Network Security

Session 4A
Forwarding Vs Routing

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Session 4A: Focus

- Forwarding
- Forwarding Vs Routing
- Forwarding Table Vs Routing Table

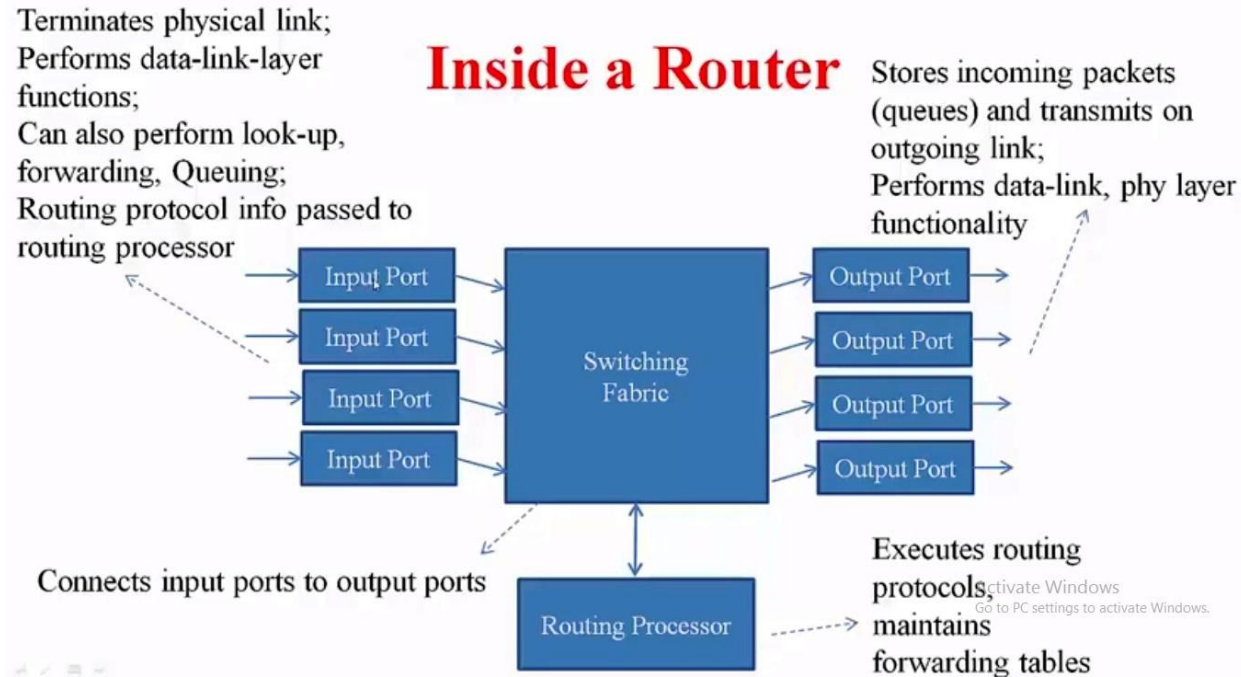**Course page** **where the course materials will be posted as the course progresses:**

Forwarding Vs Routing

Reference: Ref1: Computer Networks A Systems Approach:
Section 3.3 Routing

Forwarding Table

- So far, we have assumed that the switches and routers have enough knowledge of the network topology so they can choose the right port onto which each packet should be output.

- In datagram networks, including IP networks, routing is an issue for every packet.

- In either case, a switch or router needs to be able to look at a destination address and then to determine which of the output ports is the best choice to get a packet to that address.

- The switch makes this decision by consulting a forwarding table.

- The fundamental problem of routing is how switches and routers acquire the information in their forwarding tables.

Inside a Router

Terminates physical link; Performs data-link-layer functions; Can also perform look-up, forwarding, Queuing; Routing protocol info passed to routing processor

Inside a Router

Stores incoming packets (queues) and transmits on outgoing link; Performs data-link, phy layer functionality

Input Port — Input Port — Input Port — Input Port

Switching Fabric

Output Port — Output Port — Output Port — Output Port

Connects input ports to output ports

Routing Processor

Executes routing protocols; maintains forwarding tables

- Every frame entering the router through one of the input ports, gets routed through an output port.
- The router looks at the destination IP address in L3 layer and chooses one of the output ports based on the information stored in routing table
- Changes the MAC addresses in L2 layer and forwards it on to output port

Forwarding Vs Routing

- We need to understand an important distinction, which is often neglected, between **forwarding** and **routing**.

- Forwarding consists of taking a packet, looking at its destination address, consulting a table, and sending the packet in a direction determined by that table.

- We studied several examples of forwarding in the earlier classes.

- **Routing** is the **process** by which **forwarding tables are built**.

- We also note that forwarding is a relatively simple and well-defined process performed locally at a node.

- Whereas, **routing** depends on **complex distributed algorithms** that have continued to evolve throughout the history of networking.

Example: Forwarding and Routing Tables

Routing Table

Prefix/Length	Next Hop
18/8	171.69.245.10

Forwarding Table

Prefix/Length	Interface	MAC Address
18/8	if0	8:0:2b:e4:b:1:2

- Identify which is a Routing table and Forwarding Table above?
- Which is built first? That is the entries of which table are filled in first.
- Routing table is built first and based on its entries, the forwarding table entries are populated.
- **Which protocol is used to build the Routing table?**
- Routing Protocols (OSPF, RIP, etc.)
- **Which one has the overall network topology knowledge?**
- Routing Protocol runs across the networks by interacting with other routers and builds and maintains correct entries in the routing table of each router.

  Prefix/Length: 18/8: **18.0.0.0/8** (which is a Class A address, earlier assigned to MIT)
  Its subnet mask: 255.0.0.0
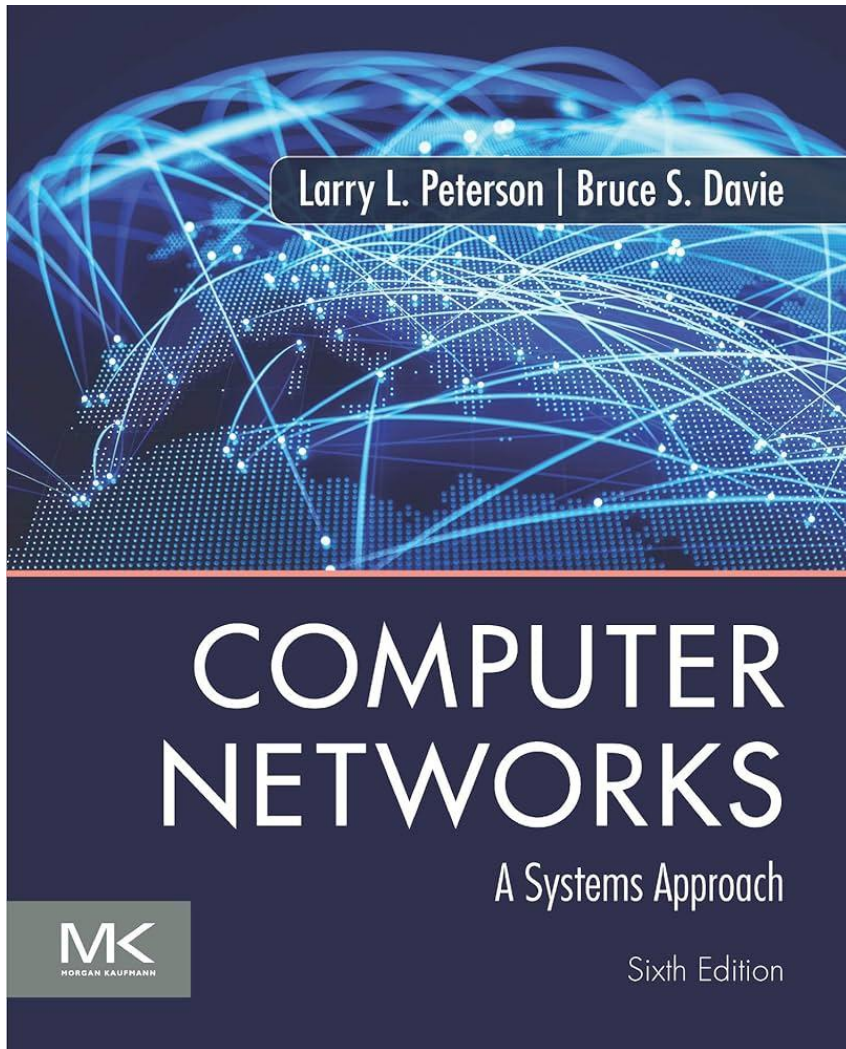
Forwarding Table Vs Routing Table

- While the terms forwarding table and routing table are sometimes used interchangeably, let us make a distinction between them here.

- The forwarding table is used when a packet is being forwarded and so must contain enough information to accomplish the forwarding function.

- This means that a row in the forwarding table contains the mapping from a network prefix to an outgoing interface and some MAC information, such as the Ethernet address of the next hop.

- The routing table, on the other hand, is the table that is built by the routing algorithms as a precursor to building the forwarding table.

- It generally contains mappings from network prefixes to next hops.

- It may also contain information about how this information was learned, so that the router will be able to decide when it should discard some information
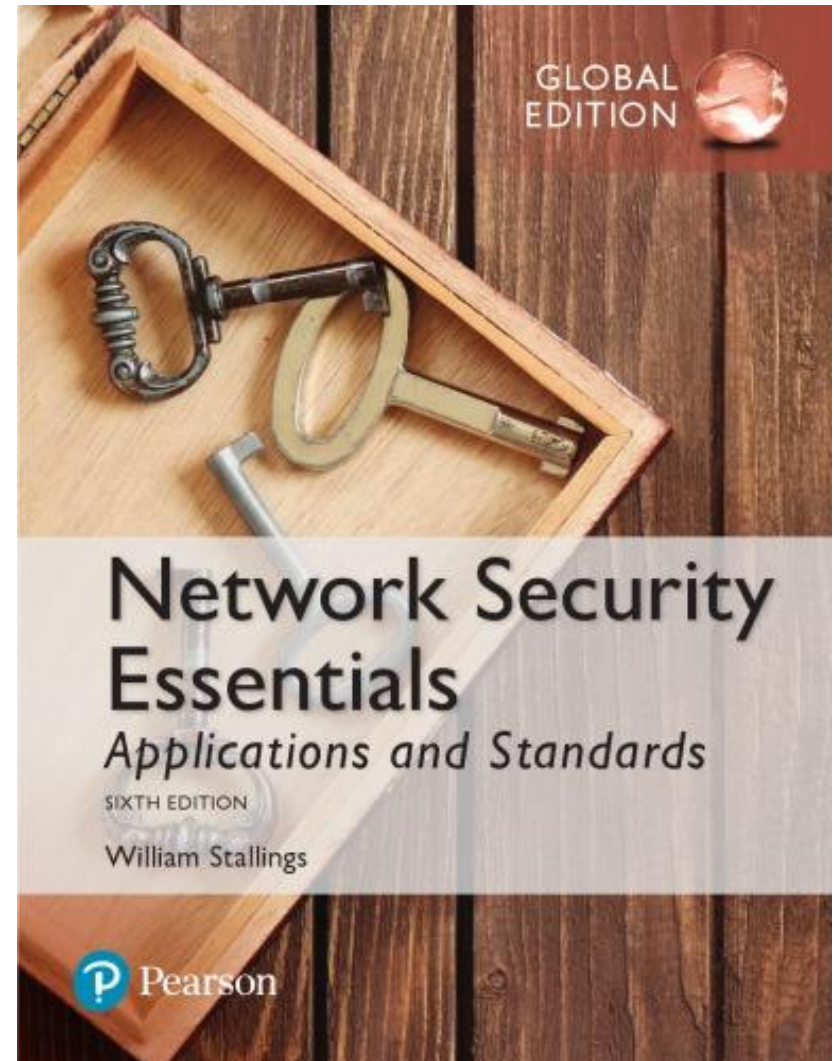
Session 4A: Summary

- Forwarding
- Forwarding Vs Routing
- Forwarding Table Vs Routing Table
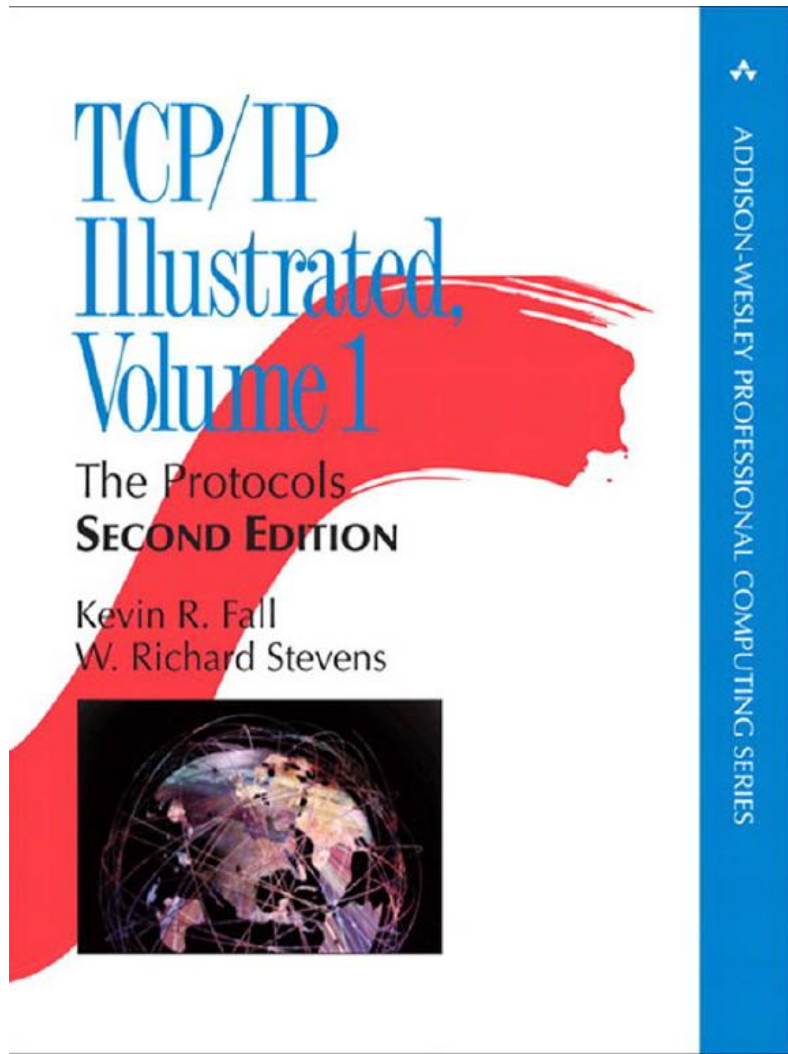
Textbooks

Textbook 1

Textbook 2

Larry L. Peterson | Bruce S. Davie

COMPUTER NETWORKS

A Systems Approach

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Applications and Standards

SIXTH EDITION

William Stallings

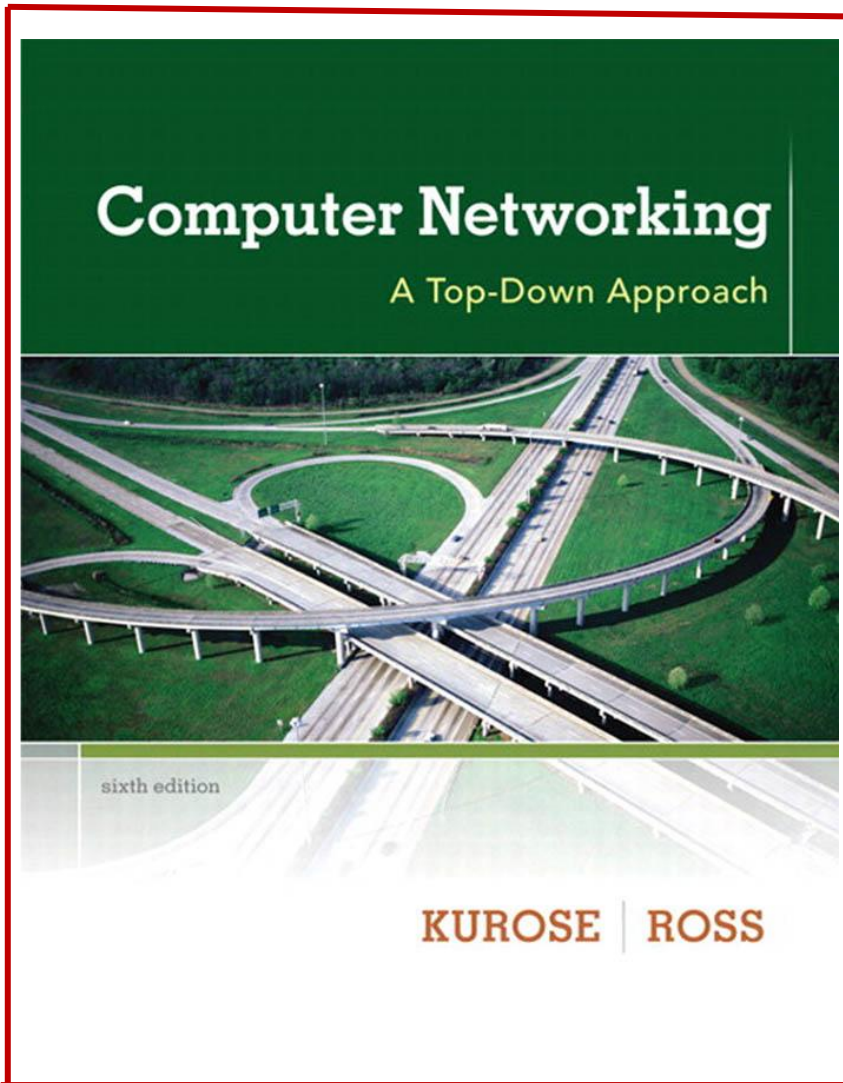# References

TCP Congestion Control: A Systems Approach

TCP Congestion Control: A Systems Approach

Peterson, Brakmo, and Davie

References

Ref 3

Ref 4

Computer Networking
A Top-Down Approach
sixth edition
KUROSE | ROSS

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