Report 2 – Ethernet and Wi-Fi

CIIC 4070 – Computer Networks

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I. Introduction

This paper is a project for the CIIC 4070 course at UPRM. It will expand upon the research of the student surrounding the topics and questions prompted by the professor in regards of the Ethernet and Wi-Fi topics which were discussed in the class.

II. The Basics

- <u>Ethernet History</u>

In late 1972, Metcalfe and his Xerox PARC colleagues developed the first experimental Ethernet system to interconnect the Xerox Alto and it was used to link itself with other servers and laser printers. It was called Alto **Aloha** Network, later changing the name to Ethernet in 1973 to specify the new standard as one that was not limited to Alto systems only.

- <u>Wi-Fi History</u>

In 1971, ALOHAnet connected the Hawaiian Islands with a UHF wireless packet network. ALOHAnet and the ALOHA protocol were early forerunners to Ethernet, and later the IEEE 802.11 protocols, respectively.

Later, in 1985, a ruling by the U.S. Federal Communications Commission released the band for unlicensed use. From there it travelled all the way to the Netherlands, where the first drafts of the Wi-Fi protocols were written and established.

Finally, the first version of the 802.11 protocol was released in 1997 and provided up to 2 Mbit/s link speeds.

III. 10-Gigabit Ethernet

- Standard = **<u>(IEEE) 802.3 working group</u>**
- Physical Layer (modules)
  - XENPAK
    First MSA for 10GE and had the largest form factor
  - XFP
    Competing standard
  - X2
    Competing standard
  - SFP+ (small form-factor pluggable)
    The most popular socket on 10GE systems.
- MAC Layer
  Carrier-Sense Multiple Access/Collision Detection (CSMA/CD) protocol on a shared medium.

IV. 100-Gigabit Ethernet

- Standard (IEEE)
  - **<u>802.3bj</u>**
  - **<u>802.3bm</u>**
  - **<u>802.3cd</u>**
  - **<u>802.3cu</u>**
- Physical Layer
  - QSFP28
    modules use the CAUI-4 electrical interface
  - Support full-duplex operation.
  - Preserve the 802.3 Ethernet frame format which utilizes 802.3 MAC layer

- o Preserve minimum and maximum frame size of current 802.3 standard
- o Support a bit error rate (BER) >= 10-12 at the MAC or physical layer service interface
- o Provide appropriate support for optical transport network
- MAC Layer

Carrier-Sense Multiple Access/Collision Detection (CSMA/CD) protocol on a shared medium.

V.   Terabit Ethernet

- Standard
  - o 802.3bs
  - o 802.3cd
  - o 802.3cn
  - o 802.3cm
  - o 802.3cu
- Physical Layer
  - o copper twin-axial cables with lengths up to at least 3 m (200GBASE-CR4).
  - o printed circuit board backplane with a total channel insertion loss of ≤ 30 dB at 13.28125 GHz (200GBASE-KR4).
- MAC Layer

Carrier-Sense Multiple Access/Collision Detection (CSMA/CD) protocol on a shared medium

VI.   Wi-Fi 5

- Standard = **(IEEE) 802.11ac**
- Physical Layer

- o support for 80 MHz bandwidth as well as an optional 160 MHz bandwidth
- o OFDM encoding scheme
- MAC Layer

Carrier Sense Multiple Access with Collision Avoidance (CSMA/CA).

VII.   Wi-Fi 6

- Standard = **(IEEE) 802.11ax**
- Physical Layer
  - o support for 80 MHz bandwidth as well as an optional 160 MHz bandwidth
  - o OFDM encoding scheme
- MAC Layer

Carrier Sense Multiple Access with Collision Avoidance (CSMA/CA).

VIII.   Conclusions

To conclude this report the student understood the relationships and details of the several protocols in the physical and MAC network layers in the several connections studied in this report.

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