Oliver Luo
10/23/2020
Sprint 3

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 assumes that the level of technology used in any such local networks or lower-level links could be very simple. If you take into account the fact that IP has been around much longer than some of the modern technologies we've been accustomed to, there is really nothing remenicscent of a 'network' that IP can't run over. It coincides with the IP's design goals by ensuring that even the most primitive/low-level tech can theoretically run over anything (although not always reliably).

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

   Best-effort service in the context of IP means that any device or possible type of host would be able to utilize the technology of IP because of its undemanding nature. It doesn't *guarantee* that data will be transferred 100% successfully all the time, but it will try its best even when using the lowest level of network technology. If it does not manage to send successfully, it won't be bothered to try and recover the lost data.

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?

   While each MAC address is unique for every device, it does not provide sufficient enough information for use by routing protocols. It's like saying you would be able to find every person using their SSN alone--it uniquely identifies a person but does not tell you where they live.

   In contrast, IP is constructed hierarchically. This means part of the address is used as a prefix to identify the network location, and then the other part can help find the host you want to reach.

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?

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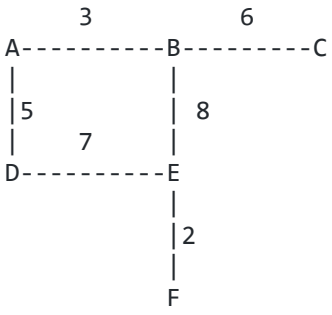
The address is 32-bits long, so 32 - 20 would give you the length of the host part. 2 ^ 12 = 4096 hosts.

Dijkstra

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



Node	Best Distance	Shortest Path
B	3	A → B
C	9	A → B → C
D	5	A → D
E	11	A → B → E
F	13	A → B → E → F

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RIP

Using the graph above, fill in the table below to show each hosts's distance vector before the routing algorithm executes.

	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

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

	A	B	C	D	E	F
A	0	3	9	5	11	13
B	3	0	6	8	8	0
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

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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?

At its core, the whole idea of separating the two planes is analogous to the separation of "mechanism and policy" from our OS class. The control plane refers not to the direct foreground processing of each packet from input to output ports, but rather the background process used to control various network algorithims. The data plane works with the control plane by directly working with the movement of each packet from in port to out port.

The separation of these planes is necessary because it allows dedicated performance increases on bottlenecks that have plagued older versions of the router/switch. NPUs or Network Processing Units are designed to offload the work for processing packet headers etc. and allow the control plane to run its background processes more efficiently. Analgous to how having a GPU on a gaming PC allows one processor to focus solely on the graphical processing of the game, the CPU can focus on other tasks without having to worry about many different things.

One of the biggest advantages SDN offers over traditional network architectures is its ability to process multiple packets simultaneously, and is generally much faster than the procedures they used in the past--it doesn't have to go through traditional main memory but instead uses something called "SRAM" or Static Random Access Memory.

Another huge advantage of SDN is just like in an OS, it's easy to update or change the "software" aspect of the architecture, but generally difficult to constantly change the hardware aspect. Keeping things separate will encourage modularization.