

FINAL LECTURE – A REVIEW

COMP 30650: NETWORKS AND INTERNET SYSTEMS

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Office Hours: Thursday 13:00 - 14:00

OBJECTIVES OF COMP30650

Learn how Computer Networks and Internet works!



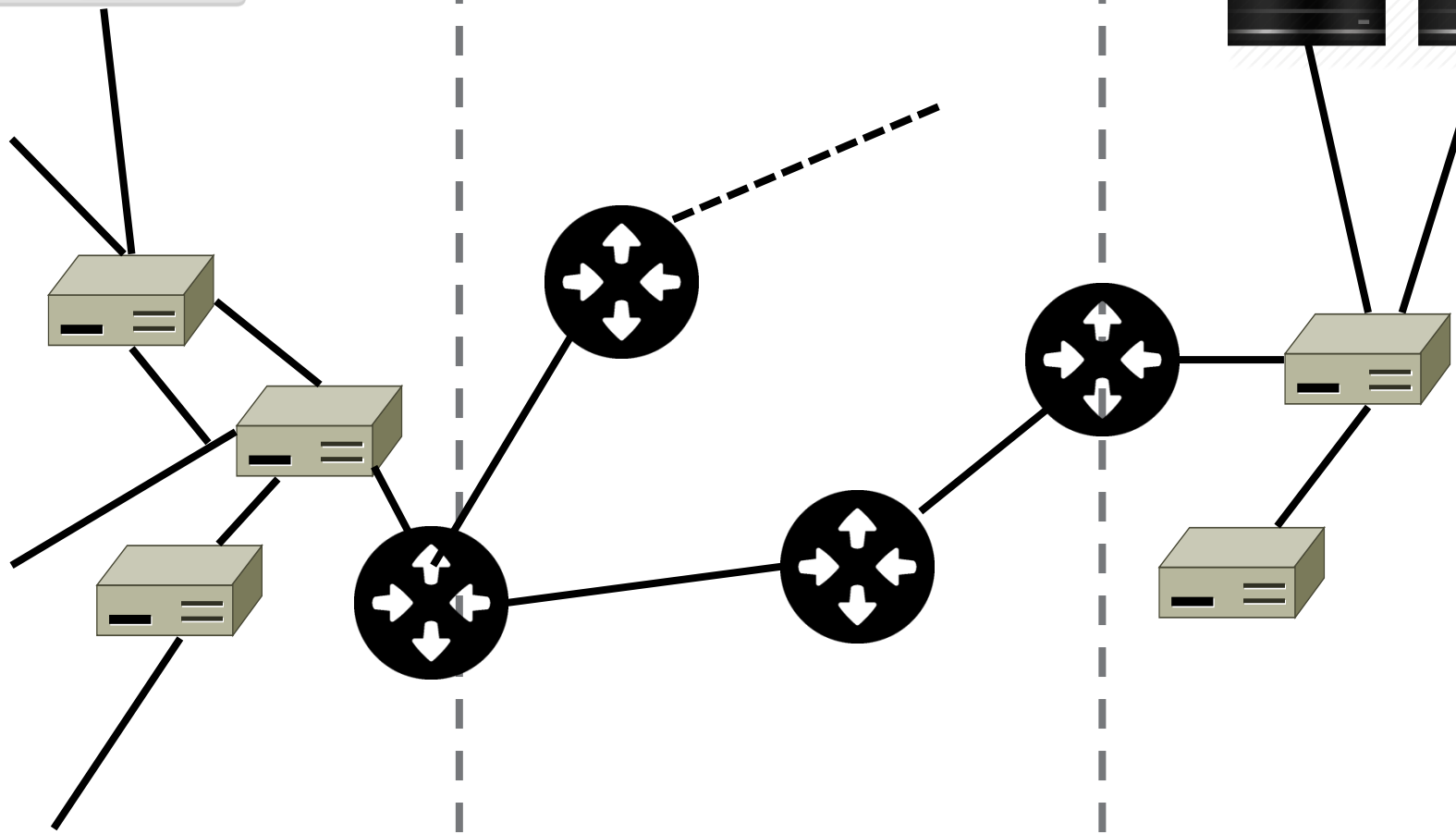
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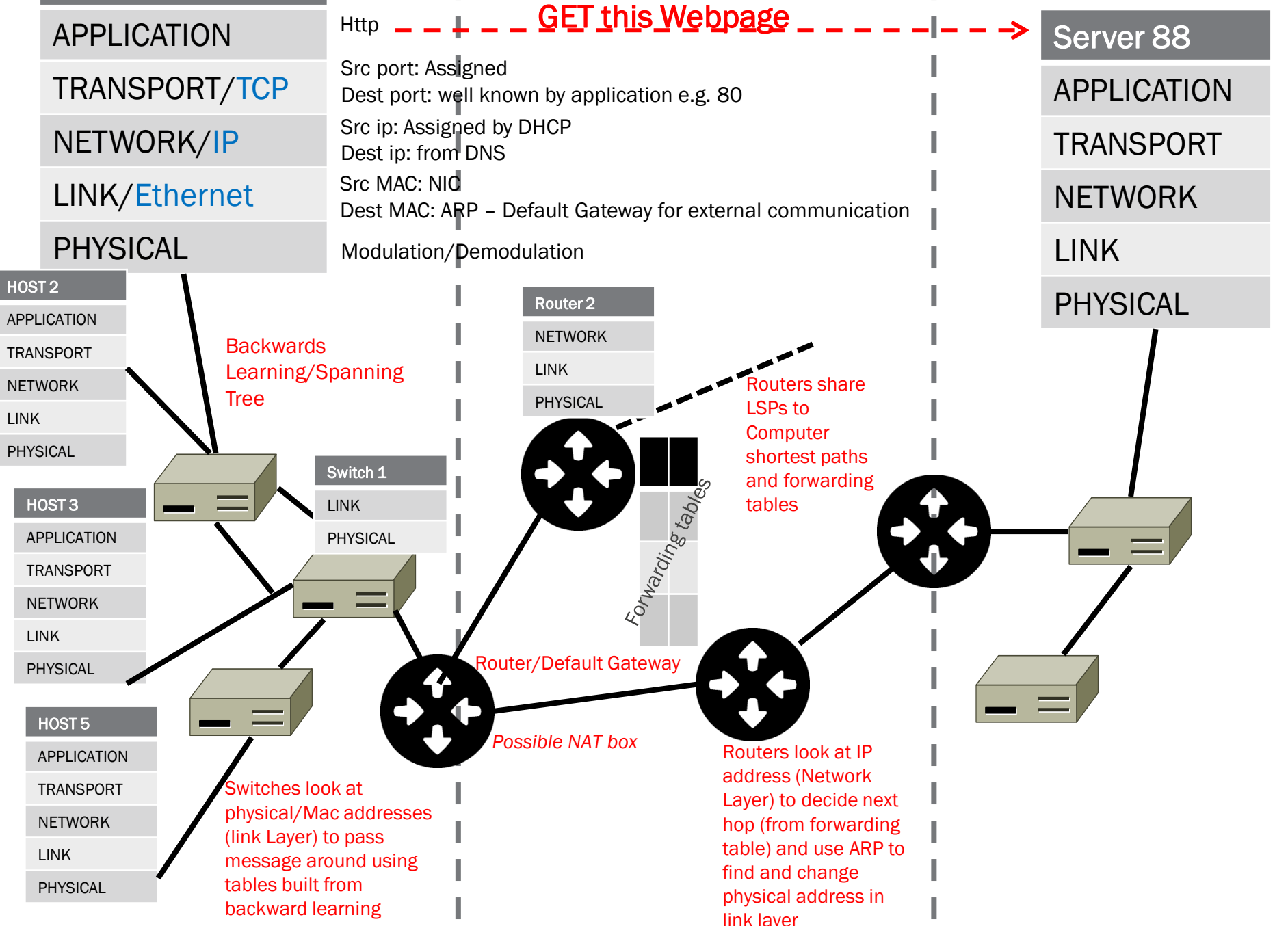
INTERNET/ISP

LAN



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DESIGN ISSUES FOR THE NETWORKS

Recurring design issues of Networks

Issue	Mechanisms at different layers	Examples from Lectures
Reliability despite failures	Codes for error detection/correction Routing around failures	
Network growth and evolution	Addressing and naming Protocol layering	
Allocation of resources like bandwidth	Multiple access Congestion control	
Security against various threats	Confidentiality of messages Authentication of communicating parties	

DESIGN ISSUES FOR THE NETWORKS

Recurring design issues of Networks

Issue	Mechanisms at different layers	Examples from Lectures
Reliability despite failures	Codes for error detection/correction Routing around failures	Hamming Codes, ARQ, CRC, Routing Algorithms (LSP), TCP
Network growth and evolution	Addressing and naming Protocol layering	IPv4, IPv6, NAT, IP Pre-Fixes Changing protocols, DNS, ARP
Allocation of resources like bandwidth	Multiple access Congestion control	Caching, Proxies, CDNs, TDFM, FDM
Security against various threats	Confidentiality of messages Authentication of communicating parties	Encryption, Authentication Signatures, Public Keys, DNSSec

INTRODUCTORY TOPICS

1. Wondrous Uses of Computer Networks

- Smart Devices/IOT
- Fetching Webpages/communication

2. Origins of Computer Networks

- ARPANET

3. Network topology

- Bus/Star/Mesh/etc.



PHYSICAL LAYER

1. Properties of the physical layer

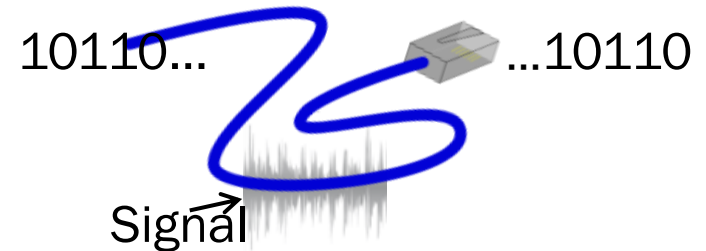
- Message Latency, propagation delay

2. Types of media

- Wires, fiber optics, wireless

3. Modulation

- Encoding/Decoding
- Clock Recovery
- Passband Modulation



LINK LAYER

1. Framing

- Delimiting start/end of frames
- Bit/Byte Stuffing – PPP over SONET

2. Error detection/correction

- Handling errors
- Hamming, CRC, Checksums, etc

3. Retransmissions

- Handling loss
- ARQ

LINK LAYER

4. Multiple Access

- Classic Ethernet, 802.11

5. Multiplexing

- TDM
- FDM

6. Multiple Access Control

- Aloha protocol
- Carrier Sense Multiple Access
 - Collision Detection

7. Switching

- Modern Ethernet
- Backward Learning
- Spanning Trees



NETWORK LAYER

1. Network service

- Datagrams (packets), virtual circuits

2. IP (Internet Protocol)

- Forwarding (Longest Matching Prefix)
- Helpers: ARP and DHCP
- Fragmentation and MTU discovery
- Errors: ICMP

3. NAT, a “middlebox”

4. Routing algorithms


- Forwarding v Routing
- Shortest Path
- Link-State Packets
- Forwarding Tables

TRANSPORT LAYER

1. Connection Establishment

- Sockets
- Three-way handshake – TCP
- Connection Release

2. Sliding Window

- Increasing Efficiency
 - Sequence Numbers
 - Flow Control
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APPLICATION LAYER


1. DNS (Domain Name System)

- Name servers

2. HTTP (HyperText Transfer Protocol)

- Performance
- Parallel and Persistent connections

3. Web proxies and caching

- Efficiency
 - Caching locally and in proxy servers
 - CDNs
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SECURITY

1. Encryption

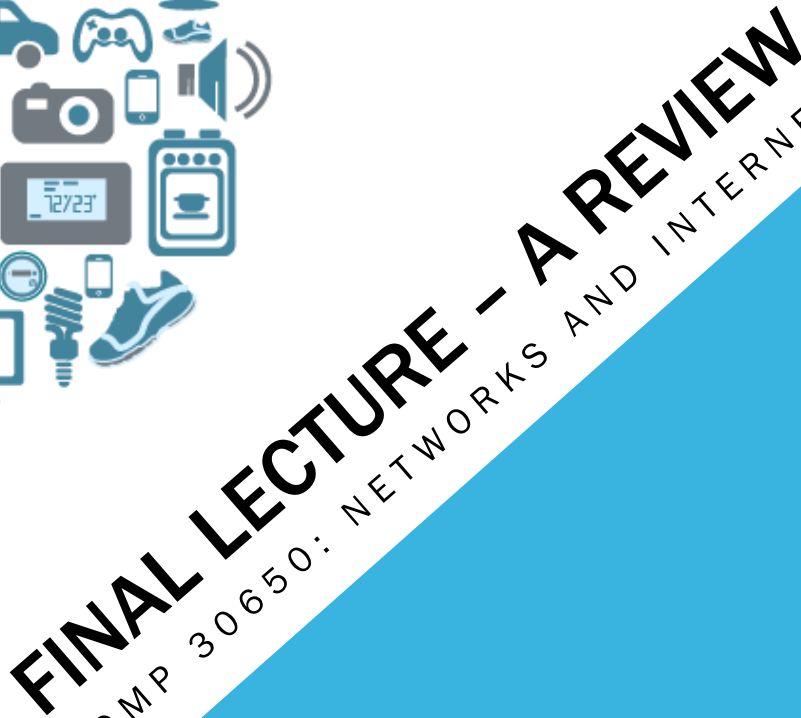
- Symmetric Keys
- public keys

2. Authentication and Integrity

- MACs, Signatures and Hashing
- Parallel and Persistent connections

3. Practical Application

- HTTPS/SSL/TLS
- PKI
- DNS Security



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