

CS144

An Introduction to Computer Networks

Physical Links

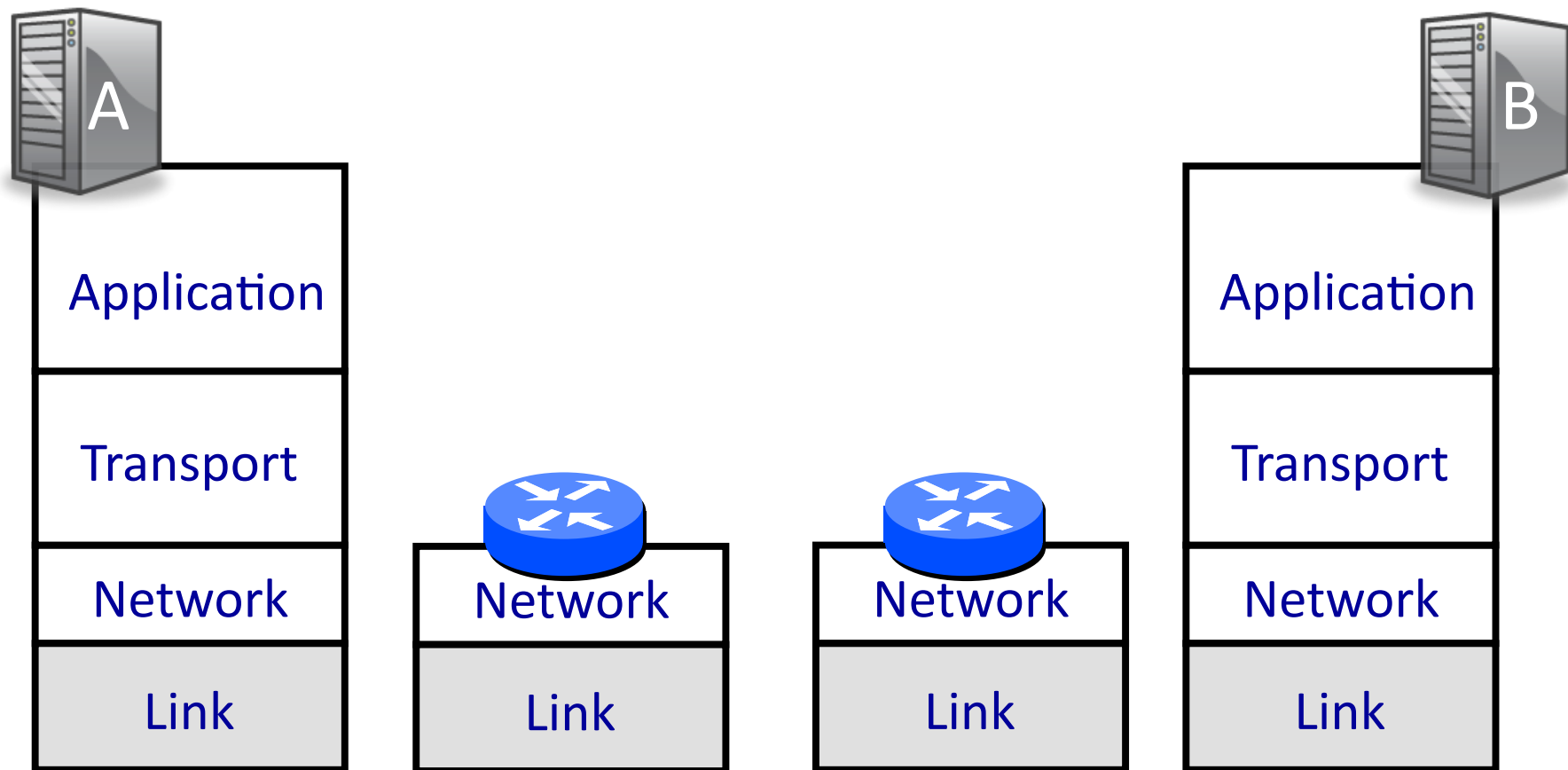
CSMA/CD and Ethernet



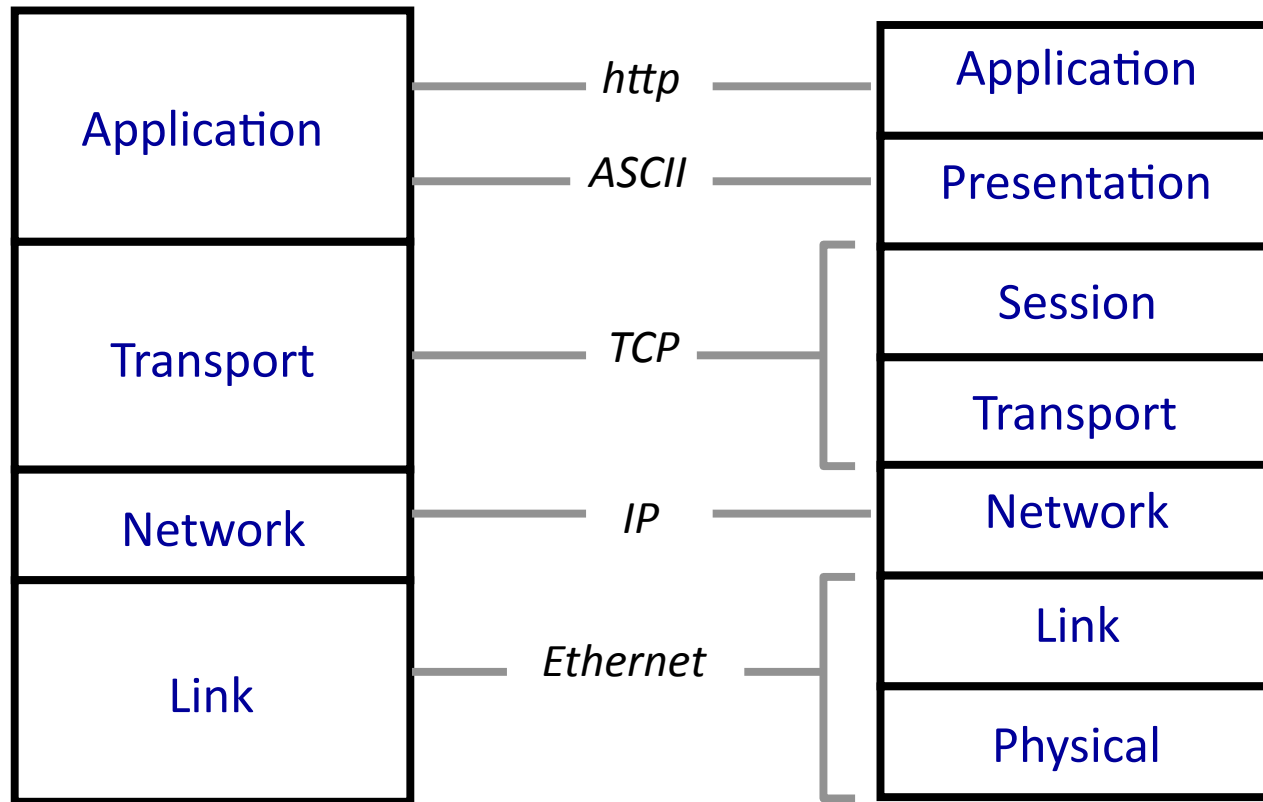
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The Link Layer



Why is Ethernet often referred to as “Layer 2”?



The 4-layer Internet model

The 7-layer OSI Model

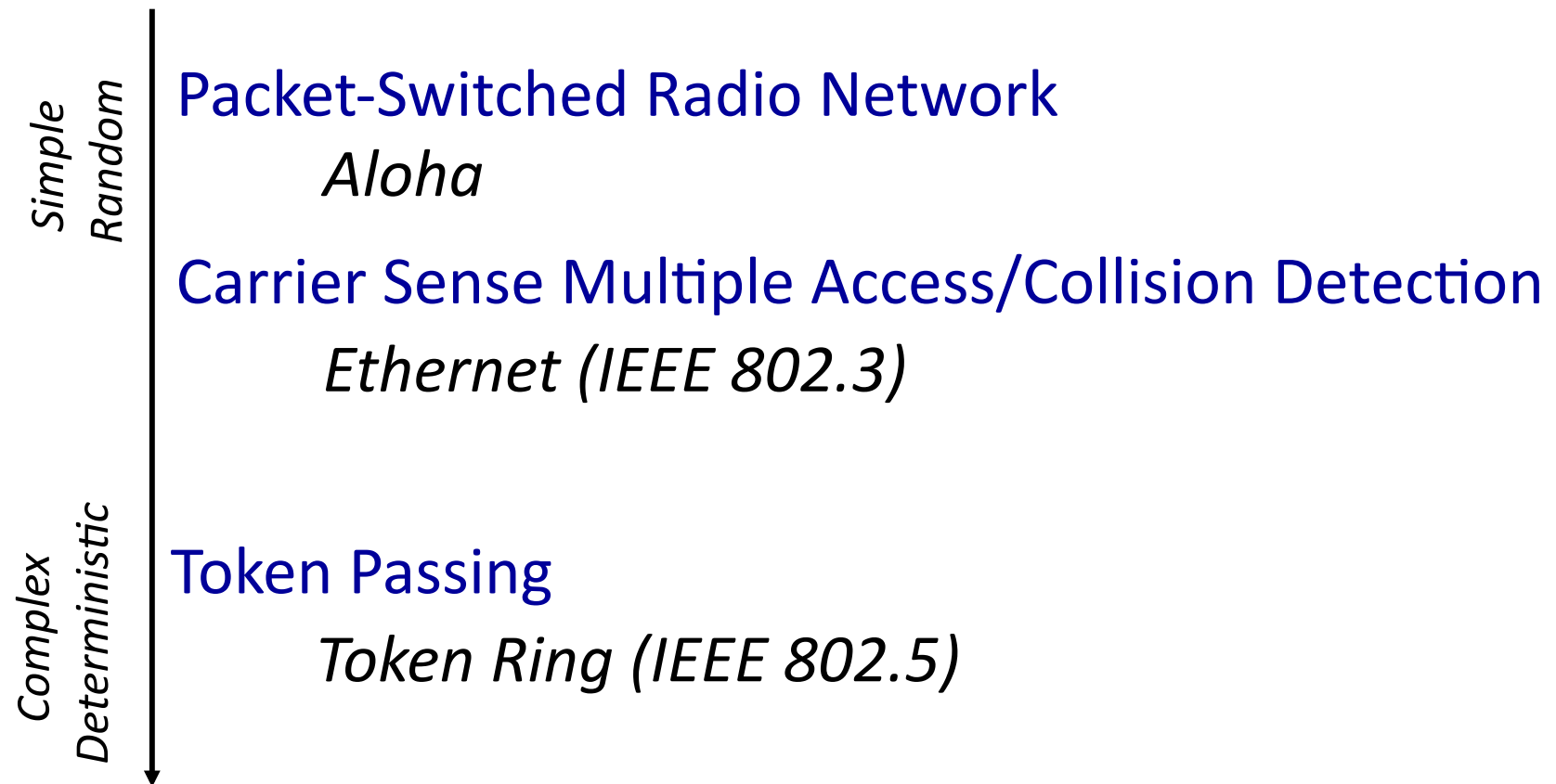
The origins of Ethernet



Sharing a “medium”

- Ethernet is an example of multiple hosts sharing a common cable (“medium”).
- To share the medium, we need to decide who gets to send, and when.
- There is a general class of “Medium Access Control Protocols”, or MAC Protocols.
- We will take a look at some examples.

Examples of MAC Protocols

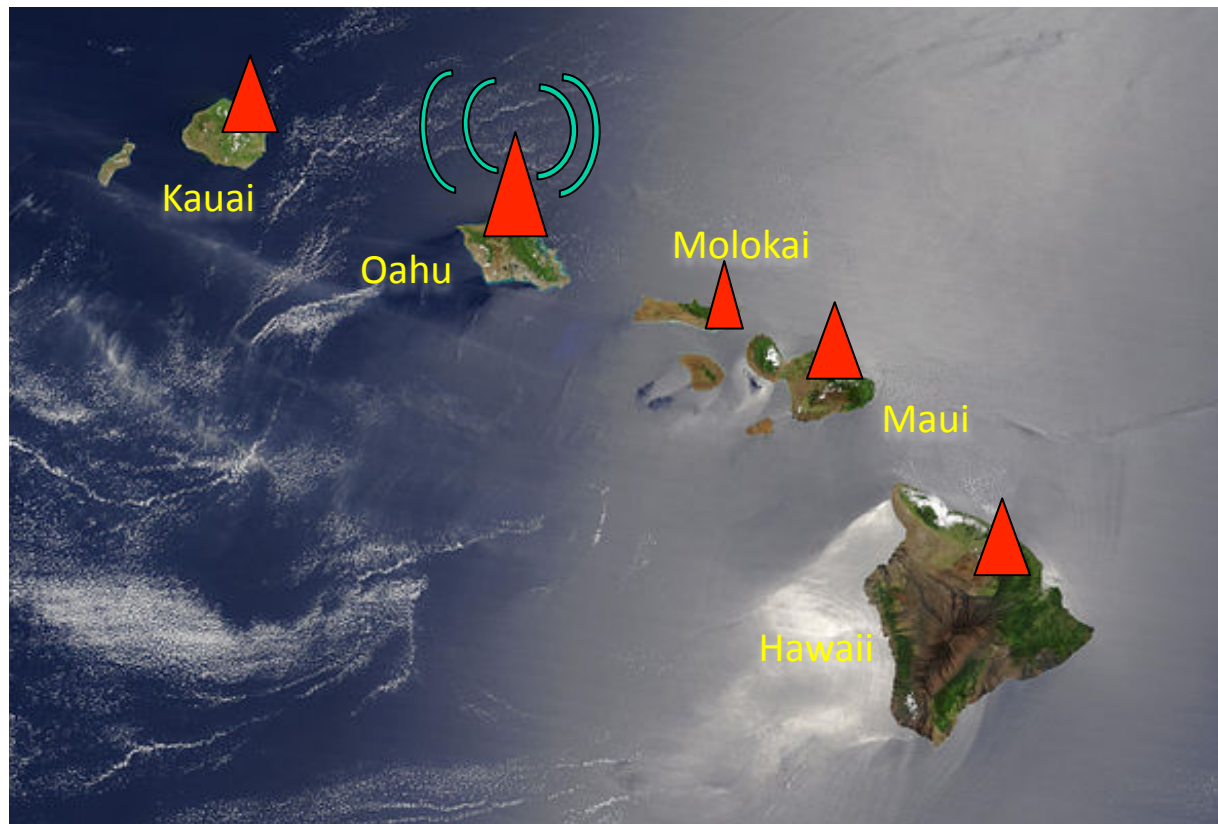


Goals of MAC Protocols

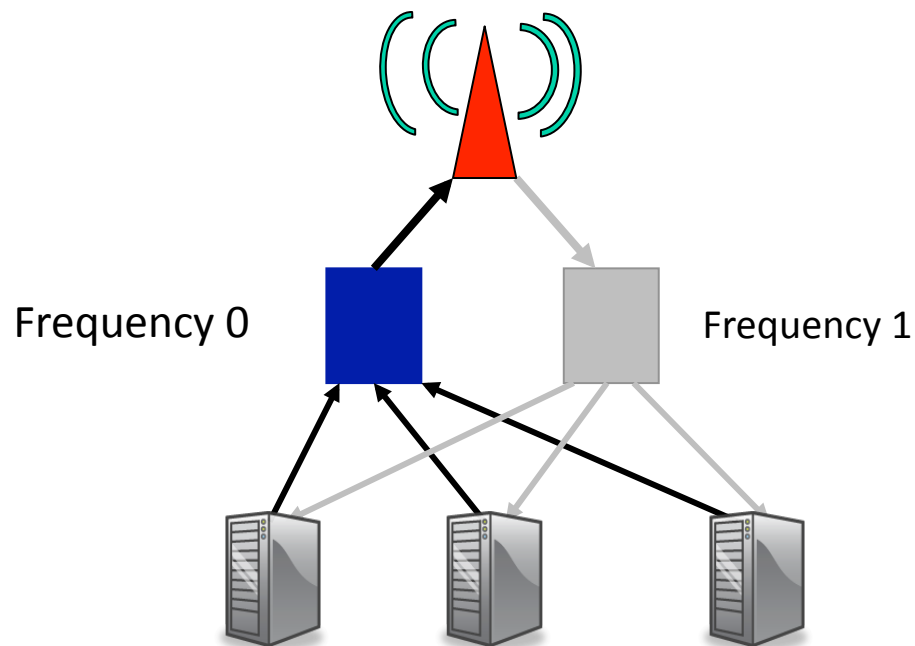
Medium Access Control protocols arbitrate access to a common shared channel among a population of users

1. High utilization of the shared channel
2. Fair among end hosts
3. Simple and low cost to implement
4. Robust to errors; fault tolerant

Aloha Network (1968)



Aloha



Original Aloha MAC protocol

1. If you have data to send, transmit it.
2. If your transmission “collides” with another, retry later.

Aloha Protocol

- Aloha protocol is very simple
- (Quite) robust against failure of a host.
- The protocol is distributed among the hosts.
- Under low-load, we can expect the delay to be small.
- Under high-load, a lot of time “wasted” sending packets that collide.

Improving performance:

1. Listen for activity (“carrier sense”) before sending a packet.
2. Detect collisions quickly and stop transmitting.
3. After collision, pick random waiting time based on the load.

CSMA/CD Protocol



All hosts transmit & receive on one channel
Packets are of variable size.

When a host has a packet to transmit:

1. **Carrier Sense:** Check the line is quiet before transmitting.
2. **Collision Detection:** Detect collision as soon as possible. If a collision is detected, stop transmitting; wait a random time, then return to step 1.

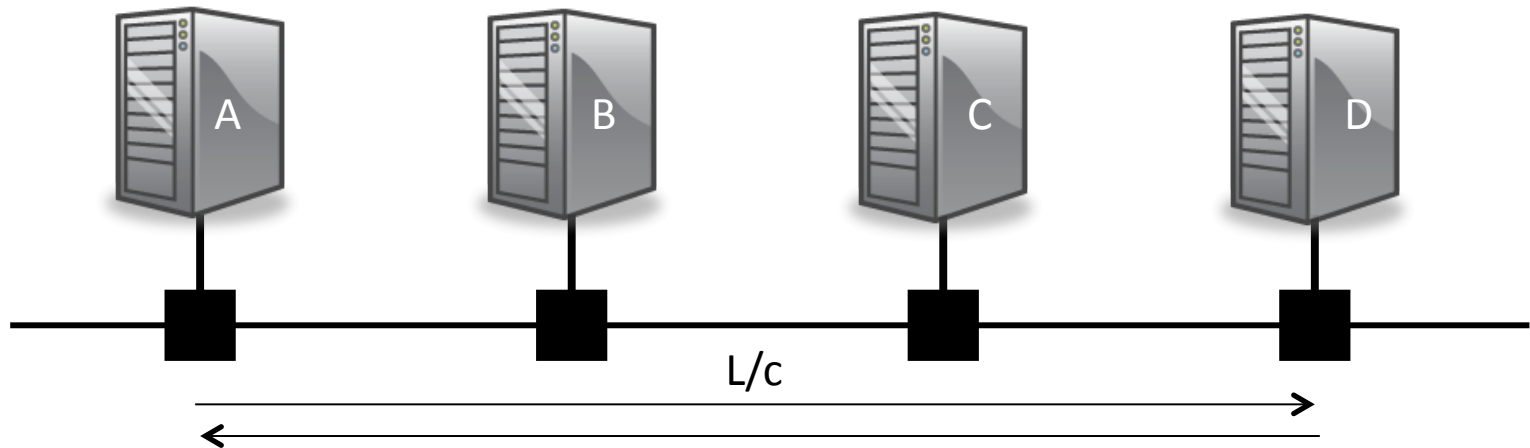


binary exponential backoff

CSMA/CD operation



CSMA/CD Packet size requirement



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