

sscjunction.com

IBPS IT OFFICER EXAM CAPSULE

Overview on SQL Queries

- **DML - Data Manipulation Language:**

Command	Description
SELECT	Retrieves certain records from one or more tables
INSERT	Creates a record
UPDATE	Modifies records
DELETE	Deletes records

- **DCL - Data Control Language:**

Command	Description
GRANT	Gives a privilege to user
REVOKE	Takes back privileges granted from user

- **DDL - Data Definition Language:**

Command	Description
CREATE	Creates a new table, a view of a table, or other object in database
ALTER	Modifies an existing database object, such as a table.
DROP	Deletes an entire table, a view of a table or other object in the database.

- Dr. Edgar F. "Ted" Codd of IBM is known as the father of relational databases. He described a relational model for databases.
- SQL is Structured Query Language, which is a computer language for storing, manipulating and retrieving data stored in relational database.
- **Primary and Unique Key difference:**
>>Both primary key and unique enforce uniqueness of the column on which they are defined. But by default primary key creates a clustered index on the column, where are unique creates a nonclustered index by default. Another

major difference is that, primary key doesn't allow NULLs, but unique key allows one NULL only.

- Difference between **GROUP BY** and **HAVING** Clause

>>Specifies a search condition for a group or an aggregate. HAVING can be used only with the SELECT statement. HAVING is typically used in a GROUP BY clause. When GROUP BY is not used, HAVING behaves like a WHERE clause. Having Clause is basically used only with the GROUP BY function in a query. WHERE Clause is applied to each row before they are part of the GROUP BY function in a query.

- Difference between a **local** and a **global** variable:

>>A local temporary table exists only for the duration of a connection or, if defined inside a compound statement, for the duration of the compound statement.

A global temporary table remains in the database permanently, but the rows exist only within a given connection. When connection are closed, the data in the global temporary table disappears.

- Primary keys are the unique identifiers for each row. They must contain unique values and cannot be null. Due to their importance in relational databases, Primary keys are the most fundamental of all keys and constraints. A table can have only one Primary key.
- Foreign keys are both a method of ensuring data integrity and a manifestation of the relationship between tables.
- SQL Profiler is a graphical tool that allows system administrators to monitor events in an instance of Microsoft SQL Server. You can capture and save data about each event to a file or SQL Server table to analyze later.
- SQL Server agent plays an important role in the day-to-day tasks of a database administrator (DBA).
- Log shipping is the process of automating the backup of database and transaction log files on a production SQL server, and then restoring them onto a standby server.
- Difference between a **Local and a Global temporary table**:
>>A local **temporary** table exists only for the duration of a connection or, if defined inside a compound statement, for the duration of the compound statement.

>>A global temporary table remains in the database **permanently**, but the rows exist only within a given connection. When connection is closed, the data in the global temporary table disappears.

- STUFF function is used to overwrite existing characters.

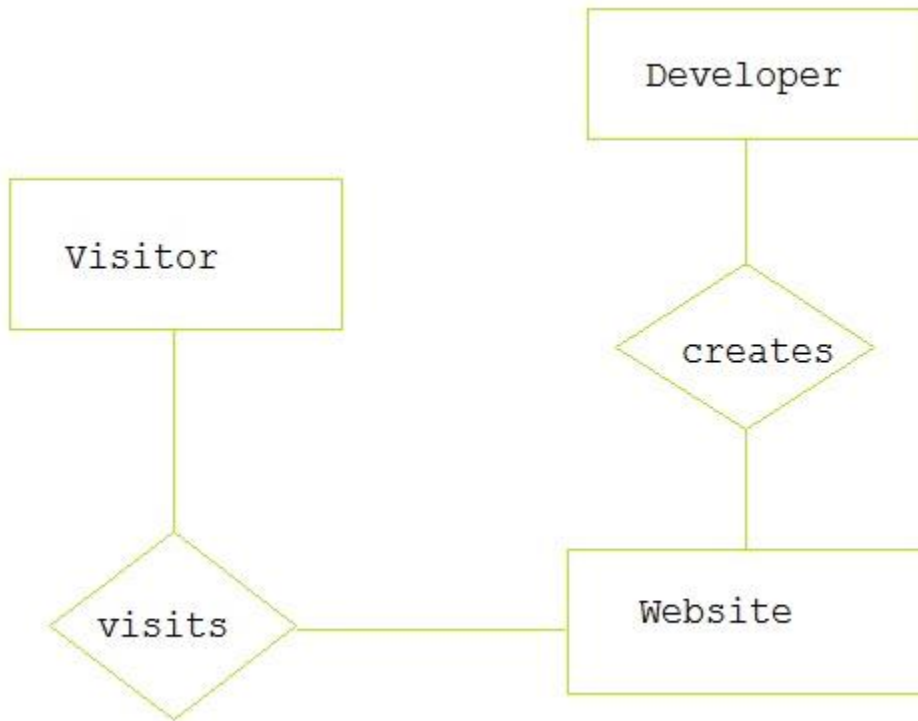
NORMALISATION

- **Normalisation** is a technique of organizing data in the database. Normalization is a systematic approach of decomposing tables to eliminate data redundancy and undesirable characteristics like Insertion, Update and Deletion Anamolies. It is a multi-step process that puts data into tabular form by removing duplicated data from the relation tables.
- Normalization is used for mainly two purpose:
 - Eliminating reduntant(useless) data.
 - Ensuring data dependencies make sense i.e data is logically stored.
- **Problem Without Normalization :**
 - Without Normalization, it becomes difficult to handle and update the database, without facing data loss. Insertion, Updation and Deletion Anamolies are very frequent if Database is not Normalized.
- **Updation Anamoly:** To update address which occurs twice or more than twice in a table, we will have to update Address column in all the rows, else data will become inconsistent.
- **Insertion Anamoly :**Suppose for a new admission, we have a Student id(S_id), name and address of a student but if student has not opted for any subjects yet then we have to insert **NULL** there, leading to Insertion Anamoly.
- **Deletion Anamoly** has only one subject and temporarily he drops it, when we delete that row, entire student record will be deleted along with it.
- Normalization rule are divided into following normal form.
 - 1.First Normal Form
 - 2.Second Normal Form
 - 3.Third Normal Form
 - 4.BCNF

- **First Normal Form (1NF)** :As per First Normal Form, no two Rows of data must contain repeating group of information i.e each set of column must have a unique value, such that multiple columns cannot be used to fetch the same row. Each table should be organized into rows, and each row should have a primary key that distinguishes it as unique.The Primary key is usually a single column, but sometimes more than one column can be combined to create a single primary key.
- **Second Normal Form (2NF)** :As per the Second Normal Form there must not be any partial dependency of any column on primary key. It means that for a table that has concatenated primary key, each column in the table that is not part of the primary key must depend upon the entire concatenated key for its existence. If any column depends only on one part of the concatenated key, then the table fails Second normal form.
- **Third Normal Form (3NF)** :Third Normal form applies that every non-prime attribute of table must be dependent on primary key. The *transitive functional dependency* should be removed from the table. The table must be in Second Normal form
- **Boyce and Codd Normal Form (BCNF)**:Boyce and Codd Normal Form is a higher version of the Third Normal form. This form deals with certain type of anomaly that is not handled by 3NF. A 3NF table which does not have multiple overlapping candidate keys is said to be in BCNF.

E-R Diagrams

- ER-Diagram is a visual representation of data that describes how data is related to each other.

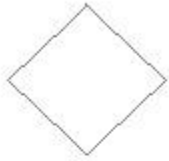


Symbols and Notations:

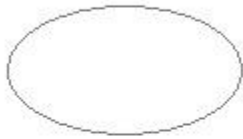
represents



Entity



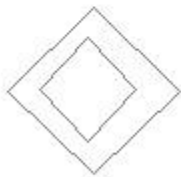
relationship



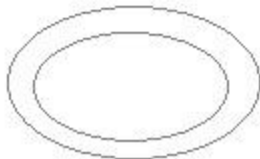
attribute



weak entity



weak entity
relationship



Multivalued
attribute

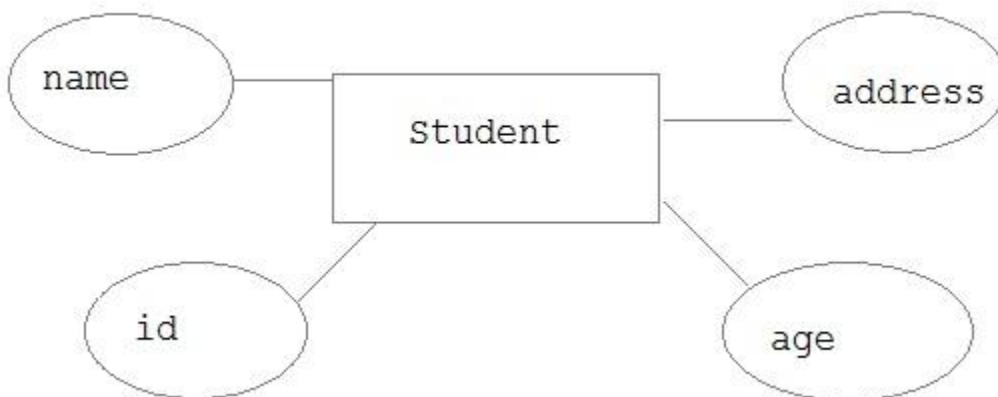
- Components of E-R Diagram
- The E-R diagram has three main components.
- Entity: An Entity can be any object, place, person or class. In E-R Diagram, an entity is represented using rectangles. Consider an example of an Organisation. Employee, Manager, Department, Product and many more can be taken as entities from an Organisation.



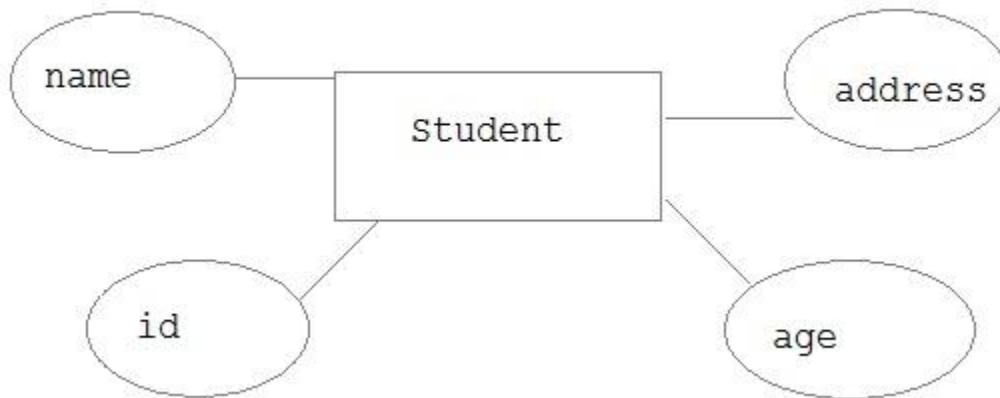
Weak Entity: Weak entity is an entity that depends on another entity. Weak entity doesn't have key attribute of their own. Double rectangle represents weak entity.



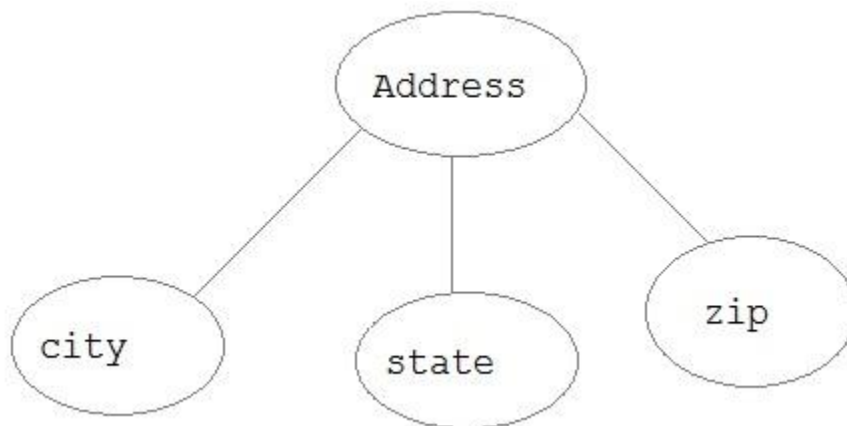
Attribute :An Attribute describes a property or characteristic of an entity. For example, Name, Age, Address etc can be attributes of a Student. An attribute is represented using eclipse.



Key Attribute: Key attribute represents the main characteristic of an Entity. It is used to represent Primary key. Ellipse with underlying lines represent Key Attribute.



Composite Attribute: An attribute can also have their own attributes. These attributes are known as Composite attribute.



3) Relationship: A Relationship describes relations between entities. Relationship is represented using diamonds.



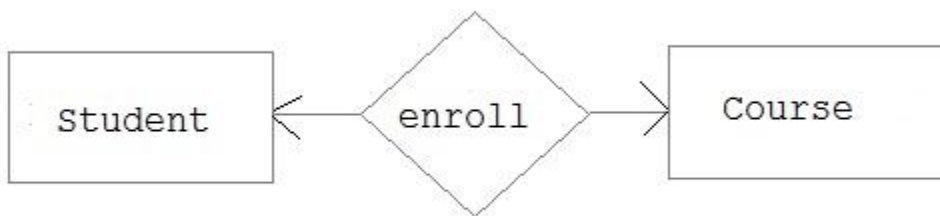
There are three types of relationship that exist between Entities.

- Binary Relationship
- Recursive Relationship
- Ternary Relationship

Binary Relationship

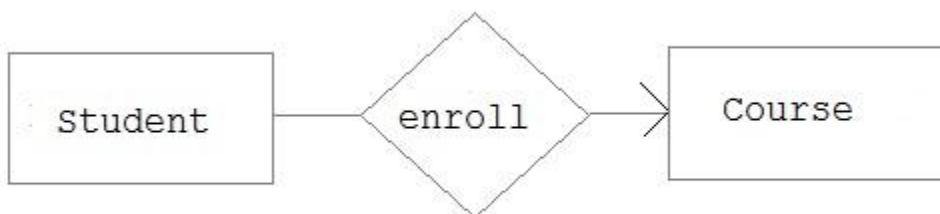
1. Binary Relationship means relation between two Entities. This is further divided into three types.

1. One to One : This type of relationship is rarely seen in real world.



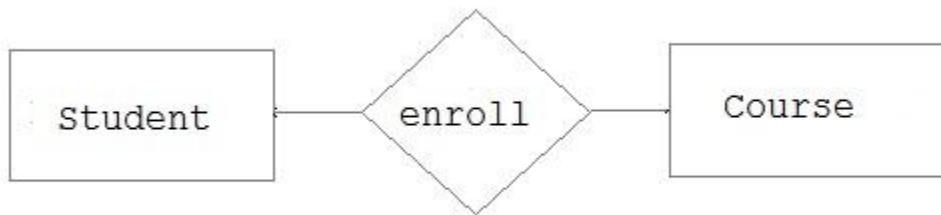
The above example describes that one student can enroll only for one course and a course will also have only one Student. This is not what you will usually see in relationship.

- **One to Many :** It reflects business rule that one entity is associated with many number of same entity. For example, Student enrolls for only one Course but a Course can have many Students.

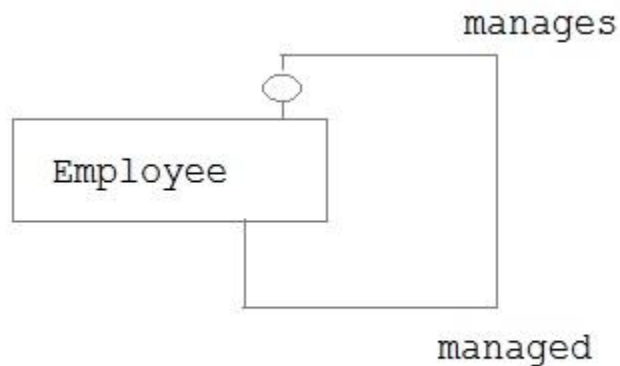


The arrows in the diagram describes that one student can enroll for only one course.

2. **Many to Many** : The below diagram shows the many to many relationship



Recursive Relationship : When an Entity is related with itself it is known as Recursive Relationship.



Ternary Relationship: Relationship of degree three is called Ternary relationship.

Generalization, Specialization and Aggregation

Generalization is a bottom-up approach in which two lower level entities combine to form a higher level entity. In generalization, the higher level entity can also combine with other lower level entity to make further higher level entity.

Specialization: Specialization is opposite to Generalization. It is a top-down approach in which one higher level entity can be broken down into two lower level entity. In specialization, some higher level entities may not have lower-level entity sets at all.

Aggregation: Aggregation is a process when relation between two entity is treated as a single entity. Here the relation between Center and Course, is acting as an Entity in relation with Visitor.

Transaction Management

Transaction Control Language(TCL) commands are used to manage transactions in database. These are used to manage the changes made by DML statements. It also allows statements to be grouped together into logical transactions.

Commit command

Commit command is used to permanently save any transaction into database.

Following is Commit command's syntax,

commit;

Rollback command

This command restores the database to last committed state. It is also use with savepoint command to jump to a savepoint in a transaction.

Following is Rollback command's syntax,

rollback to savepoint-name;

Savepoint command

savepoint command is used to temporarily save a transaction so that you can rollback to that point whenever necessary.

Following is savepoint command's syntax,

savepoint savepoint-name;

RDBMS CONCEPTS

RDBMS Concts

A **Relational Database management System**(RDBMS) is a database management system based on relational model introduced by E.F Codd. In relational model, data is represented in terms of tuples(rows).

RDBMS is used to manage Relational database. **Relational database** is a collection of organized set of tables from which data can be accessed easily. Relational Database is most commonly used database. It consists of number of tables and each table has its own primary key.

What is Table ?

In Relational database, a **table** is a collection of data elements organised in terms of rows and columns. A table is also considered as convenient representation of **relations**. But a table can have duplicate tuples while a true **relation** cannot have duplicate tuples. Table is the most simplest form of data storage. Below is an example of Employee table.

I D	Name	Age	Salary
1	Adam	34	13000
2	Alex	28	15000
3	Stuart	20	18000
4	Ross	42	19020

What is a Record ?

A single entry in a table is called a **Record** or **Row**. A **Record** in a table represents set of related data. For example, the above **Employee** table has 4 records. Following is an example of single record.

1	Adam	34	13000
---	------	----	-------

What is Field ?

A table consists of several records(row), each record can be broken into several smaller entities known as Fields. The above Employee table consist of four fields, ID, Name, Age and Salary.

What is a Column ?

In Relational table, a column is a set of value of a particular type. The term Attribute is also used to represent a column. For example, in Employee table, Name is a column that represent names of employee.

Name
Adam
Alex
Stuart
Ross

Codd's Rule

E.F Codd was a Computer Scientist who invented **Relational model** for Database management. Based on relational model, **Relation database** was created. Codd

proposed 13 rules popularly known as **Codd's 12 rules** to test DBMS's concept against his relational model. Codd's rule actually define what quality a DBMS requires in order to become a Relational Database Management System(RDBMS). Till now, there is hardly any commercial product that follows all the 13 Codd's rules. Even **Oracle** follows only eight and half out(8.5) of 13. The Codd's 12 rules are as follows.

Rule zero

This rule states that for a system to qualify as an **RDBMS**, it must be able to manage database entirely through the relational capabilities.

Rule 1 : Information rule

All information (including metadata) is to be represented as stored data in cells of tables. The rows and columns have to be strictly unordered.

Rule 2 : Guaranteed Access

Each unique piece of data(atomic value) should be accesible by : **Table Name + primary key(Row) + Attribute(column)**.

NOTE : Ability to directly access via POINTER is a violation of this rule.

Rule 3 : Systemetic treatment of NULL

Null has several meanings, it can mean missing data, not applicable or no value. It should be handled consistently. Primary key must not be null. Expression on **NULL** must give null.

Rule 4 : Active Online Catalog

Database dictionary(catalog) must have description of **Database**. Catalog to be governed by same rule as rest of the database. The same query language to be used on catalog as on application database.

Rule 5 : Powerful language

One well defined language must be there to provide all manners of access to data. Example: **SQL**. If a file supporting table can be accessed by any manner except SQL interface, then its a violation to this rule.

Rule 6 : View Updation rule

All view that are theoretically updatable should be updatable by the system.

Rule 7 : Relational Level Operation

There must be Insert, Delete, Update operations at each level of relations. Set operation like Union, Intersection and minus should also be supported.

Rule 8 : Physical Data Independence

The physical storage of data should not matter to the system. If say, some file supporting table were renamed or moved from one disk to another, it should not effect the application.

Rule 9 : Logical Data Independence

If there is change in the logical structure (table structures) of the database the user view of data should not change. Say, if a table is split into two tables, a new view should give result as the join of the two tables. This rule is most difficult to satisfy.

Rule 10 : Integrity Independence

The database should be able to conforce its own integrity rather than using other programs. Key and Check constraints, trigger etc should be stored in Data Dictionary. This also make **RDBMS** independent of front-end.

Rule 11 : Distribution Independence

A database should work properly regardless of its distribution across a network. This lays foundation of distributed database.

Rule 12 : Nonsubversion rule

If low level access is allowed to a system it should not be able to subvert or bypass integrity rule to change data. This can be achieved by some sort of locking or encryption.

DATA COMMUNICATION AND NETWORKING

Network Architecture:

1. **Network architecture** is the design of a communications **network**. It is a framework for the specification of a **network's** physical components and their functional organization and configuration, its operational principles and procedures, as well as data formats used in its operation.

Transmission:

There are two type of transmission:

1. **Parallel Transmission:** In this mode, message information is transmitted bit by bit over the link. The transmission speed of the transmitting site depends on the signaling speed. The **Signalling** Rate is defined for the communication device and usually expressed in Baud.
2. **Parallel Transmission:** In this Transmission mode, Each Bit is assigned a specific ,separate channel number and all the bits are transmitted over the different channels.

There are different configuration of transmission of a signal for example

1. **Simplex:** Information always flow in one direction.
2. **Half Simplex:** Allows the transmission of a signal in one direction at a time.
3. **Full Duplex:** Allows the transmission of a signal in both directions simultaneously.

Multiplexing:

Multiplexing is a set of technique that allows a simultaneous transmission of multiple signals across a single data link.

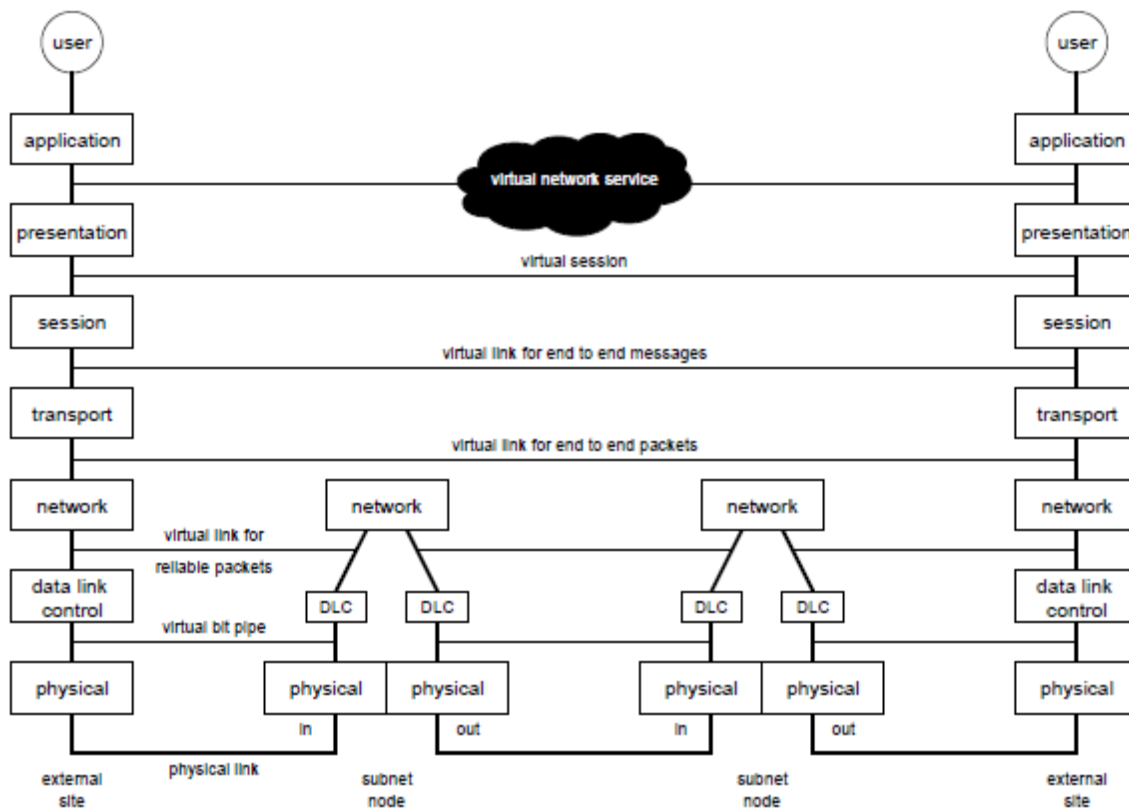
Type of Multiplexing:

1.Frequency division multiplexing: is an analog technique that can be applied when the bandwidth of a link is greater the combined band width.

2.Time division multiplexing: is a digital process that allows several connections to share the high bandwidth of signal.

OSI MODEL

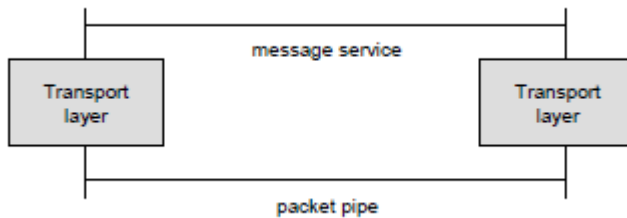
The open system interconnection Model does not define any services or protocols for OSI but instead provides a framework for coordinating the development of various standards for interconnecting different systems. It is a way of sub-dividing a communications system into smaller parts called layers. A layer is a collection of similar functions that provide services to the layer above it and receives services from the layer below it. On each layer, an instance provides services to the instances at the layer above and requests service from the layer below. The various layers of OSI Models are as follows:



Starting from Top Layer:

1. **Application layer:** This is the application that is used to access the network. Each application performs something specific to the user needs, e.g. browsing the web, transferring files, sending email, etc
2. **Presentation layer:** The main functions of the presentation layer are data formats, data encryption/decryption, data compression/decompression, etc.
3. **Session layer:** Mainly deals with access rights in setting up sessions, e.g. who has access to particular network services, billing functions, etc. There is not a strong agreement about the definition of these three top layers. Usually the focus is on the Transport layer, the Network layer, and the DLC layer.

4. **Transport layer:** While the network layer (see section below) provides end-to-end packet pipe to the transport layer, the transport layer provides end-to-end message service to the top layers.



Functions of the transport layer include:

- Breaking messages into packets and reassembling packets into messages (packets of suitable size to network) Resequencing packets at destination to retrieve correct order (e.g. Datagram)
- Achieving end-to-end reliable communication in case network is not reliable,
- Recover from errors and failures (arbitrary networks can join the Internet!)
- Flow control to prevent a fast sender from overrunning a slow receiver
- Examples of transport protocols for the Internet are TCP (Transmission Control Protocol) and UDP (User Datagram Protocol). When combined with the IP protocol at the network layer, we refer to TCP as TCP/IP.

5. **Network layer:** The main function of the network layer is to route each packet to the proper outgoing DLC or to the transport layer (if the node is the destination). Typically, the network layer adds its own header (e.g. source/destination or VC

number) to the packet received from the transport layer to accomplish this routing

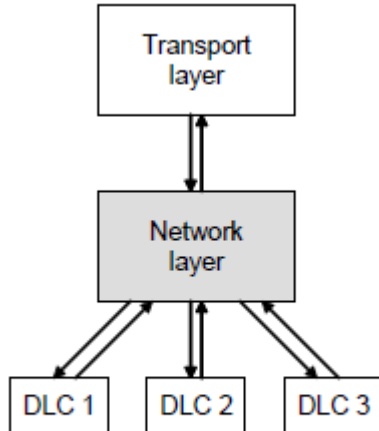


Figure 3: Routing

function..

Headers represent a general mechanism across the layers. Each layer/protocol provides a service to the upper layer/protocol, and peer processes/protocols communicate information through the headers. The DLC layer adds also a Trailer for error detection and correction.

6. **The DLC layer:** is responsible for error-free transmission of packets over a single link. The goal is to ensure that every packet is delivered once, only once, without errors and in order. To accomplish this task, DLC adds its own header/trailer. For instance, the header may contain sequence numbers to ensure delivery of packets in order. The packet thus modified is called a *frame*.

7. **Physical layer** :is responsible for the actual transmission of bits over a link. This layer is usually the network hardware. Higher layers, like DLC, must deal with transmission errors due to noise and signal power loss. A simple model for the physical layer is the Binary Symmetric Channel with a probability p of flipping each bit independently, i.e. $pf0 ! 1g = pf1 ! 0g = p$. However, in practice errors are bursty.

There are a number of delays associated with the physical transmission:

>> Propagation delay: time it takes for signal to travel from one end of link to another = distance/speed of light

>> Bandwidth: number of bits that can be transmitted over a period of time, i.e. bits per second (bps)

>> Latency of packet = Propagation delay + size of packet/Bandwidth + Queuing delay

>> RTT = Round Trip Time for exchanging small messages $\frac{1}{4} \times 2$ (Propagation delay + Queuing)

TCP/IP MODEL

A TCP/IP network is generally a heterogeneous network, meaning there are many different types of network computing devices attached.

Layering Model

In the early days of networking, before the rise of the ubiquitous Internet, the International Organization for Standardization (ISO) developed a layering model whose terminology persists today.

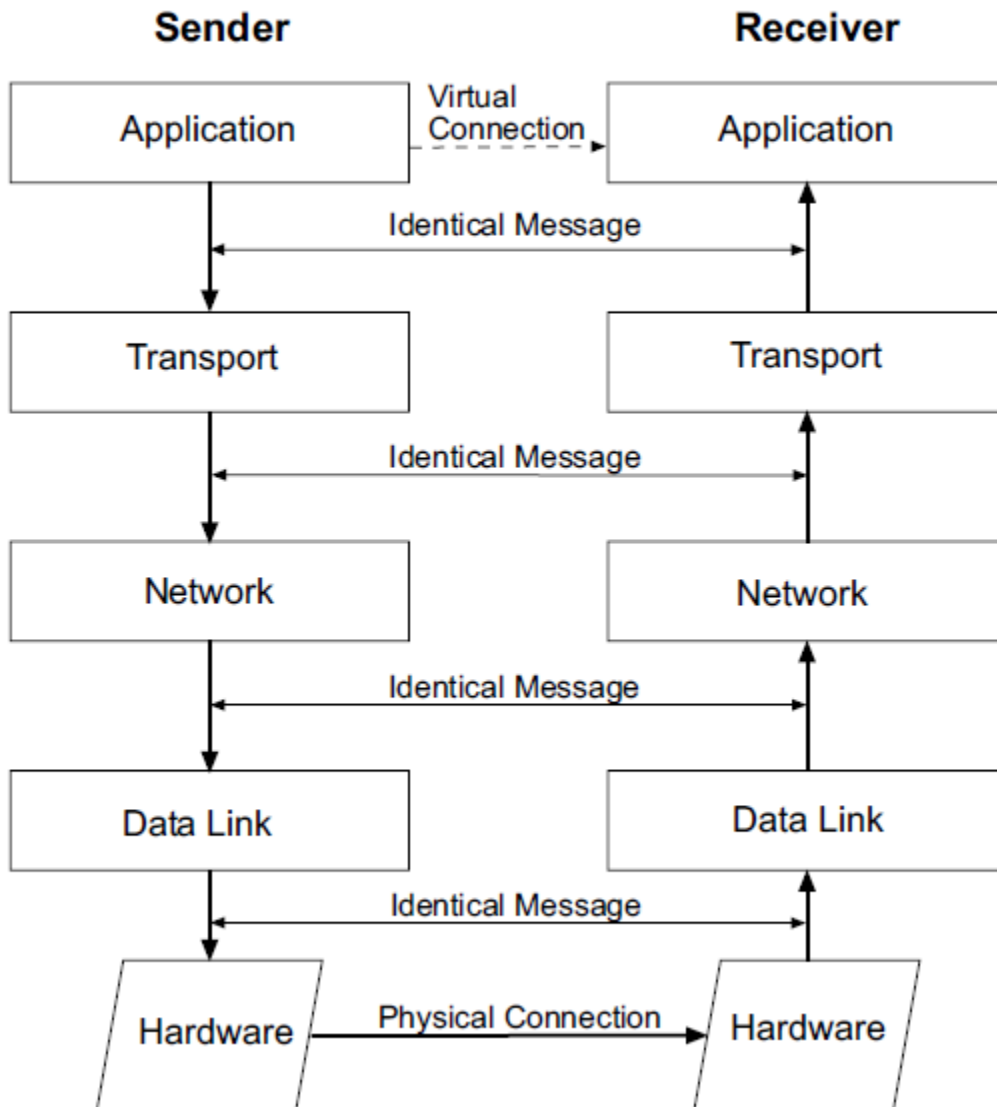
	Name of Layer	Purpose of Layer
Layer 5	Application	Specifies how a particular application uses a network.
Layer 4	Transport	Specifies how to ensure reliable transport of data.
Layer 3	Internet	Specifies packet format and routing.
Layer 2	Network	Specifies frame organization and transmittal.
Layer 1	Physical	Specifies the basic network hardware.

TCP/IP Protocol Stack

TCP/IP is the protocol suite upon which all Internet communication is based. Different vendors have developed other networking protocols, but even most network operating systems with their own protocols, such as Netware, support TCP/IP. It has become the de facto standard.

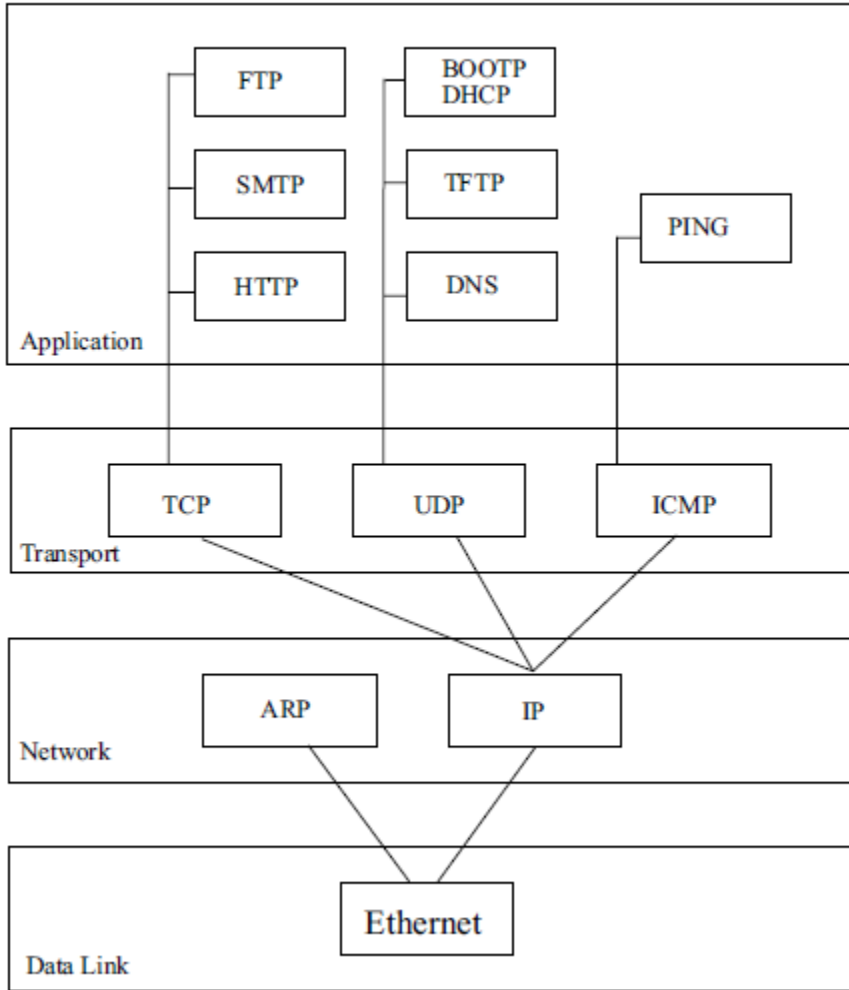
Protocols are sometimes referred to as protocol stacks or protocol suites. A protocol stack is an appropriate term because it indicates the layered approach used to design the networking software

Figure 4.1 Flow of Data Between Two Computers Using TCP/IP Stacks



TCP/IP Protocol Flow:

Figure 5.1 TCP/IP Protocol Flow



IP ADDRESSING:

IP: IP provides communication between hosts on different kinds of networks (i.e., different data-link implementations such as Ethernet and Token Ring). It is a connectionless, unreliable packet delivery service.

Connectionless means that there is no handshaking, each packet is independent of any other packet. It is unreliable because there is no guarantee that a packet gets delivered; higher-level protocols must deal with that.

IP Address

IP defines an addressing scheme that is independent of the underlying physical address (e.g; 48-bit MAC address). IP specifies a unique 32-bit number for each host on a network. This number is known as the Internet Protocol Address, the IP

Address or the Internet Address. These terms are interchangeable. Each packet sent across the internet contains the IP address of the source of the packet and the IP address of its destination. For routing efficiency, the IP address is considered in two parts: the prefix which identifies the physical network, and the suffix which identifies a computer on the network. A unique prefix is needed for each network in an internet. For the global Internet, network numbers are obtained from Internet Service Providers (ISPs) . ISPs coordinate with a central organization called the Internet Assigned Number Authority (IANA).

IP Address Classes

The first four bits of an IP address determine the class of the network. The class specifies how many of the remaining bits belong to the prefix (aka Network ID) and to the suffix (aka Host ID). The first three classes, A, B and C, are the primary network classes.

Class	First 4 Bits	Number Of Prefix Bits	Max # Of Networks	Number Of Suffix Bits	Max # Of Hosts Per Network
A	0xxx	7	128	24	16,777,216
B	10xx	14	16,384	16	65,536
C	110x	21	2,097,152	8	256
D	1110	Multicast			
E	1111	Reserved for future use.			

When interacting with mere humans, software uses dotted decimal notation; each 8 bits is treated as an unsigned binary integer separated by periods. IP reserves host address 0 to denote a network. 140.211.0.0 denotes the network that was assigned the class B prefix 140.211.

Netmasks: Netmasks are used to identify which part of the address is the Network ID and which part is the Host ID. This is done by a logical bitwise-AND of the IP address and the netmask. For class A networks the netmask is always 255.0.0.0; for class B networks it is 255.255.0.0 and for class C networks the netmask is 255.255.255.0.

Subnet Address

All hosts are required to support subnet addressing. While the IP address classes are the convention, IP addresses are typically subnetted to smaller address sets that do not match the class system. The suffix bits are divided into a subnet ID and a host ID. This makes sense for class A and B networks, since no one attaches as many hosts to these networks as is allowed. Whether to subnet and how many bits to use for the subnet ID is determined by the local network administrator of each network. If subnetting is used, then the netmask will have to reflect this fact. On a class B network with subnetting, the netmask would not be 255.255.0.0. The bits of the Host ID that were used for the subnet would need to be set in the netmask.

Directed Broadcast Address

IP defines a directed broadcast address for each physical network as all ones in the host ID part of the address. The network ID and the subnet ID must be valid network and subnet values. When a packet is sent to a network's broadcast address, a single copy travels to the network, and then the packet is sent to every host on that network or sub network.

Limited Broadcast Address

If the IP address is all ones (255.255.255.255), this is a limited broadcast address; the packet is addressed to all hosts on the current (sub)network. A router will not forward this type of broadcast to other (sub)networks.

Some **terminology** used in Data communication and Networking:

1. Automatic repeat request: This error control technique provides error recovery after the error is detected in the event of error detected by the ARQ at the receiving site, The receiver requests the sending site to retransmit the protocol data unit. This provides reliable data link. There are three version of ARQ:

A. Stop-and-wait ARQ: A sending station a frame to the destination station and waits until it receives an acknowledgement from the destination station.

B. Go-Back-N ARQ: If an error is detected in any frame (when an acknowledgment arrives at sending station) or the acknowledgment is lost or it is times out, in all three cases, the sending station will retransmit the same frame until it is received error-free on the receiving side.

C. **Go-Back-Select ARQ**: this is similar to Go-Back-N ARQ ,the only difference is being that here the frames behind the error frame are stored in a buffer at the receiving site until the error frame received error-free.

2.Datagram: It is a basic transfer unit associated with a packet-switched network in which the delivery, arrival time, and order of arrival are not guaranteed by the network service.

3. **Modulation**: It is an operation which translate a modulating signal into another signal using a constant carrier signal of high frequency.The main classes of modulation techniques :

A. **Analog Modulation (AM)** is of three type : Amplitude, Frequency and Phase Modulation

B. **Digital Modulation (DM)**

4. **Integrity**: means the data must arrive at the receiver exactly as it was send.There must b no change in the data. Technique used for the data integrity:

A. **Parity Check**; which is of 4 types:

1. **Simple Parity Check**: A redundant bit called the parity bit is added to every data unit so that total no of 1s n the becomes even.

2. **Even Parity Concept**: Before Transmitting the data, we pass the unit through a parity generator. The Parity generator counts no of 1s and appends the parity bit to the end. If in the end the no of parity bits are even then the whole unit is rejected.

3. **Cyclic redundancy Check (CRC)**: The receiver side calculates the proper parity character from the received block of data. The calculated parity is compared with that sent in the character check field. If both are same then there is no error and if they are not same then the negative acknowledgment is sent indicating the occurance of error.

4. **Check Sum:** If parity bit leave some error undetected then parity bits of all the characters in the frame can incorporate an additional check for error detection. It can be implemented in many ways.; for example 1s complement of a number.

5. **Hamming Code:** These codes were originally designed with $D_{min}=3$ which means they can detect upto two errors and correct a single error.

Error Control Methods: are used to reduce the effect of noise on the signals.

- **Block Codes:** consist of information bit, redundant bits and various Code are implemented to detect and correct the errors.
- **Convolution Codes:** They also generate codes words and they depend upon current as well as previous value of information.

6. **Switches:** A switched network consist of a series of interconnection nodes called switches. They are the devices capable of creating temporary connections between two or more devices linked to a switch.

- **Circuit Switching:** A dedicated connection is established for the duration of message between two nodes .This type of switching is done in telephone networks and some of the upcoming switched networks.
- **Packet Switching:** Data is sent in a sequence of small chunks called the packets. Each packet passed through node to node along some path leading from source to destination.

7. **Frame Relay:** Frame relay is a Virtual circuit wide area network .It operates at a high speed (1.54 - 44.376 MBPS)

- Operates in physical and data link layer.
- Allows bursty data
- It allows frame size of 9000 bytes and less expensive than other WANs.
- Has a error detection at the Data link layer only.

8. **LAN (Local area network):** are privately owned networks within a single building.

9. **MAN (Metropolitan Area Network)** covers a city. Best example of this is cable networks and MTNL.
10. **WAN(Wide Area Network)** spans a large geographical area often countries or continents.
11. **Repeater:** It is a device that works in a physical layer. Signals that carry information within a network can travel a fixed distance before attenuation endangers the integrity of data. A repeater receives the data signal and before it becomes too weak regenerates the original bit pattern.
12. **Router:** It provides interconnection between two networks. It is a networking unit which is compatible with the lower three layers.
13. A **gateway** is a network point that acts as an entrance to another network. On the Internet, a node or stopping point can be either a gateway node or a host (end-point) node. Both the computers of Internet users and the computers that serve pages to users are host nodes. The computers that control traffic within your company's network or at your local Internet service provider (ISP) are gateway nodes.
14. A **network bridge** is a network device that connects multiple network segments. It is a physical layer device. It regenerates the signal it receives. It can check the MAC addresses contained in the frame.