

Lecture 4a - Network Layer

TypeLecture

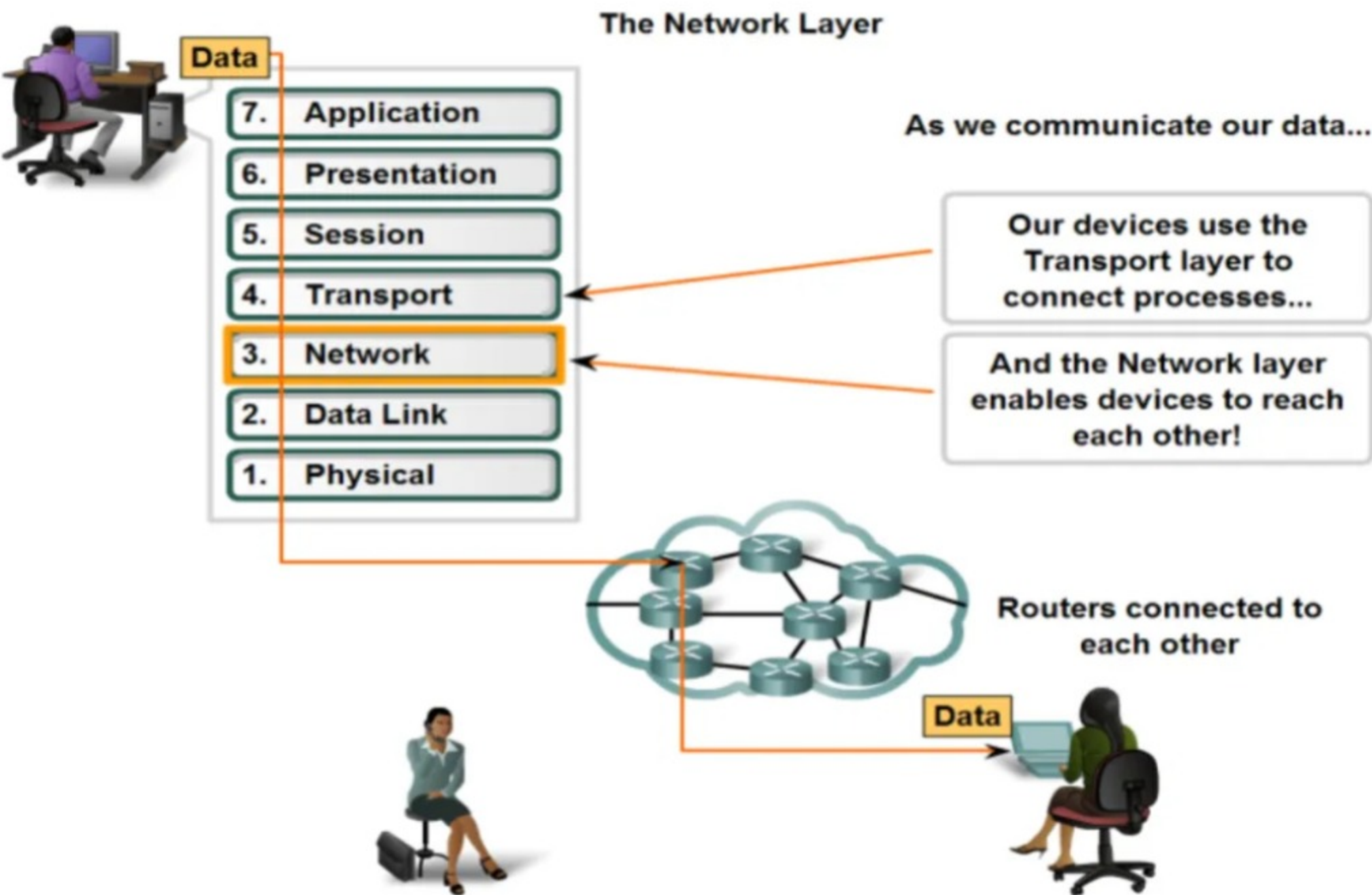
MaterialsEmpty

Reviewed✔

1. Role of the Network Layer
2. Network Layer Responsibilities
3. Network Layer Addressing
4. Handling Problems
5. Quizzes:

1. Role of the Network Layer

- **Addressing:** Take care of unique identity devices
- **Encapsulation:**
 - Encapsulate Transport PDU into a layer 3 header ⇒ packets
 - In each layer of the communication, as the data is passed down, the stacks perform encapsulation tasks, and then the reverse process needs to happen at the receiving end (decapsulation)
- **Decapsulation:**
 - Remove the layer 3 header
 - Deliver the transport PDU to the upper layers.
- **Packet routing:**
 - The routing table specifies the exit interface a package should take based on the destination address in the layer three header.



2. Network Layer Responsibilities

- Provide end-to-end connectivity across multiple Link Layer networks
 - Responsible for routing connections through the network
 - Only provides device connectivity – **not** application
- ⇒ The job of the network layers is to make sure those packets are **successfully** righted across the multiple hosts and received by the server, **not** which **application** on the server is receiving the information.
- ⇒ Keeping track of the sending and receiving of applications is the job of the **Transport layer**
- **Defines generic network behaviors:**
 - **Packet-based vs Connection-based**
 - **Packet-based:** each packet goes in different ways (i.e. **IP Network**)
 - **Connection-based:** need to establish a connection between 2 hosts, and then send the packets
 - **Best Effort or Guaranteed throughput**
 - **Best-effort protocols** will not implement mechanisms to **detect packet loss** and **reception acknowledgment** on retransmitting lost packets. (i.e. **IP network**)
⇒ Instead, it will be the job of the transport layer to deal with the information loss.
 - **Guaranteed:** specify an implement mechanisms to guarantee **minimum connectivity** requirements and **same order delivery**.
⇒ Before sending information on during the session, establishment applications will inform the network layer of its requirements
 - **Secure or Open**
 - Should aim to be Link Layer agnostic

3. Network Layer Addressing

- Should provide **unique, network-wide** addresses
- Addresses should have **structure** – helps routing traffic
- Addresses need to consider **potential network size**
 - The primary reason we now need **IPv6**

4. Handling Problems

- **Network connectivity issues**
 - Dealing with **loss**
 - Dealing with **duplication** ⇒ **DHCP IP detection**
- **Network routing issues**
 - Dealing with problems **routing traffic**
- **Network throughput issues**
 - How to guarantee **performance**
 - How to **deal** with **bottlenecks**

5. Quizzes:

- **Handling problems at the Network Layer:** Match the solution to the problem.

Routing Protocols✔

DHCP IP detection✔

Routing Protocols✔

Resource Reservation✔

Network paths can become unavailable due to a hardware failure or a cable breakage along the path.

Layer 3 addresses must be unique network wide. For example, IP address duplication will disrupt connectivity for the hosts involved.

Due to congestion or varying bandwidth links across the path, a device might not be able to transmit data at the same rate it's receiving it.

Different applications have different network requirements in terms of delay, bandwidth and packet loss.