the swapped drive. If another drive dies during that time, you still lose all of your data. With RAID 6, the RAID array will even survive that second failure.

Advantages of RAID 6

- Like with RAID 5, read data transactions are very fast.
- If two drives fail, you still have access to all data, even while the failed drives are being replaced. So RAID 6 is more secure than RAID 5.

Disadvantages of RAID 6

- Write data transactions are slower than RAID 5 due to the additional parity data that have to be calculated. In one report I read the write performance was 20% lower.
- Drive failures have an effect on throughput, although this is still acceptable.
- This is complex technology. Rebuilding an array in which one drive failed can take a long time.

RAID 10 (One Zero)

It is possible to combine the advantages (and disadvantages) of RAID 0 and RAID 1 in one single system.

This is a nested or hybrid RAID configuration. It provides security by mirroring all data on secondary drives while using striping across each set of drives to speed up data transfers.

Advantages of RAID 10

- If something goes wrong with one of the disks in a RAID 10 configuration, the rebuild time is very fast since all that is needed is copying all the data from the surviving mirror to a new drive. This can take as little as 30 minutes for drives of 1 TB.

Disadvantages of RAID 10

- Half of the storage capacity goes to mirroring, so compared to large RAID 5 or RAID 6 arrays, this is an expensive way to have redundancy.

JBOD (Just a Bunch of Disks)

JBOD arrays do not usually have any formal structure or pooling architecture within them. Each drive in the system can be accessed individually

or as a combined unit. The disks utilized within the JBOD can be of any size. It does not support redundancy and improves the performance of the underlying system. Failure of one drive within the volume can result in failure of the whole volume. The drives can be pooled together using disk volume technologies or applications.