ECE 315 Assignment 1

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1. MAC determines which device can access the medium at one moment
2. provides an abstraction for the physical layer to the other higher higher-level layers in the OSI model.
3. collision detection, resolution, and avoidance (like CSMA/CD and CSMA/CA for example). Also handles retransmission
4. offers some protection against transmission errors, usually through frame check sequences
5. resolves addressing of destination stations
6. controls access to the PHY
7. translates data packets to digital bits for the PHY

Compared to the PHY, the MAC layer operates at one layer above the PHY in the OSI model. Additionally, the physical layer does not handle error detection and correction. It does not determine which device can access the medium either. The physical layer transmits raw bits, instead of data frames. It is an interface to the transmission medium, while the MAC layer is an interface to the physical layer. The MAC converts data packets to digital bits, while the PHY converts between digital and analog signals.

2

The FIFO buffer in the FEC helps with handling short term burstiness of the data that is both recieved by the FEC and transmitted from the FEC from the CPU. If the CPU cannot keep up for a moment with sending bits or receiving bits fast enough, the buffer ensures that data is available to be processed when the CPU is ready without having to abandon or truncate packets.

The DMA allows for data to be transferred more efficiently between the system's memory, and the FIFO buffer in the FEC. The DMA controller allows for the movement of blocks to take up less CPU cycles, since the direct memory access is done in place of a bunch of CPU move instructions.

If the system designer is expecting more bits to be sent than recieved, they may choose to partition the FIFO buffer such that more space is allocated for sending bits than receiving. Similarly, if more bits are expected to be received than sent, then the FIFO buffer may be allocated such that the buffer for receiving is larger.

This decision would be implemented by loading the value into an FEC register.

i dunno

3

Advantages

- A receive interrupt will always happen when a packet is received, meaning no ethernet packets would be ignored by the system
- If the EMRBR value was smaller, ethernet frames that are longer than expected will be dropped. With a larger EMRBR value, this is not a problem.

Disadvantages

- The FEC would accept frames that are larger than the ethernet standard, if the value in the EMRBR register is too big which could result in garbage data being read
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4

The number of teeth a gear has determines how many steps there are in a full rotation. For example, a gear with four teeth will have 4 steps in a 360°rotation. Therefore, the step angle for the one gear would be $360°/4 = 25°$. The formula is 360°divided by the number of teeth. Now, in the stepper motor, there is a rotor and stator, and the rotor has more teeth than the stator. Because the rotor has more teeth than the stator, we can see both visually and mathematically that the individual step angle for the gear would be smaller than the stator. Because these gears rotate in opposite directions, the overall rotation would be the larger step angle of the stator, subtracted by the smaller step angle of the rotor. We subtract the step angle of the rotor, because it goes in the opposite direction of the stator. So, overall, we get

$$\frac{360°}{n_s} - \frac{360°}{n_r}$$

where n_s is the number of teeth of the stator, and n_r is the number of teeth of the rotor. This matches with the formula described in slide 10-10.

5

slew = speed_limit / something

6

IP provides only an unreliable and connectionless service using its own node addressing scheme even if at least some of the underlying networks might already provide reliable communication or a large number of unique addresses for every node because the priority is compatibility between the existing networks. Not all networks connected to the internet are reliable. Not all of them have a very large number of unique addresses for every node. If a connection is made between an unreliable network, and a reliable one, overall, the transmission is still unrunreliable. Providing an only unreliable allows for greater compatibility between the networks. It also allows for separation of concerns. If reliability is required, or state information about the connection is required, that can be provided by the higher level layers. For example, the TCP protocol can be used to have a reliable connection. Similarly, IP using its own addressing scheme allows for the upper layers to use their own addressing schemes which allow for more options and compatibility for connections and protocols.

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If we start at the closed state, we can transition to the listening state if passive open???

Next, if a syn is recieved, or a syn + ack, we reach the syn recieved state. From there, if an ack is recieved, we then reach the established state.

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Smaller packets have higher overhead. This should be considered when selecting the maximum packet size. If the connection is unreliable, and packets tend to get lost, then smaller packets are better. If the connection is more stable, then a larger maximum packet size may be more desireable due to less retransmissions, and less overhead.

These values are comunicated during the handshake process. The sender will advertise the maximum amount of data that can be sent before it must wait for an acknowledgement from the receiver. The reciever will then manage flow control.

If window advertisement is not done, the reciever continually informs the sender of how much data it is prepared to receive.