Network and Distributed Systems

Roadmap

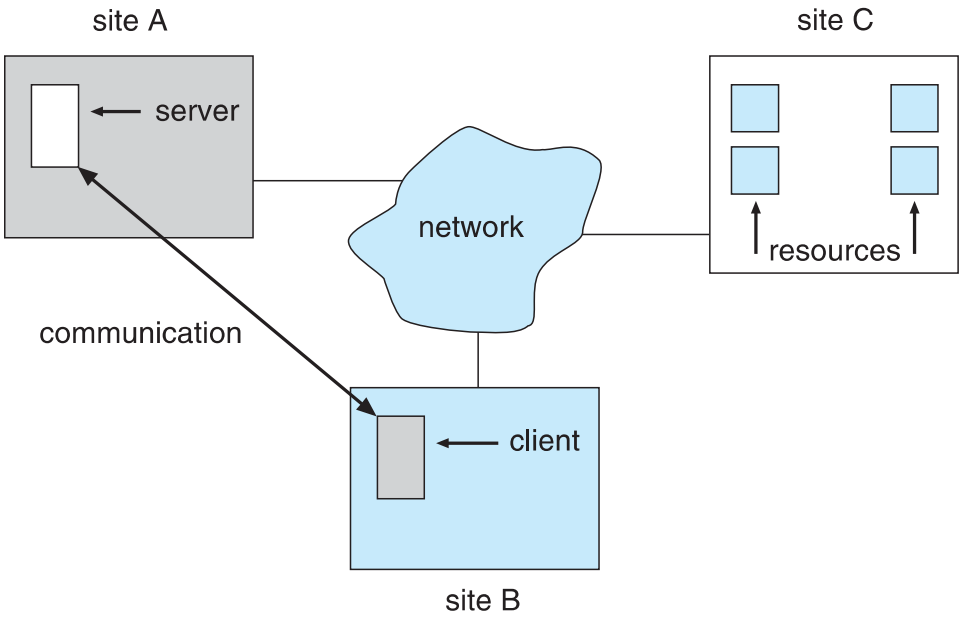
- CPU management
- Memory management
- Disk management
- **Network and Distributed System**
- Virtual machine
- Protection & Security

Today

- Distributed systems overview
- Basic network concepts
- TCP/IP protocol
- Sending/Receiving a packet in Linux

Distributed Systems

- A collection of connected computers



Why Distributed Computing?

- Resource sharing
  - Sharing and printing files at remote sites
  - Processing information in a distributed database
  - Using remote specialized hardware devices
- Performance
  - More computers → more performance
- Reliability
  - Detect and recover from site failure, function transfer, reintegrate failed site

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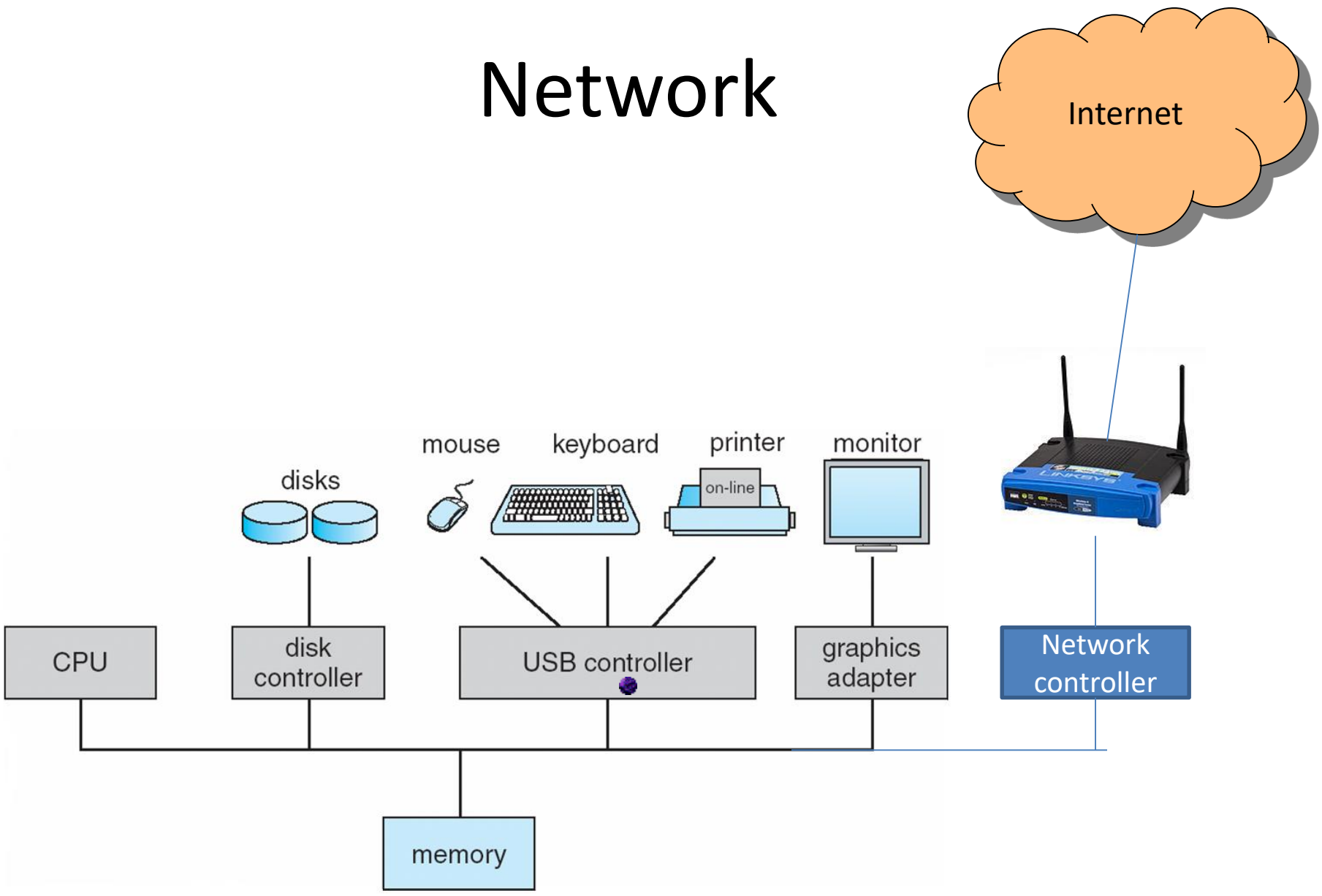
Network


Internet
mouse
keyboard
printer
monitor
disks
on-line
CPU
disk controller
USB controller
graphics adapter
Network controller
memory

Terminologies

- Network
  - Physical medium of data transfer among multiple computers (e.g., Ethernet, CDMA,…)
- Packet
  - A unit of transfer in the network
- Protocol
  - A contract on how to transfer and receive data among the computers in the network

Communication Protocol

- Layered architecture

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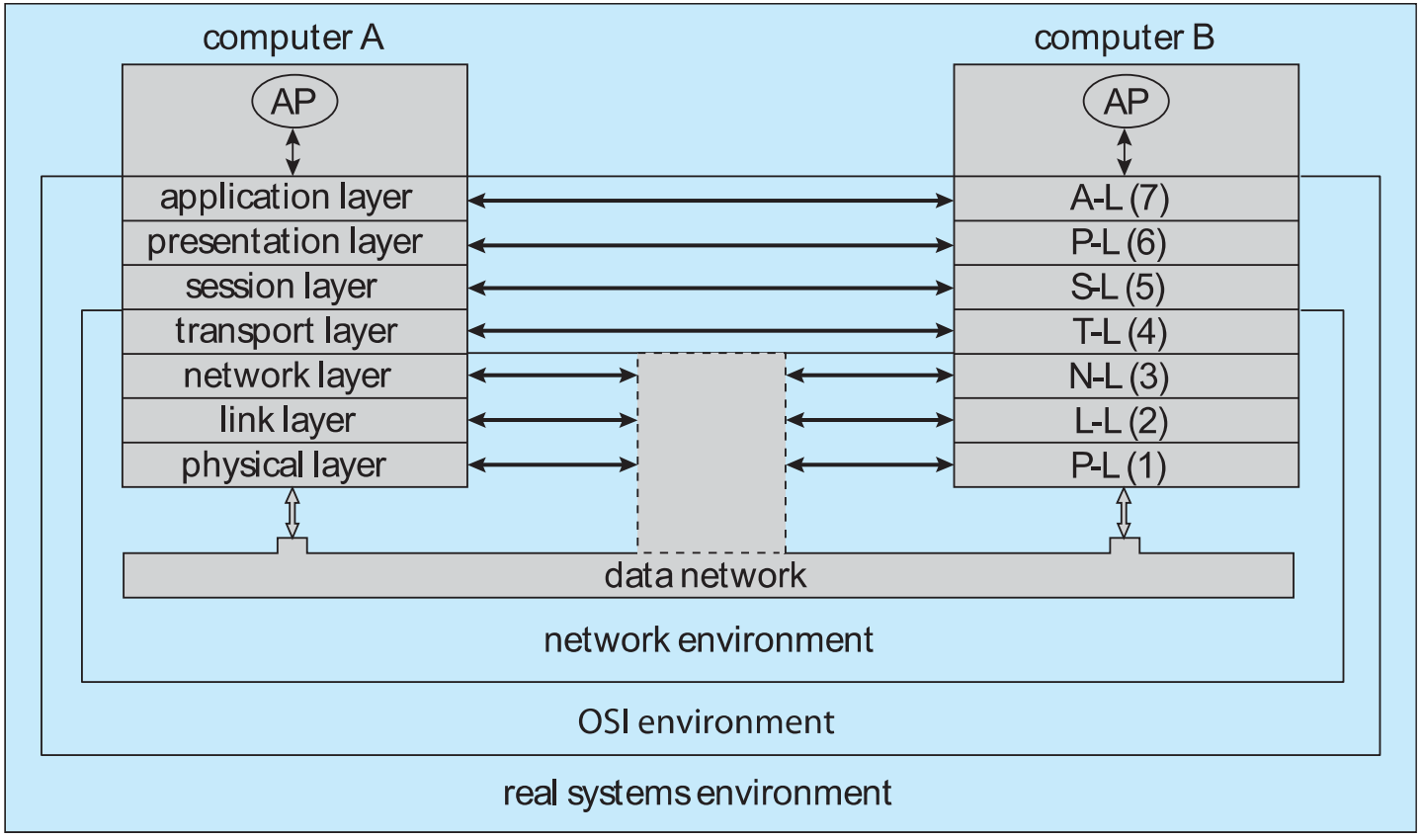


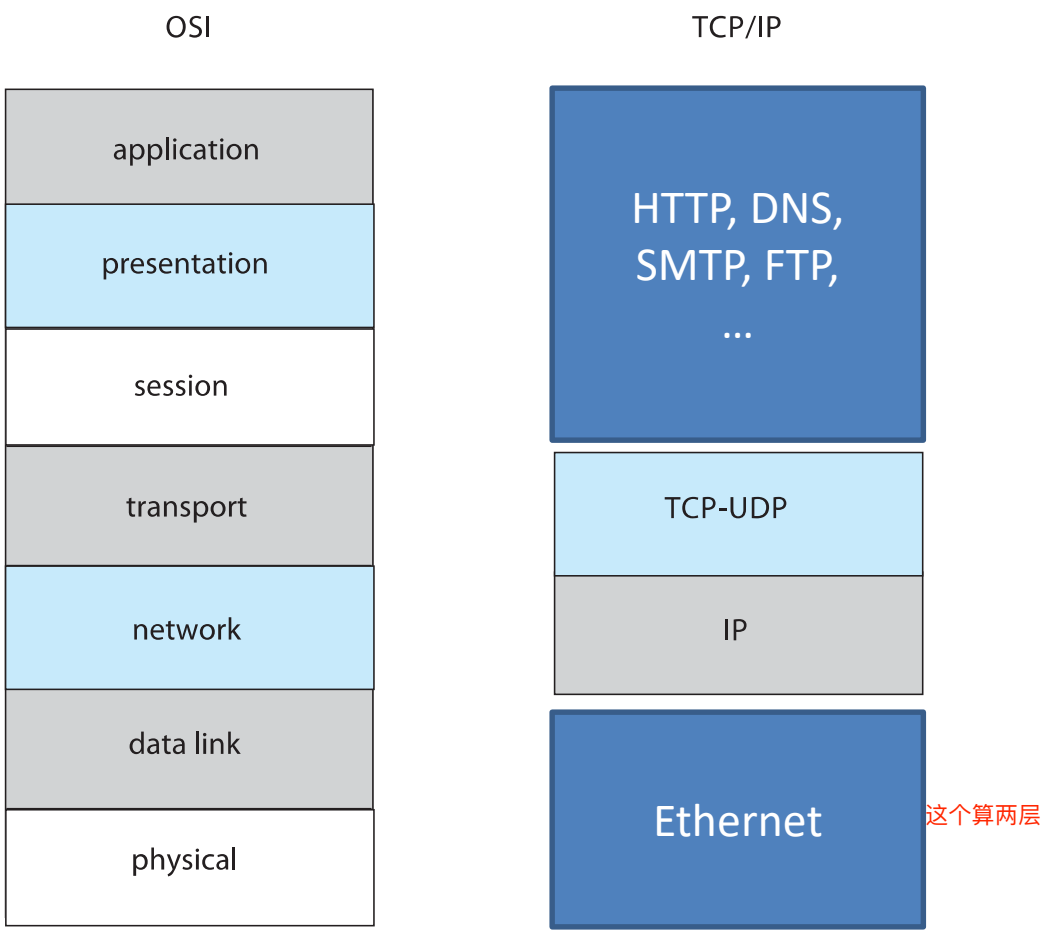
OSI 7 Layer communication model

OSI Layers

1. Physical - electrical details of the physical transmission of a bit stream
2. Data-link - reliable data delivery on the physical medium
3. Network - addressing, routing, and delivery of packets
4. Transport – reliable delivery over the network
5. Session – session management among applications
6. Presentation – data representation, encryption
7. Application – application specific

- Pros and Cons
  - Pros: separation of concerns
  - Cons: overhead, duplication

TCP/IP Protocol Layers



A Packet

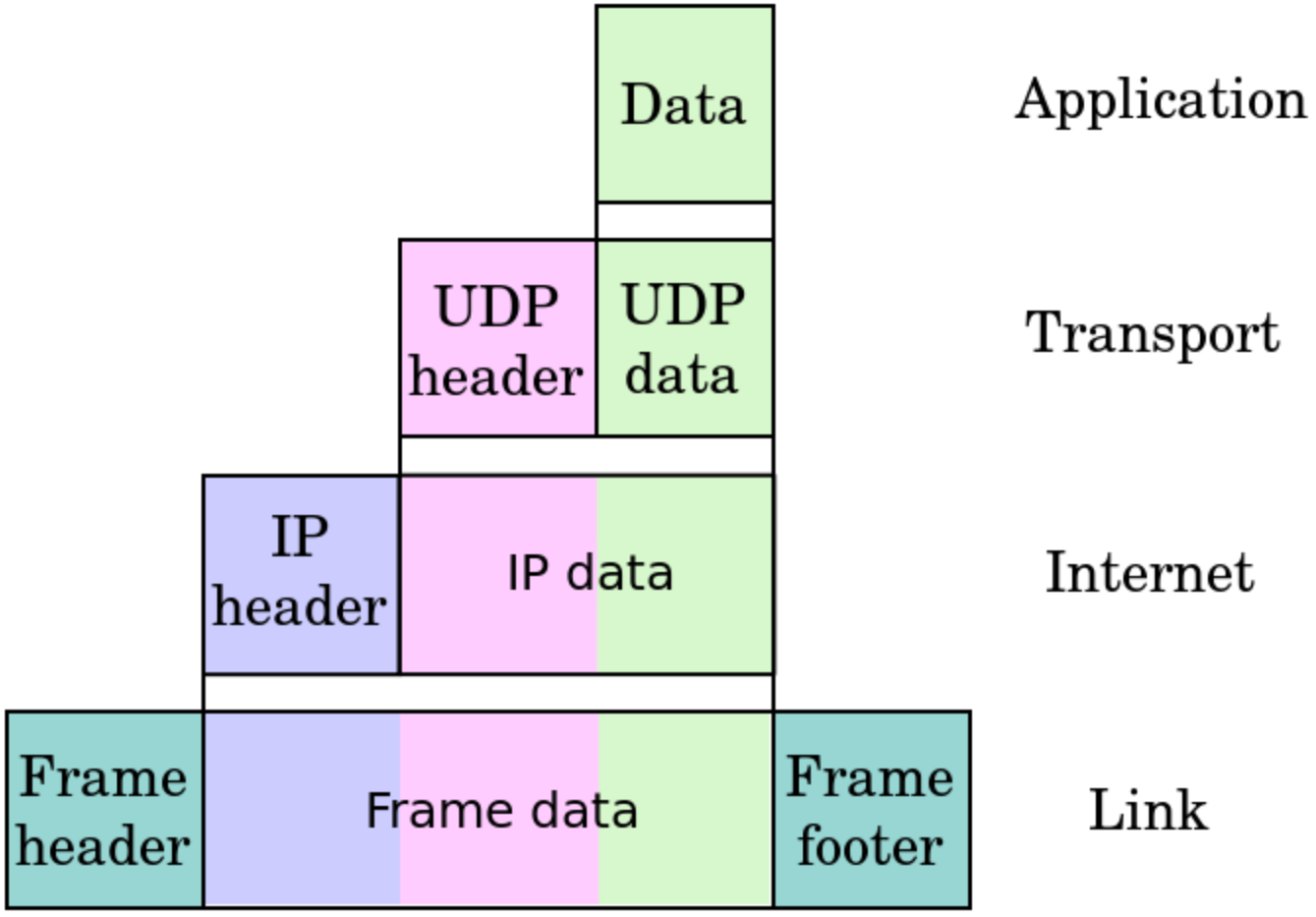
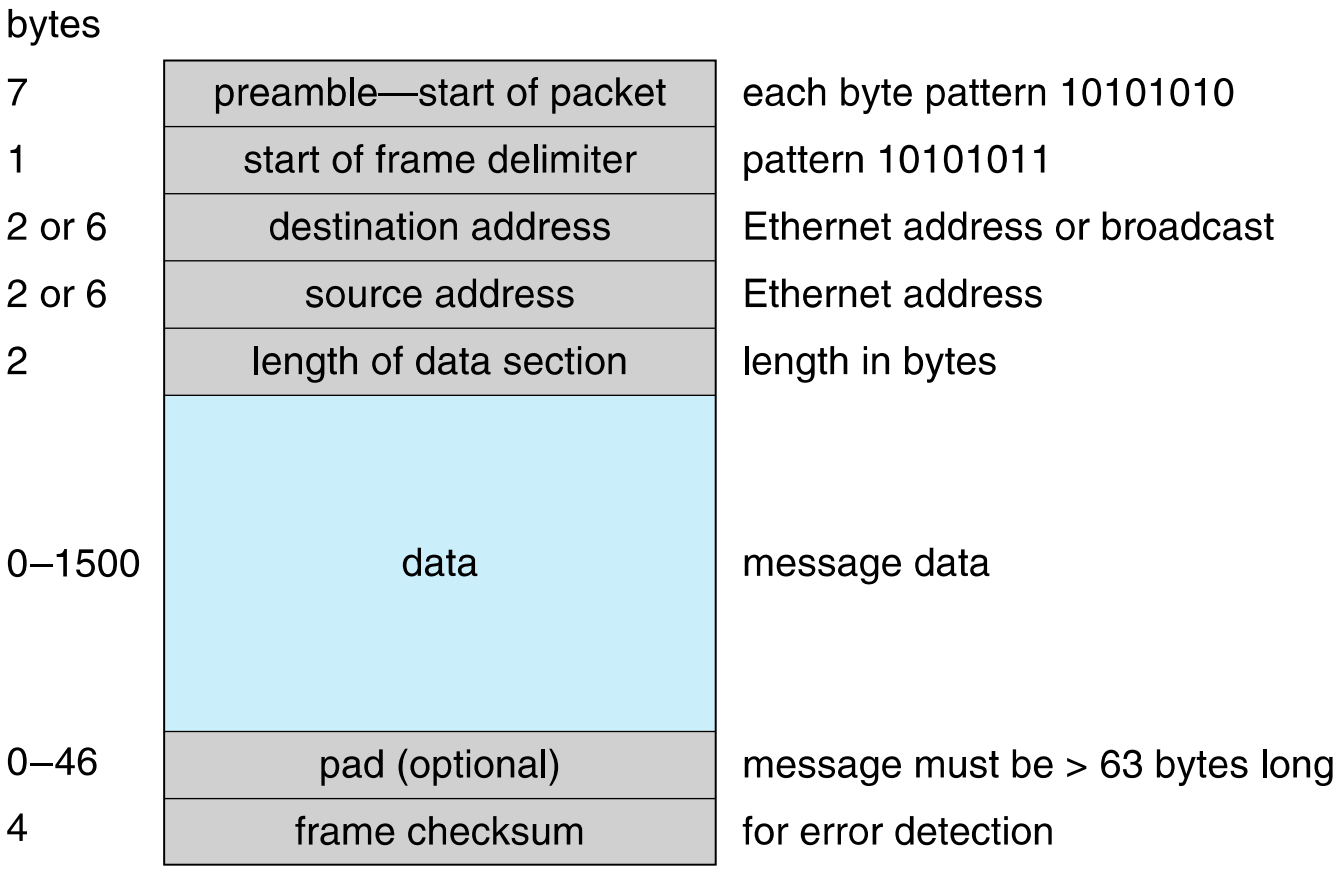


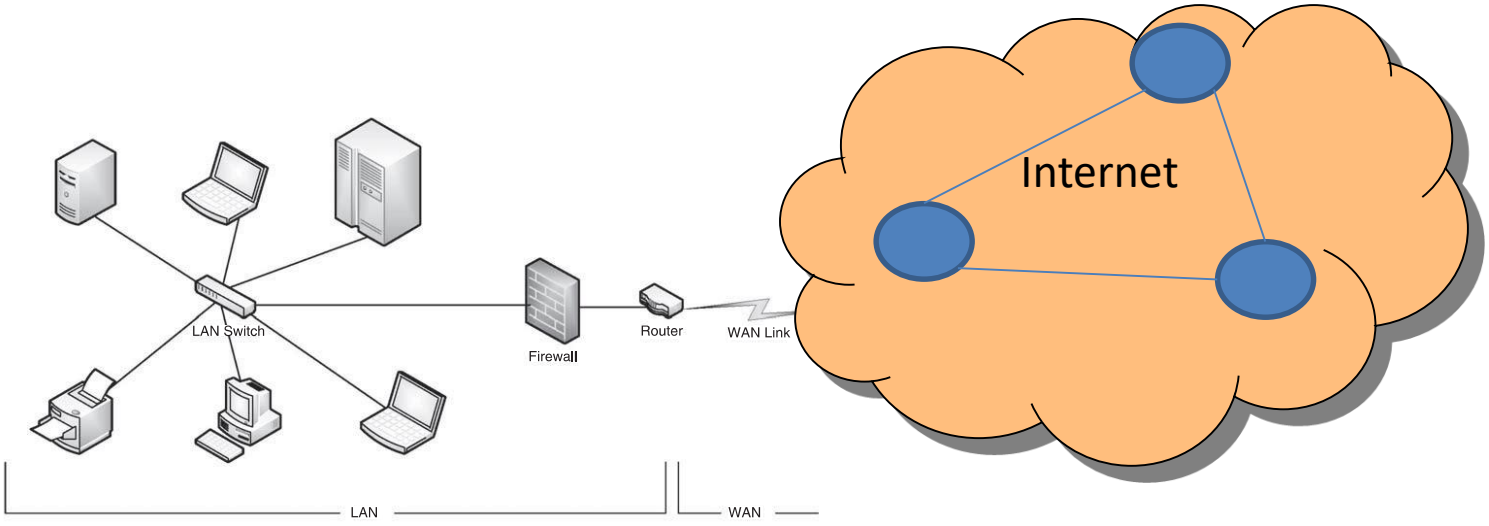
Image source: http://en.wikipedia.org/wiki/Internet_protocol_suite

An Ethernet Frame



Internet Protocol (IP)

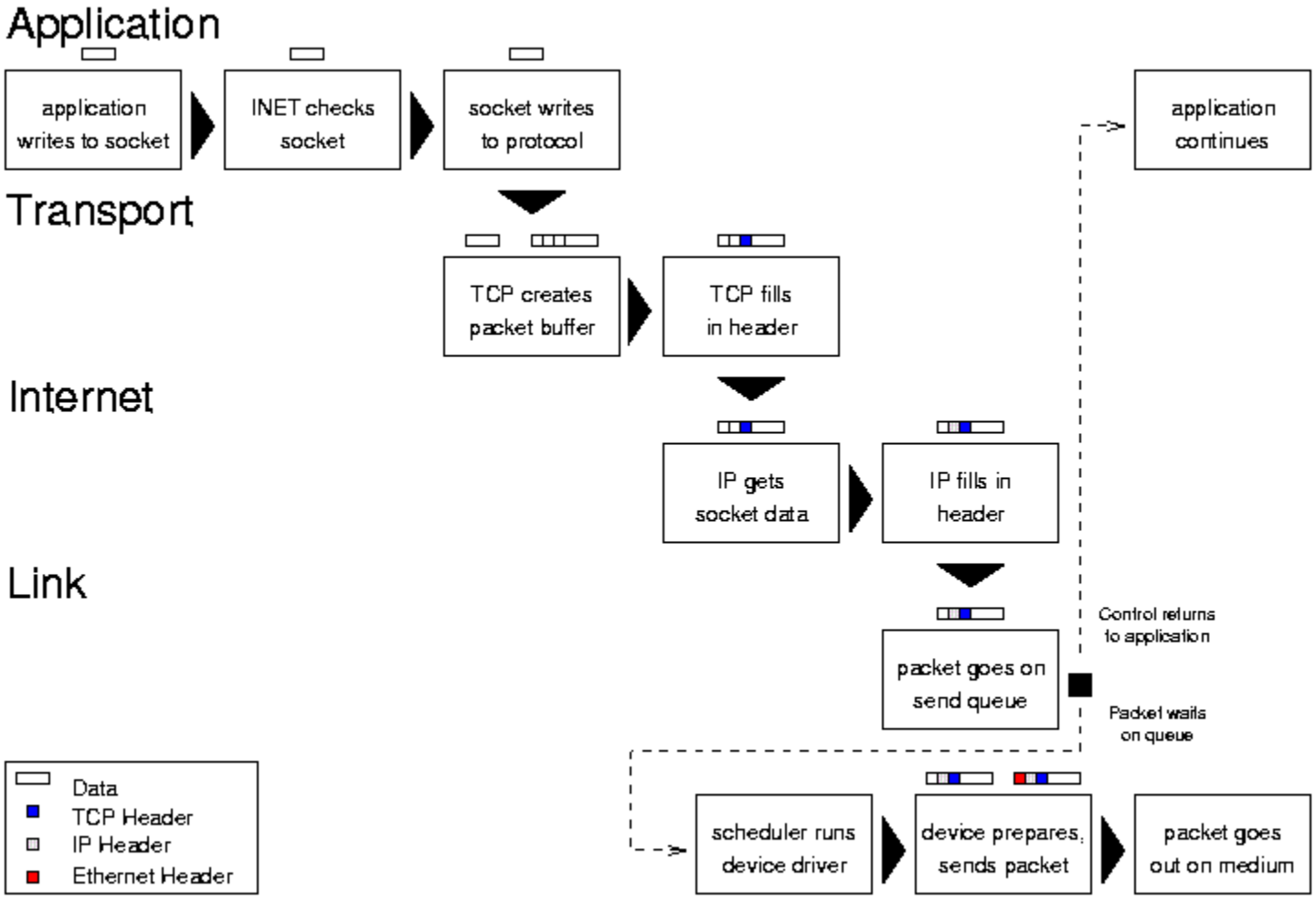
- Addressing
  - 32 bit (4 bytes) address: e.g., 129.237.123.1
- Routing
  - Forwarding packets through routers to reach their destination



Domain Name System (DNS)

- Domain name
  - Human readable internet address:
    e.g., www.ku.edu
- How to map domain names to IP addresses?
  - www.ku.edu → 129.237.11.182
  - www.google.com → may vary depending on your location, server load, etc.
- Domain Name System
  - A distributed database of domain name, IP addr.

Sending a Packet



Source: G. Herrin, Linux IP Networking: A Guide to the Implementation and Modification of the Linux Protocol Stack, 2000

Receiving a Packet

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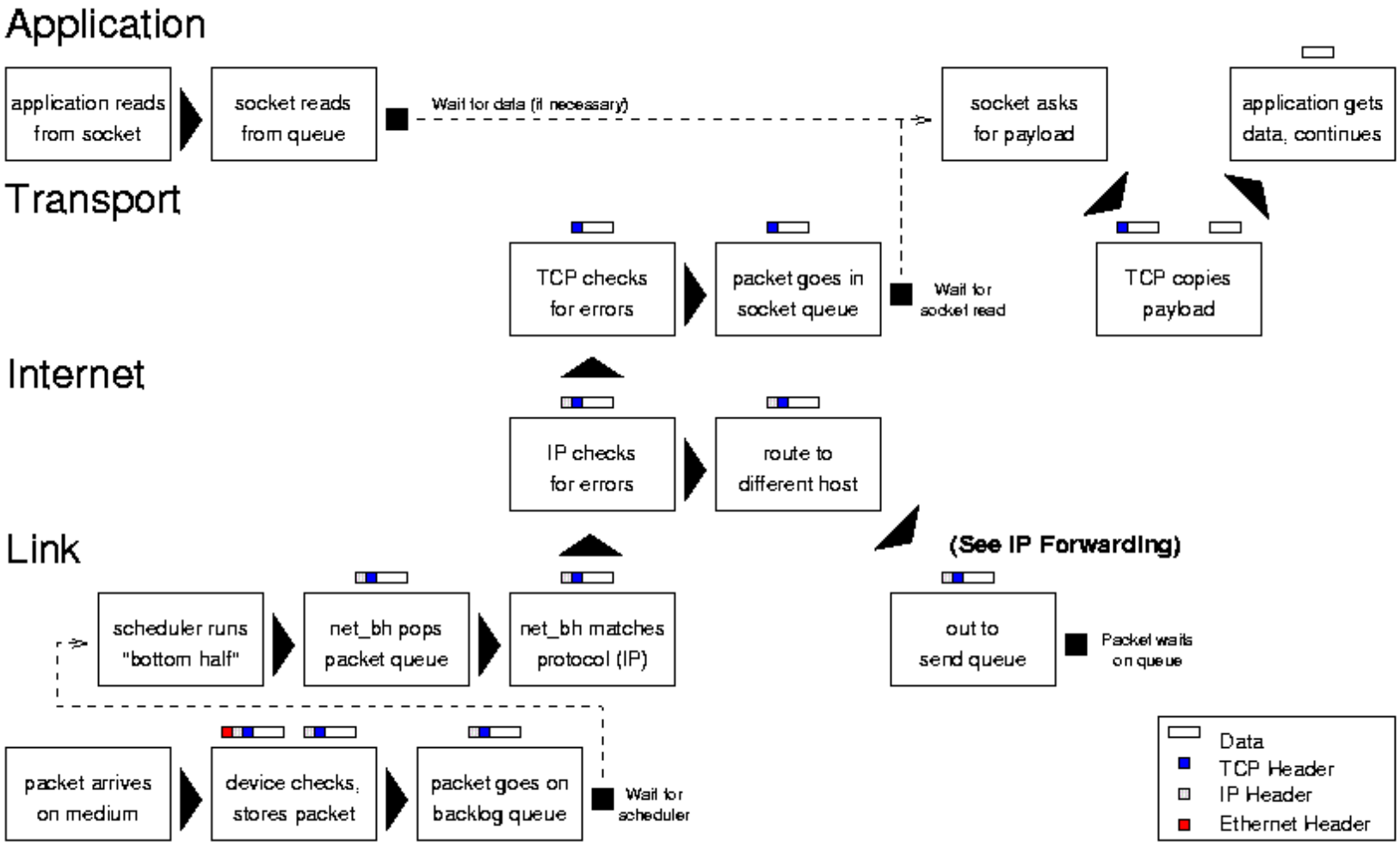

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