



# **System Administration**



# Introduction to System Administration and Server Operating System

System Administration and Maintenance

## **By the end of this module:**

- Discuss the different components of a Computer System;
- Identify the duties and Responsibilities of a System Admin;
- Justify how resources will be allocated for the various administrative domains.
- Formulate policies governing the use of IT Systems within the organization



# Introduction to System Administration and Server Operating System

System Administration and Maintenance

## What are we going to learn in this course?

- The course provides students with a mixture of theory and practice related to system administration, also, it aims to extract ideas and principles of system administration that are essential to day-to-day basis and present them in a defensible manner.
- The course also trains students on how to plan, deploy, and maintain modern computer systems, with particular emphasis on the administration of user accounts. It also includes an overview of basic administrative tasks associated with network operating systems such as Windows or Linux.



# Introduction to System Administration and Server Operating System

## What is Systems Administration?

- It is the field of IT that is responsible for maintaining reliable computer systems in a *multi-user environment*.
- It is the task of managing an entire organization's *computer network* or any existing interconnected computer systems, backing up organization data, and executing data recovery in case of disaster.





# System Administrators and Duties





### What or Who are System Administrators?

- Also known as **sysadmins**, the unsung heroes in any organization.
- They work in the background to make sure a company's IT infrastructure is always working, constantly fighting to prevent IT disasters from happening.
- They are the IT personnel that manage the IT infrastructure of an organization including, software, hardware, network, and services required for an organization to operate in an enterprise IT environment.





## System Administrators and Duties

### Duties of Systadmins:

- Install, Setup
- Implement, Deploy
- Manage, Maintenance, Monitor
- Support
- Troubleshoot
- Security
- Backup

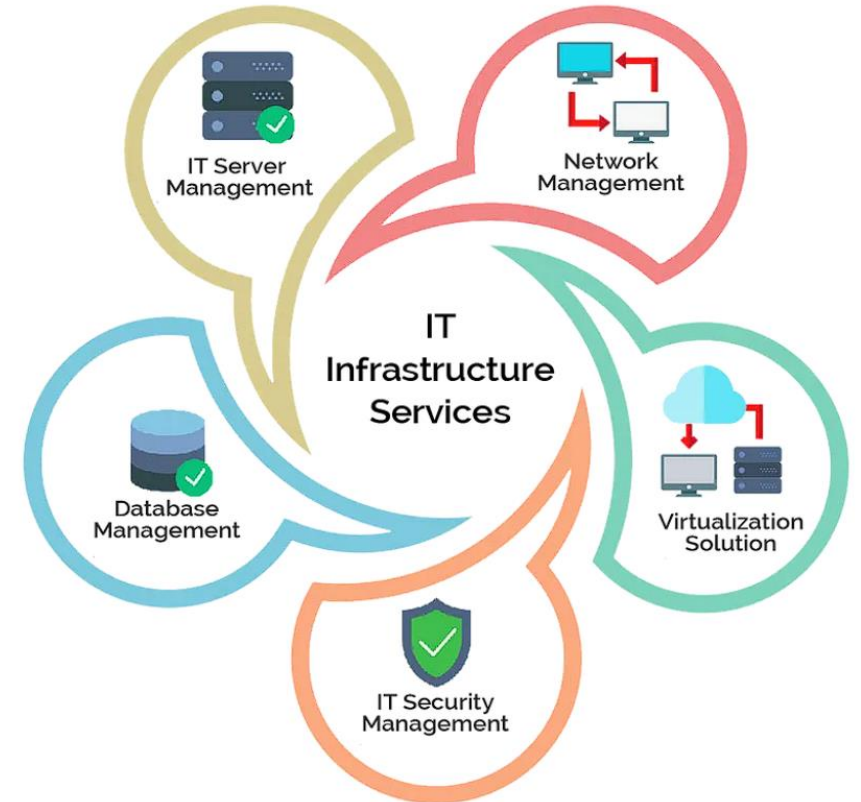






# IT Infrastructure

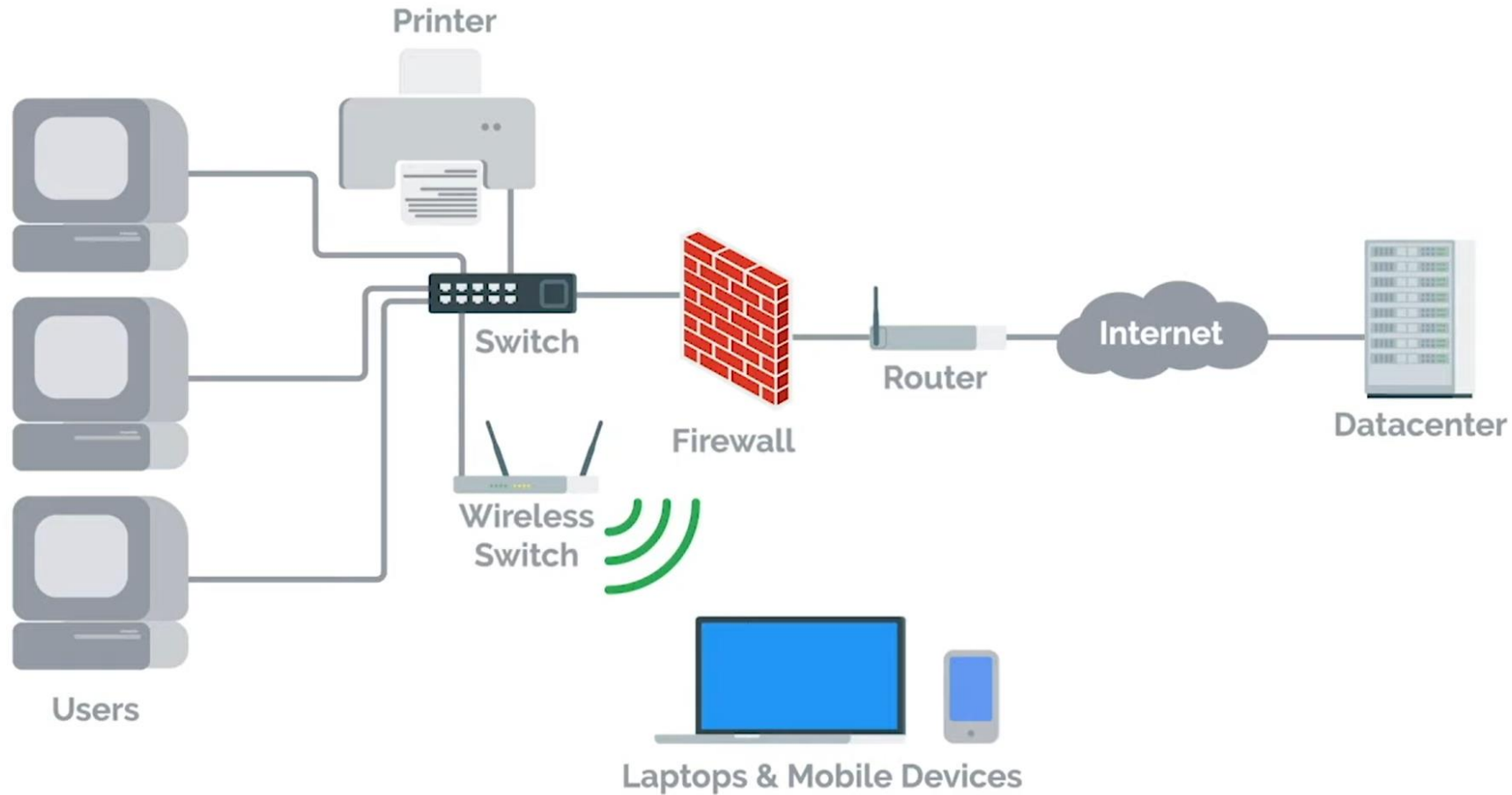
It encompasses the software, hardware, network, and services required for an organization to operate in an enterprise IT environment







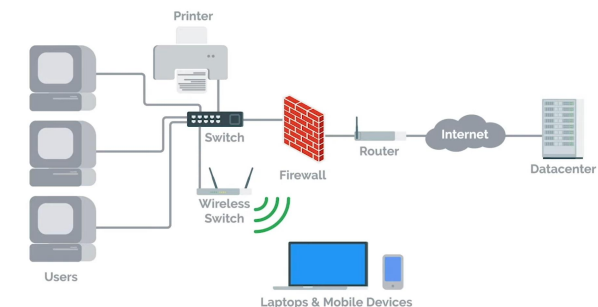
# Computer Systems





# Computer Systems

- A computer system is a combination of computer hardware and software that are connected to a network along with internet access to reach out to clients.
  - *Example:* Organization Website, Portals, Information Data Systems etc.
- Computer systems work with the help of four basic works: **INPUT, STORAGE, PROCESSING, and OUTPUT.**





# Computer Systems

**Server** - Software or a machine that provides services to other software or machines.

*Example: Web Server, Email Server, SSH Server etc.*

**Server Clients** – request services from a server and in turn the servers respond with these services.

**Server Hardware** – a powerful hardware that needs to run almost all the time to support the services of an existing servers.

*Example: Tower Servers, Rack Servers, Blade Servers*



Tower Server



Rack Server

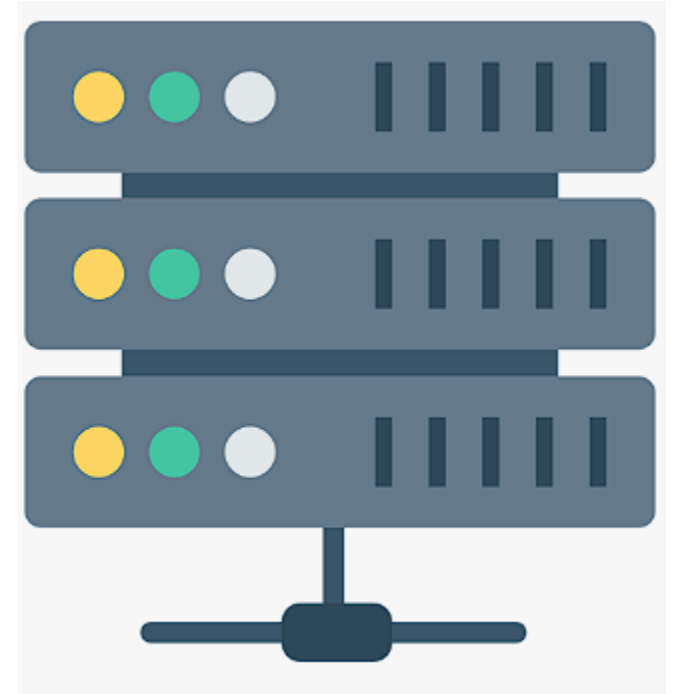


Blade Server



### How do you manage multiple servers?

1. Centralized Management Tools
2. Monitoring and Logging
3. Automation
4. Security Management
5. Backup and Recovery
6. Cloud and Hybrid Solutions



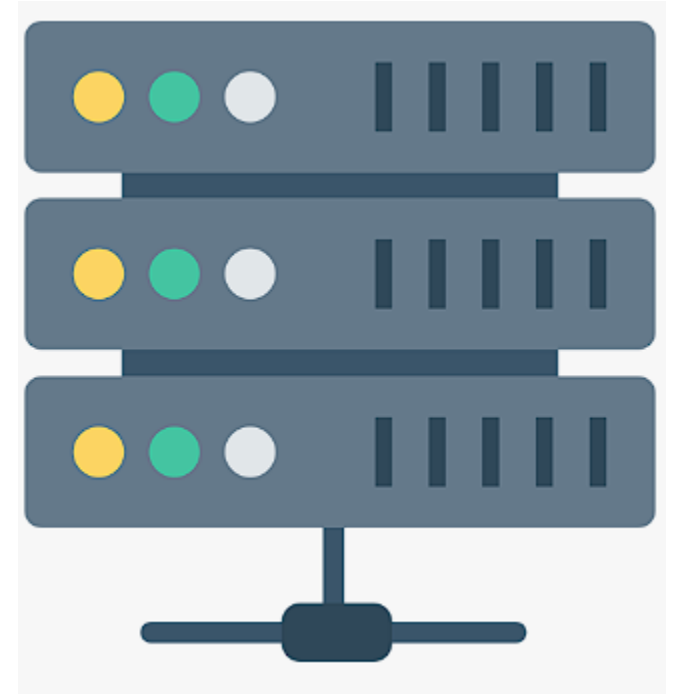


## How do you manage multiple servers?

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### 1. Centralized Management Tools

- Configuration Management Tools: these are tools that allow administrators to define configurations in code and apply them across multiple servers. These tools help ensure consistency and reduce the chance of configuration drift, which can occur when servers are manually updated.
  - *Examples: Ansible, Puppet, Chef, and SaltStack ;*
- Server Orchestration: these are tools that help automate the deployment, scaling, and management of applications across multiple servers or clusters.
  - Kubernetes (for containerized applications) or Terraform (for infrastructure as code)



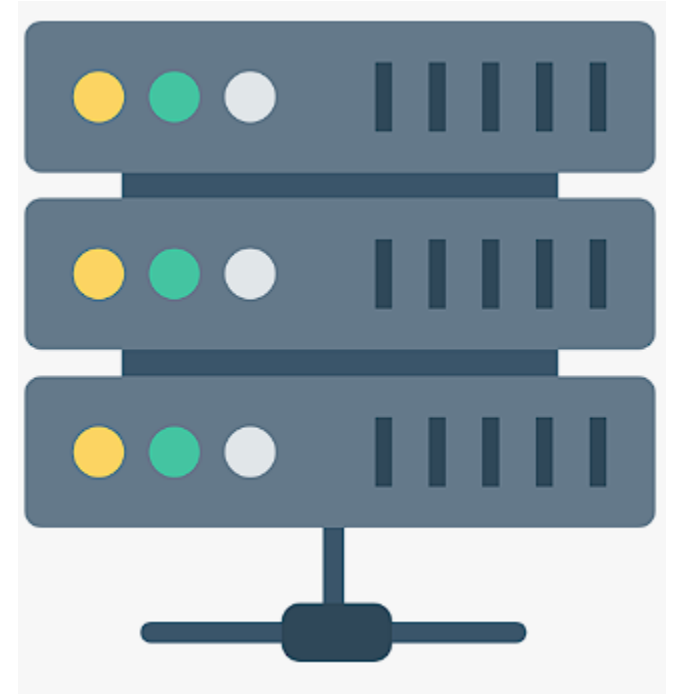


## How do you manage multiple servers?

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### 2. Monitoring and Logging

- Monitoring: Tools like Nagios, Zabbix, Prometheus, and Datadog monitor server performance, resource usage, and availability. Alerts can be set up to notify administrators of any issues, such as high CPU usage or low disk space.
- Centralized Logging: Solutions like ELK Stack (Elasticsearch, Logstash, Kibana), Splunk, or Graylog collect and analyze logs from multiple servers in one location. This centralization makes it easier to identify and troubleshoot issues.



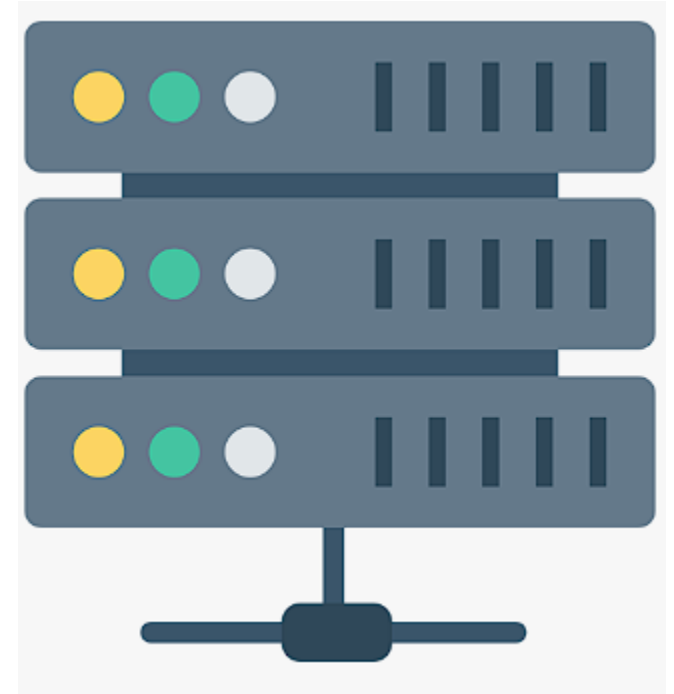


## How do you manage multiple servers?

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### 3. Automation

- Scripts and Automation: Writing scripts (in Bash, Python, PowerShell, etc.) for routine tasks like backups, updates, or deployments can save time and reduce errors. Automation tools like Cron (Linux) or Task Scheduler (Windows) can be used to run these scripts on a schedule.
- Infrastructure as Code (IaC): IaC tools like Terraform, AWS CloudFormation, and Azure Resource Manager allow infrastructure to be defined in code and versioned. This enables reproducible environments and automated provisioning of servers.





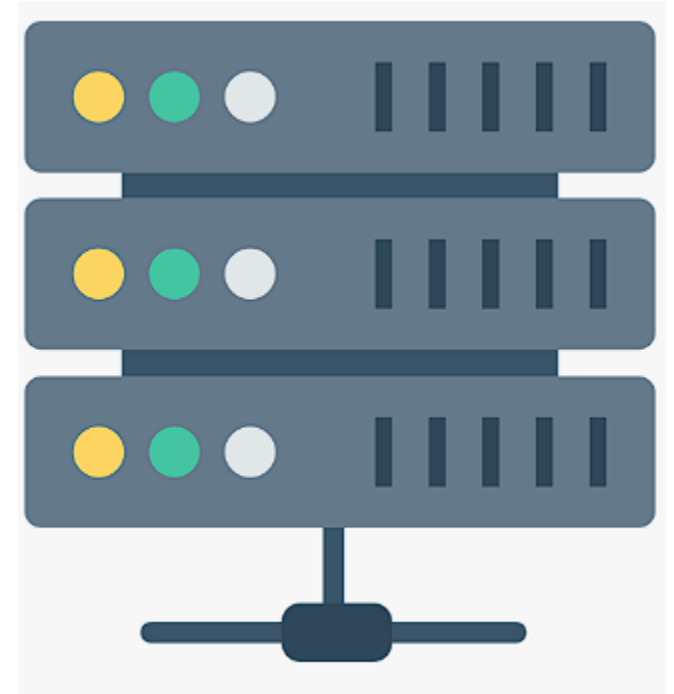


## How do you manage multiple servers?

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### 4. Security Management

- Access Control: Implementing strict access controls with tools like SSH keys, Active Directory, or LDAP ensures that only authorized users can access servers. Using tools like Vault or AWS IAM can help manage and rotate credentials securely.
- Patching and Updates: Regularly applying patches and updates is essential to protect servers from vulnerabilities. Automation tools can help apply patches consistently across multiple servers.



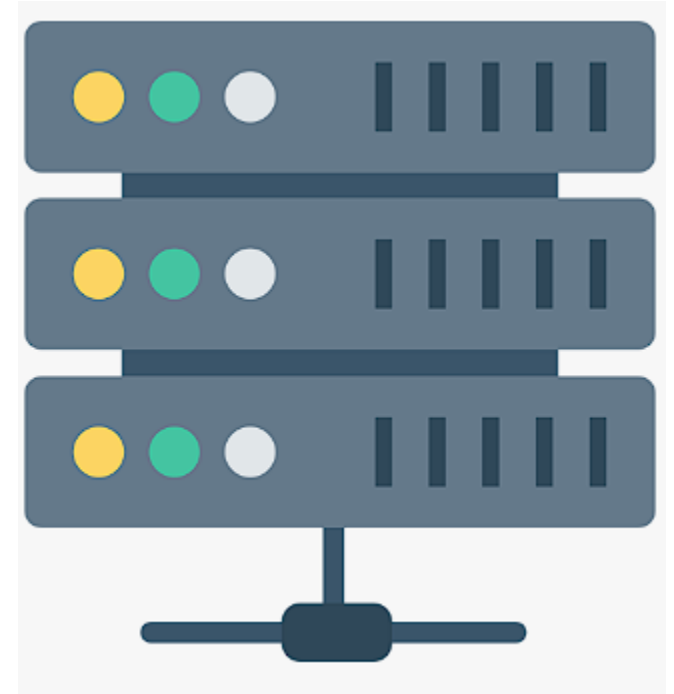


## How do you manage multiple servers?

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### 5. Backup and Recovery

- Regular Backups: Automated backup solutions ensure data is regularly backed up and can be quickly restored in the event of a failure. Tools like Veeam, Bacula, or cloud-based solutions (AWS Backup, Azure Backup) are commonly used.
- Disaster Recovery Planning: Having a well-defined disaster recovery plan, including failover strategies and data recovery processes, is crucial for minimizing downtime and data loss.



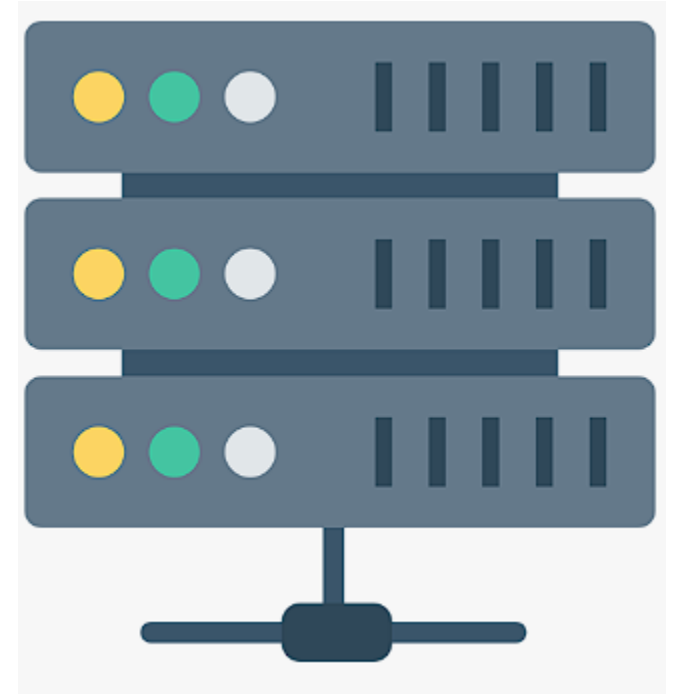


## How do you manage multiple servers?

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### 6. Cloud and Hybrid Solutions

- Cloud Management: Utilizing cloud platforms like AWS, Azure, or Google Cloud can simplify server management through their built-in tools and services, such as auto-scaling, managed databases, and serverless computing.
- Hybrid Environments: Managing both on-premises and cloud servers requires tools that support hybrid environments, ensuring seamless management across different infrastructures.





# What is Cloud Computing?

## Cloud Computing

- It is a technology that allows individuals and businesses to access and use computing resources (such as servers, storage, databases, networking, software, and more) over the internet ("the cloud") rather than owning and maintaining physical hardware and software on-site.





## Benefits of Cloud Computing

1. **Cost Efficiency:** Reduces the capital expense of buying hardware and software and setting up and running on-site data centers. It also allows companies to pay for only what they use, often referred to as a "pay-as-you-go" model.
2. **Scalability:** Easily scale resources up or down based on demand, without the need for significant upfront investment or infrastructure changes.
3. **Performance:** Cloud providers regularly upgrade to the latest, most powerful hardware, ensuring high performance and reliability.





## Benefits of Cloud Computing

4. **Disaster Recovery and Backup:** Cloud services often come with built-in backup and recovery solutions, providing peace of mind and minimizing downtime.
5. **Collaboration and Flexibility:** Cloud computing facilitates collaboration among teams, as users can access applications and data from anywhere, making it ideal for remote work and global businesses.
6. **Security:** Most cloud providers implement robust security measures and offer tools to help protect data, applications, and infrastructure from potential threats.





### What is a Data Center?

- A facility that stores hundreds, if not thousands, of servers;
- Companies with large amounts of data have to keep their information stored in places like data centers. Large companies like Google and Facebook usually own their data centers because they have billions of users who always need access to their data.
- instead of holding onto terabytes of storage space on your laptop, you can upload that data to a file storage service like Dropbox, which stores that data in a managed location like a data centre.







# System Administration Tasks

- Organizational Policies
- IT Infrastructure Services
- User and Hardware Provisioning
- Routine Maintenance
- Troubleshooting and Managing Issues





### Organizational Policies

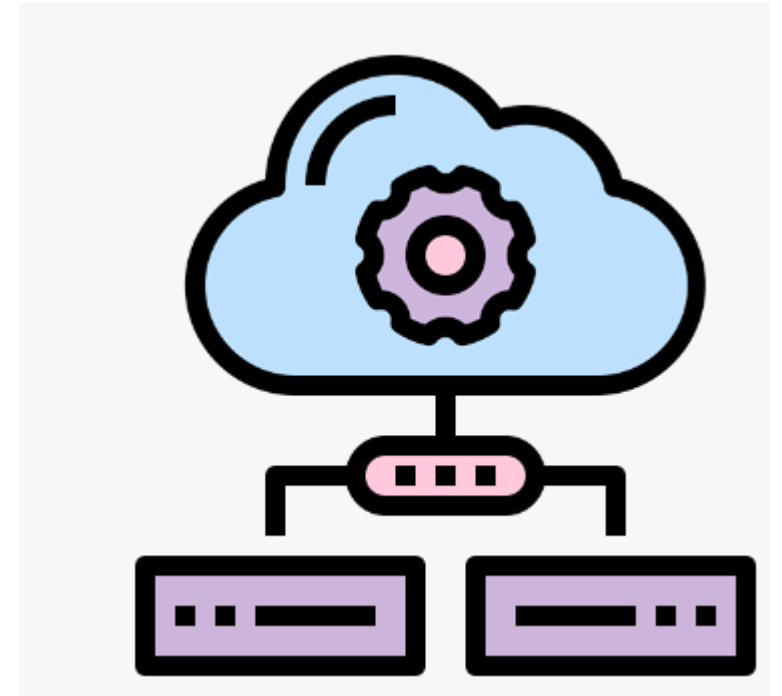
- Should users be allowed to install software?
- Should users have complex passwords with certain requirements?
- Should users be allowed to view non-work-related websites, like Facebook?
- If you hand out a company phone to an employee, should you set a device password?





### IT Infrastructure Services

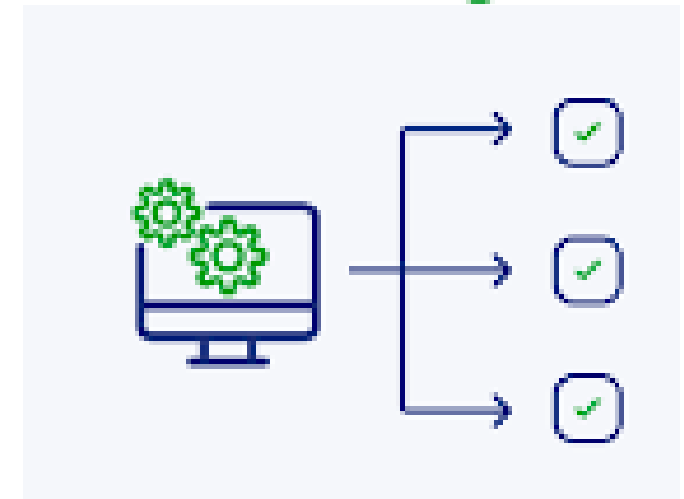
- As an IT support specialist doing system administration, you'd be responsible for the IT infrastructure services in your organization.
- Managing services doesn't just mean setting them up. They have to be updated routinely, patched for security holes, and compatible with the computer within your organization.





### User and Hardware Provisioning

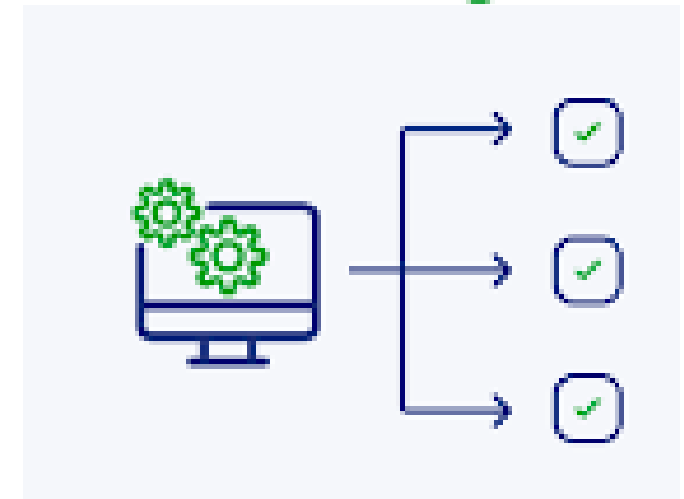
- One other responsibilities sys admins have is managing users and hardware.
- Sysadmins have to be able to create new users and give them access to their company's resources and vice versa.
- Sysadmins are also responsible for user machines. They have to make sure a user is able to log in and that the computer has the necessary software that a user needs to be productive.





### User and Hardware Provisioning (continue...)

- Aside from providing the needed hardware sysadmins also need to take note of the hardware life cycle of each machine.
- When was it built?
- When was it first used?
- Did the organization buy it brand new or was it used?
- Who maintained it before?
- How many users have used it in the current organization?
- What happens to this machine if someone needs a new one?

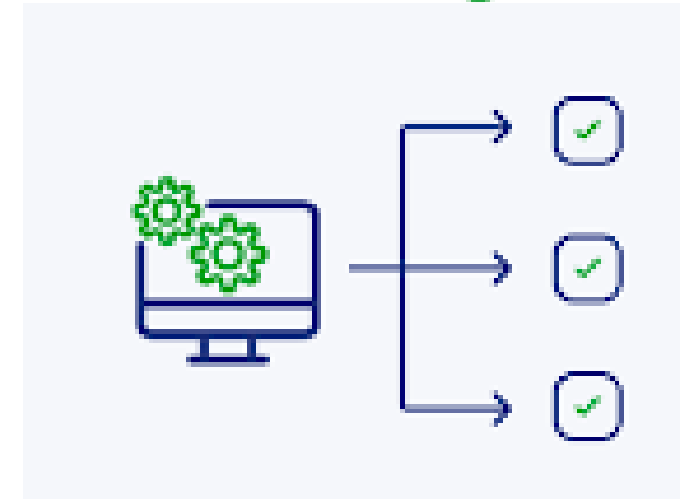




### User and Hardware Provisioning (continue...)

#### Hardware Life Cycle Phases

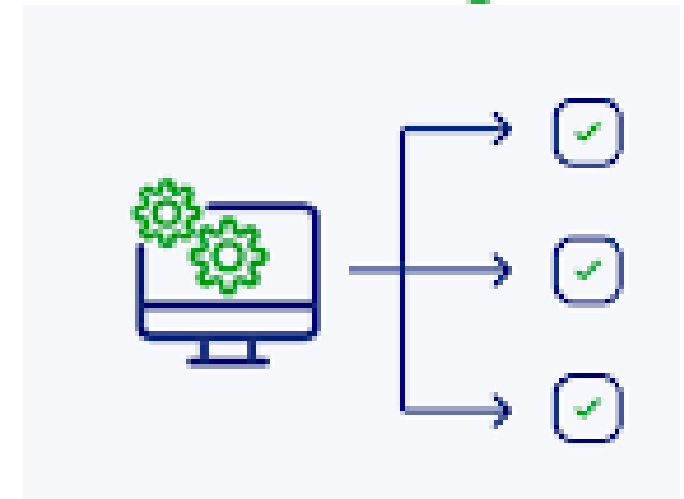
- Procurement
- Deployment
- Maintenance
- Retirement





### Routine Maintenance

- **Batch Update.** This means that once every month or so, you update all your servers with the latest security patches. You have to find time to take their services offline, perform the update, and verify that the new update works with the service.

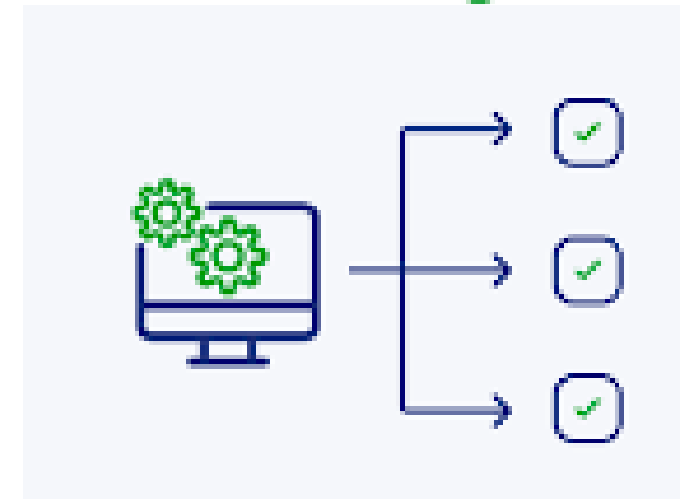






### Troubleshooting and Managing Issues

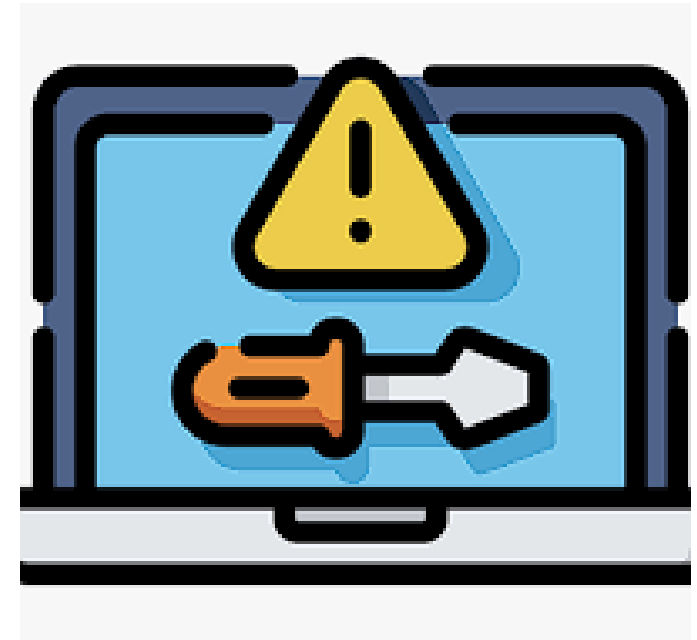
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### Troubleshooting and Managing Issues

If a server that the sysadmin manages stops providing services to a thousand users and one person had an issue about the printer, which do you think would have to be worked on first?





### Troubleshooting and Managing Issues

**Troubleshooting.** The first is troubleshooting, asking questions, isolating the problem, following the cookie crumbs, and reading logs are the best ways to figure out the issue





## System Administration Tasks

### Troubleshooting and Managing Issues

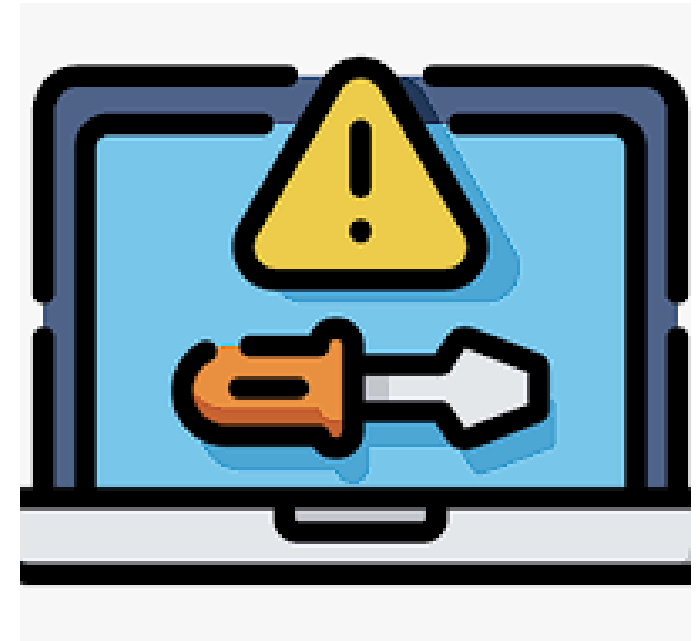
**Customer Service.** Showing empathy, using the right tone of voice and dealing well with difficult situations.





### Troubleshooting and Managing Issues

**Bug/Ticketing System.** This is where users can request help on an issue and then you can track your troubleshooting work, through the ticketing system.





## Learning Activity 1

1. What is the importance of an IT infrastructure?
2. What are the drawbacks of Cloud Computing?
3. Give one duty of systemadmin and discuss its importance



## Learning Activity 2

### 1. Given the following situations, answer the questions that follow:

**A. *Scenario:*** Several employees have reported receiving phishing emails that appear to come from a trusted source within the organization.

***Question:*** What actions would you take to protect the network, inform employees, and ensure that all responses align with the organization's security policies?

**B. *Scenario:*** A department head requests elevated access for a new employee to several systems that contain sensitive data.

***Question:*** How would you evaluate this request and determine whether it aligns with organizational policies on user privileges and least privilege principles?





## Learning Activity 2

### 1. Given the following situations, answer the questions that follow:

**A. *Scenario:*** You discover that an employee has been accessing sensitive data they are not authorized to view.

***Question:*** How would you handle this situation to ensure both the immediate security of the system and adherence to organizational policies?

**B. *Scenario:*** A system audit reveals that a senior employee has been bypassing security protocols to use unauthorized software.

***Question:*** How would you handle this policy violation while ensuring fairness, adherence to organizational policies, and minimizing any potential impact on operations?