

Week 1 – Introduction to Networking Continued

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COMP90007 Internet Technologies

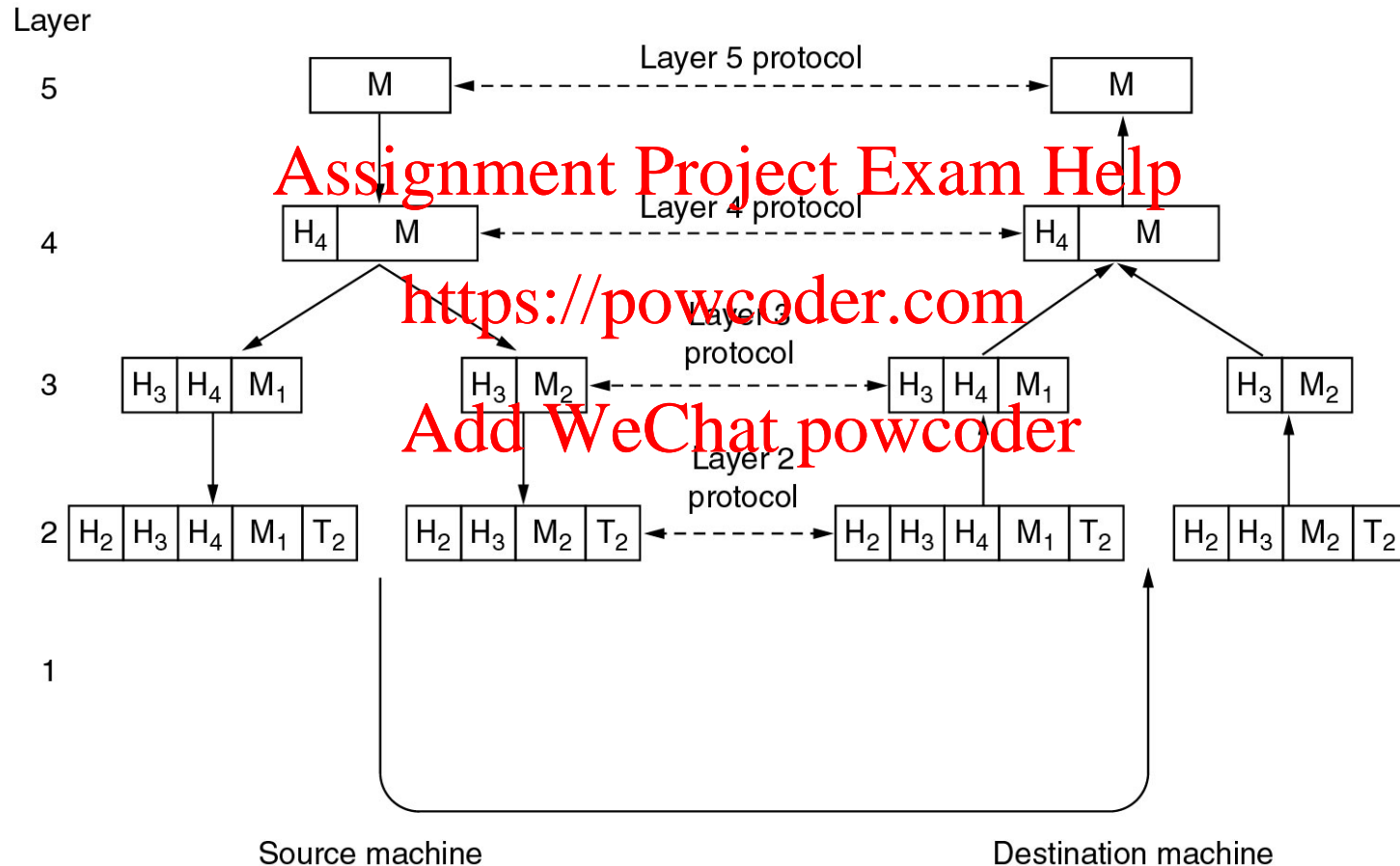
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Lecturer: Ling Luo

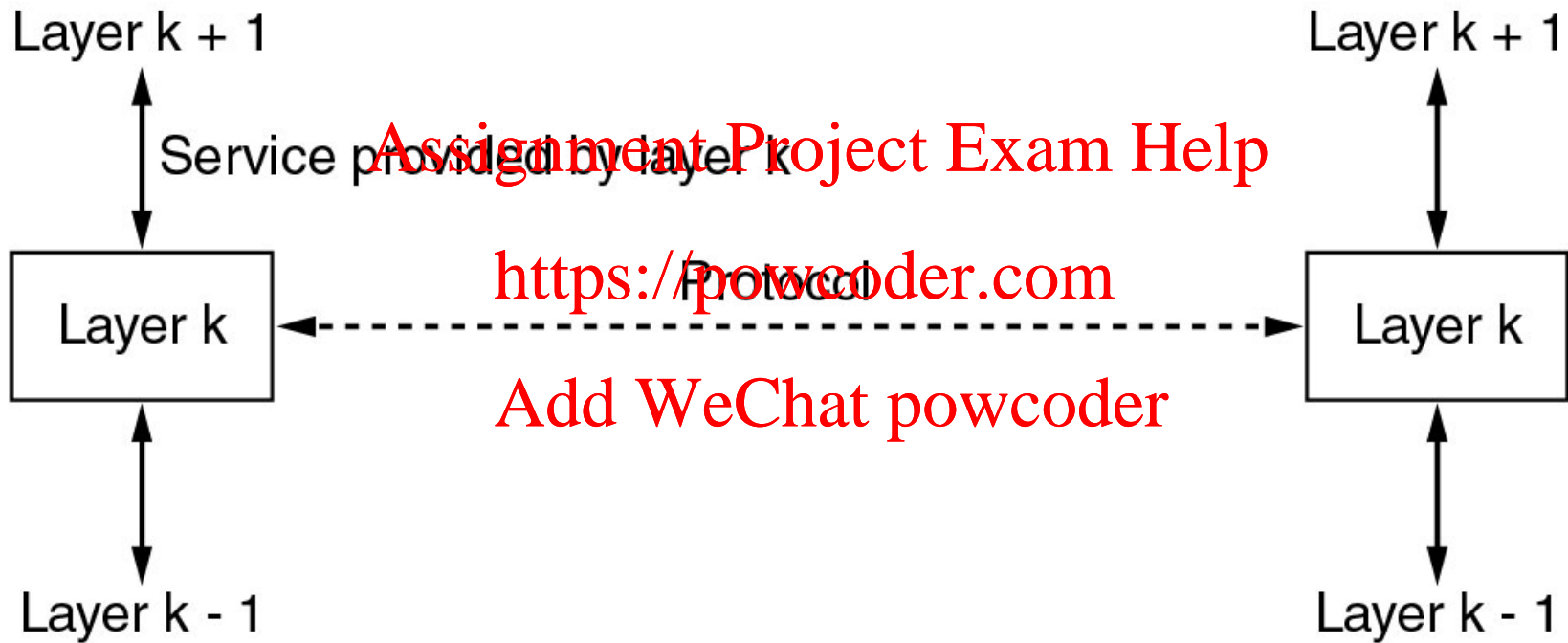
Semester 2, 2021

Recap: Protocol Hierarchies

- Example information flow supporting the virtual communication in layer 5



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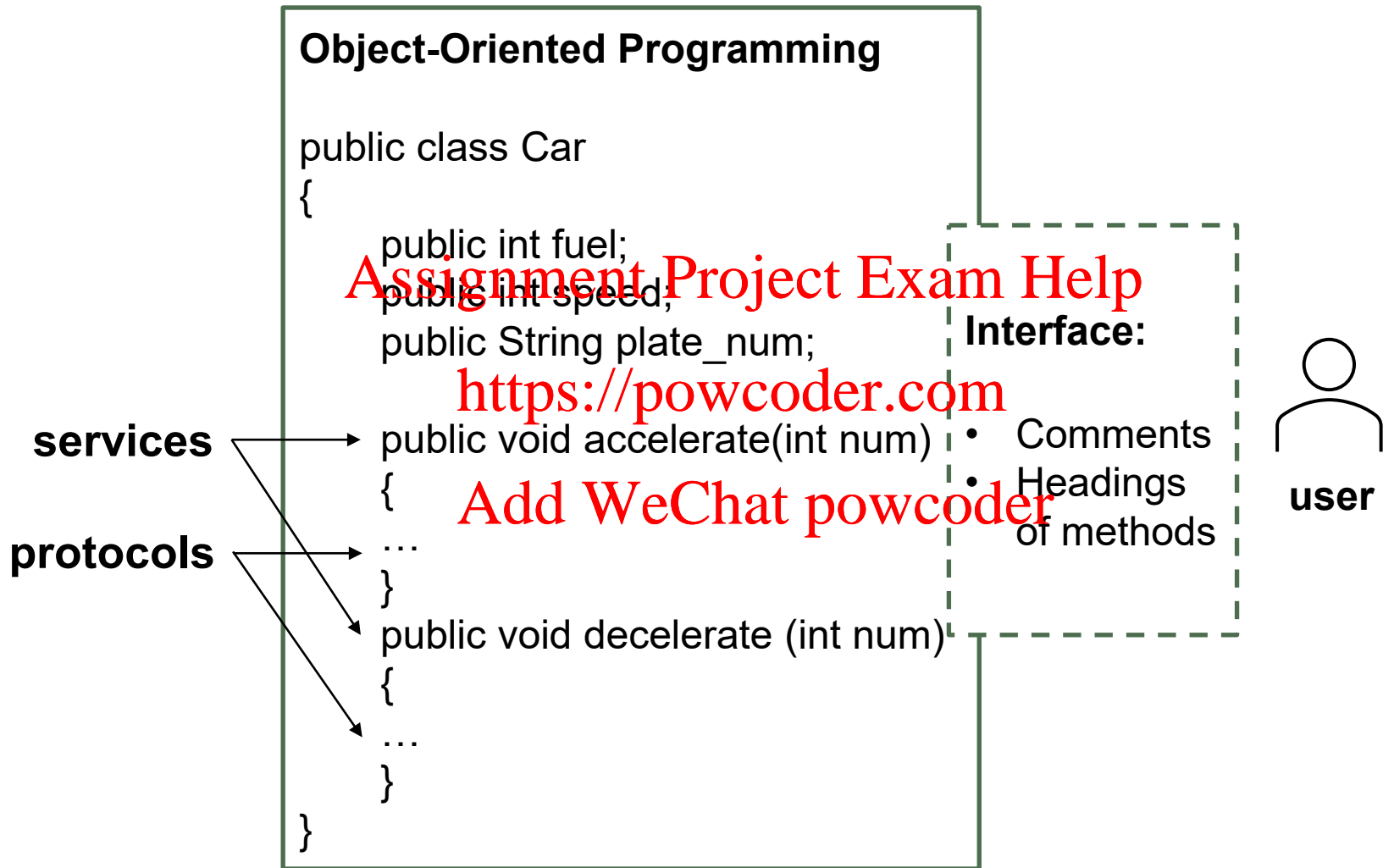
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- **Protocol = a set of rules governing the format and meaning of packets that are exchanged by peers within a layer**

- Packets sent between peer entities

Relationship of Services and Protocols



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

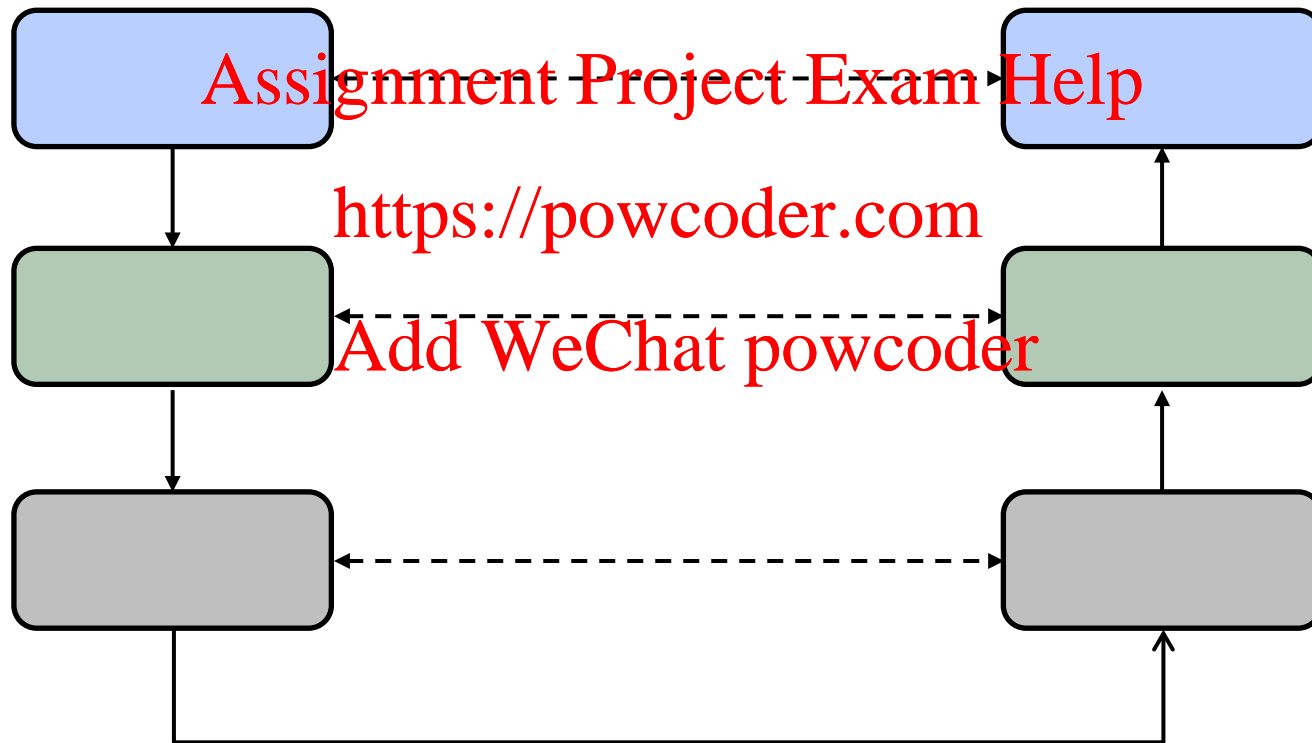
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Reference Model

- Concepts and their relationship



Why Do We Need a Reference Model?

- A reference model provides a **common baseline for the development** of many services and protocols by independent parties
- It's engineering *best practice* to have an “**abstract reference model**” and corresponding implementations are always required for validation purposes
- Since networks are very complex systems, a reference model can serve to **simplify the design process**

OSI Reference Model

- Open Systems Interconnection (OSI)
- ISO, John Day (revised 1995)
- 7 Layers
- Layer divisions based on principled decisions

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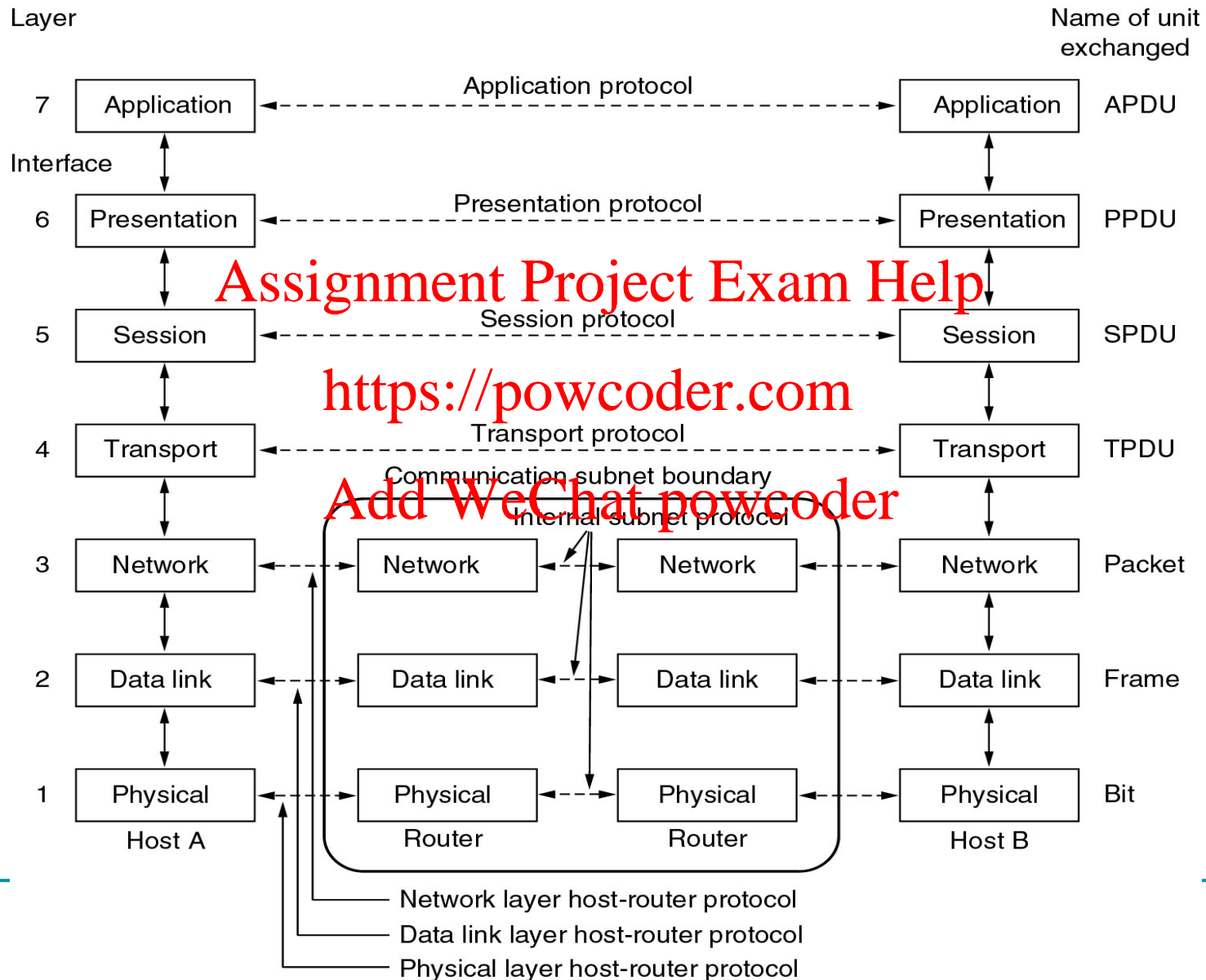
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OSI Layer Division Principles

1. A layer should be created where a **different abstraction** is needed.
2. Each layer should **perform a well-defined function**.
3. The layer boundaries should be chosen to **minimise the information flow across the interfaces**.
4. The number of layers should be **large enough that** distinct functions need not to be thrown together in the same layer out of necessity; and **small enough that** the architecture does not become unwieldy.
5. The function of each layer should be chosen with a view toward defining **internationally standardised protocols**.

OSI Reference Model



TCP/IP Reference Model

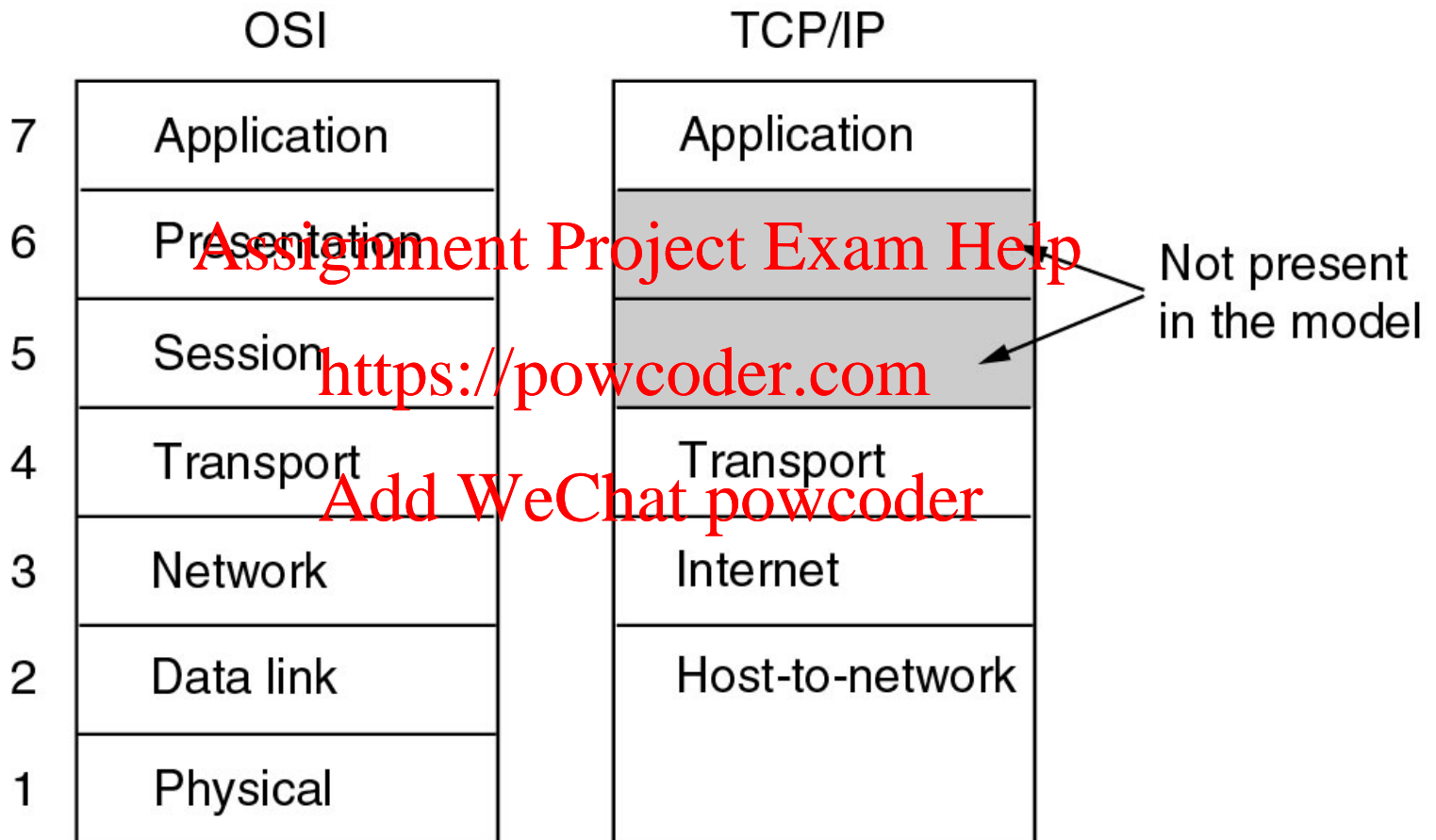
- Transmission Control Protocol/Internet Protocol
- Vint Cerf & Bob Kahn (1974)
- 4 layers

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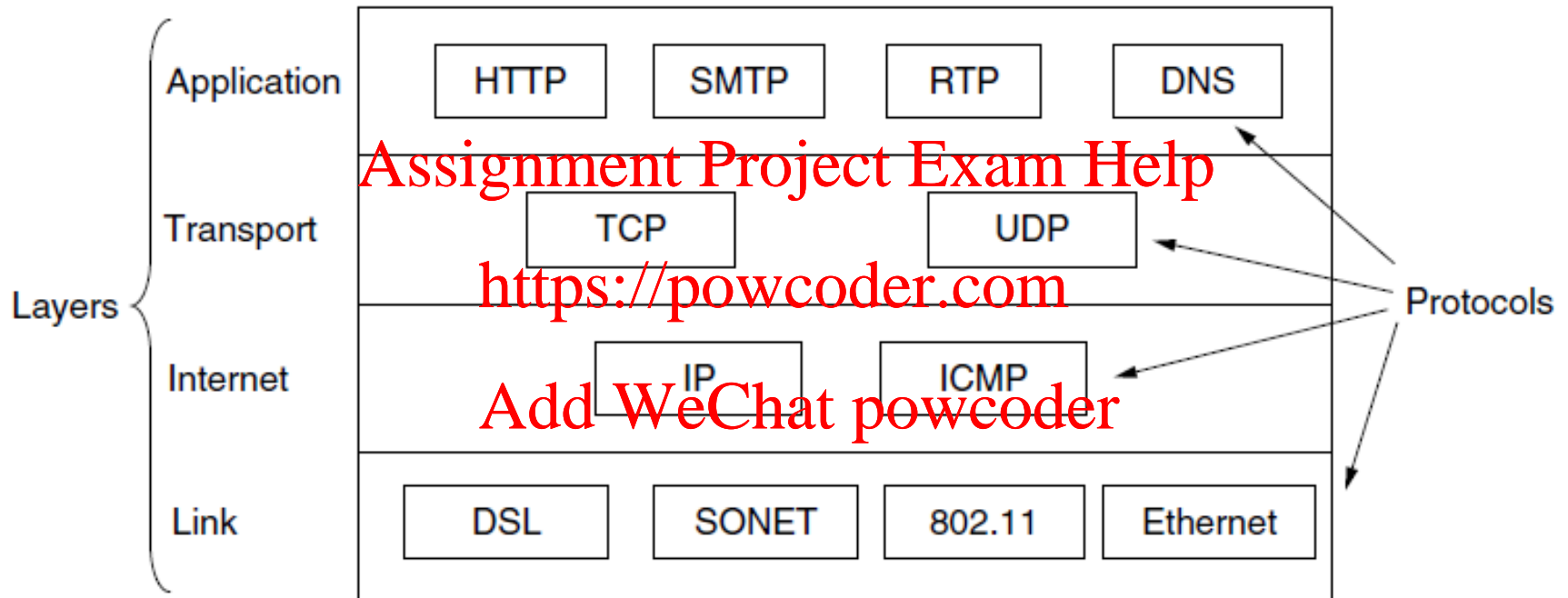
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TCP/IP Reference Model (2)



TCP/IP Reference Model (3)



Comparing OSI and TCP/IP Models

- Different numbers of layers
- OSI distinguishes the following three concepts explicitly
 - Services
 - Interfaces
 - Protocols
- TCP/IP has successful protocols

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A Critique of the OSI Model

Why OSI did not take over the world?

- Bad technology
- Bad implementations
- Bad timing
- Bad politics

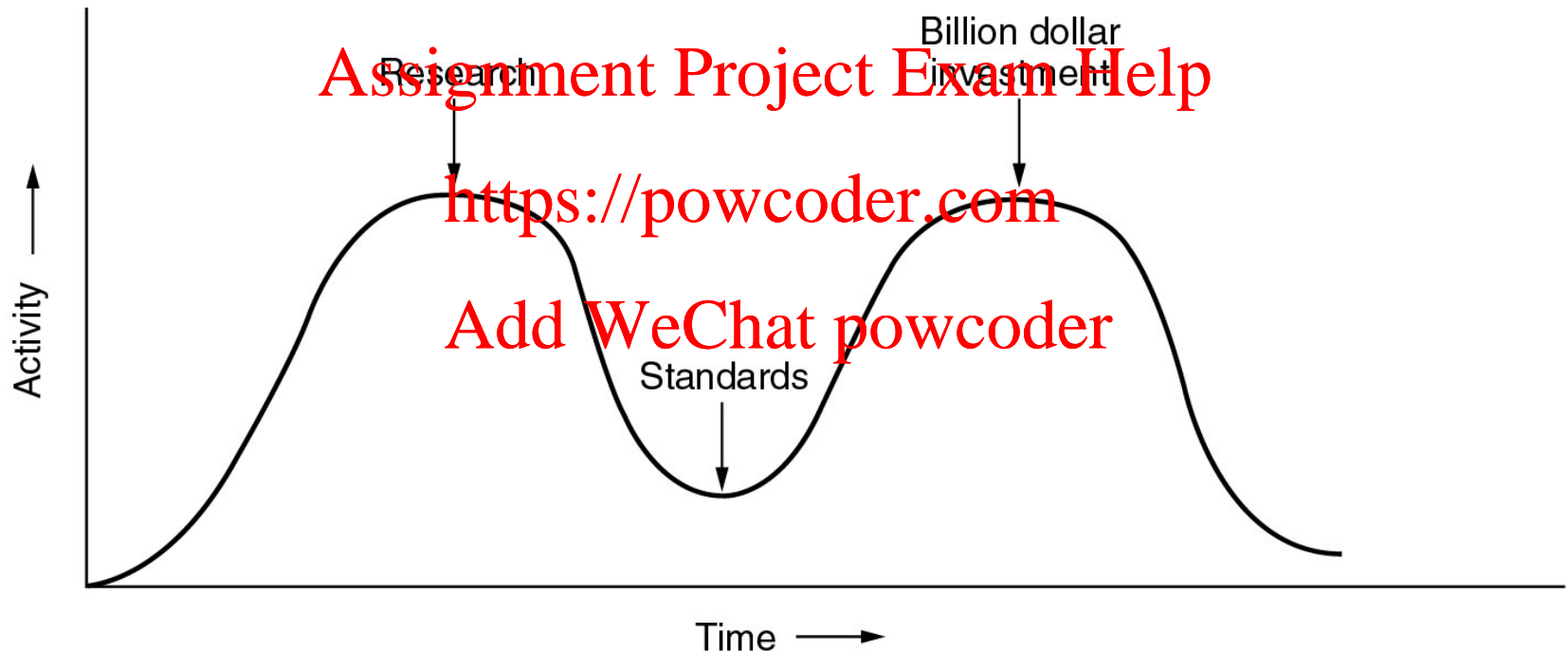
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A Critique of the OSI Model: Bad Timing

- When is good timing for a standard?



A Critique of the TCP/IP Model

Problems:

- Not a general model
- Service, interface, and protocol not distinguished
- Did not split physical and data link layers
- Minor protocols deeply entrenched, hard to replace

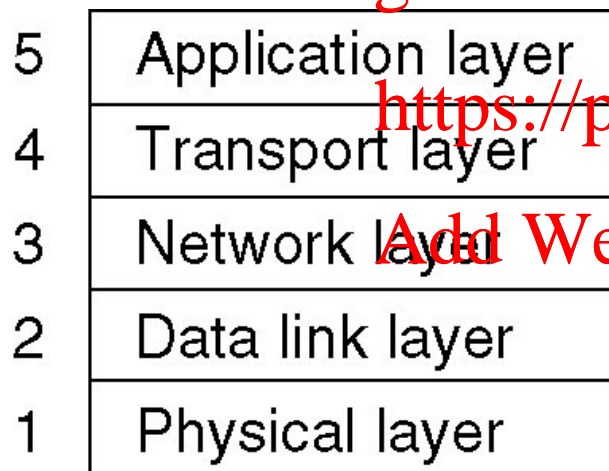
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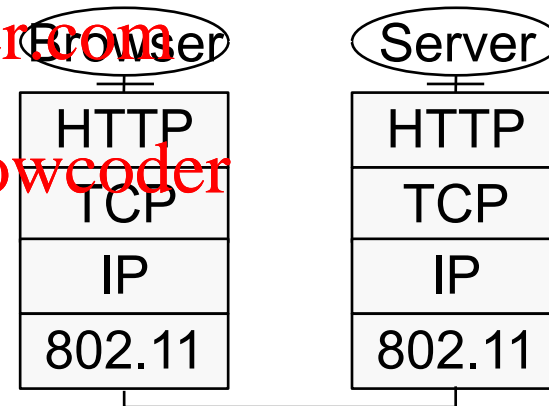
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Hybrid Model

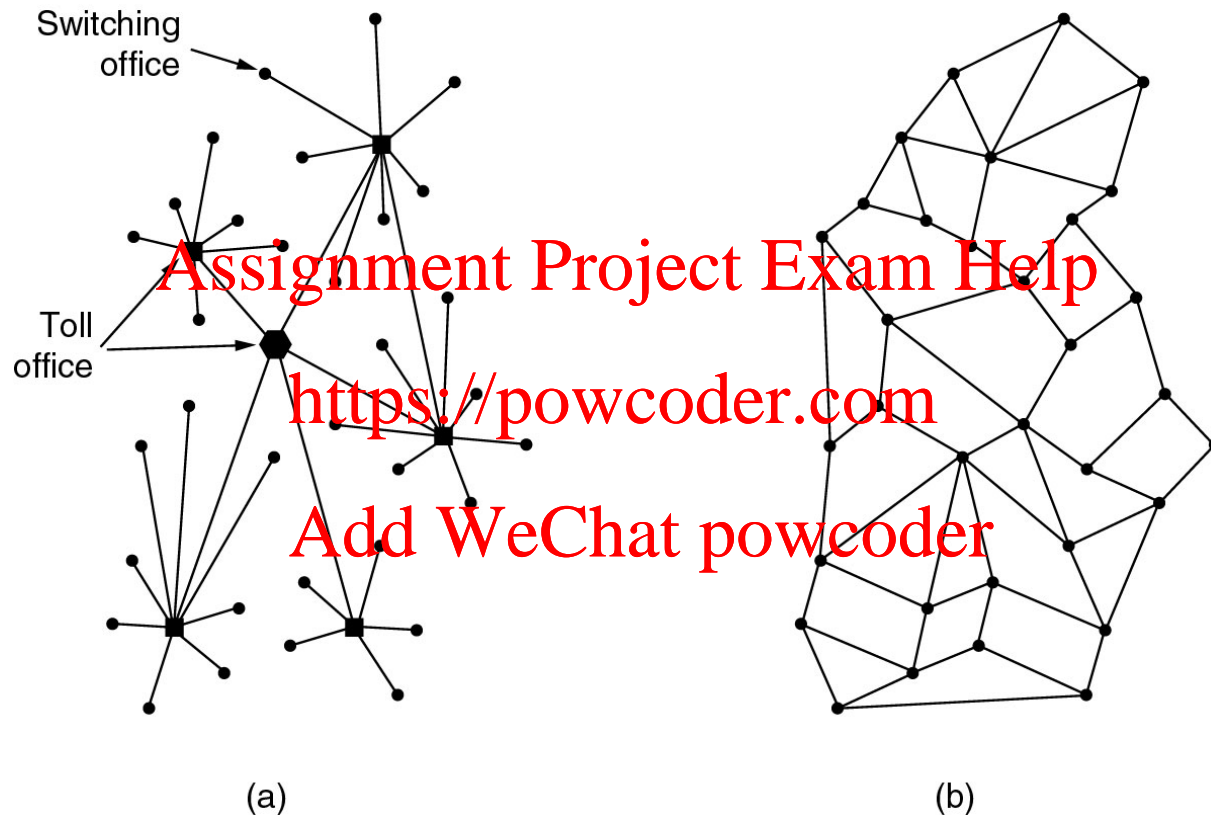
- The hybrid reference model to be used in this subject



A typical network scenario

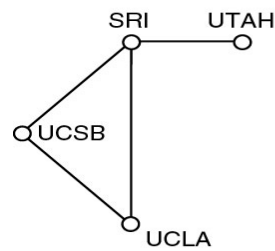


Origins of Internet: The ARPANET

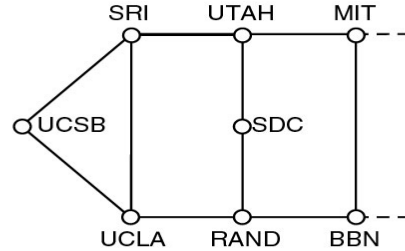


- (a) Structure of the telephone system.
- (b) Baran's proposed distributed switching system.

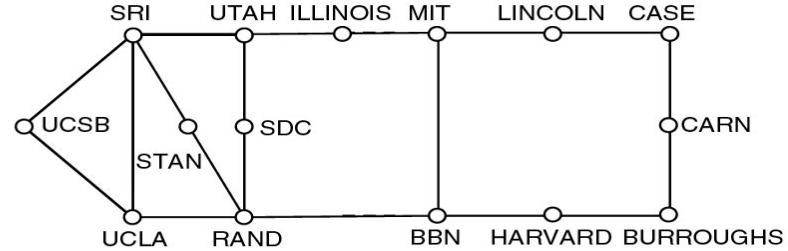
The ARPANET



(a)



(b)

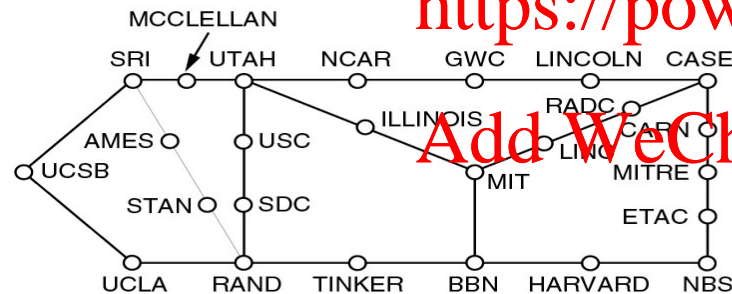


(c)

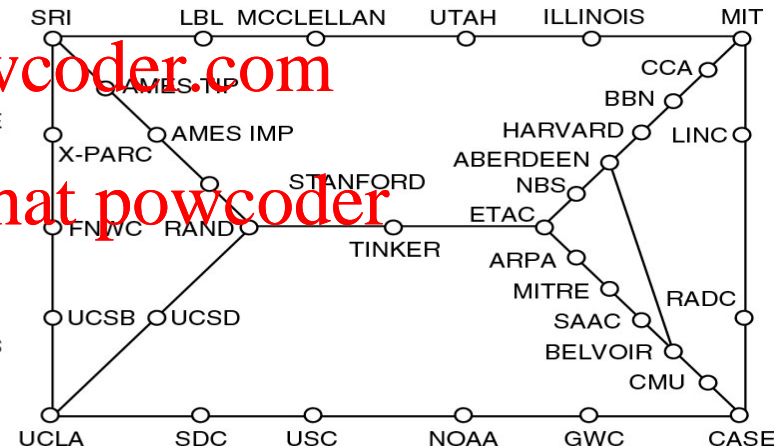
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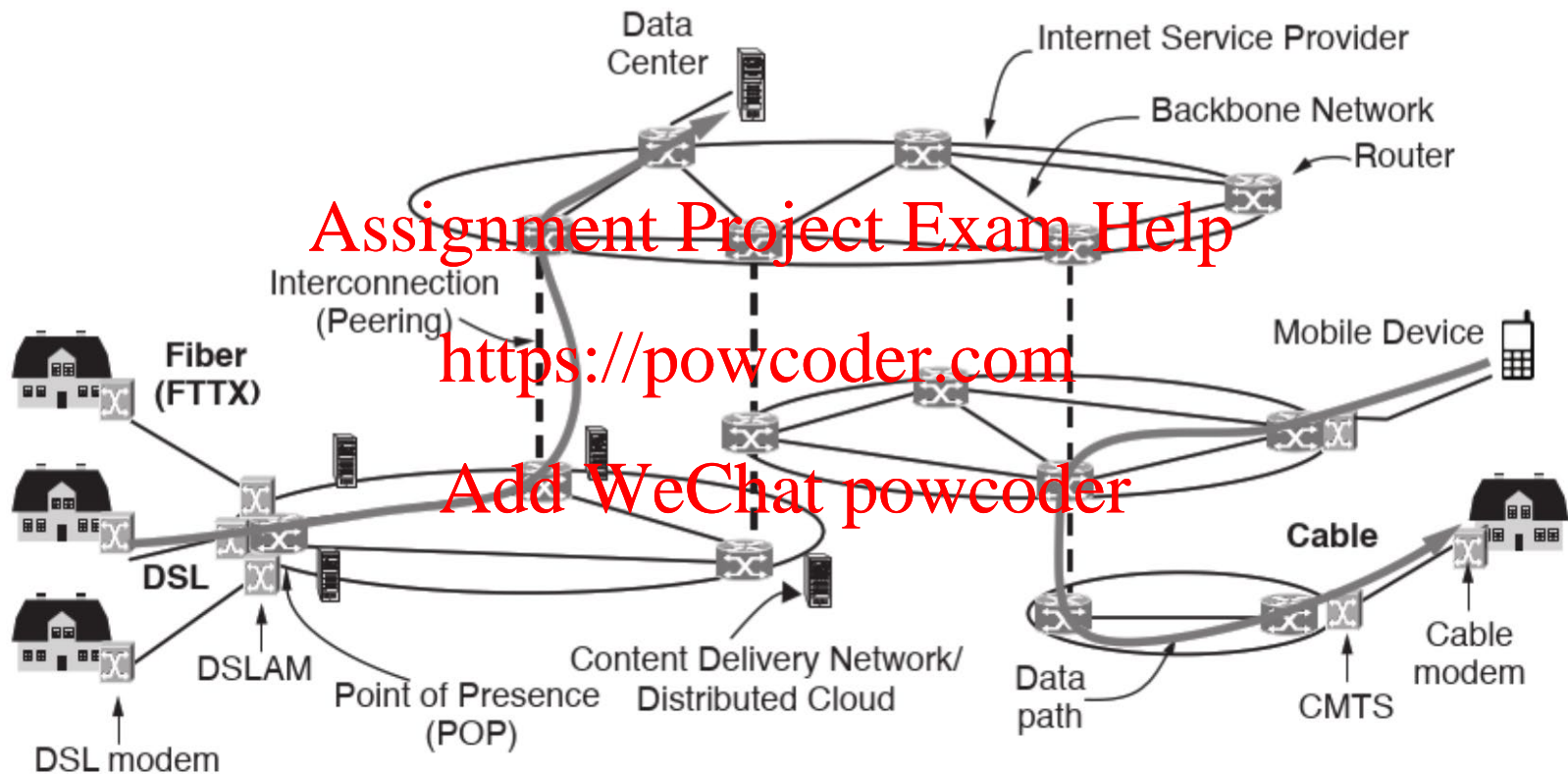
(d)



(e)

- Growth of the ARPANET (a) December 1969. (b) July 1970.
- (c) March 1971. (d) April 1972. (e) September 1972.

Architecture of the Internet



Network Standardisation

Body	Area	Examples
ITU (International Telecommunication Union)	Telecommunications	ADSL MPEG4
IEEE (Institute of Electrical and Electronics Engineers)	Communications	Ethernet WiFi
IETF (Internet Engineering Task Force)	Internet	HTTP/1.1 DNS
W3C (The World Wide Web Consortium)	Web	HTML5 standard