

NSCOM01

Introduction to Network Applications

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NETWORK APPLICATIONS

- ❑ **Network applications provide users with the capability to exchange data over a computer network**
- ❑ **Are essentially *distributed applications* – applications whose components are located on different computers, which accomplish a goal through coordination and communication over a network**
- ❑ **Implement application layer protocols to define operations that may be done across a network and prepare data for exchange**
- ❑ **Rely on transport protocols to manage connections and exchange data between hosts**

TYPES OF NETWORK APPLICATIONS

❑ Network-Aware Applications

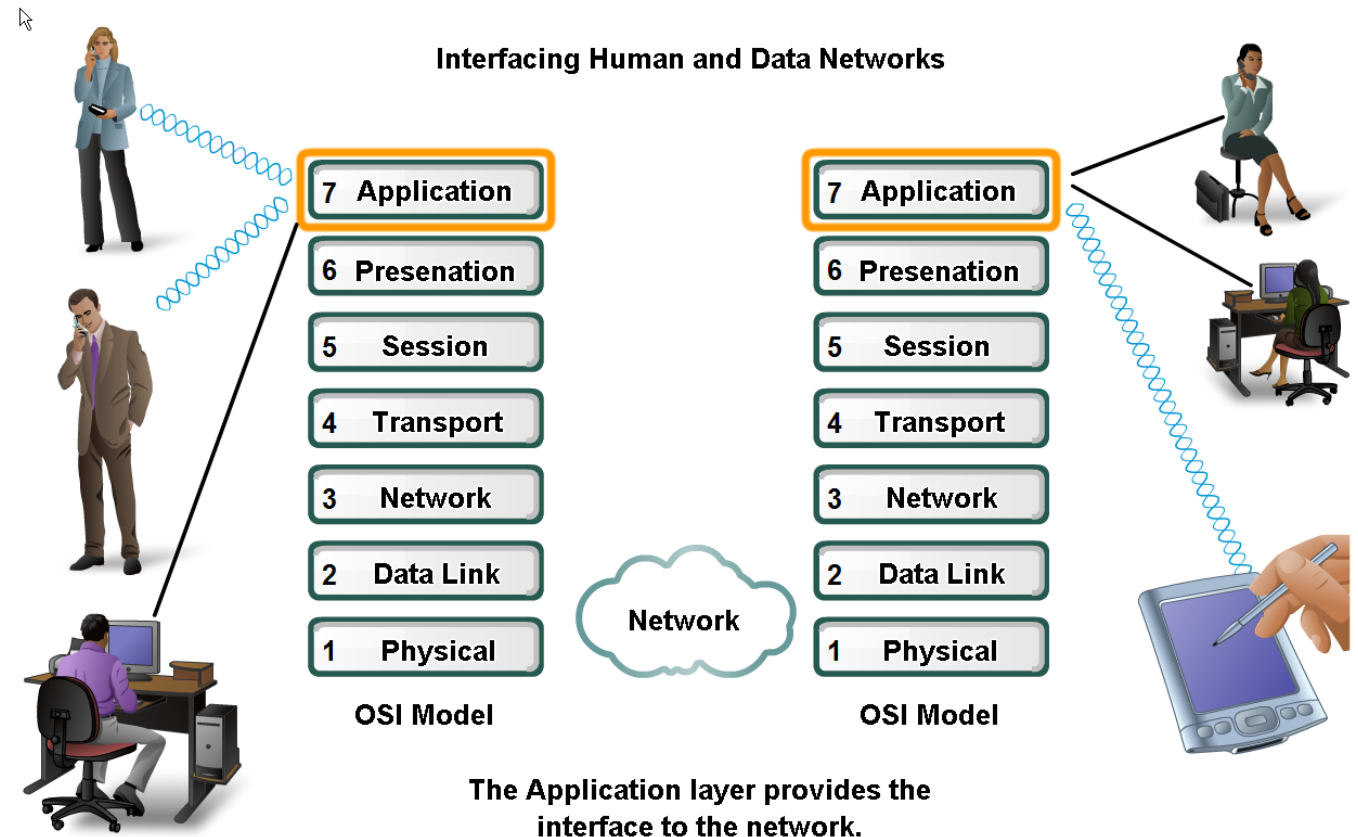
- Software programs that implement network protocols and are able to communicate directly with the network.
- Ex: Email clients, web browsers, instant messengers

❑ Application Services

- Provide network resource access to non-network aware software.
- Are not directly accessed by users.
- Follow protocols to prepare data for the network
- Ex: print spooling services, file transfer service

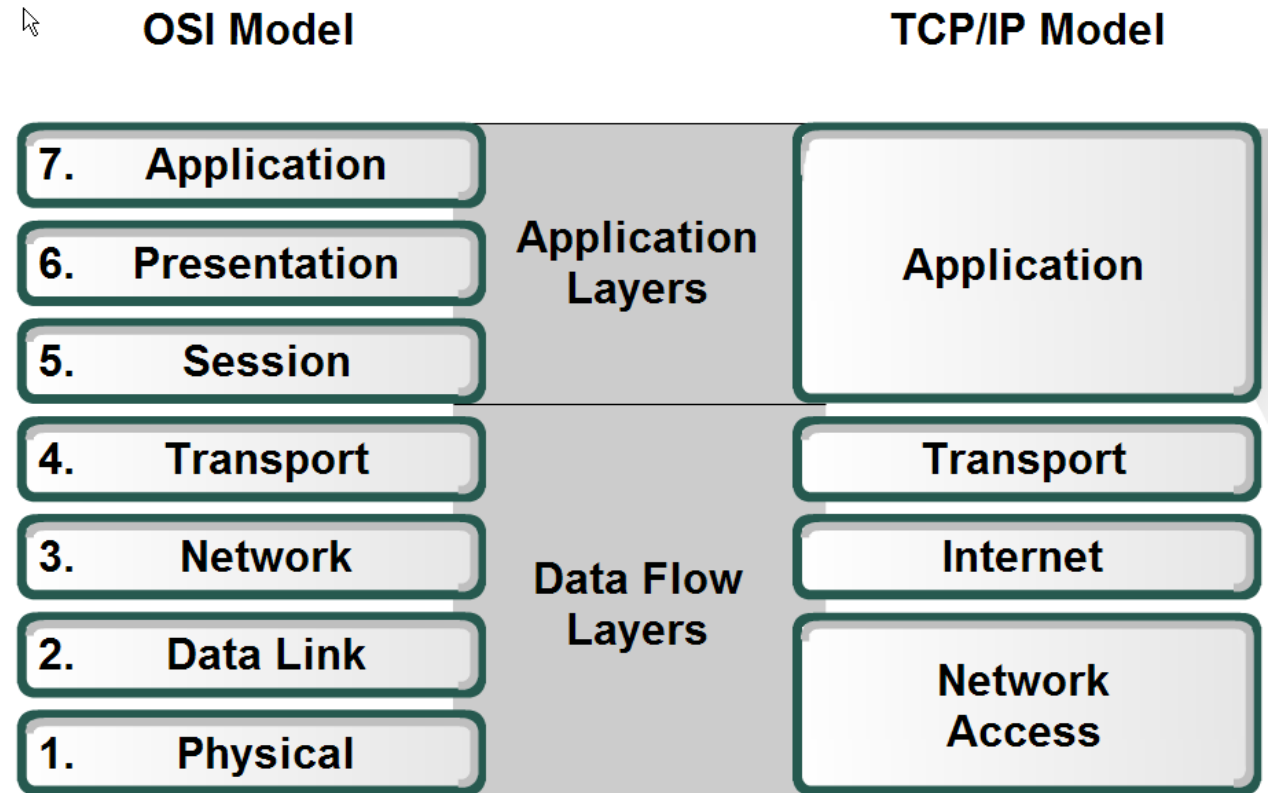
APPLICATION LAYER

- ❑ Provides the interface between applications and the underlying network over which messages are transmitted



APPLICATION LAYER - OSI vs TCP/IP

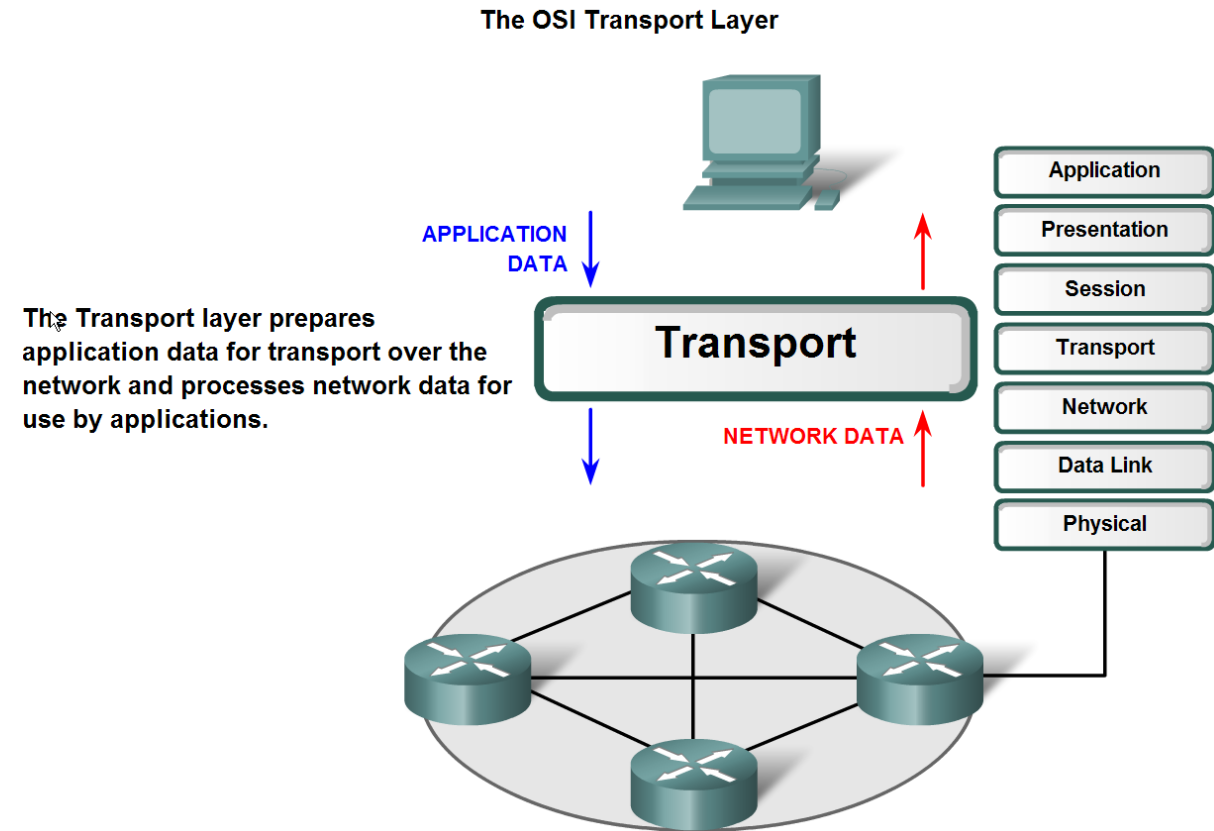
- ❑ **The TCP/IP Application layer implements the functions of the application, presentation, and session layers of the OSI model**



REVIEW: TRANSPORT LAYER

❑ The transport layer prepares application data for delivery over the network

- Tracking individual communications between applications
- Segmenting data and managing each segment
- Reassembling segments into application data streams
- Performing flow control
- Enabling error recovery
- Initiating a session



DESIGN CONSIDERATIONS

Network
Architecture

Scalability

Performance

Modifiability

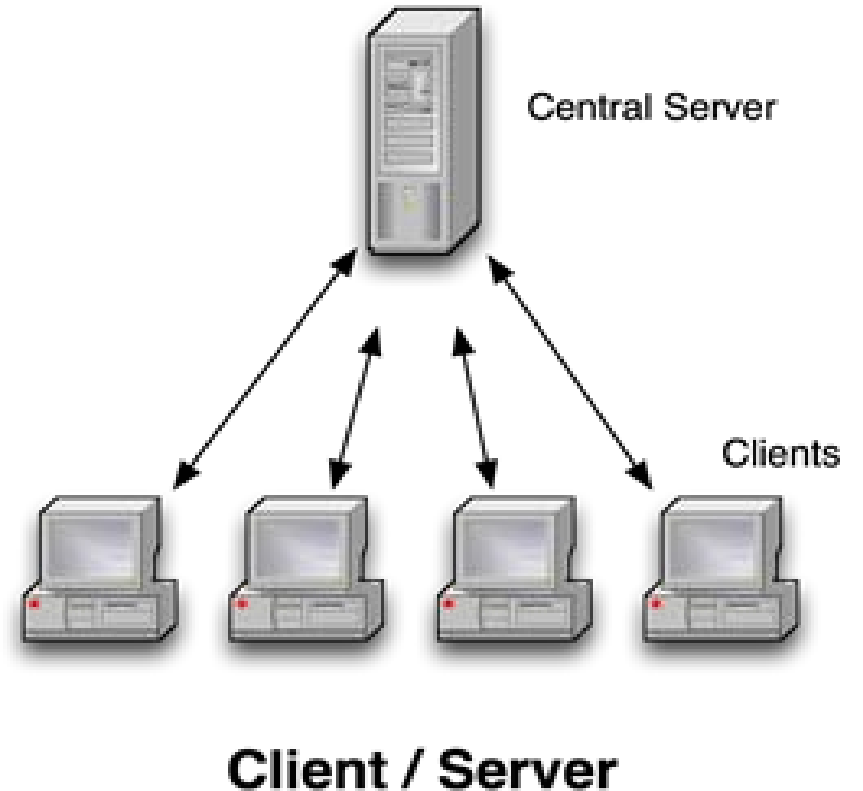
Reliability

Security

NETWORK ARCHITECTURE

❑ Client-Server Model

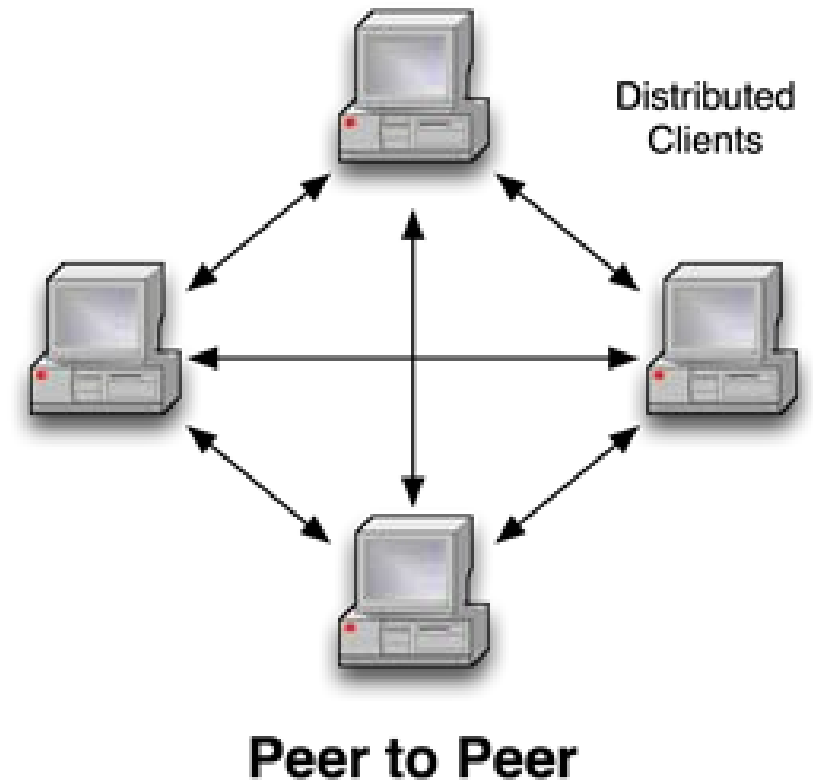
- A network architecture wherein hosts called 'clients' retrieve resources or request for services from a central host
- The server is a central host that runs services or daemons which listen for client requests and perform operations as requested by a client
- Easy administration and management of data but requires a dedicated host to function as server



NETWORK ARCHITECTURE

□ Peer-to-Peer Model

- An architecture that divides tasks or workloads among multiple computers called 'peers'
- Peers share resources without a dedicated server. Instead, each 'peer' can request for resources (similar to a client), and can offer resources to others (similar to a server).
- Easy to deploy, but more difficult to manage because of its decentralized nature



PERFORMANCE

- ❑ **Is roughly defined as the 'speed' and 'efficiency' at which an application accomplishes a given operation**
- ❑ **Can be further qualified as network performance and user-perceived performance**
- ❑ **Network Performance**
 - **Throughput** - rate at which information, including both application data and communication overhead, is transferred between components.
 - **Overhead** – accounts for additional data and time consumed for protocol control messages and error correction. This includes both initial setup overhead and per-interaction overhead
 - **Goodput** - amount of useful information that is delivered per second

PERFORMANCE

□ User-Perceived Performance

- measured in terms of its impact on the user in front of an application rather than the rate at which the network moves information
- **Latency** - time period between the onset of a request and the first indication of a response
- **Completion Time** – amount of time taken to complete an application action

WHAT AFFECTS PERFORMANCE?

- ❑ **Time needed for the application to set up a session between hosts and the transport layers to set up a connection**
- ❑ **Amount of data that needs to be exchanged per interaction**
 - Control messages – messages that do not contain user data but are nonetheless required for protocol operations
 - Amount of metadata (e.g. protocol headers)
 - Size and encoding of actual useful data
- ❑ **Error correction and recovery requirements**
- ❑ **Actual processing of the data by the application**

MODIFIABILITY

- ❑ Refers to the ease with which a change can be made to the application design
- ❑ **Extensibility** - ability to add functionality to a system without negatively impacting the rest of the system.
- ❑ **Customizability** - ability to temporarily specialize the behavior of a component such that it can be extended by one client without adversely impacting other clients
- ❑ **Configurability** – ability to accommodate post-deployment modification of components, or configurations of components, such that they are capable of using a new service or data element type

RELIABILITY

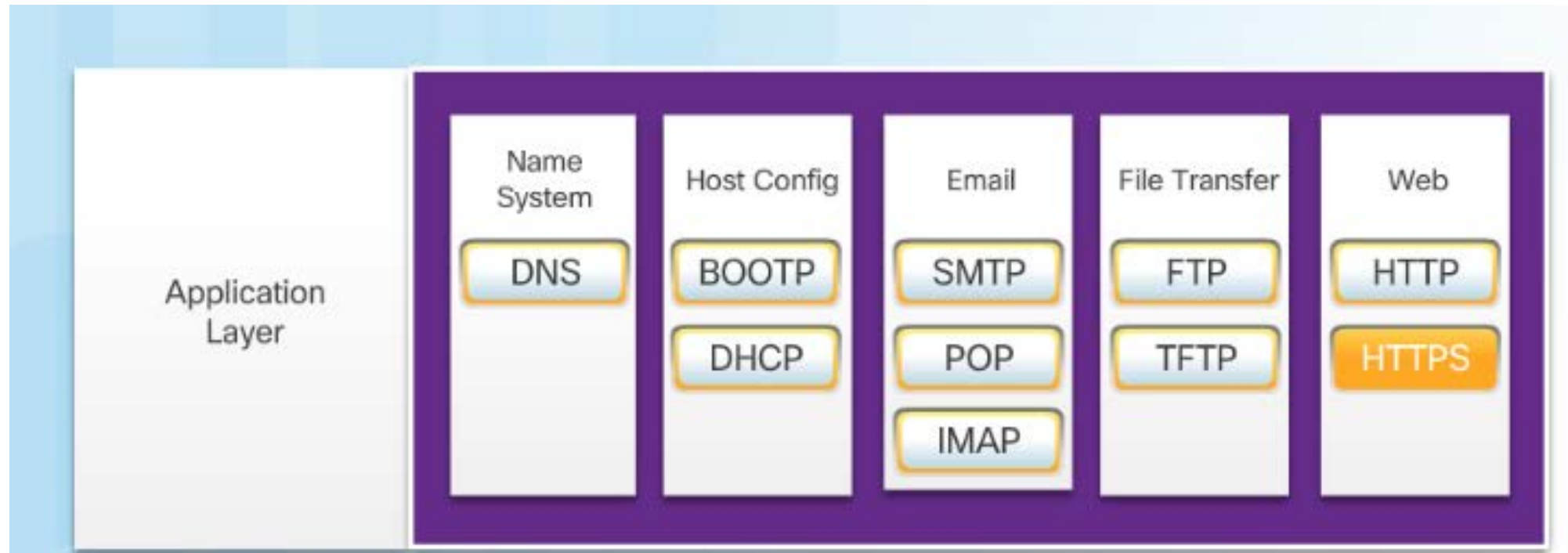
- ❑ **Degree to which the application is susceptible to failure at the system level in the presence of partial failures within components, connectors, or data**
- ❑ **What affects reliability?**
 - Network architecture – single point of failure or redundancy
 - Monitoring mechanisms – e.g. keepalives
 - Mechanisms for error detection – e.g. checksums, data acknowledgments, error codes
 - Mechanisms for error recovery – e.g. timeouts, support for retransmissions

SECURITY

- ❑ **Refers to the capability of the application to protect the data it handles from improper access**
- ❑ **Factors that affect security:**
 - Access control - requirement of user credentials, authorization
 - Encryption of data
 - Data integrity protection - checksums and hashes

TCP/IP APPLICATION LAYER PROTOCOLS

- ❑ Most widely known TCP/IP application layer protocols define the operations that fulfill the roles of the OSI application, presentation and session layers



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