**1.Explain the utility of layered network architecture. Discuss protocols and standards in brief.**

Layered network architecture, commonly known as the OSI (Open Systems Interconnection) model or TCP/IP (Transmission Control Protocol / Internet Protocol) model, is a conceptual framework used to understand and design computer networks. It divides the communication process into several different layers, each responsible for specific functions.

The utilities of layered network architecture are as follows:

* **Modularity:** By dividing the network functionality into separate layers, the complexity of network design is reduced. Each level can be developed, maintained and modified individually, allowing for easier troubleshooting and upgrades.
* **Interoperability:** Layers define standard interfaces, protocols and procedures for the communication between different network components.
* **Abstraction:** Layers provide a level of abstraction, hiding the complexity of lower layers from higher layers. This abstraction allows the developers to focus on specific aspects of network functionality without needing to understand the underlying details of every layer.
* **Flexibility:** Layered architecture allows for the development of new protocols and technologies within a specific layer without affecting the functionality of other layers.

Layers of the OSI model:

1. Physical Layer – Deals with physical transmission of data over the network medium.
2. Data-Link Layer – This layer establishes, maintains, and terminates connections across the physical medium.
3. Network Layer – This layer handles routing and forwarding of data packets between different networks.
4. Transport Layer – This layer ensures reliable and orderly delivery of data between endpoints.
5. Session Layer – This layer establishes, manages and terminates sessions between applications.
6. Presentation Layer – Responsible for data representation.
7. Application Layer – Provides network services directly to user applications.

2.Compare OSI and TCP/IP reference model.

|  |  |  |
| --- | --- | --- |
| Aspect | OSI Model | TCP/IP Model |
| Layers | Seven Layers: Physical, Data-Link, Network, Transport, Session, Presentation, Application. | Four Layers: Network Interface, Internet, Transport, Application. |
| Protocols | Conceptual Model; Protocols based on it are less widely adopted. | Practical Standard for the internet; Protocols are closely aligned with the model. |
| Encapsulation | Data encapsulation occurs at every layer during transmission and reception. | Data encapsulation occurs but at a less rigid structure. |
| Development | Developed by the international organization of standardization (ISO) | Developed as a practical standard for the internet |
| Flexibility | More rigid structure providing a clear separation of concerns. | More flexible, often adopted to suit specific needs. |

3.What are the responsibilities of the network layer and transport layer in the Internet model?

Responsibilities of Network Layer:

* **Addressing** – The network layer is responsible for providing logical addresses to devices on the network. It assigns unique IP addresses to devices to enable communication.
* **Routing** – It determines the best path for data packets to reach their destination across interconnected networks.
* **Packet Forwardin**g – Once the route is determined, the network layer is responsible for forwarding packets from the source to the destination through intermediate routers.
* **Fragmentation and reassembly** – If necessary, the Network Layer can fragment data packets into smaller units for maximum transmission unit sizes and reassemble them at the destination.

Responsibilities of Transport Layer:

* **End-to-end communication:** The Transport layer facilitates communication between processes running on different hosts (computers) by providing reliable or unreliable data delivery services.
* **Segmentation and reassembly:** It divides data received from the upper layers into smaller segments for transmission and reassembles them at the destination.
* **Error detection and correction:** The Transport layer ensures data integrity by adding error detection codes (e.g., checksums) to detect transmission errors and, in some cases, providing mechanisms for error recovery.
* **Flow control:** It manages the flow of data between the sender and receiver to prevent congestion and ensure efficient data transmission.
* **Multiplexing and demultiplexing:** The Transport layer multiplexes data from different applications into a single connection and demultiplexes received data to the appropriate application.

4.How do the layers of the TCP/IP model correlate to the layers of the OSI model?

5.Briefly describe TCP/IP model.

6.What are the responsibilities of the Physical layer and Data Link layer in the Internet model?

Responsibilities of Physical Layer:

* Transmission of raw data-bits over a physical medium: The physical layer is responsible for transmitting raw binary data bits over the physical medium without considering the meaning or structure of the data.
* Physical characteristics of the transmission medium: It deals with specifications such as voltage levels, signalling rates, modulation techniques and connector types.
* Physical topologies: The physical layer defines the physical layout or topology of the network.
* Physical addressing: In some cases the physical layer may involve assigning physical addresses such as MAC address to devices to enable communication within the local network.

Responsibilities of Data-link Layer:

* Framing
* Media Access Control
* Error detection and correction
* Flow control
* Addressing within the local network