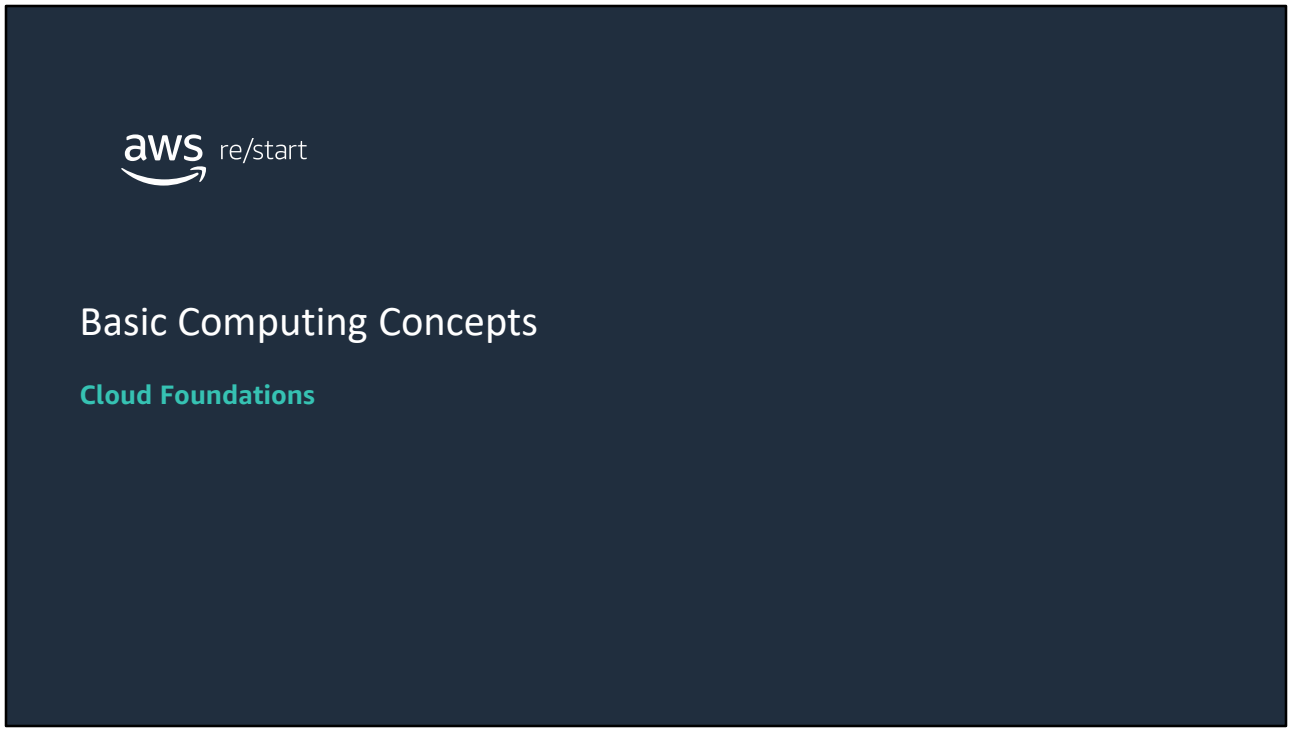

Welcome to Basic Computing Concepts.

What you will learn

At the core of the lesson

You will learn how to do the following:

- Describe servers and data centers.
- Discuss computing technology that makes cloud computing possible.
- Describe how software is developed.

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After completing this module, you should be able to do the following:

- Describe servers and data centers.
- Discuss computing technology that enables cloud computing.
- Describe how software is developed.

Servers and data centers

What is a server?

A server is a computer that provides data or services to other computers.

- A server provides a response to a request from a client computer over a network.
- Server hardware typically differs from desktop hardware to support the following:
  - More memory and multiple CPUs
  - Redundant power supplies and network interfaces
  - Smaller form factor
- Examples of servers include the following:
  - Web server
  - Database server
  - Mail server

aws re/start

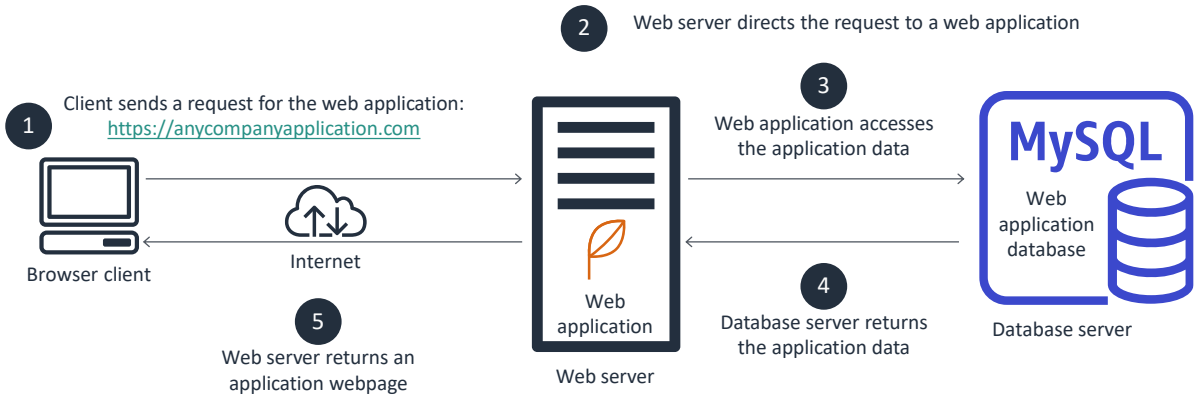
A server is a computer that provides resources or services to other computers over a network.

The many different types of servers include the following:

- A web server is used by web applications to serve Hypertext Markup Language (HTML) pages to a requesting client.
- A database server hosts database software that applications use to store and retrieve data.
- A mail server is used to send and receive email from and to clients.

Client and server example: Web application

A web application runs on a web server and accesses a database server.



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Running a web application is an example use case for servers. A web application is typically deployed to a web server, which is responsible for directing client requests to it. A web application usually stores its application data on a database server. The database server runs a special type of software that's called a database management system (DBMS). The DBMS controls the organization, security, and access of the data. Examples of a DBMS are MySQL, an open-source relational database management system; and Oracle, a relational DBMS that Oracle Corporation owns and offers.

The following list shows the flow of information in the example:

1. The user opens a browser on a client machine and enters the address of the web application's homepage. This address is called its home Uniform Resource Locator (URL) (for example, https://anycompanywebapp.com).
2. The web server receives the client request and directs it to the appropriate web application.
3. The web application sends a request to the database server to access its application data.
4. The database server returns the requested data to the web application.
5. The web application builds the response webpage and passes it to the web server, which returns the page to the client browser.

Where does a server reside?

Servers reside in a data center.

A data center hosts all of an organization's computer and networking equipment, including the following:

- Servers
- Storage devices
- Network devices (routers, switches, and hubs)
- Cooling equipment
- Uninterruptable power supplies (UPS)

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Servers reside in a data center. A data center is a physical location that is used to host computer systems and associated components such as networks, storage devices, and power supplies.

Data centers are designed to be secure and to provide an ideal climate for the contained equipment to operate. They must protect the equipment from many types of failures and accidents, including power losses and fire.

Who owns the data center?

Traditional on-premises model

- You own the data center and host it at your location.
- You buy, install, configure, and manage all of the hardware and software in your own facility.
- You hire the staff who are responsible for managing and maintaining the data center.
- You use your own data center resources.

Cloud model

- A cloud services provider owns the data center.
- The cloud services provider buys the hardware and infrastructure software for its own facility.
- The cloud services provider hires the personnel to support the data center.
- You pay to use the cloud service provider's data center resources.

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Traditionally, organizations owned their data centers. The equipment was on premises at a location that the company owned. If you follow this model, you are the one who buys, installs, configures, and manages all the hardware and software in your own facility. You are responsible for installation, maintenance, and numerous other costs. You also must hire the staff who are responsible for the maintenance of the hardware, software, and the facility itself.

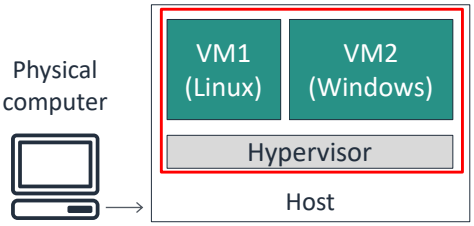
The cloud model provides another option: a cloud services provider buys the hardware and infrastructure software in their own facility. They manage and maintain it with their own personnel. You bring your application or workload to run on their servers and pay for the services that they offer.

Later, you will learn the advantages of the cloud model as compared with the on-premises model.

Virtual machines

What is a virtual machine?

A virtual machine (VM) is a **software-based computer.**



- A VM runs on a physical computer, which is called a **host**.
- A software layer, which is called a **hypervisor**, provides access to the resources of the physical computer (CPU, memory, disk, and network) to the VM.
- The VM runs **its own operating system (OS)** and interacts with the host through the hypervisor.
- **Multiple VMs** can be provisioned on a single host.

Virtualization gives you the ability to create multiple VMs, each with its own OS and applications, on a single physical machine.

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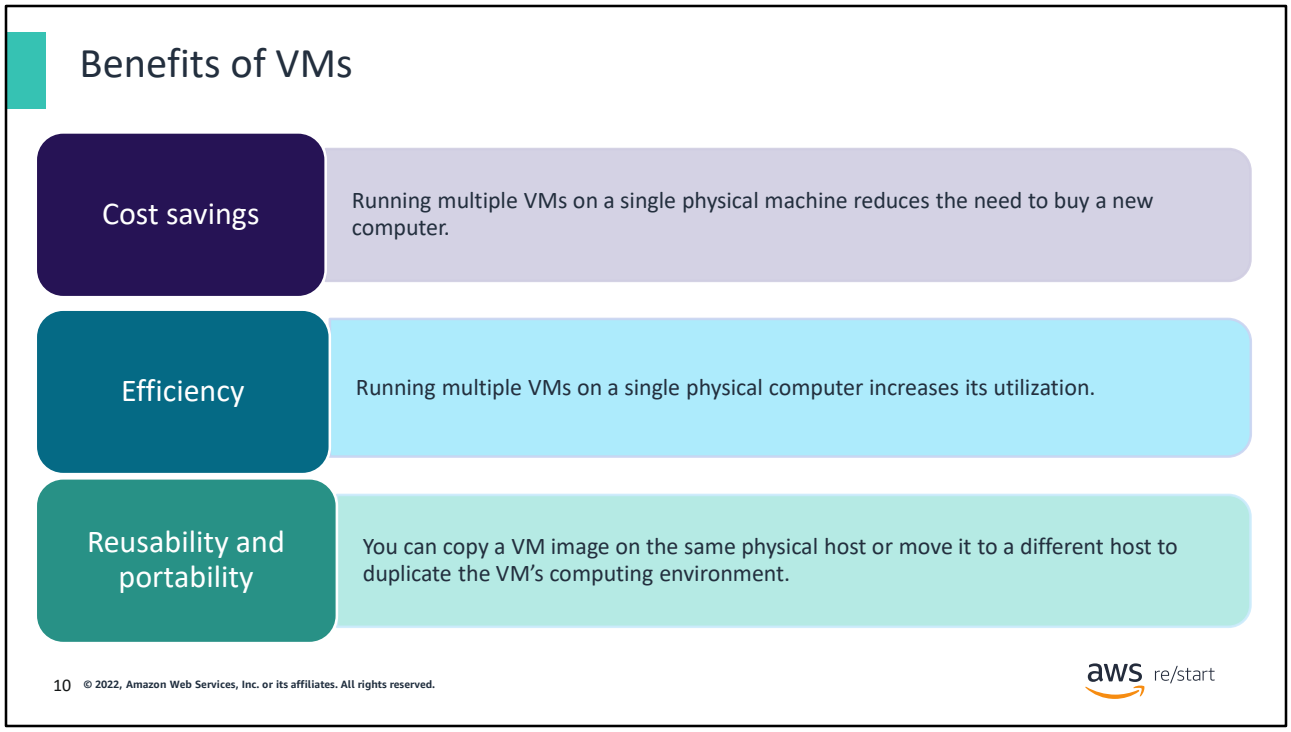
A virtual machine (VM) is a computer that is emulated through software. It is virtual because it is not a physical computer. Instead, specialized software, which is called virtualization software, runs inside a physical computer to provide the computing capabilities of a VM. In other words, a VM is a software-based computer that runs inside a physical computer.

The physical computer where a VM runs is called a host. The VM provides computing capabilities by accessing the physical resources of the host through a software layer, which is called a hypervisor. The hypervisor shares the host's physical resources—such as its CPU, memory, disk drives, and networking capabilities—among the VMs that run on the host. A VM can run its own operating system, and multiple VMs can run on a single host. With virtualization, you can separate your operating system and applications from the computer's hardware. Use cases for VMs include virtual desktops, multiple operating support, and cloud computing.



The following are the benefits of using a VMs:

- Cost savings – For example, you don't need to buy a new machine if you want to run a different operating system (OS) on your existing machine. You create a VM with the new OS and run it on your machine with virtualization software.

- Efficiency – You can run multiple VMs on a single physical computer to handle different types of workloads and increase its utilization. You can use VMs to reduce computing resource waste due to underused servers.

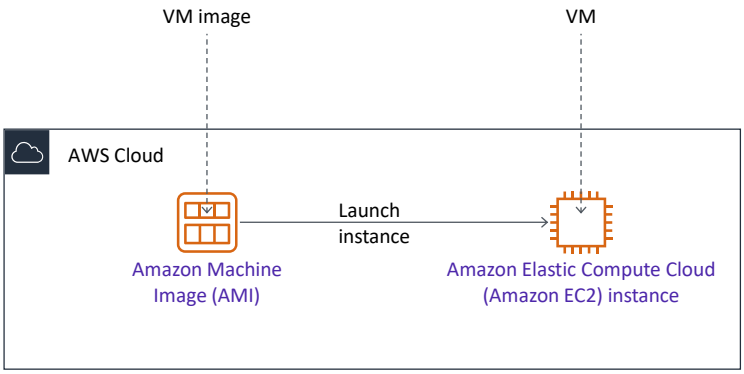
- Reusability and portability – A virtual machine image defines all of the configuration, software, and applications that are installed in a VM. You can duplicate a VM image on one or more physical hosts without creating a new VM from scratch. This duplication promotes reusability and portability. For example, creating multiple copies of the same VM to respond to incoming requests can improve your applications' performance when the number of requests increases. You can also copy a VM image to a different host for backup purposes.

VMs in the cloud

VMs are the fundamental unit of computing in the cloud.

VMs provide the following:

- Self-service
- Ability to pay for only what you use
- Scalability



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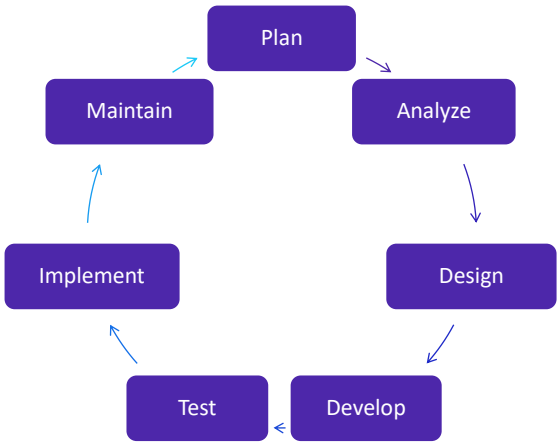
VMs facilitate computing in the cloud. In the AWS Cloud, the core service that offers computing capabilities is Amazon Elastic Compute Cloud (Amazon EC2).

You can use Amazon EC2 to provision virtual servers, and you can completely control the computing resources of those servers. You can obtain and start new server instances in minutes. From a cost perspective, you pay only for the capacity that you use. In addition, you can quickly scale capacity both up and down as your computing requirements change.

Software development life cycle

How software is developed

Software development life cycle (SDLC)



- Plan: What is the problem and what resources do you need to solve it?
- Analyze: What do you want from a solution?
- Design: How will you build what you want?
- Develop: Build what you designed.
- Test: Did you get what you want?
- Implement: Start to use what you built.
- Maintain: Improve what you built.

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The software development life cycle (SDLC) is a process that is used to produce software in a disciplined and organized way. When it is used correctly, it usually results in high-quality software that meets the customer's requirements.

At a high level, the purpose of each phase can be described by the following questions and actions:

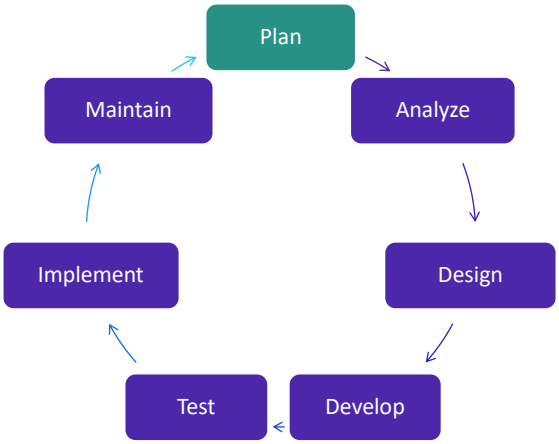
- Plan – What is the problem, and what resources do you need to solve it?
- Analyze – What do you want from a solution?
- Design – How will you built what you want?
- Develop – Build what you have designed.
- Test – Did you get what you want?
- Implement – Start to use what you built.
- Maintain – Improve what you built.

The SDLC is repeated over the lifetime of an application. It is used to create, update, fix, and maintain the application.

The next slides discuss each phase in more detail.

Plan

SDLC



- The goals of the project are identified along with the resources that are required to implement them. The output of this phase is a project plan.
- Many factors are taken into account at this stage, including the economical, operational, and technical aspects of project implementation.
- Planning for quality assurance also happens at this stage.

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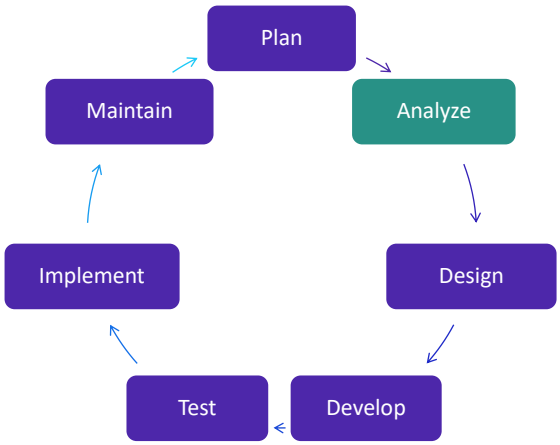
In this organizational phase, a plan is formulated to identify the goals of the project and the resources that are required to implement them. Many factors, such as costs, human resources, and tools, are considered and defined. The output of the plan phase is a project plan.

Analyze

SDLC



- Product requirements are clearly defined and documented in a software requirement specification (SRS).
- The customer then approves the requirements.
- An SRS is used as a reference tool at every subsequent step of the SDLC.

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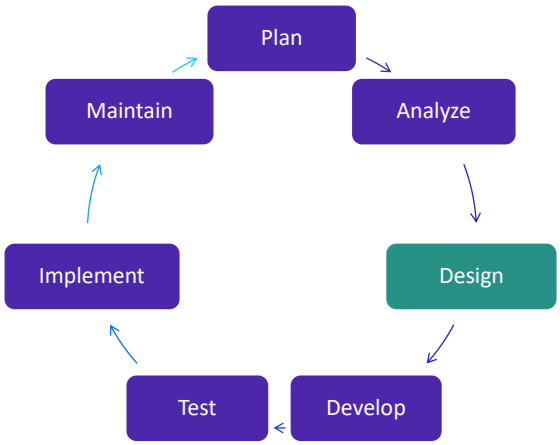
The analyze phase focuses on gathering the requirements for the application from the user and documenting them in a software requirement specification (SRS) document.

Design

SDLC



- Using the SRS, different types of architecture are evaluated for the best use in the project.
- More than one design approach is created and proposed in a design specification document.
- The design specification document contains detailed functional descriptions and other information, such as user interface descriptions.
- The design options are reviewed for risk, budget, and time constraints. The best design is then selected.

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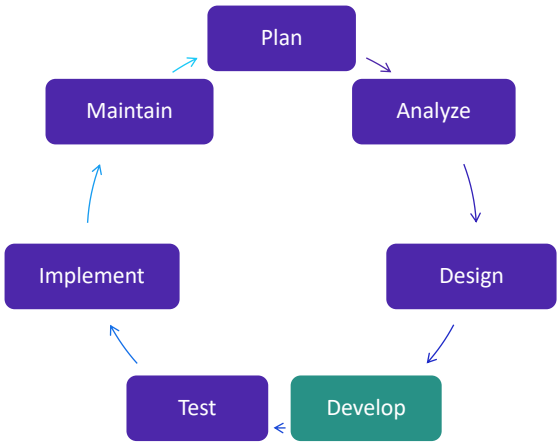
In the design phase, user requirements are translated into a technical design. The output of the design phase is a design specification document.

Develop

SDLC



- The actual writing of the computer code happens in this phase, and the product is built.
- The code is written according to the design specification document, and the organization's software development standards and guidelines.
- The programming language is chosen and is based on the type of software that will be created.

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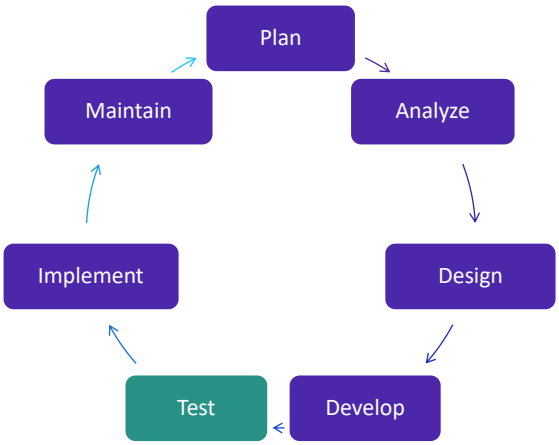
During the develop phase, the code for the application is written according to the organization's software development standards and guidelines. The programming language that is used is chosen based on what best suits the application.

Test

SDLC



- Testing is one of the most important steps in the SDLC.
- Code can be written to test other code. This process is called *automated testing*.
- Common types of testing include the following:
  - Unit test
  - Integration test
  - Security test
  - Performance test

aws re/start

The purpose of the test phase is to validate that the application components function as intended. This phase is also used to uncover and correct defects before the application is released to users.

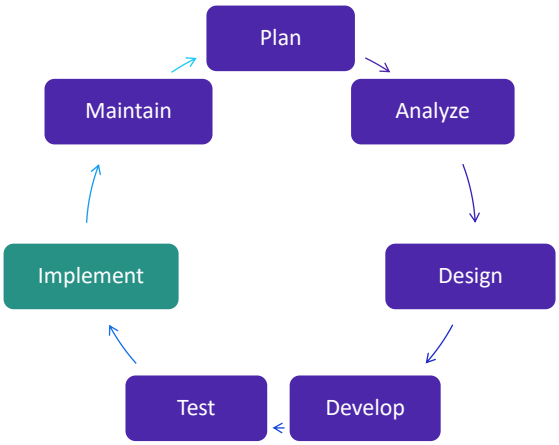
Most defects, also called bugs, should be discovered and fixed during this phase. It is important to correct them in this phase because they are usually more expensive to fix when they are found in later phases.

The many types of testing include the following:

- Unit testing tests individual application components at the program level. The programmer usually does this test.
- Integration testing tests the combination of multiple application components to verify that they work together correctly.
- Security testing tests to see whether the application is vulnerable from internal or external threats.
- Performance testing tests to see whether the application meets its expected performance requirements.

Implement

SDLC



- Implementation is often called deployment.
- The customer approves and signs off the completion of the application.
- The application is released and used in production.

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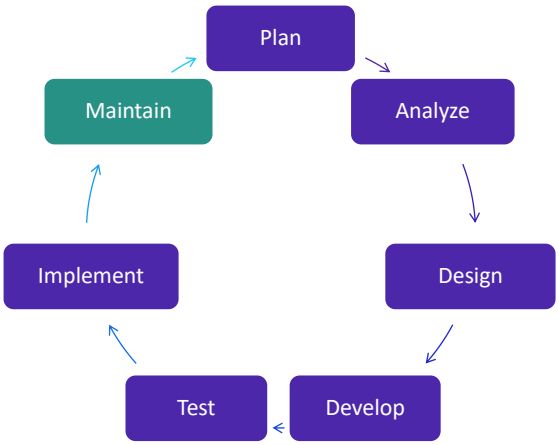
In the implement phase, the finished application is deployed to a final environment, or the production environment, where users can start to use it.

Maintain

SDLC



- While in production, applications must be monitored constantly to ensure their correct operation.
- The need for maintenance can arise from different reasons:
  - Defect or error identified → Corrective maintenance
  - Changes in application environment → Adaptive maintenance
  - Changes in application requirements → Perfective maintenance
  - Prevent the occurrence of errors → Preventive maintenance

aws re/start

As soon as the application is in production, it must be monitored and maintained. The following are the four general types of application maintenance:

- Corrective maintenance is used to fix a problem that occurs and for which a solution is identified.
- Adaptive maintenance is required when something in the application's runtime environment is going to change. For example, an upgrade is planned for the database software that the application uses.
- Perfective maintenance occurs when new or revised functionality is identified for the application. For example, the user requests a change in the user interface.
- Preventive maintenance consists of changes that are made to avoid potential issues in the future. For example, code is redesigned or restructured for easier maintenance.

Key takeaways

- A server is a computer that provides data or services to other computers.
- A data center is a physical location where an organization stores and operates its computer and networking equipment.
- Hardware virtualization gives you the ability to create VMs on a physical computer. It is a fundamental technology that is used in cloud computing.
- The following are the phases of the SDLC:
  - Plan
  - Analyze
  - Design
  - Develop
  - Test
  - Implement
  - Maintain

aws re/start

The following are some key takeaways from this module:

- A server is a computer that provides data or services to other computers.
- A data center is a physical location where an organization stores and operates its computer and networking equipment.
- Hardware virtualization gives you the ability to create VMs on a physical computer. It is a fundamental technology that is used in cloud computing.
- The following are the phases of the SDLC:
  - Plan
  - Analyze
  - Design
  - Develop
  - Test
  - Implement
  - Maintain

Thank you

Thank you for completing this module.