



Architecture of Internet protocols

Protocols

A *protocol* is a set of rules and associated formats that govern the process of exchange of information (communication) between communicating peer entities:

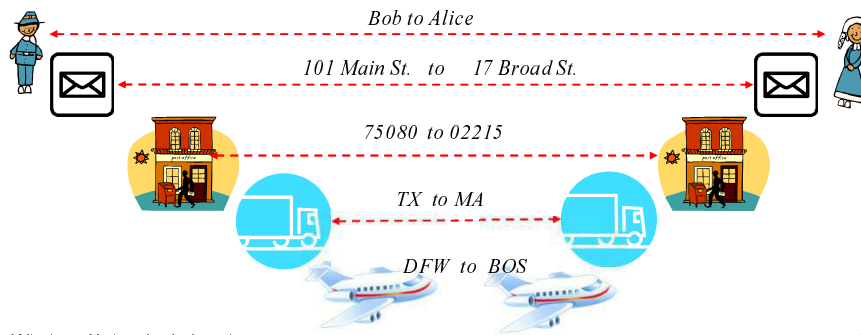
- ❖ the set of valid messages
- ❖ the meaning of each message

A *protocol* provides a service – consider the post-office services as an example. E.g., certified letters, priority mail, express mail, bulk mailings

Peer entities use protocols to provide service to a higher-layer peer entity.

Protocols (con't)

- ⌘ A “practical networking system” will typically provide many services and, thus, requires many protocols.
- ⌘ Some services are dependent of one another (although some may be independent). This form of dependency is called *layering*. Consider the postal service example ...
- ⌘ A *protocol* may use another protocol as a step in its execution.



Wireless Networks Laboratory

Copyright ©by Zygmunt J. Haas, 2017

3

Protocols (con't)

- ⌘ A set of protocols is referred to as “open” if:
 - ❖ the details of the protocols are publicly available
 - ❖ the protocols are managed by an organization whose membership and transactions are open to the public
- ⌘ A system that implements open protocols is referred to as an “open system”
- ⌘ The *International Organization of Standards (ISO)* defined a standard that allows connecting open systems – the *Open System Interconnect (OSI)*. This standard is referred to as the *ISO/OSI* protocol stack.

Wireless Networks Laboratory

Copyright ©by Zygmunt J. Haas, 2017

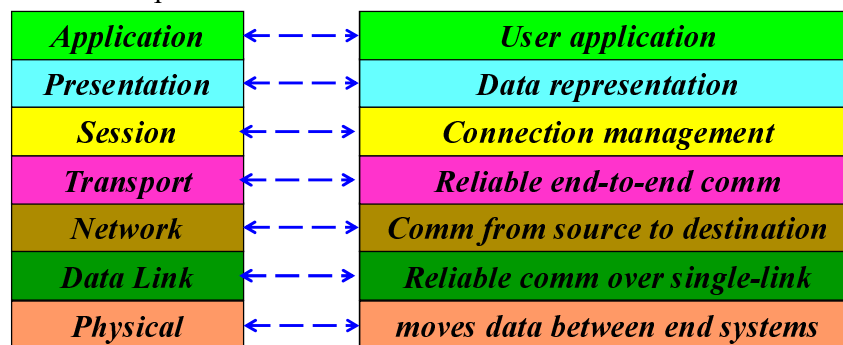
4

Protocols (con't)

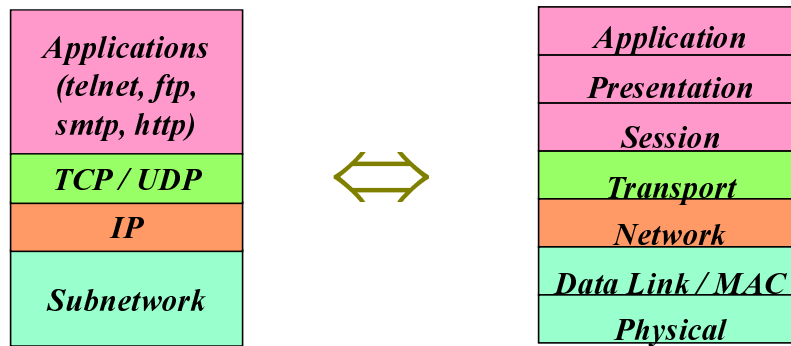
- ⌘ The *International Organization of Standards (ISO)* defined a standard that allows connecting open systems – the *Open System Interconnect (OSI)*. This standard is referred to as the *ISO/OSI* protocol stack.

Protocols (con't)

- ⌘ The *International Organization of Standards (ISO)* defined a standard that allows connecting open systems – the *Open System Interconnect (OSI)*. This standard is referred to as the *ISO/OSI* protocol stack.



The OSI and the TCP protocol stacks

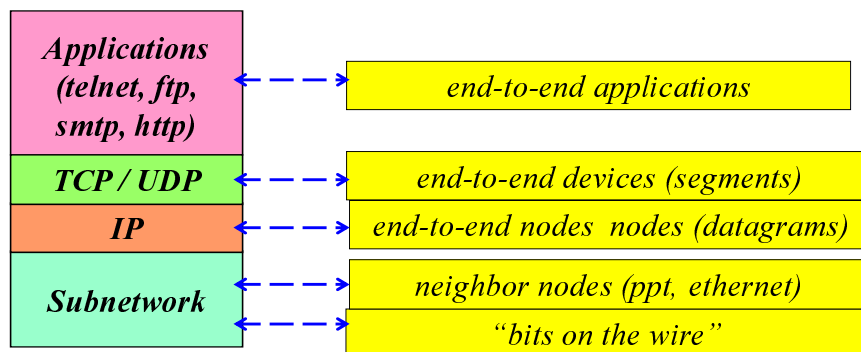


Wireless Networks Laboratory

Copyright ©by Zygmunt J. Haas, 2017

7

The OSI and the TCP protocol stacks

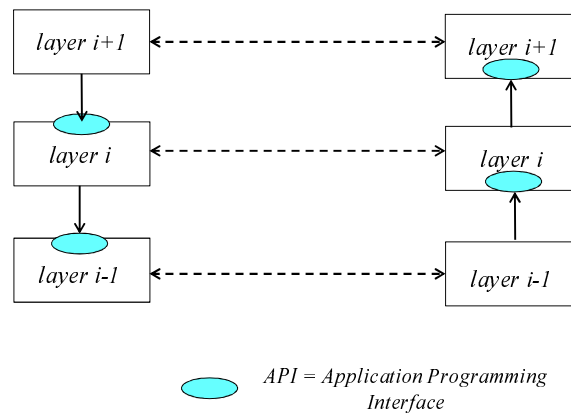


Wireless Networks Laboratory

Copyright ©by Zygmunt J. Haas, 2017

8

Inter-layer Communications



Wireless Networks Laboratory

Copyright ©by Zygmunt J. Haas, 2017

9

Inter-layer Communications

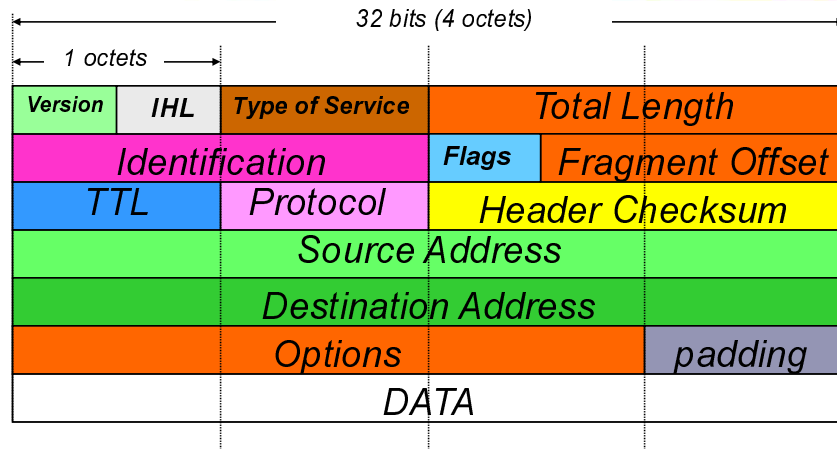
- ❖ Each layer relies on services from layer below and exports services to layer above
- ❖ Interface defines interaction
- ❖ Hides implementation - layers can change without disturbing other layers (black box)

Wireless Networks Laboratory

Copyright ©by Zygmunt J. Haas, 2017

10

IP - Internet Protocol

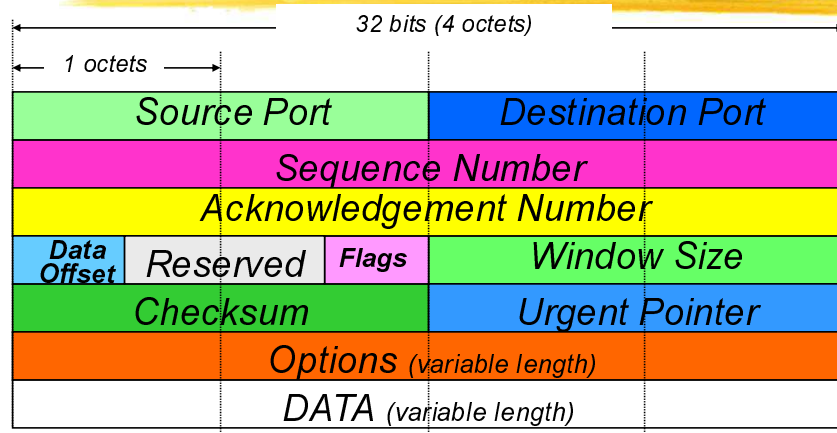


Wireless Networks Laboratory

Copyright ©by Zygmunt J. Haas, 2017

11

TCP - Transmission Control Protocol

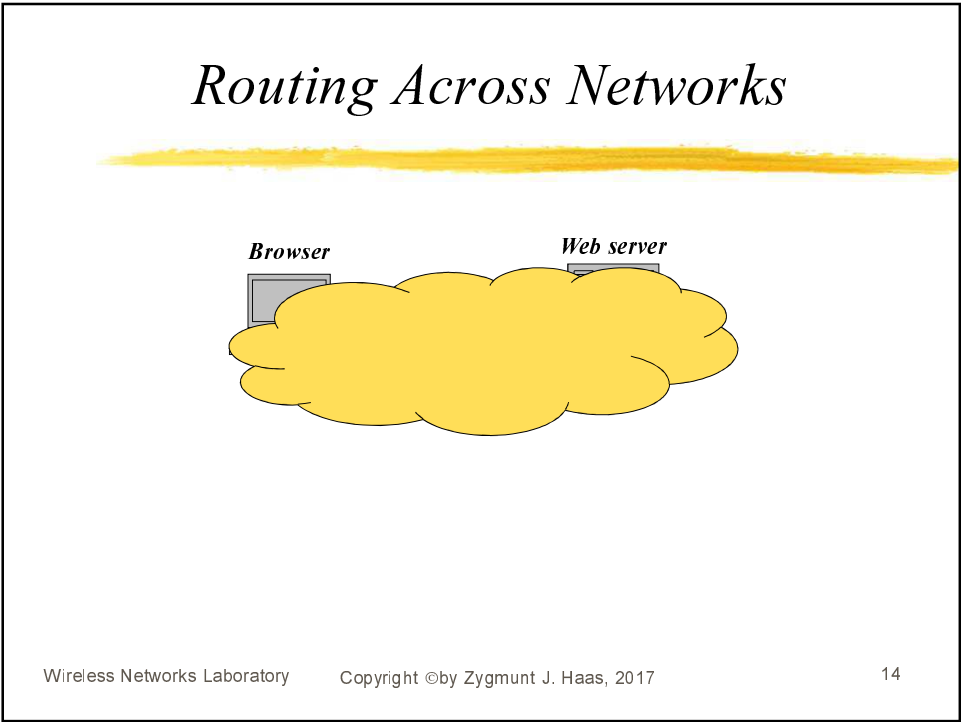
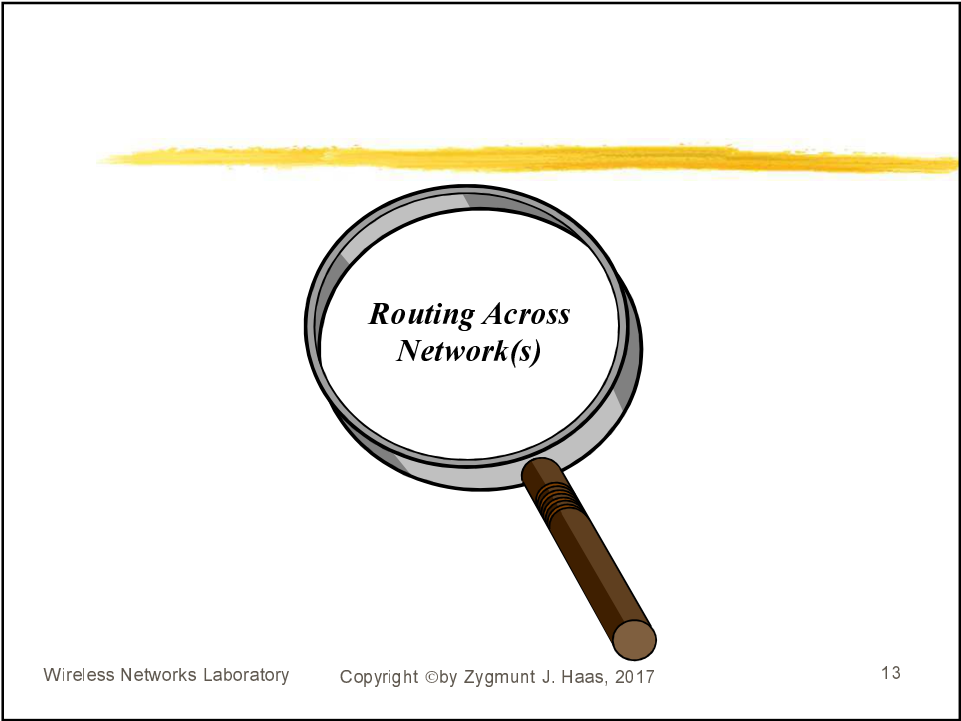


Flags: URG; ACK; PSH; RST; SYN; FIN

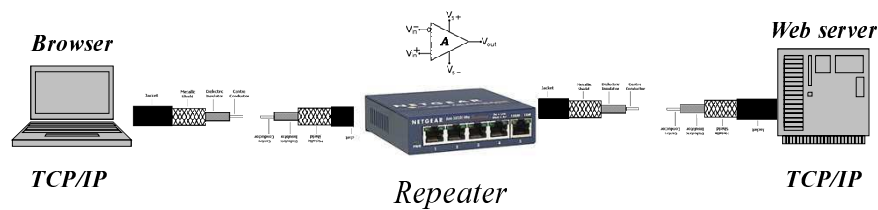
Wireless Networks Laboratory

Copyright ©by Zygmunt J. Haas, 2017

12

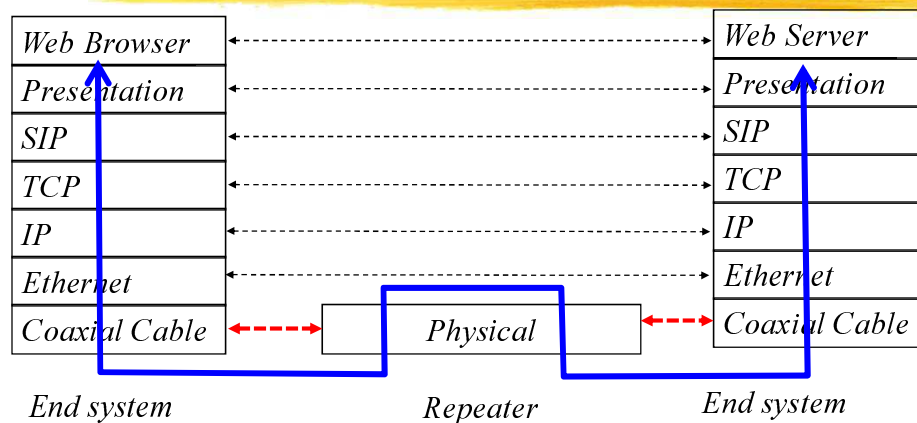


Routing Across Networks

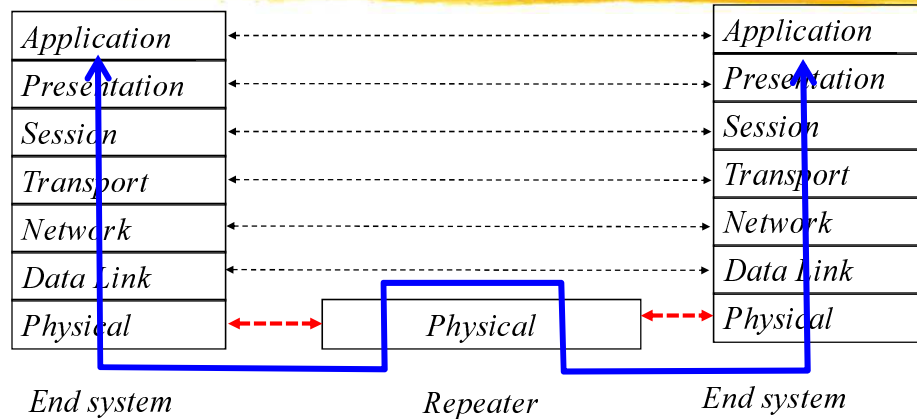


- Repeater is NOT an amplifier.
- Repeaters are used in digital systems.
- Amplifiers are used in analog systems.
- Digital vs. Analog Systems Why?

Routing Across Networks



Routing Across Networks

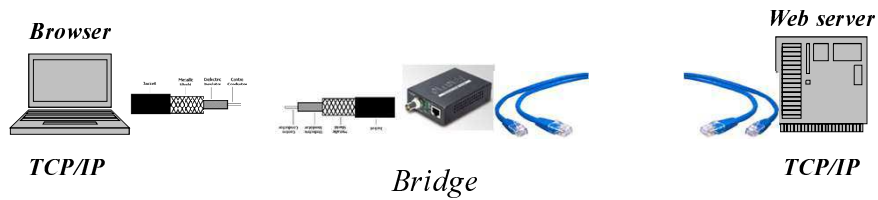


Wireless Networks Laboratory

Copyright ©by Zygmunt J. Haas, 2017

17

Routing Across Networks

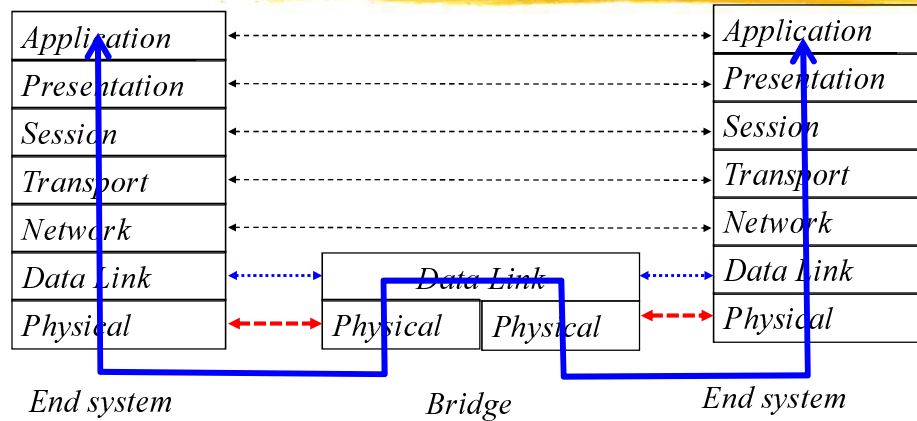


Wireless Networks Laboratory

Copyright ©by Zygmunt J. Haas, 2017

18

Routing Across Networks



Wireless Networks Laboratory

Copyright ©by Zygmunt J. Haas, 2017

19

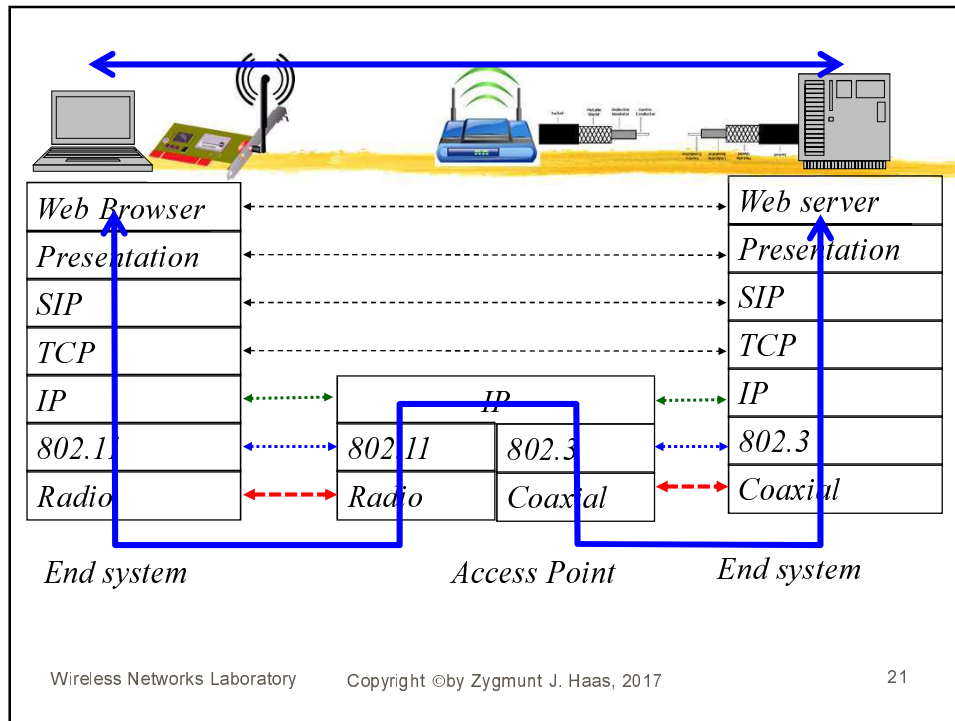
Routing Across Networks



Wireless Networks Laboratory

Copyright ©by Zygmunt J. Haas, 2017

20



Routing Across Networks

