CIS 375
CHAPTER 4

Data Link Layer

Outline

- Media Access Control
- Error Control
- Data Link Layer Protocols
  - (Ethernet)
- Transmission Efficiency
- Implications for Cyber Security

4. 1 Introduction

- Purpose of the Data Link Layer is

- Data Link Layer is divided into 2 sub-layers
  - Logical Link Control (LLC) sub-layer
  - Media Access Control (MAC) sub-layer

- Data Link Layer has three functions:
  1. Media Access Control
  2. Error Control
  3. Message Delineation

4.2 Media Access Control

- Controlled Access
  - By Request
  - Roll Call Polling
  - Token Passing
- Contention Based
- Relative Performance

4.3 Error Control

Error control

- Detect, Correct, and Prevent Errors
- 2 types of network errors
  - Corrupted data
  - Lost data

Sources of error

- White Noise
- Impulse Noise
- Echo
- Cross Talk
- Attenuation

4.3.2 Error Detection

Parity Check

- One bit check code
- Count the # of 1's in the message and add the check code to make the count of 1's either even or odd

10110110|_

10110111|_

P (detecting and error/error occurred) =

CRC

- CRC-16 add 16 bits to message
- Treats message as a binary number
- Divides by a preset #
- Uses reminder as check code

CRC-16 P( ) = 99.998%

CRC-32 P ( ) = 99.99999998%

4.3.3 Error Correction

- If error is detected → packet is discarded
- Which layer fixes it then?

4.4 Data Link Layer Protocols

- ASYNC (VT100, Telnet)
- Ethernet

4.4.1 ASYNC

- transmits 1 character at time
- FRAME = 1 start bit + character + parity bit + stop bit

- Transmission efficiency = (# databits / # databits + # overhead bits) =

4.4.2 Ethernet

Ethernet (DIX) and Revised (1997) IEEE 802.3

8	6	6	2	Variable	4
Preamble	Dest. Address	Source Address	Type/ Length	Data	FCS

Original IEEE Ethernet (802.3)

7	1	6	6	2	1	1	1-2	Variable	4
Preamble	SD	Dest. address	Source address	Length	DSAP	SSAP	Control	Data	FCS
802.3					802.2				802.3

IEEE 802.3 with SNAP Header

7	1	6	6	2	1	1	1-2	3	2	Variable	4
Preamble	SD	Dest. address	Source address	Length	DSAP	SSAP	Control	OUI	TYPE	Data	FCS
802.3					802.2			SNAP			802.3

802.3ac Ethernet II

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- Efficiency =
- Destination Address
- Source Address

4.5 Implications for Cyber Security