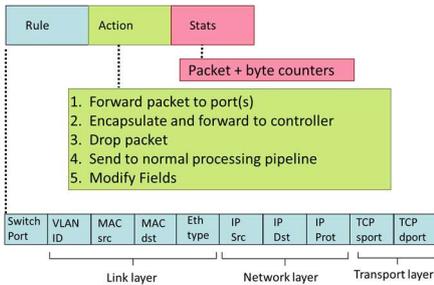


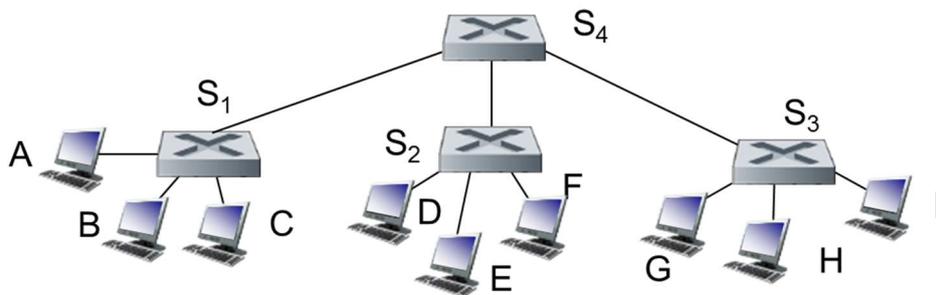
Department of Computer Science and Engineering
National Sun Yat-sen University
First Semester of 2023 PhD Qualifying Exam

Subject : Computer Networks

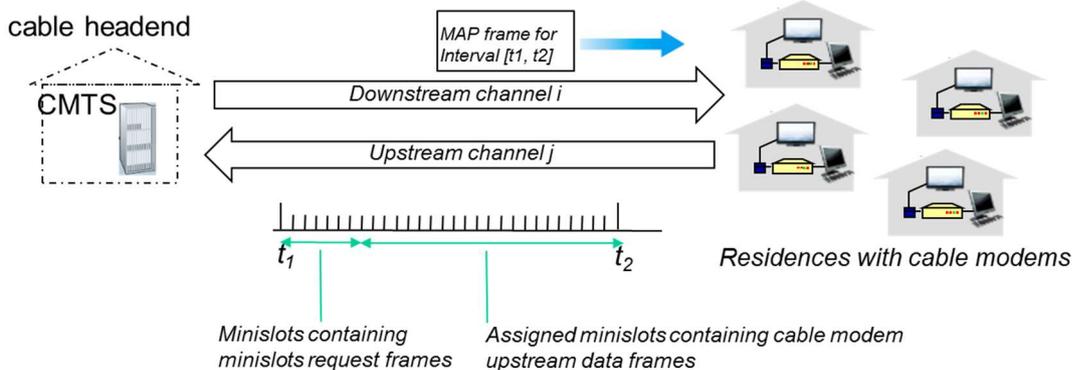
1. What is a delay? There are four sources of packet delays. Please explain them according to the order of delays while it enters into a node such as a router. What are the advantages and disadvantages of adopting packet switching for sending packets?
2. Why are there losses in networks? How are throughputs determined when packets travel through many hops?
3. The Internet protocol stack consists of five layers. Please explain the functions of each layer, respectively. Then please depict the advantages and disadvantages behind layering.
4. Encapsulation is a common approach adopted by networking engineers. Please list four examples of applying encapsulation in networking. What are the advantages of the encapsulation method?
5. The concept of identifiers is broadly used in identifying connections in networks. Why are we prone to name a connection by an identifier? Can you give two examples of identifiers in networks?
6. How can we achieve reliable data transfer under unreliable channel conditions? Please list and explain related techniques used to realize reliable packet transmissions under changing channel conditions.
7. Briefly explain the operations of TCP congestion control by drawing a graph of congestion window size versus transmission round. Your explanation must include the slow start phase, the congestion avoidance phase, and the condition of experiencing a time-out or three repeated ACK losses.
8. Please draw a generic router architecture and explain its operations. Please draw a picture to show and explain the operations of input port functions of a router,
9. There are two methods for the network control plane, which are per-router control for traditional routers and logically centralized control for software-defined networking (SDN) routers. Please draw two graphs for illustrating the differences between these two kinds of methods.
10. Please write a pseudo code for Dijkstra's algorithm. Please also give remarks on your codes for easy reading.
11. Please use the following graph of OpenFlow to explain the rule, the action, and the stats of flow table entries. Please also use the graph to explain the wide applicability of OpenFlow, which unifies various kinds of devices such as routers, switches, firewalls, NATs, and so on.



12. What is CSMA? What is CSMA/CD? What is CSMA/CA? Why is CSMA/CD used in IEEE 802.3 wired Ethernet and why is CSMA/CA used in 802.11 wireless networks? Please draw a picture to show the early abort of transmission if a collision is detected along the time by CSMA/CD.
13. Please draw pictures to explain the hidden terminal problem and the exposed terminal problem in wireless networks.
14. Please use a table to compare TCP and UDP, two Internet transport-protocol services, to the point. Your table should include comparisons of if reliable transport, flow control, congestion control, timing, throughput, and connection-oriented are supported. The reasons why there are two protocols should also be included.
15. There are four types of DNS resource records, which are types A, NS, CNAME, and MX. Please briefly explain them, respectively.
16. Please write a pseudo-code of TCP socket programming for simple client-server interactions. Please also give remarks on your codes for easy reading.
17. What is the longest prefix matching? Please draw a picture to explain it clearly.
18. Please draw pictures to explain weighted fair queueing (WFQ), FIFO scheduling, round-robin scheduling, and priority scheduling, respectively.



19. Please use the above graph to explain how to virtually emulate the CSMA/CD protocol of bus architecture by the star architecture and describe how it works.



20. Please explain the operations of data over cable service interface spec (DOCSIS) above. Please give your remarks about the size of t_1 and t_2 , respectively.