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Homework 5

P1 Cell switching and virtual circuit switching are connection oriented switching methods that require a virtual connection to be set up before packets can be forwarded between nodes. In contrast, datagram switching works similarly to UDP in that the sending node does not know if the destination node is available when it sends data. The switch forwards the packet without a previous connection existing. Because of this connectionless characteristic, datagram switching has the advantage over the other two kinds of switching when a link connecting two nodes has failed. If another path from the source to the destination exists, datagram switching sends the packets over that path. However, cell and virtual circuit switching requires that a new virtual connection to be established before it will reroute packets. Cell switching is unique from the other two methods in that cell switching sends fixed size packets. Each cell sent with the cell switching method is 53 bytes long, so cell switches can configure the packet transfer at the hardware level. Datagram and virtual circuit switching send packets of variable length.

P2 Fixed length packets are advantageous because switch hardware can be configured to handle the exact number of bits used for every packet. This makes the hardware faster, because it requires no software components to determine where headers and data start and end. In contrast, variable length packets require that a switch knows the protocol used (and therefore the headers and their lengths) for the packets it receives. A switch handling variable length packages also must be able to determine where data starts and ends, so it will frame packets correctly. This requires overhead that fixed length packets does not need. An important disadvantage in using fixed length packets is the need to have either small packets or to pad large packets carrying only a small number of bytes. If the fixed size chosen is small, then the header to data ratio will be increased. If the fixed size is large, then short data transfers such as ACK messages. Variable sized packets can be catered to the data being sent in them. There is less overhead for small messages since there is less (or no) padding needed, and larger packets can be sent with a good header to payload ratio.

P3 A bridge is a switch with only two ports. While a bridge can only connect two network segments together, switches can accept multiple segments at its ports and forward data to any of the networks. While a switch can only connect two interfaces that are of the same media (ie. Ethernet to Ethernet), routers can accept and forward packets from multiple technologies. Switching occurs at layer two of the OSI stack, while routing is done at layer 3 of the OSI stack.

P4 Network switches are devices that forward packets across networks using the same technology. They have multiple ports, and therefore typically have a star topology. Switches are part of layer 2 of the OSI stack (data link layer). Switches can either be “dumb” and forward all packets onto all links that connect to it, or they can learn the link that corresponds to each host and forward the packet only on the link of the destination host.

P5 I would choose to switched Ethernet and datagram switching for the media level access-control. I chose switched Ethernet because of the reduction in collisions, since each node has point-to-point connectivity with switches. With this, a network's bandwidth is not wasted on resending packets after a collision has occurred. Collisions are detected within the switch, and occur only when many nodes on the switch are utilizing a large amount of their bandwidth. I chose the datagram switching method for fast packet delivery without a virtual circuit setup, and quick recovery if a link is broken.