1. ***[5 marks]* Is Token Ring Data-Link protocol point-to-point or multi-access?**
2. ***[5 marks]* What framing technique does Token Ring use?**
3. ***[5 marks]* Create a simple diagram of the structure of a frame for Token Ring that includes the name, size, and position of all fields…**
4. ***[5 marks]* Provide a description of the purpose of each field in the frame…**
5. ***[5 marks]* What kind of network is Token Ring primarily used in? (LAN/WAN/etc.)**
6. ***[5 marks]* Explain why Token Ring is used for the kind of network you have indicated…**

MUST INCLUDE AN EXPLANATION / EXAMPLE

**a)** Token Ring networks utilise Media Access Control (MAC) addresses to manage and transmit data within a Local Area Network (LAN) between hosts. **Token Ring is an implementation of point-to-point communication ()**.

A Token Ring network typically consists of stations connected in a ring or, more commonly, a star topology, where all stations are connected sequentially. Therefore, each station is connected to a total of two other stations, the previous and next station in the network. A token is the frame of which stations can read and write data to and then be transmitted throughout the network. Tokens are passed sequentially from one host to the next and circulate around the network. This is called Token Passing.

When a station looks to transmit data, first they must receive an empty token which is circulating in the network. This station can then insert their data into the token and pass the data to the next station in the network. When a station receives a token that is not destined for them, they will not alter the token and just pass the token to the next station. When the token eventually arrives at the token’s desired destination, the data will be read, an acknowledgement flag to the end of the frame and the Token Passing process will continue. Finally, the token will reach the sending station that originally set the data in the token, see that the acknowledgement flag exists and remove the data from the token, transforming it back into an empty token. Finally, the Token Passing process will continue allowing other stations to use the empty token for their own data transmission within the network. This demonstrates the point-to-point communication functionality of a Token Ring network.

A data frame is a set of rules that break up a packet into a predetermined and standardised data structure. This process of breaking messages into blocks of information enables hosts to interpret aspects of the message, such as the start, end, and payload of a message. As the physical layer’s purpose is to provide a stream of bits without structure, framing is used to enable the distinguishability of a message. This technique is called message delineation.

**A Token Ring network uses a Coding Violation framing technique**. This technique involves the use of non-data symbols and strict clock synchronization and timing. Signalling techniques such as Manchester encoding interpret data through the change of voltage within a specified period. When using this encoding method as an example, transmitting a value of 0 would see rise in voltage and a value of 1 would see a fall of voltage. Due to these rules, to transmit valid data, there must be movement of voltage over the wire. Therefore, there are two non-data possibilities. These include the maintaining of a high voltage and maintaining of a low voltage over the period without movement. Using these non-data symbols, a frame’s start and end delimiters are easily distinguished from the payload as the payload does not use these symbols.

The two non-data symbols are the K non-data symbol and the J non-data symbol. The K symbol is achieved by using the opposite voltage to the previous bit end voltage. The J symbol uses the same voltage of the previous bit end voltage.

For example, if the previous bit had a value of 0, it would indicate a rise in voltage and would have a high voltage at the end of the period. As

Framing techniques are used to solve

*However, with the implementation of message delineation, a new problem arises. How can a frame distinguish between the which is the occurrence of the bit sequence within the payload of a*



A picture containing graphical user interface

Description automatically generated

A picture containing graphical user interface

Description automatically generated

**Start Frame Delimiter (SFD)**

The SFD is a special flag which sits at the beginning token and data frames and has two key features.

The first key feature of the SFD is to alert a station of the arrival of the token or data frame (<https://www.geeksforgeeks.org/token-ring-frame-format/>).

The second use of the SFD is to synchronize the signal clocks of the receiving station for the SFD’s corresponding frame (<https://www.geeksforgeeks.org/token-ring-frame-format/>). This is crucial so that stations within the network can comprehend data by matching the signal speed of the frame and implementing frame timing (<https://www.mathworks.com/help/lte/ug/synchronization-signals-pss-and-sss.html>). If for example a host is looking to send a message through the network, the signal length of and distance between each bit must be sent in a strict and consistent manor. The SFD is then used to help each subsequent station identify the signal synchronization used for this frame.

<https://www.ibm.com/docs/en/i/7.2?topic=standards-token-ring-networks> (IBM - Token Ring)

<https://www.pcmag.com/encyclopedia/term/token-ring> (Token Ring)

<https://www.blackbox.be/en-be/page/25363/Resources/Technical-Resources/Black-Box-Explains/networking-standards/token-ring> (Token Ring)

<https://www.techtarget.com/searchnetworking/definition/Token-Ring> (Token Ring)

<https://computer.howstuffworks.com/ethernet17.htm> (frame gives permission to transmit – token passing method)

<https://www.geeksforgeeks.org/token-ring-frame-format/> (Token Ring Frame Format)

<https://www.youtube.com/watch?v=5F_IBfqt-Cs> (Token Ring Frame Format)

<https://www.tutorialspoint.com/framing-in-data-link-layer> (Bit / Byte Stuffing)

<https://learning.oreilly.com/library/view/fundamentals-of-data/9781119436256/c03.xhtml#c03_level1_3> (Textbook – Bit stuffing, framing)

<https://www.geeksforgeeks.org/bit-stuffing-in-computer-network/> (Bit Stuffing)

<https://www.tutorialspoint.com/what-are-the-token-ring-frame-formats-in-computer-network> (Token Ring Format GOOD)

<https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&ved=2ahUKEwj7q8Xq6_P0AhUPSGwGHUFiCjgQFnoECA4QAw&url=https%3A%2F%2Fwww.unf.edu%2F~sahuja%2Fcnt5505%2FTokenRing.pdf&usg=AOvVaw3ppiI2yCMMs03rIXWhMAoe>

<https://www.unf.edu/~sahuja/cnt5505/TokenRing.pdf> (ALSO THIS LINK IS SAME AS ABOVE)

* PDF
* Token Ring PPT
* **Says the words Point-to-point**

<https://flylib.com/books/en/1.180.1.20/1/> (Massive document all about Token Ring)

<https://www.geeksforgeeks.org/framing-in-data-link-layer/> (