

EECS 489 - Winter 2024

Discussion 12

Assignment 4 is out!

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- **Due: Tuesday, April 23rd @ 11:59 pm EDT**
 - **PLEASE TEST IN THE VIRTUAL MACHINE**
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- Final Exam: Tuesday, April 30th, 1:30pm – 3:30pm
 - Only 90 minutes in length

Today

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- IEEE 802.11 Wi-Fi
 - CSMA/CA
- Datacenter Network

Q1: Getting Connected

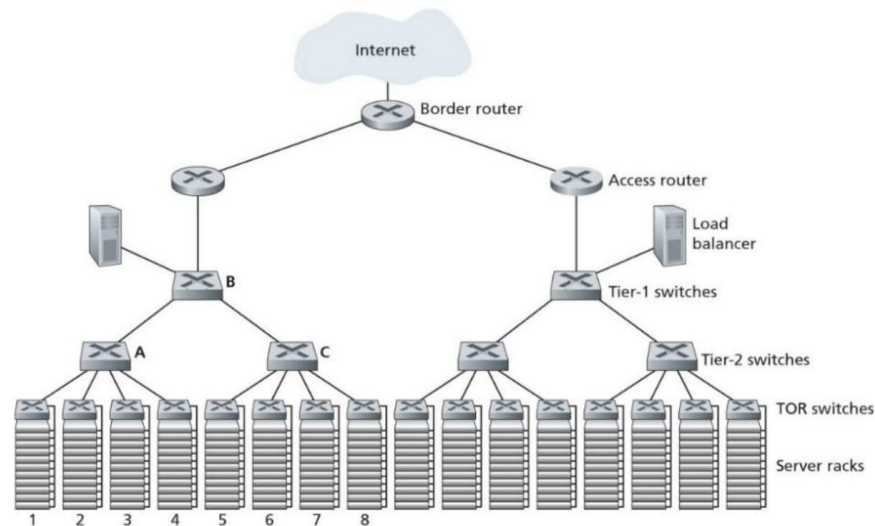
- Suppose you walk into a room, connect to Ethernet, and want to download a Web page. What are all the network protocol steps that take place, starting from powering on your PC to getting the Web page?

Q1: Getting Connected

- Suppose you walk into a room, connect to Ethernet, and want to download a Web page. What are all the network protocol steps that take place, starting from powering on your PC to getting the Web page?
- Broadcast DHCP (Dynamic Host Configuration Protocol) request to get an IP address.
- Broadcast ARP message to get MAC of the next hop router.
- Issue a DNS query to get the IP address of the content server.
- Construct a TCP connection to the content server.

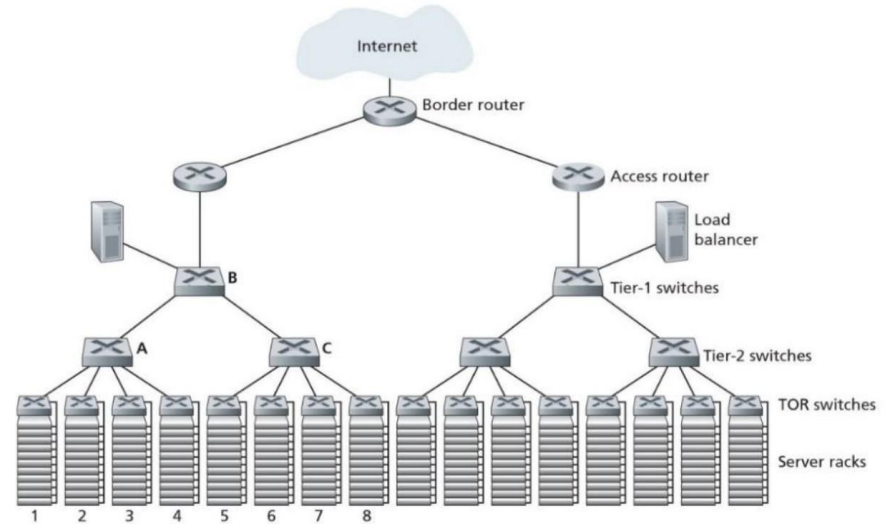
Q2: Datacenter I

- Consider the datacenter network with hierarchical topology in the figure to the right. Suppose now there are 80 pairs of flows, with ten flows between the first and ninth rack, ten flows between the second and the tenth rack, and so on. Further suppose that all links in the network are 10 Gbps, except for the links between hosts and TOR switches, which are 1 Gbps.



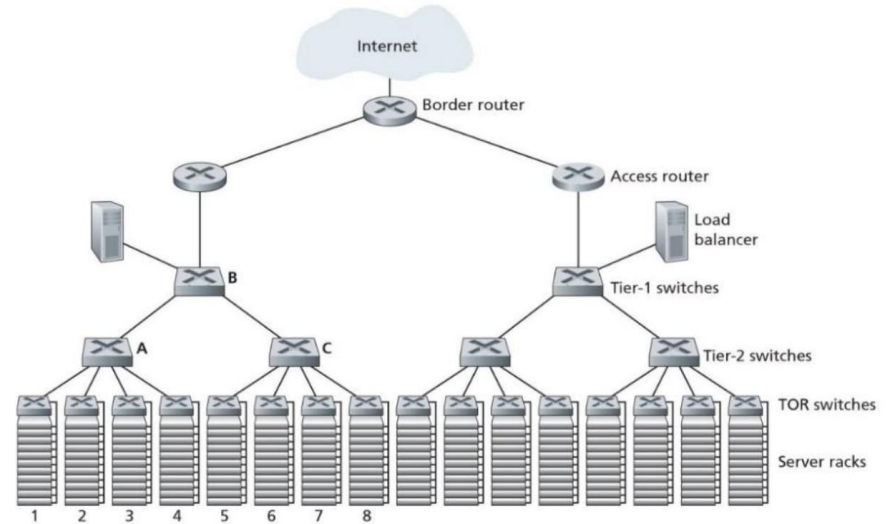
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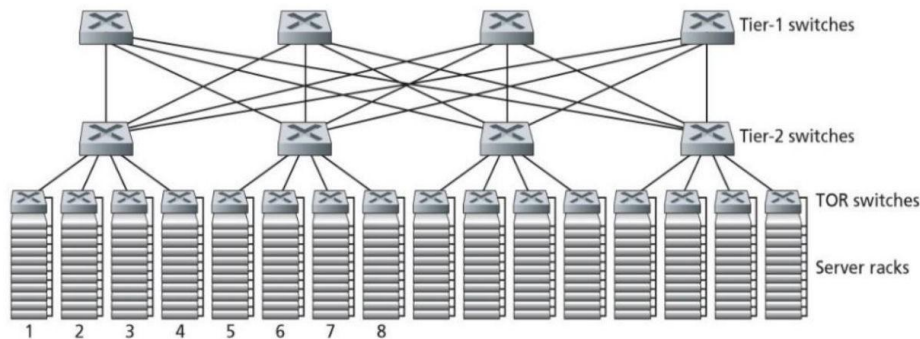
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- 125 Mbps



Q3: Datacenter II

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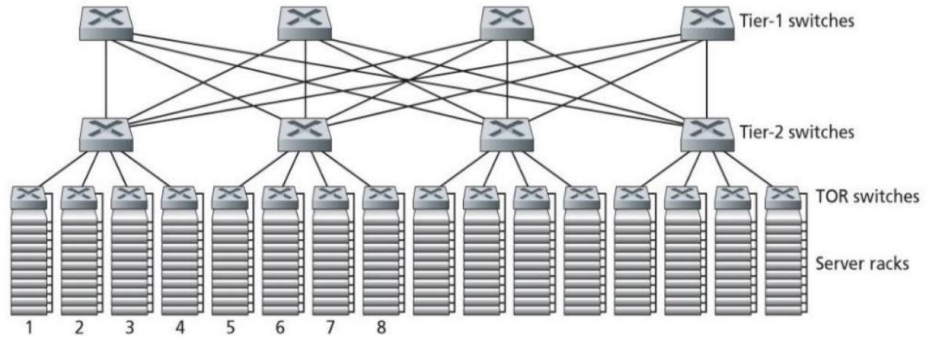
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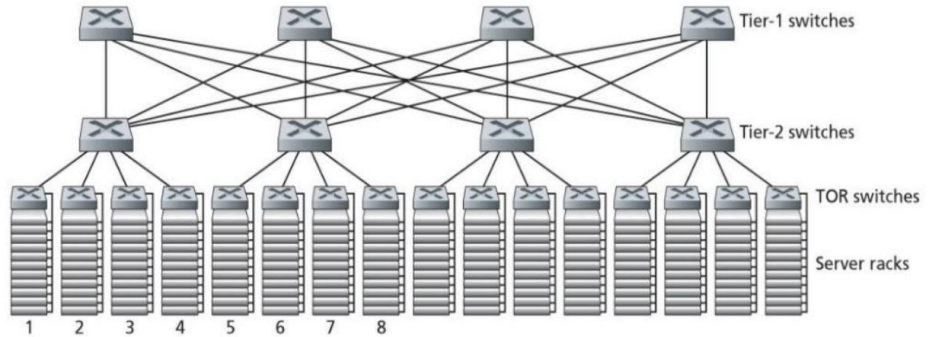
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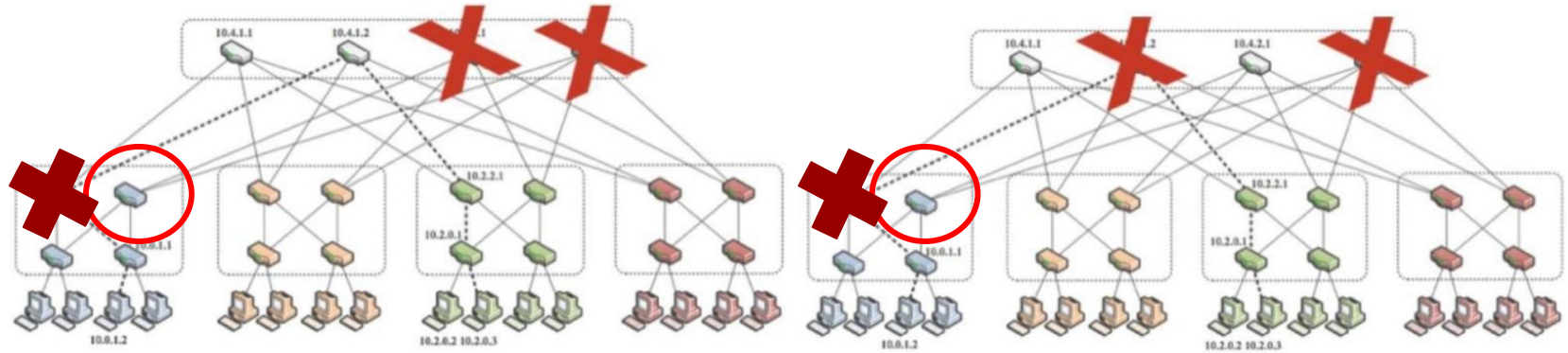
Q3: Datacenter II

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- Assume each flow has the same data rate. Determine the maximum rate of a flow.
- 1 Gbps



Q4: Datacenter III



- With the switches marked with X eliminated, are these two topologies identical? Would they have identical responses to further failures? If not, can you point out one failure scenario where they behave differently?

Q5: CSMA/CA

- Suppose an 802.11b station is configured to always reserve the channel with RTS/CTS sequence. Suppose this station suddenly wants to transmit a 1,000 byte segment of data, and all other stations are idle at this time. Assume a transmission rate of 10 Mbps. Ignoring propagation delay and assuming no bit errors, calculate the time required to transmit the frame and receive the acknowledgement. Further assume that a frame without data is 32 bytes long.

Q5: CSMA/CA

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$$\left(32 \times \frac{8}{10 \times 10^6}\right) \times 3 + (1000 + 32) \times \frac{8}{10 \times 10^6} = 9.024 \times 10^{-4} \text{ sec} = 902 \text{ usec}$$

Q6: Fair Share

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- Consider the following idealized LTE scenario. The downstream channel is slotted in time. There are four nodes, A, B, C, and D, reachable from the base station at rates of 10 Mbps, 5 Mbps, 2.5 Mbps, and 1 Mbps, respectively, on the downstream channel. These rates assume that the base station fully utilizes the time slot to send to just one station. The base station has an infinite amount of data to send to each of the nodes. If there is a fairness requirement that each node must receive an equal amount of data during each one second interval, what is the average transmission rate by the base station (to all nodes) during the downstream sub-frame?

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$$10 \times \frac{1}{17} + 5 \times \frac{2}{17} + 2.5 \times \frac{4}{17} + 1 \times \frac{10}{17} = 2.35 \text{ Mbps}$$

Wrap-Up

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- Start Assignment 4 if you have not already!
- **Discussions next week will be converted into Office Hours for Assignment 4!**
- Start thinking about the Final Exam
 - Tuesday, April 30th, 1:30 pm – 3:30 pm EDT
 - More details will be out soon
- Thanks for coming to discussion, and thanks for a great semester!