

# Computación en Internet I

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2023-1

## 1 Network

- A Nuts-and-bolts description
- A Services description
- Protocols

## 2 Layers

- Layered Architecture
- Encapsulation

## 3 The OSI model

- Definition
- OSI layers
- Comparison

## 4 Workshop

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## 4 Workshop

### What is the Internet?

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- End systems are connected together by a network of communication links and packet switches.
  - ▶ Many types of communication links made of different types of physical media (coaxial cable, copper wire, optical fiber, radio spectrum).
  - ▶ Links can transmit data at different rates, with the transmission rate of a link measured in bits/second.

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- Finally, these packets are reassembled into the original data.

**What does a packet switch do?**



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- Both types of switches forward packets toward their ultimate destinations.
- Link-layer switches are typically used in access networks, while routers are typically used in the network core.

**What is a route or a path?**

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- Enable sending data or network packets between a source and destination node over a network channel that is shared between multiple users and/or applications.
- The segregation of data into small packets enables efficient data transportation and better utilization of the network channel.

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- ISPs that provide access to end systems must also be interconnected.

### How are ISPs organized?



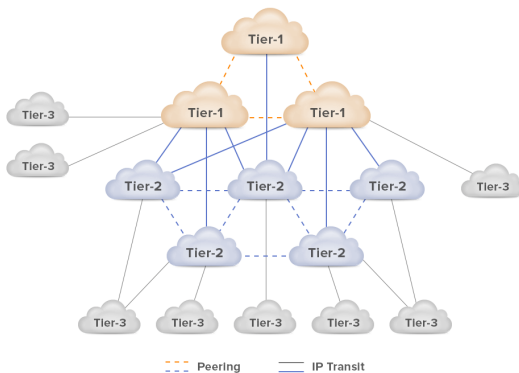
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# A Nuts-and-bolts description

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### How do these tiers work?

- Tier 1

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- Tier 1
  - ▶ Have a global reach and they are the backbone of the Internet.
  - ▶ Do not buy transit service, and they peer with each other at zero cost.
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- ▶ Local providers with national reach.
- ▶ Usually buy IP transit from Tier-2 providers to avoid expensive Tier-1 IP transit.
- ▶ Are typically without any transit customers and have no peering connections.



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- Traditional applications such as e-mail and Web surfing.
- Also mobile smartphone and tablet applications, including Internet messaging, music streaming, movie and television streaming, online social media, etc.

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### How do programs communicate via the Internet?

- End systems attached to the Internet provide a socket interface.
- This socket specifies how a program running on one end system asks the Internet infrastructure to deliver data to a specific destination program running on another end system.
- It is a set of rules that the sending program must follow so that the Internet can deliver the data to the destination program.

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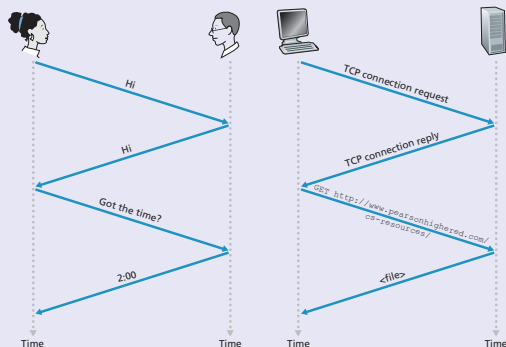
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## What is a network protocol?

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- Defines the format and the order of messages exchanged between two or more communicating entities, as well as the actions taken on the transmission and/or receipt of a message or other event.



**Figure 1.2** ♦ A human protocol and a computer network protocol

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- This simplification itself is of considerable value by providing modularity, making it much easier to change the implementation of the service provided by the layer.
- As long as the layer provides the same service to the layer above it, and uses the same services from the layer below it, the remainder of the system remains unchanged when a layer's implementation is changed.

**What is protocol layering?**



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- Each layer provides its service by performing certain actions within that layer and by using the services of the layer directly below it.
- A protocol layer can be implemented in software, in hardware, or in a combination of the two.

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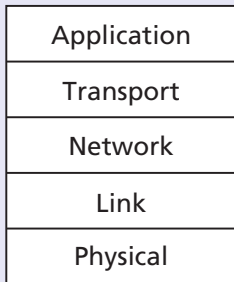
## What are the drawbacks of protocol layering?

- One layer may duplicate lower-layer functionality.
- Functionality at one layer may need information that is present only in another layer; this violates the goal of separation of layers.

**What is the protocol stack?**

## What is the protocol stack?

The protocols of the various layers.



**Five-layer  
Internet  
protocol stack**

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- An application-layer protocol is distributed over multiple end systems.
- The application in one end system uses the protocol to exchange packets of information with the application in another end system.

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  - ▶ The UDP protocol provides a connectionless service to its applications.
  - ▶ This is a no-frills service that provides no reliability, no flow control, and no congestion control.

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  - ▶ Defines the fields in the datagram as well as how the end systems and routers act on these fields.
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  - ▶ IP is the glue that binds the Internet together.
- The Internet's network layer also contains routing protocols that determine the routes that datagrams take between sources and destinations.

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- At this next node, the link layer passes the datagram up to the network layer.

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- As datagrams typically need to traverse several links , a datagram may be handled by different link-layer protocols at different links along its route.
- The network layer will receive a different service from each of the different link-layer protocols.

**What is the physical layer?**



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- Is the one in charge of moving the individual bits within the frame (link-layered packet) from one node to the next.
- The protocols in this layer are link dependent and further depend on the actual transmission medium of the link (for example, twisted-pair copper wire, single-mode fiber optics).

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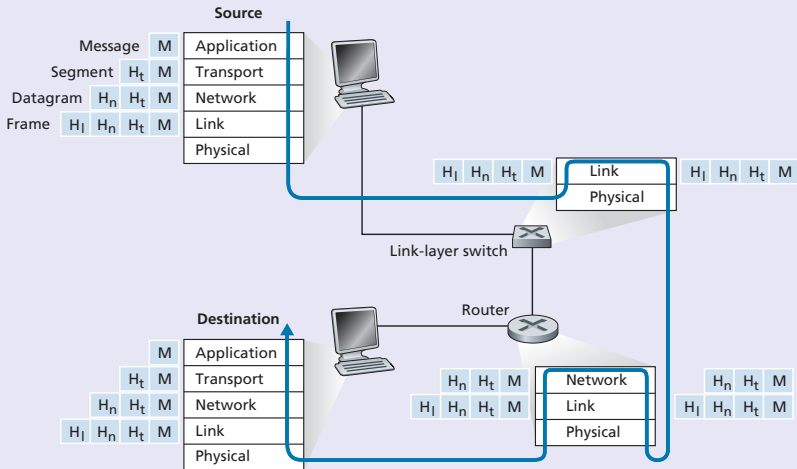
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**How is the physical path data takes from source to destination?**

# Encapsulation

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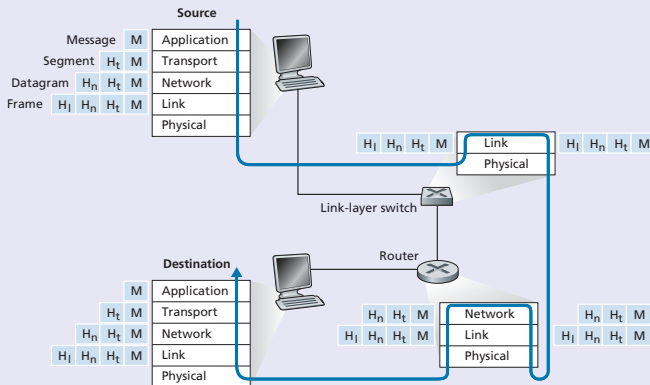
- Is a method of designing modular communication protocols in which logically separate functions in the network are abstracted from their underlying structures by inclusion or information hiding within higher-level objects.
- It takes information from a higher layer and adds a header to it, treating the higher layer information as data



**How does encapsulation work in an example?**

# Encapsulation

## How does encapsulation work in an example?



- At each layer, a packet has two types of fields: header fields and a payload field.
- The payload is typically a packet from the layer above.

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- Provided the first framework governing how information should be sent across a network, and enables diverse communication systems to communicate using standard protocols.
- Provides a standard for different computer systems to be able to communicate with each other.
- It divides the networking process into seven logical layers, each of which has unique functionality and to which are assigned specific services and protocols.



## 1 Network

- A Nuts-and-bolts description
- A Services description
- Protocols

## 2 Layers

- Layered Architecture
- Encapsulation

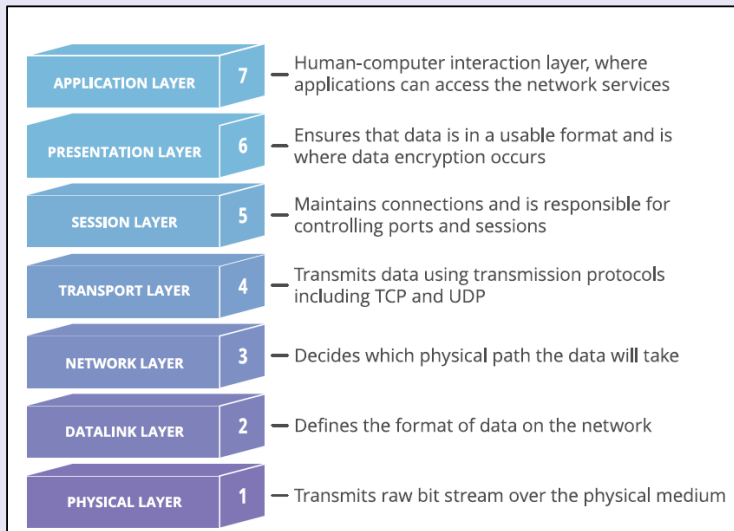
## 3 The OSI model

- Definition
- OSI layers
- Comparison

## 4 Workshop

**Which are the OSI layers?**

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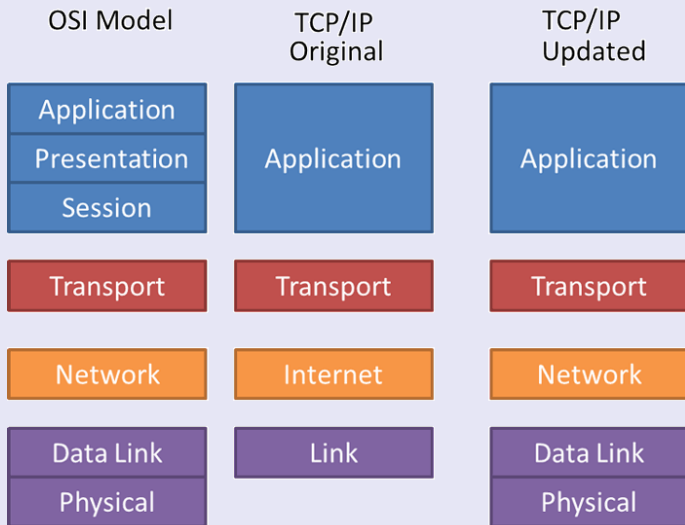
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## Comparison

# Comparison

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## Workshop

Complete workshop for today's class. To be handed in the next class.