Networks

Sprint 3 Deliverables

Group 2: Jaysa, Eric, Kyle, Nikola

IP Questions

1. What assumptions, if any, does IP make about the local networks and lower-level links used to transmit datagrams? How are these assumptions consistent with the design goals IP?

IP makes no assumptions about the local networks and the lower-level links used to transmit diagrams. The goals of IP are 1) scalability and 2) heterogeneity – which is why it is said that IP can "run over anything." Instead of limiting the size of datagrams, for example, IP includes a way to fragment/reassemble data.

2. Describe IP's *best-effort* service model.

The Internet Protocol offers no guarantees when it comes to network performance/reliability. Instead, it provides standards that *should* allow for the transfer of data – but there remains the possibility of corruption/delays/loss. But this flexibility is also what makes IP so robust. IP must be paired with other protocols (like the Transmission Control Protocol) to really address the performance concerns.

3. Recall that every Ethernet adaptor has a unique 48-bit MAC address assigned by the manufacturer and burned into its ROM. If these MAC addresses are unique, why does the Internet Protocol need to use IP addresses to identify the source and destination of IP datagrams?

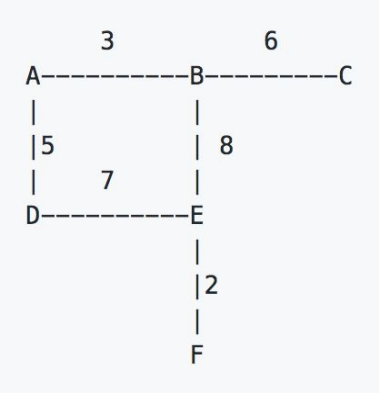
The MAC address space is flat, so knowing a MAC address gives no information about how to locate a host on the internetwork. IP addresses are hierarchical, including both a host portion and a network portion. In short, MAC addresses identify hosts locally and IP addresses identify hosts as they relate to the network they're a part of.

4. Suppose you are given an IP address with the classless network prefix 128.96.16/20. What is the maximum number of hosts that can be attached to this network, assuming one unique 32-bit IP address per host?

Since this is a classless network and 20 bits are allocated for the network part (CIDR), $2^{\text{address length} - \text{prefix length}} \rightarrow 2^{32 - 20} = 4096$.

Dijkstra

For the graph shown below, use Dijkstra's algorithm to find the shortest path and pathlength from node A to each of the other nodes.



vertex	shortest distance from A	previous vertex
A	0	
B	~~∞~~ 3	A
C	~~∞~~ 9	B
D	~~∞~~ 5	A
E	~~∞~~ 11	B
F	~~∞~~ 13	E

RIP

Using the graph above, fill in the table below to show each host's distance vector before the routing algorithm executes. Then create two more tables showing the updated distance vectors after the first two rounds of message exchanges.

before the routing algorithm:

each node initializes forwarding table using only direct connections/neighbors

	A	B	C	D	E	F
A	0	3	∞	5	∞	∞
B	3	0	6	∞	8	∞
C	∞	6	0	∞	∞	∞
D	5	∞	∞	0	7	∞
E	∞	8	∞	7	0	2
F	∞	∞	∞	∞	2	0

direct connections
A: B D
B: A C E
C: B
D: A E
E: B D F
F: E

round #1:

nodes exchange with their direct neighbors

	A	B	C	D	E	F
A	0	3	9	5	11	∞
B	3	0	6	8	8	10
C	9	6	0	∞	14	∞
D	5	8	∞	0	7	9
E	11	8	14	7	0	2
F	∞	10	∞	9	2	0

round #2:

nodes exchange with their direct neighbors, again

	A	B	C	D	E	F
A	0	3	9	5	11	13
B	3	0	6	8	8	10
C	9	6	0	14	14	16
D	5	8	14	0	7	9
E	11	8	14	7	0	2
F	13	10	16	9	2	0

SDN

The key phrase that must be memorized and chanted by all SDN acolytes is

> *"Separate the control plane from the data plane."*

What is the control plane? What is the data plane? Why might we want to separate them? What advantages does SDN offer over traditional network architectures?

The "control plane" receives and forwards packets along physical links. The control plane usually involves hardware support and is related to the question of mechanism (how/what). The "data plane" makes routing decisions and enforces policies (which/who). The data plane is generally implemented with software and is consequently more easy to change. Separating the two planes allows for greater flexibility and SDN is meant to solve the problem of complexity that arises with decentralization. Switches were becoming more expensive as tools were added to assist with management, the overhead of policy decisions, etc. and SDN introduced a way to easily manage networks with relatively simple switches.