Introduction to Networking

Unit 1

Outline

What is a Network?

Network Components

Networking Requirements

OSI Model

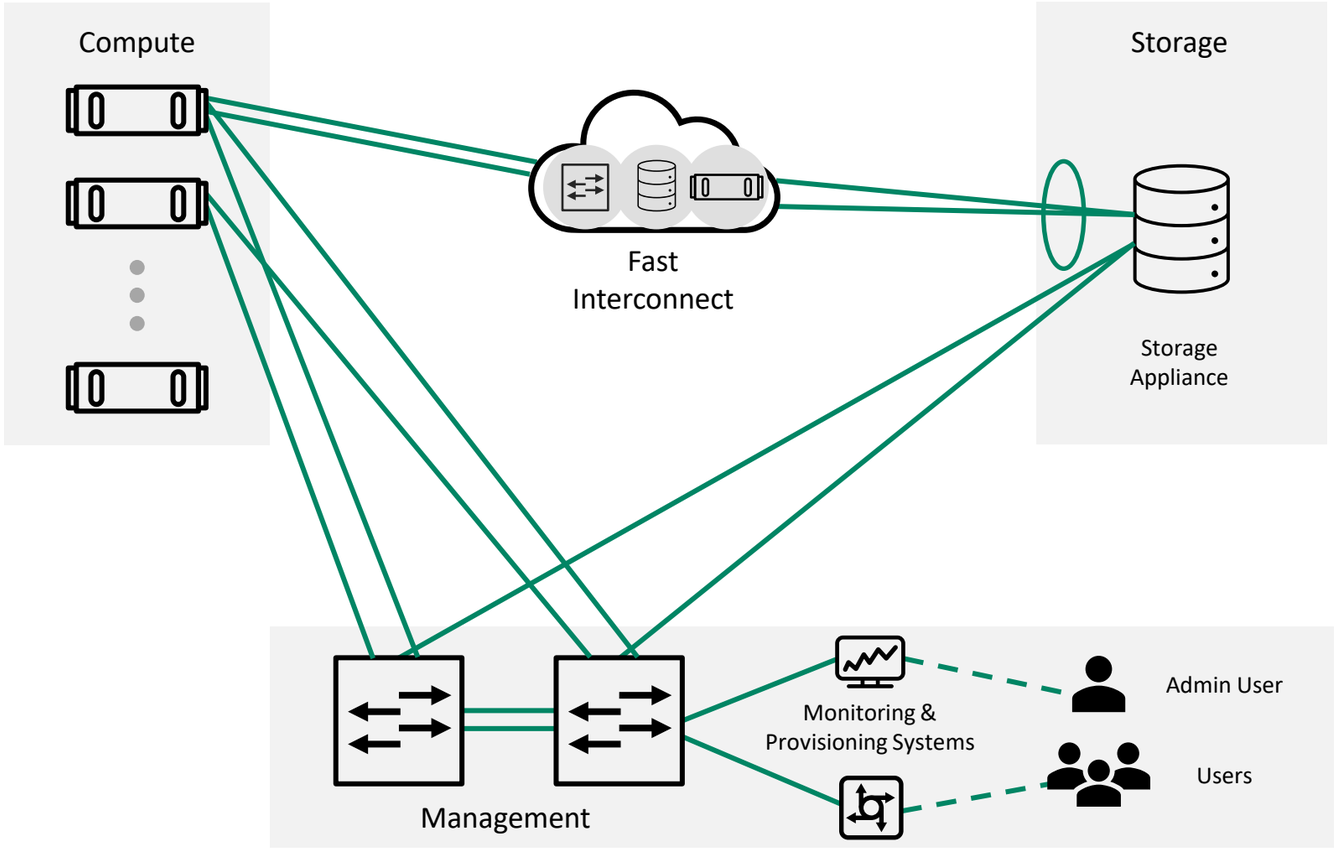
TCP/IP Protocol Suite

What is a Network?

A network is collection of nodes, connected together
so that they can exchange data such as voice, video, storage,
or management.

Characteristics of a network:

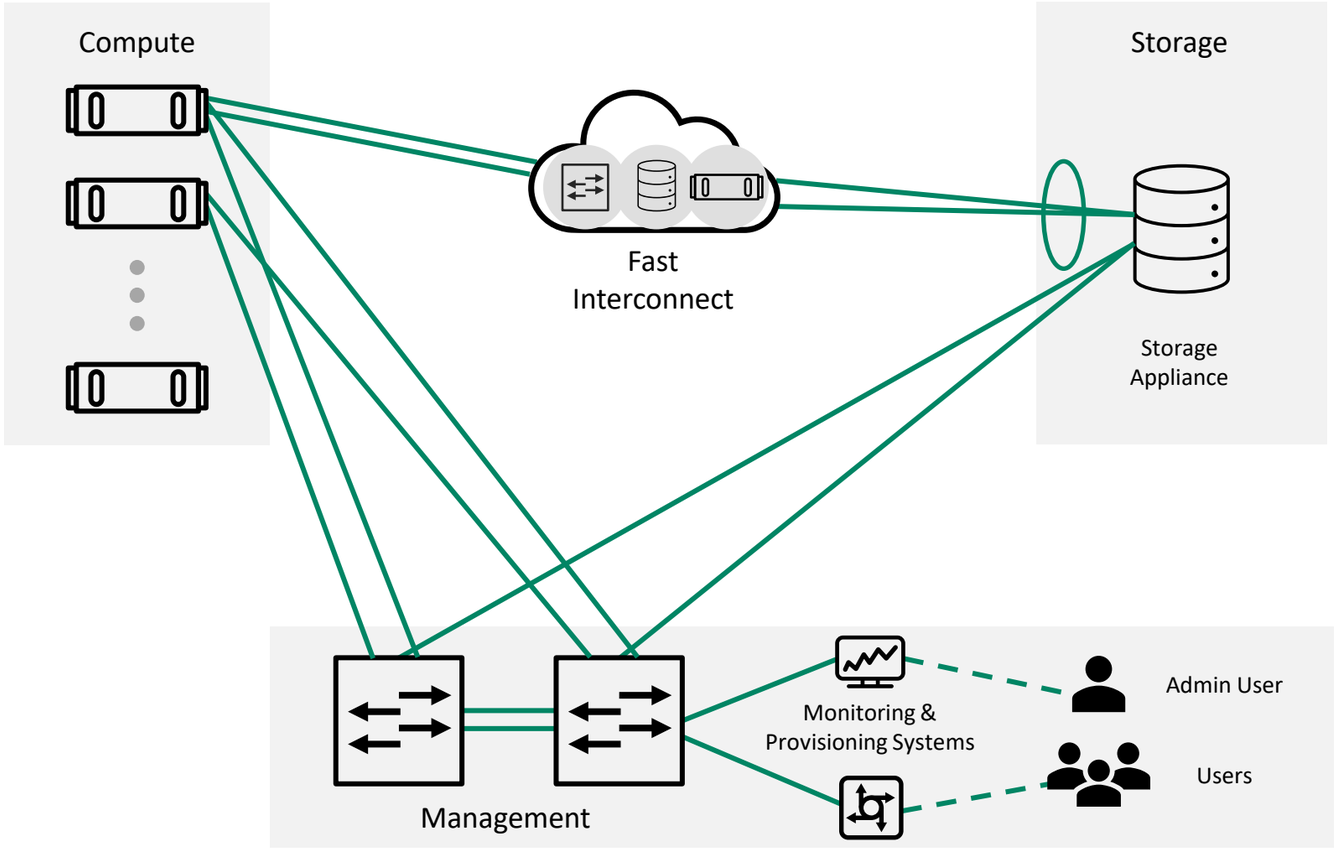
- Bandwidth
- Latency
- Availability
- Scalability
- Security



Network Components

Network components include the end nodes and intermediate nodes.

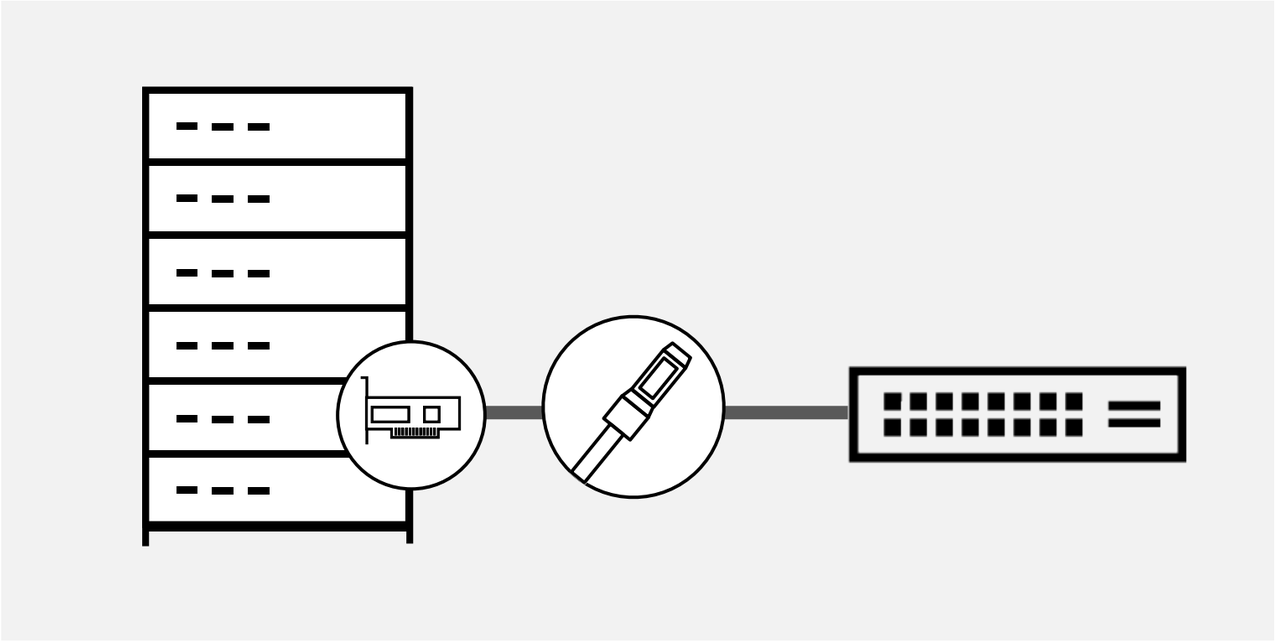
- End nodes - compute, storage, and management nodes. These are used as the source or destination of the traffic carried in the network.
- Intermediate nodes - switches and routers receive the traffic generated by the end nodes and make decisions where to forward the traffic.



Forming a Network

Build a Simple Network

- Every end node has a network interface card, or NIC.
- The NIC is a hardware component that resides in a slot and has one or more network ports.
- Use a cable to connect the network interface card (NIC) in the end point to a switch port



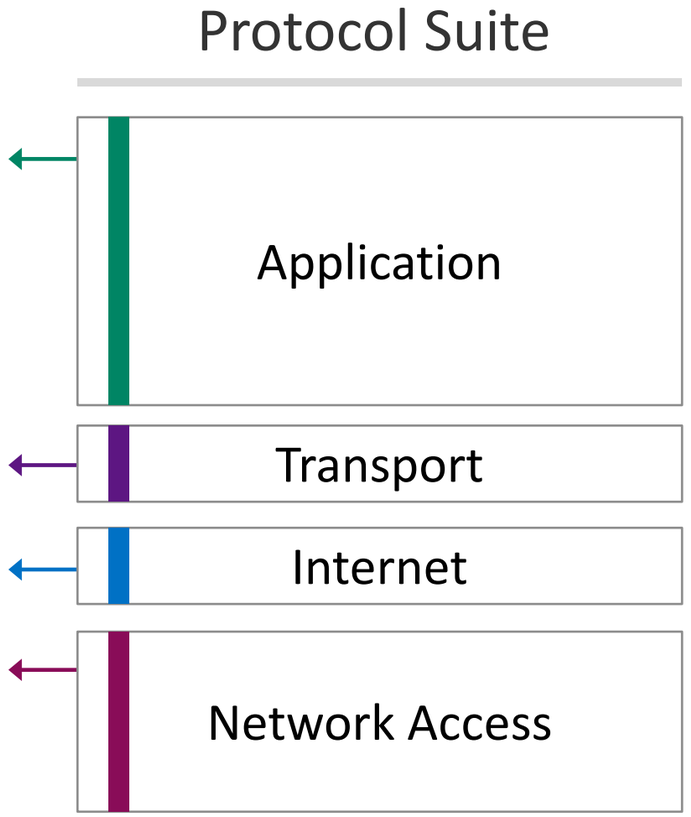
Protocol Suite

Communication between nodes requires interaction between several protocols, where each protocol is responsible for a specific set of activities.

Each protocol defines a common format and set of rules for exchanging messages between devices.

- Setup and termination of data transfer sessions
- Message format
- Error and system messages

A protocol suite is a group of protocols that run concurrently to implement network communication.



OSI Model

OSI – Open Systems Interconnection

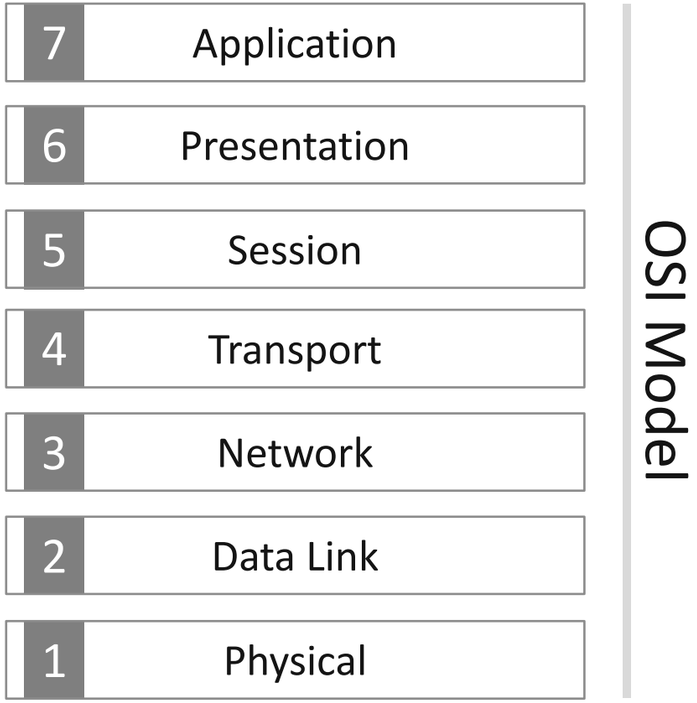
The OSI model breaks down the different components of network communication into layers, in order to make communication easier.

- Defines 7 layers
- ISO standard

OSI is a generic, protocol-independent standard

Why a layered network model?

- Standardizes interfaces
- Facilitates modular engineering
- Ensures interoperable technology
- Accelerates evolution

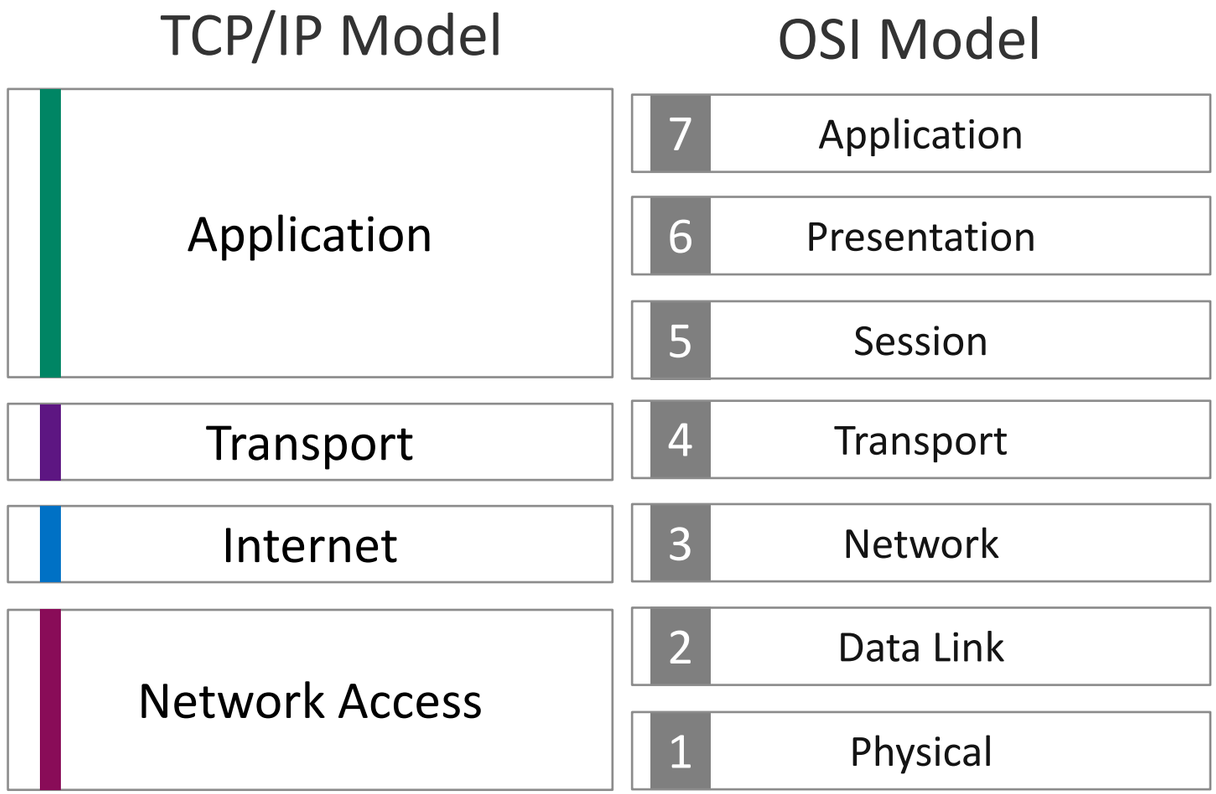


TCP/IP Model

TCP/IP model is, in a way, an implementation of the OSI model.

DoD Model:

- In the 1970s, the U.S. Department of Defense developed a network called ARPAnet that enabled data transport between computers at different locations by creating alternate routes.
- TCP/IP was used as the system protocol
- TCP/IP is the protocol for the Internet

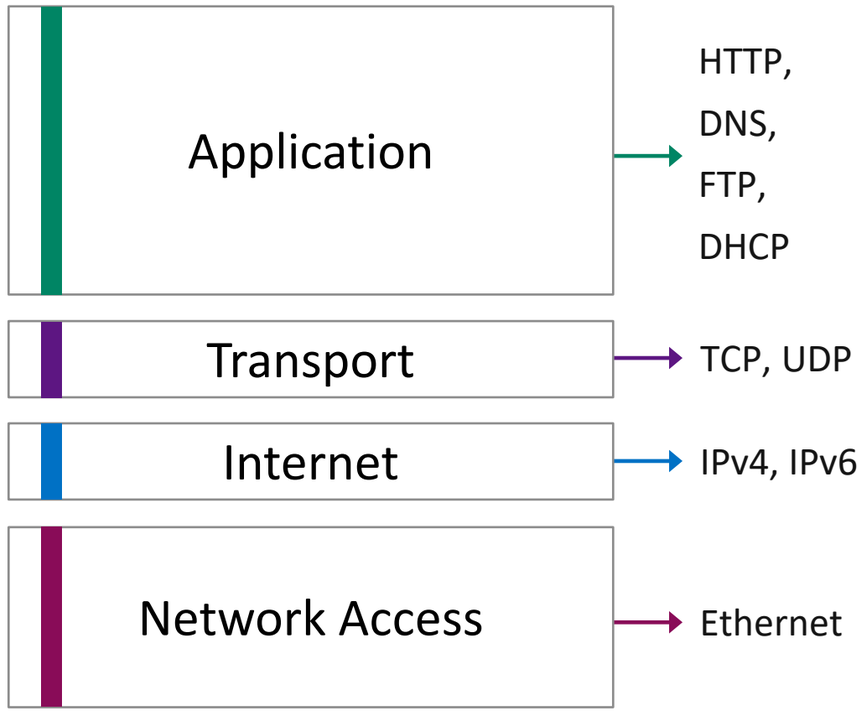


TCP/IP Protocol Suite

TCP (Transmission Control Protocol)

IP (Internet Protocol)

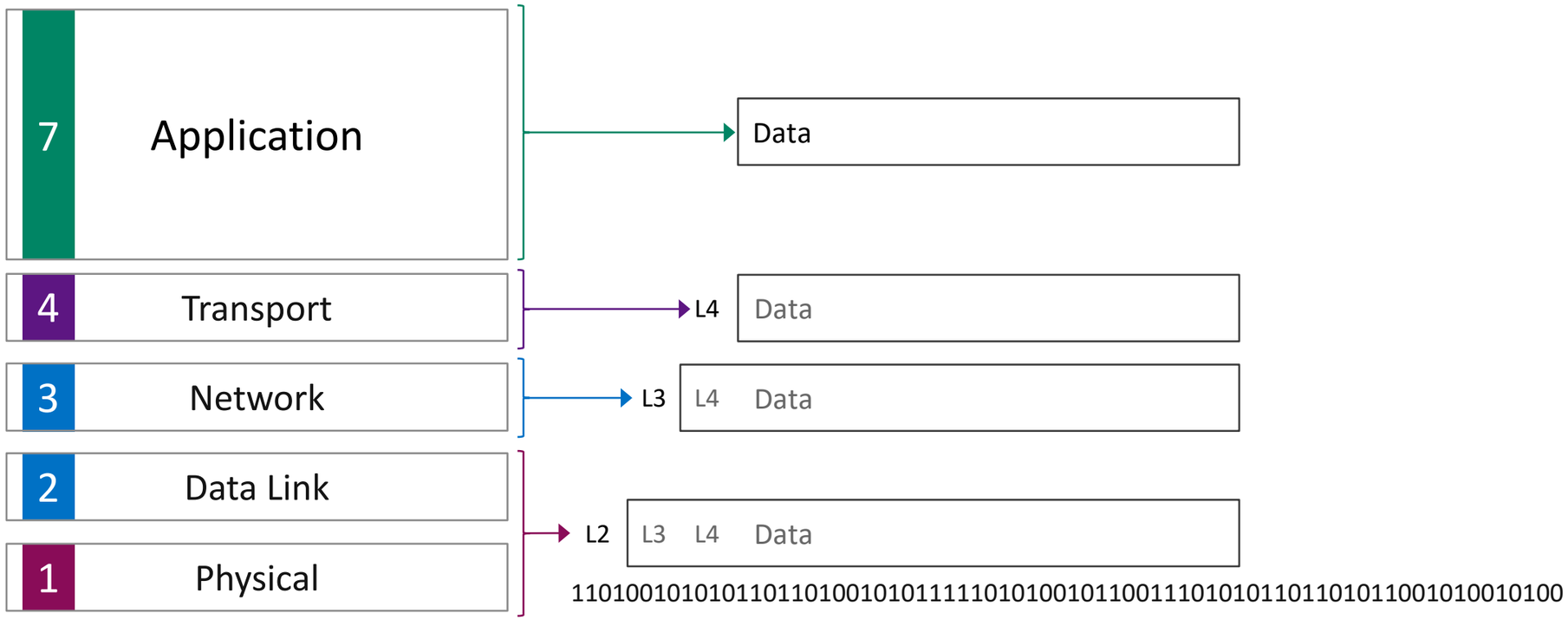
- TCP/IP suite is a set of communications protocols used on the Internet.
- It includes protocols that specify how data is packetized, addressed, transmitted, routed, and received, thus providing end-to-end data communication.
  - Internet layer protocols - IPv4 and IPv6 (layer 3)
  - Transport layer protocols - TCP and UDP (layer 4)
  - Application layer protocols - HTTP, FTP, etc. (layer 7)



Encapsulation

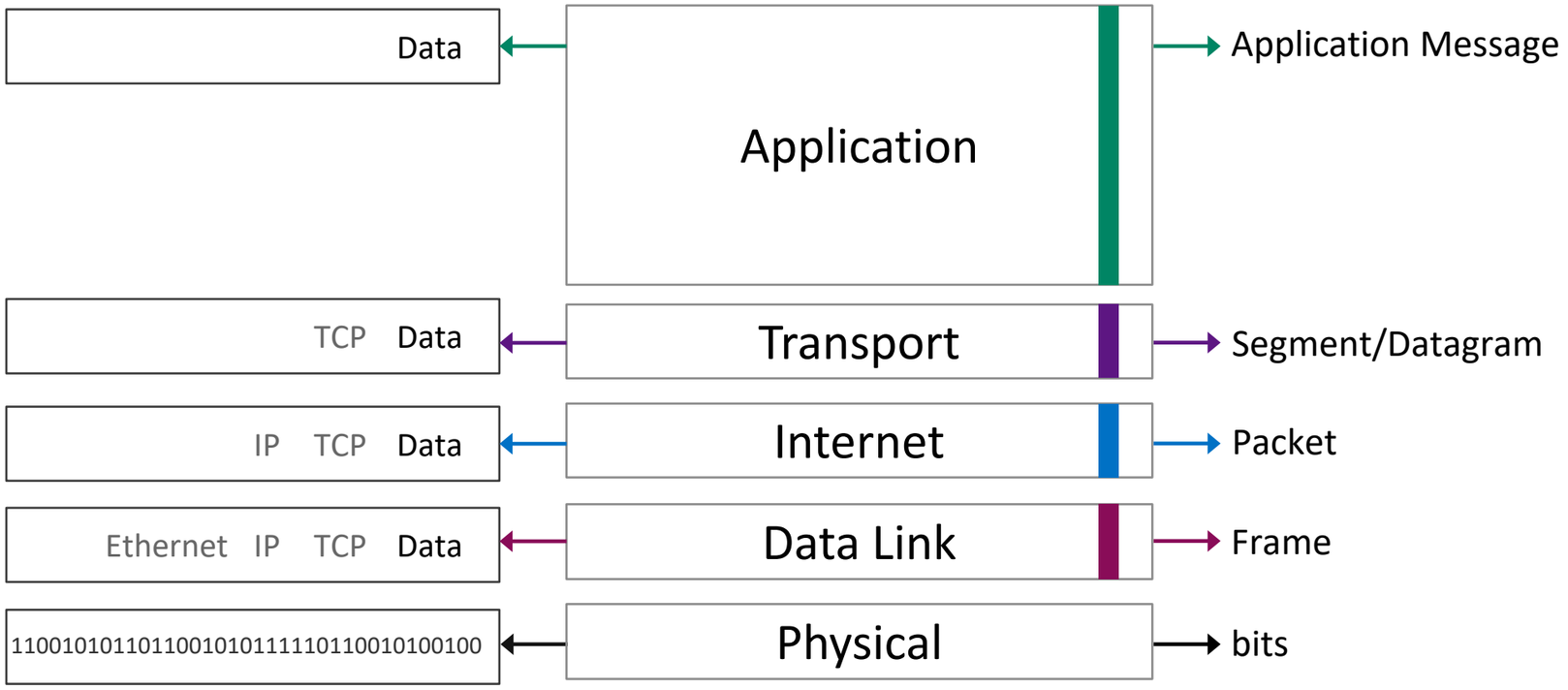
Application messages created by the application layer are passed to a “production line” of the lower layers, where each layer adds its relevant information, encapsulating the data with the layer header.

By the end of the encapsulation process, the encapsulated data is transmitted on the wire.



PDUs – Protocol Data Units

Each layer is associated with different protocols, PDUs, addresses, and devices.

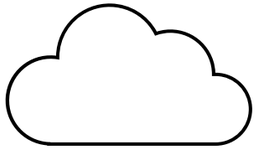


Port Number

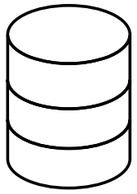
Logical Address

Physical Address

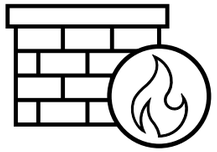
Network Topology Icons



Network Cloud



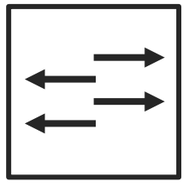
Storage



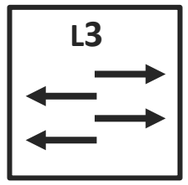
Firewall

Server

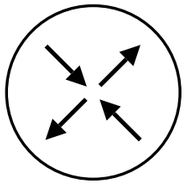
Compute



Switch



L3 Switch



Router

Summary

What is a Network?

Network Components

Networking Requirements

TCP/IP Protocol Suite

Examine Your Knowledge 1

Drag and drop the correct characteristics of each of the models.

TCP/IP Model

- DoD standard
- 4-layer model
- Provided with a suite of protocols
- Used on the Internet

OSI Model

- ISO standard
- 7-layer model
- Protocol-independent standard
- Describes generic network architecture

Examine Your Knowledge 2

What is data encapsulation?

A. The process of adding extra information at each layer of the OSI model while information flow from one host to another host.

B. The process of breaking down the different functionalities of network communication into layers, in order to make communication easier.

C. The process that specify how data is packetized, addressed, transmitted, routed, and received.