Servers

What is Server?

Servers are computers that provide data to other computers. It may serve data to systems on a Local Area Network (LAN) or a Wide Area Network (WAN) over the Internet. Most servers are accessed remotely using **remote access** software.

Many types of servers exist, including **web servers**, **mail servers**, and **file servers**. Each type runs different software, specific to the purpose of the server. While server software is specific to the type of server, the hardware is not as important. In fact, a regular desktop computer can be turned into a server by adding the appropriate software. For example, a computer connected to a home network can be designated as a file server, print server, or both. While any computer can be configured as a server, most large businesses use rack-mountable hardware designed specifically for server functionality.

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| --- |
| *Servers* |

Web Server

Every web site work on servers. These servers are web servers. A web server is a computer system that hosts websites. Web sites run web server software, such as Apache or Microsoft IIS (Internet Information Services), which provides access to hosted web pages over the Internet.

Web servers can take thousands of requests in a second, they should respond to these requests in less than seconds. Therefore most web servers are connected to the Internet via a high-speed connection.

Web servers generally host multiple websites. Some of them only host a few, while others host several hundred. For this reason, we can say that there are two types of web servers. Web servers that host websites for multiple users are called **shared hosts**. This is the most common type of hosting solution and is used for personal sites, small business sites, and websites run by small organizations. Web servers that only host websites for a single person or company are called **dedicated hosts**. These types of servers are appropriate for high-traffic websites and sites that require custom server modifications.

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| *Dedicated and shared web hosting* |

Q: Explain Web Server.  
A: A Web server is a server on the Internet that holds Web documents and makes them available for viewing by remote browsers..

 - Interview Q&A

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Mail Server

A mail server is a server that handles and delivers e-mails over a network, usually over the Internet. A mail server can receive e-mails from client computers and delivers them to other mail servers. A mail server can also deliver e-mails to client computers. A client is normally a computer or phone where you read and/or send your e-mails.

**SMTP, POP3, and IMAP**

When you press the "Send" button in your e-mail application (e-mail client) the program will connect to a server on the network / Internet that is called an **SMTP** (Simple Mail Transfer Protocol) server. SMTP is a protocol that is used when e-mails are delivered from clients to servers and from servers to other servers.

When you download e-mails to your mail program the program will connect to a server on the network / Internet that is known as a **POP3** (Post Office Protocol version 3) server.

**IMAP** (Internet Message Access Protocol) is a method of accessing and storing mail on a mail server. IMAP allows you to access your email wherever you are, from any device. When you read an email message using IMAP, you aren't actually downloading or storing it on your computer; instead, you're reading it from the email service.

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| *IMAP, SMTP and POP3* |

### File Server

A file server (or fileserver) is a computer attached to a network that provides a location for shared disk access, i.e. storage of computer [files](https://lms.clarusway.com/mod/lesson/view.php?id=1052) (such as text, image, sound, video) that can be accessed by the workstations that are able to reach the computer that shares the access through a computer network.

A file server generally does not perform any calculations, and not run any programs on behalf of clients. It is designed primarily to enable the storage and fast retrieval of data where the heavy computation is provided by the workstations.

Databases

Introduction

Databases are collections of data, usually organized under a schema, and stored in a format that is efficient for storing and retrieving the data. When people talk about databases they tend to talk about the underlying **Database Management System (DBMS)**. These are programs like MySQL or PostgreSQL which are designed to complete the tasks of storing, retrieving, updating, caching, deleting, and other data manipulation.

Databases use tables for managing data. Using tables we can handle [big data](https://lms.clarusway.com/mod/lesson/view.php?id=996) storage, build a relationship between data and give priorities to some data on the table. Thus we can reach specific information asking questions to tables. These questions called **query**.

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| *Database and tables* |

Q: Explain Database and Database Management System.  
A: A database is an organized collection of structured information, or data, typically stored electronically in a computer system. A database is usually controlled by a database management system (DBMS). Some examples of popular database software or DBMSs include MySQL, MongoDB, PostgreSQL, Microsoft SQL Server

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 - Interview Q&A

### Database Structure

Imagine an education program that stores student information, lesson and class information, teacher information, a student enrolled course information etc.

1. All of these data relate to one another:
   * All students can enroll more than one courses (students, courses, etc)
   * All courses have to have a teacher (teacher, courses)
   * Courses have a status (close, open for enrolling, etc)
2. Imagine this data is stored in [files](https://lms.clarusway.com/mod/lesson/view.php?id=1052) on a hard drive.  
   Is it stored by the student's name? If so, how can we select only students that passed "Computer Essentials and Network" Course?

A database system’s fundamental goal is to provide consistent views of structured data, just like the relationships we’ve laid out between students and courses.

**Structure**

SQL databases are based on around relational algebra

* Tables are the way we look at our relevant data.
* Columns are fields in the table.
* Rows define a relation between fields.
* A Primary key is a set of columns that uniquely identify rows in a table.
* A Foreign key is a column that matches the primary key of another table.

**Table-1 Students**

| **Student-ID (Primary key)** | **Student Name (Column-2)** | **Student Mail Address (Column-3)** |
| --- | --- | --- |
| 0001 (Row-1) | Albert Einstein | einstein@clarusway.com |
| 0002 (Row-2) | Nikola Tesla | tesla@clarusway.com |
| ... | ... | ... |

**Table-2 Courses**

| **Course Code (Primary key)** | **Course Name** | **Enrolled Student (Foreign key to Table 1)** |
| --- | --- | --- |
| CESN501 | Computer Essentials and Networking | 0002 |
| ... | ... | ... |

Types of Databases

There are two broad types of databases. These are SQL and NoSQL.

1. SQL: Stores data in tables organized by column and field.
2. NoSQL: Stores data differently than an SQL database.

SQL databases are primarily called Relational Databases (RDBMS); whereas the NoSQL database is primarily called a non-relational or distributed database.

**SQL**

* SQL databases are classic databases and are what we default to talking about when we teach databases.
* SQL databases define and manipulate data based on structured query language (SQL)
* SQL databases are table-based
* Great support is available for all SQL databases from their vendors. Also, a lot of independent consultations are there who can help you with SQL database for a very large scale deployments

Examples:

* MySQL/MariaDB
* PostgreSQL
* SQLite

**NoSQL**

* A NoSQL database has a dynamic schema for unstructured data.
* NoSQL databases are either key-value pairs, document-based, graph databases or wide-column stores.
* NoSQL databases can also offer more flexibility in storage options, allowing one to spread data across many machines more easily than SQL databases tend to do.
* In NoSQL database you have to rely on community support and only limited outside experts are available for setting up and deploying your large scale NoSQL deployments.

Examples:

* MongoDB
* Apache Casandra
* Elasticsearch

Q: What is SQL and have you heard about NoSQL?  
A: SQL is a programming language used by nearly all **relational databases** to query, manipulate, define data and to provide access control. A NoSQL, or **nonrelational database**, allows unstructured and semistructured data to be stored and manipulated (in contrast to a relational database)

 - Interview Q&A

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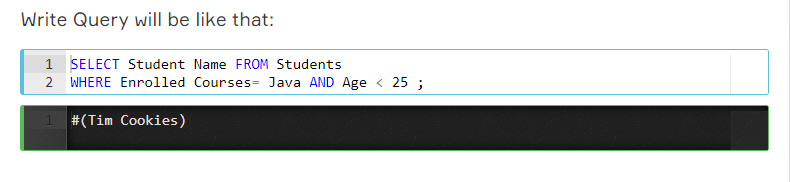
 - Interview Q&A

### Database and Query Example

Assume that Apple's HR department wants to hire a person who knows Java programming language and age is under 25. Let's look and make a query to find where is the lucky guy from Clarusway Database?

**Students** (Table)

| **ID** | **Student Name** | **Enrolled Courses** | **Age** |
| --- | --- | --- | --- |
| 0001 | Albertoo Einstein | SQL | 24 |
| 0002 | Nikolass Tesla | Introduction to Testing | 32 |
| 0003 | Steve Jobies | Java | 28 |
| 0004 | Tim Cookie | Java | 21 |



Big Data

What is Big Data?

Big data is data that contains greater **variety** arriving in increasing **volumes** and with ever-higher **velocity**. This is known as the three Vs.

Put simply, big data is larger, more complex data sets, especially from new data sources. These data sets are so voluminous that traditional data processing software just can’t manage them. But these massive volumes of data can be used to address business problems you wouldn’t have been able to tackle before.

Big data gives you new insights that open up new opportunities and business models. Getting started involves three key actions:

1. **Integrate**: Big data brings together data from many different sources and applications.
2. **Manage**: Big data requires storage. Your storage solution can be in the cloud, on-premises, or both. You can store your data in any form you want and bring your desired processing requirements and necessary process engines to those data sets on an on-demand basis.
3. **Analyze**: Your investment in big data pays off when you analyze and act on your data. Get new clarity with a visual analysis of your varied data sets. Explore the data further to make new discoveries. Share your findings with others. Build data models with machine learning and artificial intelligence. Put your data to work.

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| *Big Data Sources* |

Q: What are the **three V's** of big data?  
A: **Variety**: Refers to the different data types i.e. various data formats like text, audios, videos, etc.  
**Velocity** is the rate at which data grows. Social media contributes a major role in the velocity of growing data.  
**Volume** represents the volume i.e. amount of data that is growing at a high rate i.e. data volume in Petabytes(1 Petabytes = 1024 Terabytes).

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### Creation of Big Data

Data collection plays the most important role in the Big Data cycle. The Internet provides almost unlimited sources of data for a variety of topics. The importance of this area depends on the type of business, but traditional industries can acquire a diverse source of external data and combine those with their transactional data.

Your locations, your conversations from smartphones, weather conditions, bank account activities, stock market values, news values are some examples of big data sources.

### Challenges of Big Data

While big data holds a lot of promise, it is not without its challenges.

Some of these challenges:

* **Quick Data Growth**: Data growing at such a quick rate is making it a challenge to find insights from it. There is more and more data generated every second from which the data that is actually relevant and useful has to be picked up for further analysis.
* **Storage**: Such a large amount of data is difficult to store and manage by organizations without appropriate tools and technologies.
* **Syncing Across Data Sources**: This implies that when organizations import data from different sources the data from one source might not be up to date as compared to the data from another source.
* **Security**: A huge amount of data in organizations can easily become a target for advanced persistent threats, so here lies another challenge for organizations to keep their data secure by proper authentication, data encryption, etc.
* **Unreliable Data**: We can’t deny the fact that big data can’t be 100 percent accurate. It might contain redundant or incomplete data, along with contradictions.

Big Data Use Cases

Big data can help you address a range of business activities, from customer experience to analytics. Here are just a few:

* **Product Development**: Companies like Netflix and P&G use big data to anticipate customer demand.
* **Predictive Maintenance**: Factors that can predict mechanical failures may be deeply buried in structured data, such as the year, make, and model of equipment, as well as in unstructured data that covers millions of log entries, sensor data, error messages, and engine temperature.
* **Customer Experience**: Big data enables you to gather data from social media, web visits, call logs, and other sources to improve the interaction experience and maximize the value delivered.
* **Fraud and Compliance**: Big data helps you identify patterns in data that indicate fraud and aggregate large volumes of information to make regulatory reporting much faster.
* **Machine Learning**: You should have big data to train your machine learning models.
* **Operational Efficiency**: With big data, you can analyze and assess production, customer feedback and returns, and other factors to reduce outages and anticipate future demands.
* **Drive Innovation**: Big data can help you innovate by studying interdependencies among humans, institutions, entities, and processes and then determining new ways to use those insights.

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| *Big Data application areas* |

## Clouds

### Cloud and Cloud Computing

**The cloud** refers to [servers](https://lms.clarusway.com/mod/lesson/view.php?id=1015) that are accessed over the Internet and the software and [databases](https://lms.clarusway.com/mod/lesson/view.php?id=995) that run on those [servers](https://lms.clarusway.com/mod/lesson/view.php?id=1015). Cloud [servers](https://lms.clarusway.com/mod/lesson/view.php?id=1015) are located in data centers all over the world. By using cloud computing, users and companies don't have to manage physical [servers](https://lms.clarusway.com/mod/lesson/view.php?id=1015) themselves or run software applications on their own machines.

Cloud computing is possible because of a technology called virtualization. Virtualization allows for the creation of a simulated, digital-only **virtual computer/machine** that behaves as if it were a physical computer with its own hardware.

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| The Cloud and user device |

Service models of cloud computing

The main service models of cloud computing are:

|  |
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| *Service models* |

* **Software-as-a-Service (SaaS)**: Instead of users installing an application on their device, SaaS applications are hosted on cloud [servers](https://lms.clarusway.com/mod/lesson/view.php?id=1015), and users access them over the Internet. SaaS is like renting a house: the landlord maintains the house, but the tenant mostly gets to use it as if they owned it. Examples of SaaS applications include Salesforce, MailChimp, and Slack.
* **Platform-as-a-Service (PaaS)**: In this model, companies don't pay for hosted applications; instead they pay for the things they need to build their own applications. PaaS vendors offer everything necessary for building an application, including development tools, infrastructure, and [operating systems](https://lms.clarusway.com/mod/lesson/view.php?id=56), over the Internet. PaaS can be compared to renting all the tools and equipment necessary for building a house, instead of renting the house itself. PaaS examples include Heroku and Microsoft Azure.
* **Infrastructure-as-a-Service (IaaS)**: In this model, a company rents the [servers](https://lms.clarusway.com/mod/lesson/view.php?id=1015) and storage they need from a cloud provider. They then use that cloud infrastructure to build their applications. IaaS is like a company leasing a plot of land on which they can build whatever they want – but they need to provide their own building equipment and materials. IaaS providers include DigitalOcean, Google Compute Engine, and OpenStack.

Formerly, SaaS, PaaS, and IaaS were the three main models of cloud computing, and essentially all cloud services fit into one of these categories. However, in recent years a fourth model has emerged:

* **Function-as-a-Service (FaaS)**: FaaS, also known as serverless computing, breaks cloud applications down into even smaller components that only run when they're needed. Imagine if it was possible to rent a house one little bit at a time: for instance, the tenant only pays for the dining room at dinner time, the bedroom while they're sleeping, the living room while they're watching TV, and when they aren't using those rooms, they don't have to pay rent on them.

FaaS or serverless applications still run on [servers](https://lms.clarusway.com/mod/lesson/view.php?id=1015), as do all these models of cloud computing. But they're called "serverless" because they don't run on dedicated machines and because the companies building the applications don't have to manage any [servers](https://lms.clarusway.com/mod/lesson/view.php?id=1015).

### Types of Cloud Deployments

The most common cloud deployments are:

* **Private cloud**: A private cloud is a server, data center, or distributed network wholly dedicated to one organization.
* **Public cloud**: A public cloud is a service run by an external vendor that may include [servers](https://lms.clarusway.com/mod/lesson/view.php?id=1015) in one or multiple data centers. Unlike a private cloud, public clouds are shared by multiple organizations.
* **Hybrid cloud**: Hybrid cloud deployments combine public and private clouds, and may even include on-premises legacy [servers](https://lms.clarusway.com/mod/lesson/view.php?id=1015).
* **Multicloud**: Multicloud is a type of cloud deployment that involves using multiple public clouds.