

Week 1 – Introduction to Networking

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COMP90007 Internet Technologies

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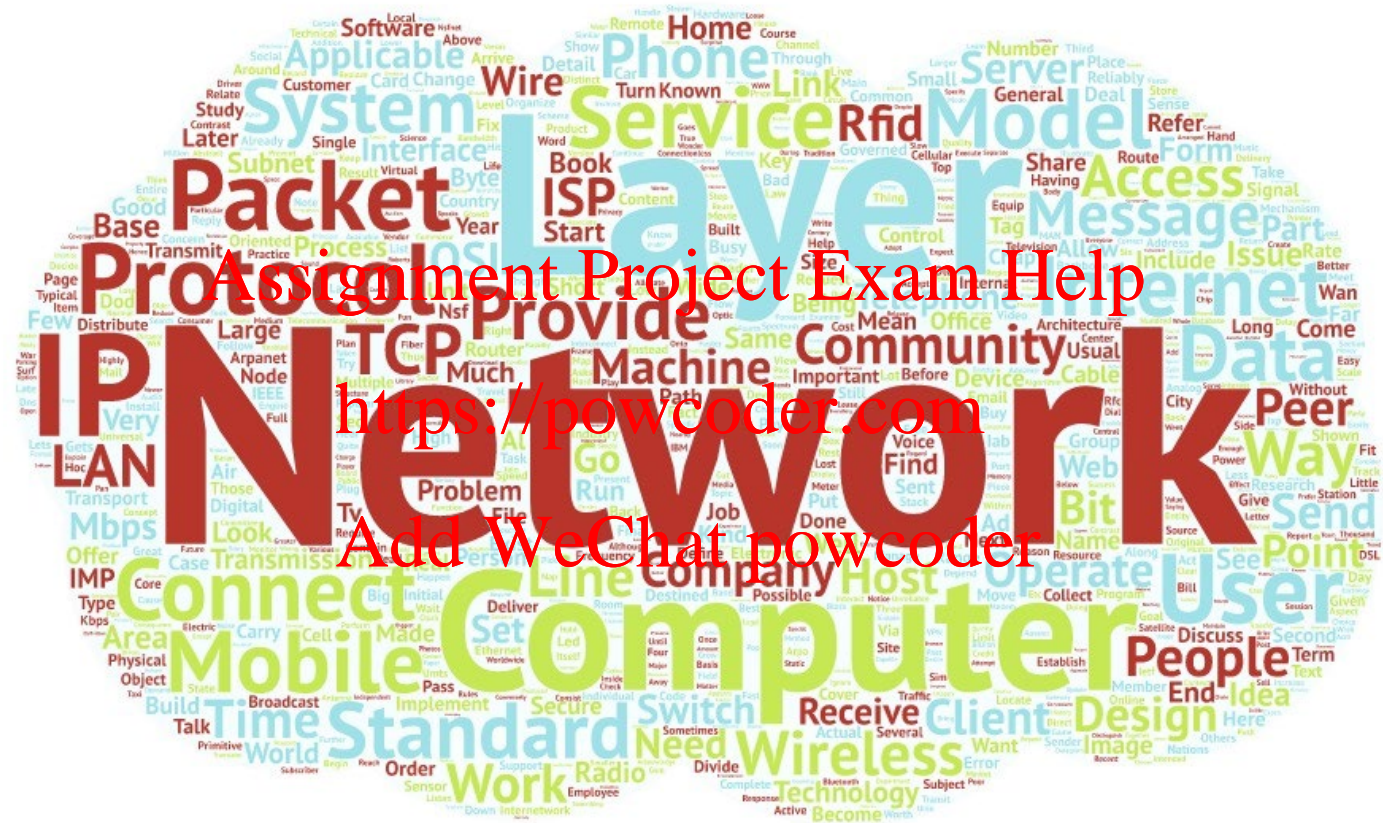
Outline

- Computer Networks
- Different types of computer networks
- Protocols, Layers and Services

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Network vs Computer Network

■ Network:

- ❑ An intricately connected system of things or people
- ❑ An interconnected or intersecting configuration or system of components

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■ Computer Network

- ❑ A collection of autonomous computers interconnected by a single technology

Terminologies

- **Network device:** e.g. PC, Phone, Router, Switch.
- **Server:** Provider of a service. Accept requests from clients.
- **Client:** A network device connecting to a server and requesting a service.
- **Packet:** A message sent between two network devices.
- **IP address:** A unique number identifying a network device.

What are the Internet and the World Wide Web?

- Is the Internet or WWW a computer network?

- Simple answers:

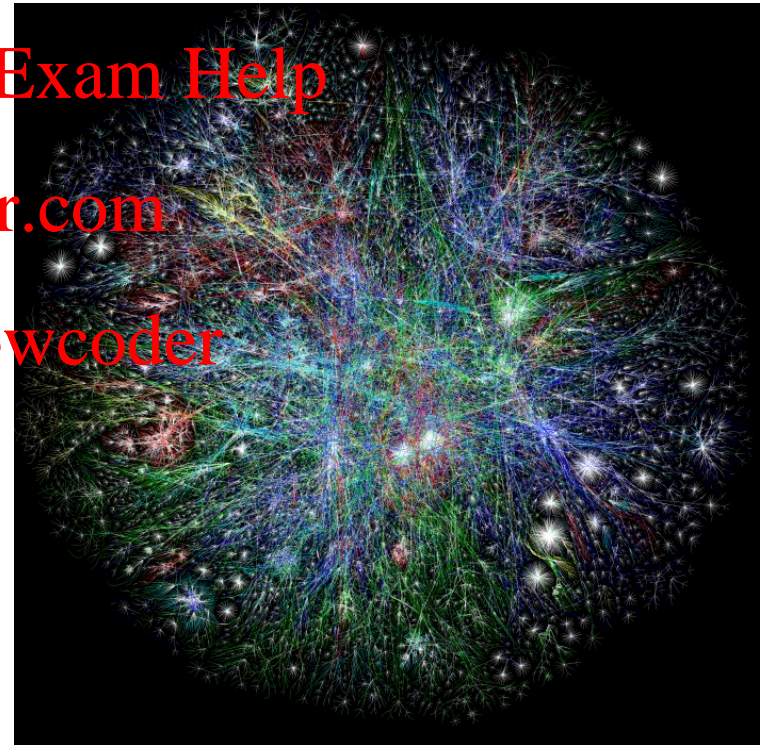
- The **Internet** is not a single network but a **network of networks!**

- The **WWW** is a distributed system that **runs on top of the Internet**

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Uses of Computer Networks

■ Business and Personal Applications

- ❑ Resource sharing (e.g., printer, scanner, files)
- ❑ Access to information
- ❑ Interactive entertainment
- ❑ E-commerce
- ❑ Social Interactions

■ Internet-of-Things

- ❑ parking, smart-meter, vending machines

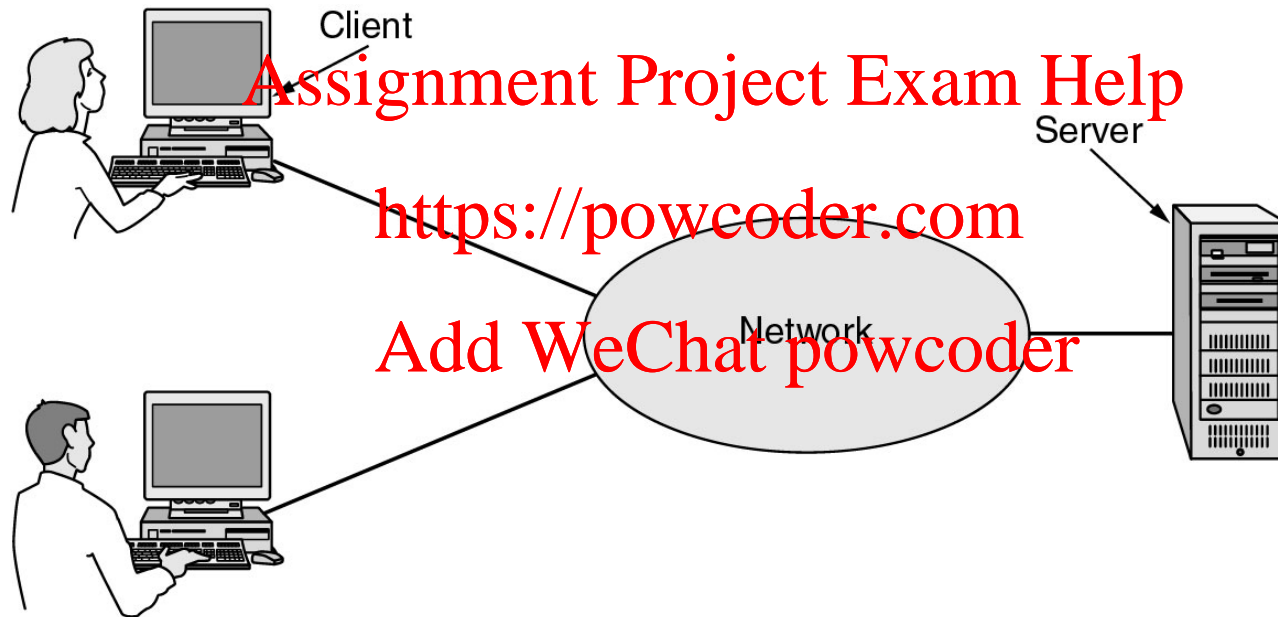
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Simple Client-Server Network

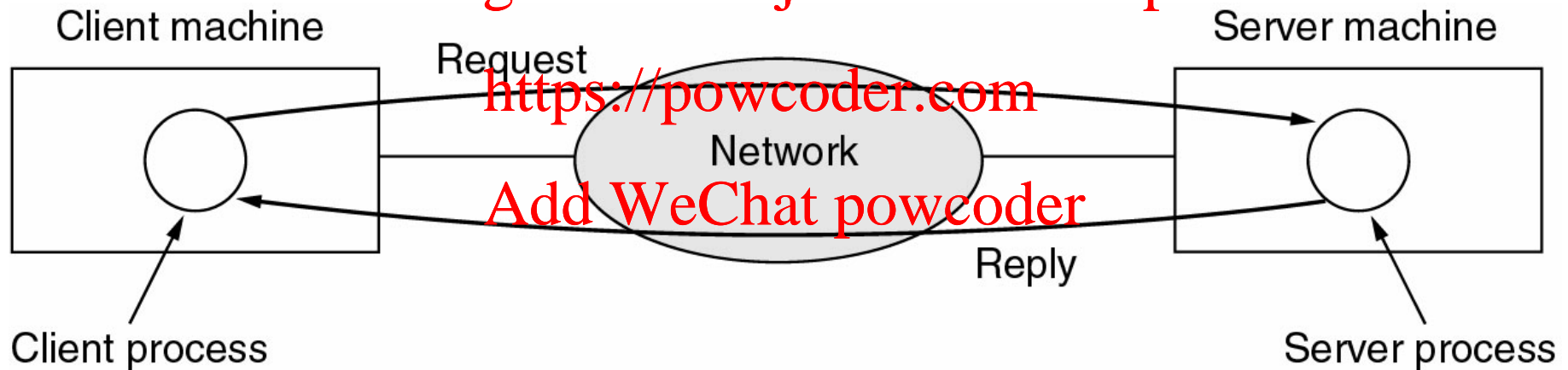
- A network with two clients and one server



Simple Client-Server Network

- The client-server model involves requests and replies

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Differentiating Factors of Networks

- Types of transmission technology

- Broadcast link

- Broadcast networks have a single communication channel shared by all machines on a network.
 - Packets sent by any machine are received by all others. Intended recipients process the packet contents, others simply ignore it.

Differentiating Factors of Networks

■ Types of transmission technology

□ Point-to-point links

- Data from sender machine is not seen and processed by other machines.
- Unicasting is the term used where point-to-point networks with a single sender and receiver pair can exchange data.
- Point-to-point networks consist of many connections between individual pairs of machines.

□ Multicasting

- Transmission to a subset of the machines.

Differentiating Factors of Networks

■ By Scale

Interprocessor distance	Processors located in same	Example
1 m	Square meter	Personal area network
10 m	Room	Local area network
100 m	Building	
1 km	Campus	
10 km	City	Metropolitan area network
100 km	Country	Wide area network
1000 km	Continent	
10,000 km	Planet	The Internet

Differentiating Factors of Networks

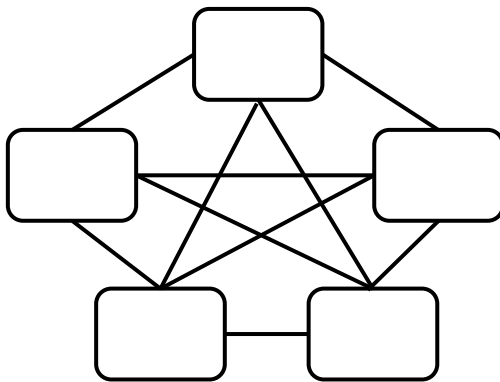
■ By Topology

□ Mesh

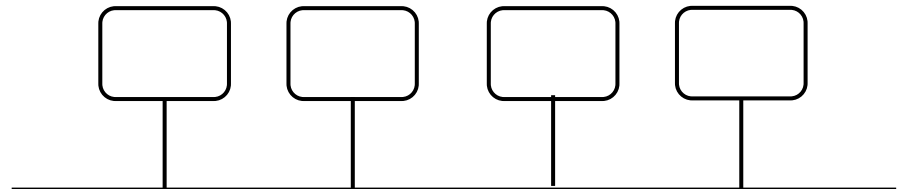
- Fully mesh: each device has a dedicated point-to-point link to every other device.

□ Bus

- All devices are attached to a shared medium.
- Only a single device on the network can transmit at any point in time. Requires a negotiation mechanism to resolve transmission conflicts.
- e.g. Ethernet is the most common bus network.



(a) mesh



(b) bus

Differentiating Factors of Networks

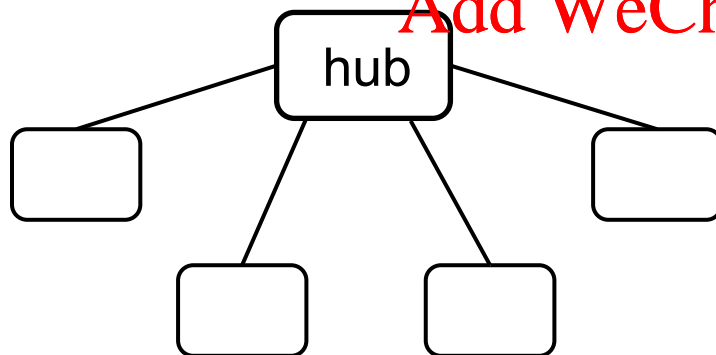
■ By Topology

□ Star

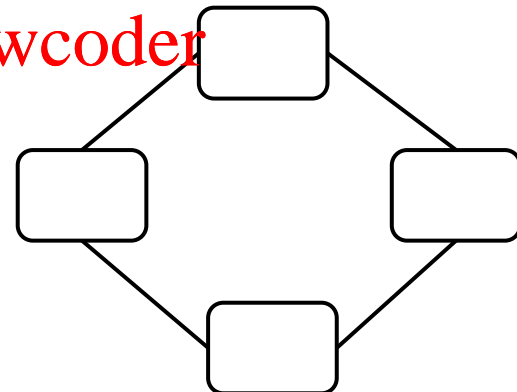
- All devices are attached to a central device.

□ Ring

- Each device on the ring receives the data from the previous device and forwards it to the next device.
- Requires access control to resolve propagation queuing.
- e.g., Token ring.



(c) star



(d) ring

What Makes the Internet Work

■ Protocols, Layers and Services

- Protocol Hierarchies
- Design of Layer Models
- Connection-Oriented and Connectionless Services
- Services Primitives
- Services and Protocols

■ Network Reference Models

- Open Systems Interconnect
- TCP/IP

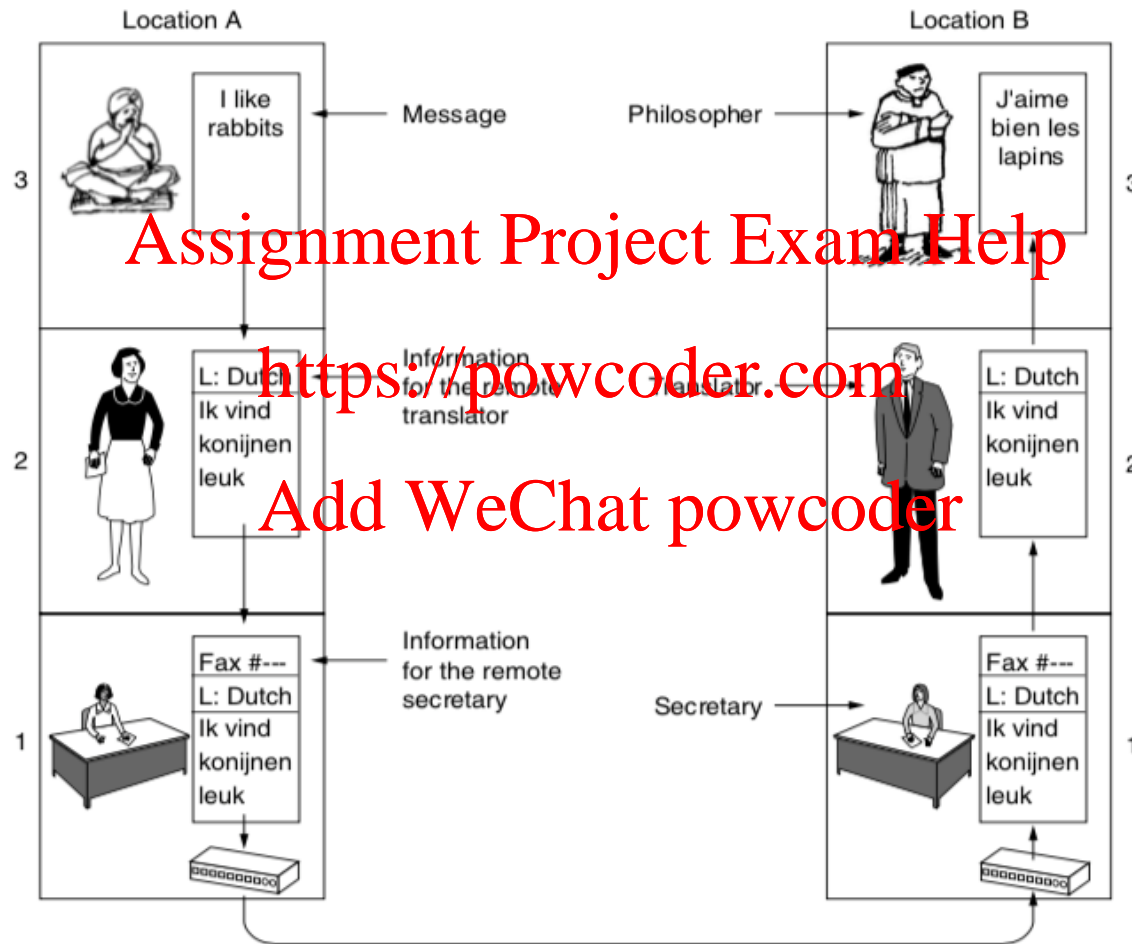
■ Network Standards

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The Philosopher-Translator-Secretary Architecture



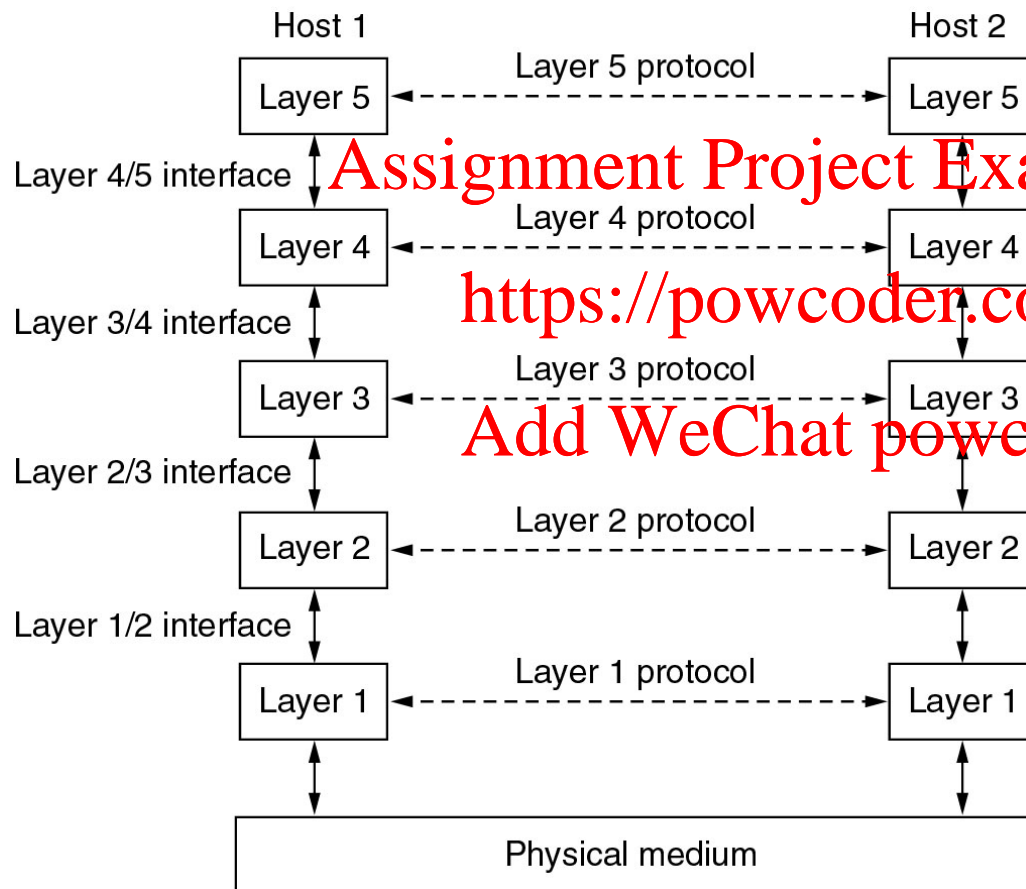
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Network Software: Protocol Hierarchies (1)

- Layers, protocols and interfaces



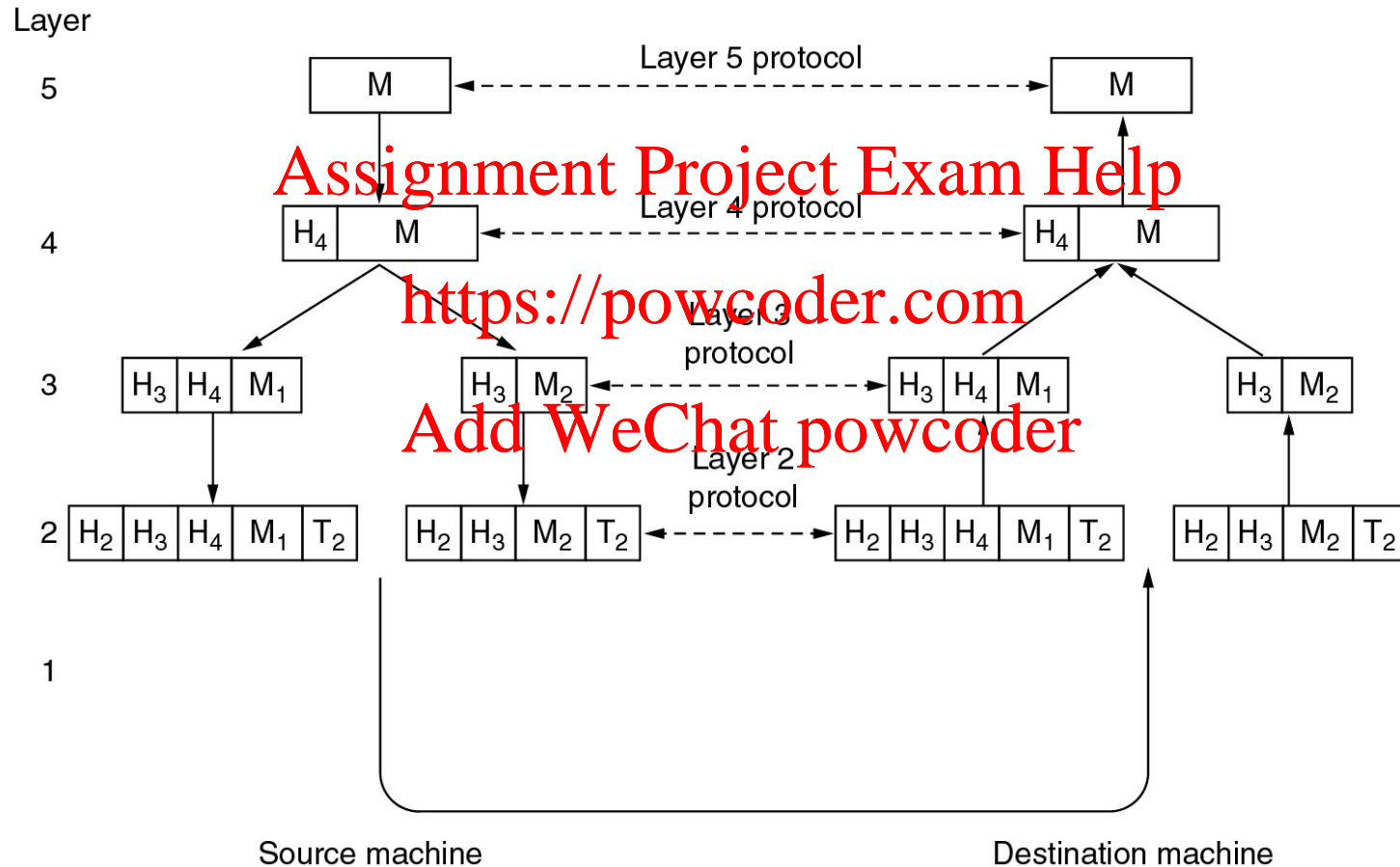
Consider the network as a stack of **layers**

Each layer offers **services** to layers above it through **interface**

Protocol is an agreement between the communicating parties on how communication is to proceed

Network Software: Protocol Hierarchies (2)

- Information flow supporting the virtual communication in layer 5



Services

- Choice of service type has a corresponding impact on the reliability and quality of the service
- Connection-Oriented vs. Connectionless
 - Connection-Oriented: connect, use, disconnect (similar to telephone service). Negotiation inherent in connection setup.
 - Connectionless: just send (similar to postal service).

Connection-Oriented and Connectionless

■ Six different types of services

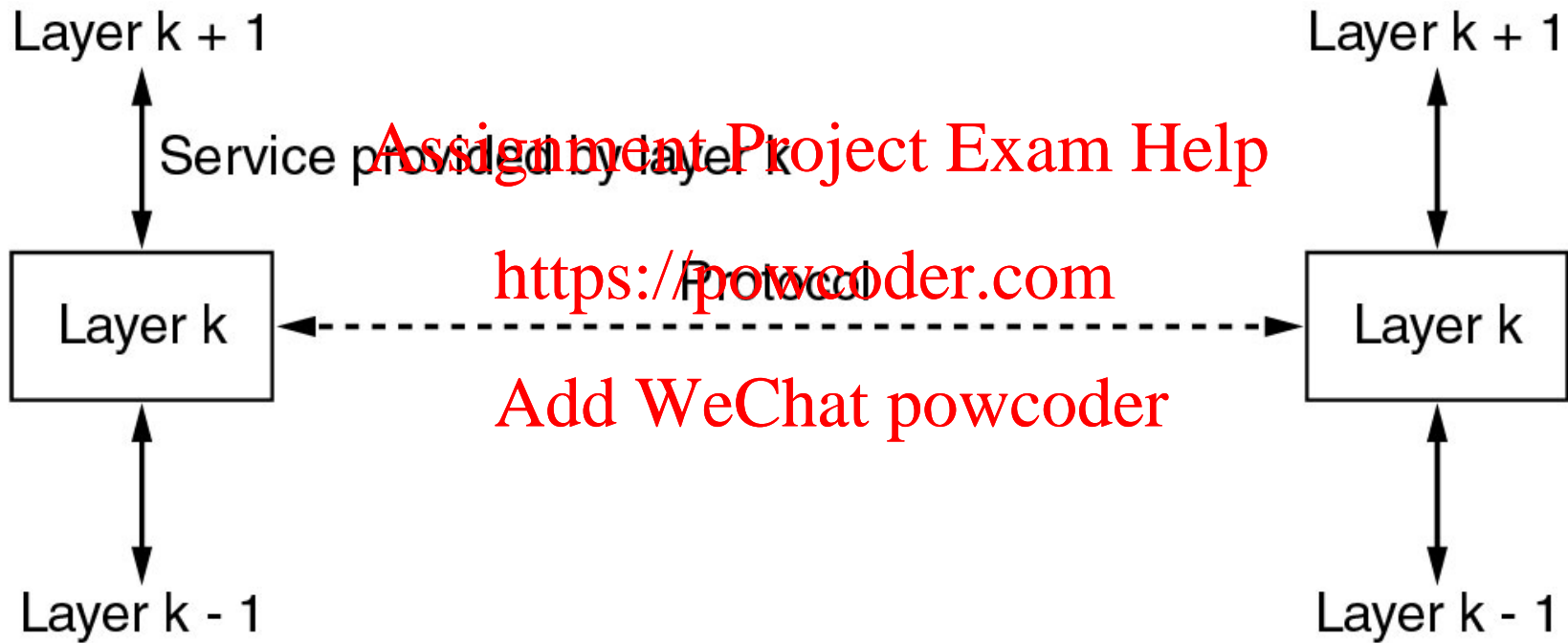
		Service	Example
Connection-oriented	{	Reliable message stream	Sequence of pages
		Reliable byte stream	Movie download
		Unreliable connection	Voice over IP
Connection-less	{	Unreliable datagram	Electronic junk mail
		Acknowledged datagram	Text messaging
		Request-reply	Database query

Service Primitives

- Primitives are a formal set of operations for services
- The number and type of primitives depends on the nature of service - in general more complex services require more service primitives
- Six service primitives for implementing a simple connection-oriented service

Primitive	Meaning
LISTEN	Block waiting for an incoming connection
CONNECT	Establish a connection with a waiting peer
ACCEPT	Accept an incoming connection from a peer
RECEIVE	Block waiting for an incoming message
SEND	Send a message to the peer
DISCONNECT	Terminate a connection

Relationship of Services and Protocols



Relationship of Services and Protocols

- **Service = set of primitives that a layer provides to a layer above it**

- Provided through the interfaces between layers (service provider vs. service users)
- Defines what operations the layer is prepared to perform on behalf of its users
- Abstract: nothing about how these operations are implemented

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- **Protocol = a set of rules governing the format and meaning of packets that are exchanged by peers within a layer**

- Packets sent between peer entities

Next: Reference Models

- The OSI Reference Model
- The TCP/IP Reference Model
- A Comparison of OSI and TCP/IP
- A Critique of the OSI Model and Protocols
- A Critique of the TCP/IP Reference Model

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