Assignment 2: Internet Protocol ver. 6 and Mobility Management

Magda Larsson Andersson, Stefan Jonsson, Michael Jonsson

Question 1: Explain in detail the IPv6 stateless auto-configuration.

Stateless address auto configuration (SLAAC) does not care about the exact addresses for hosts, as long as they are unique and routable. When a host configures its own interfaces it needs to perform several steps and needs no manual configuration. When forming addresses it uses advertisements from routers containing prefixes for identifying subnets and combines it with an interface identifier generated by the host.

In SLAAC the IPv6 address can be split up into two parts, the first 64 bits are manually set up on the router. The last 64 bits are then derived with the help of the EUI-64 process.

EUI-64:

In EUI-64 we need to generate a 64-bit unique address with only locally known values. In this process we start out with the MAC address (48 bits):
A MAC Address is a serial number consisting of 6 bytes (48 bits) of information, it's written in the MM:MM:MM:SS:SS:SS format, where the first 3 Octets, the M part, is an ID number associated with the manufacturer on the network adapter, known as the Organizationally Unique Identifier (OUI). And the last half, the S part, is a serial number for that piece of hardware, known as Network Interface Controller (NIC). A MAC address for Cisco hardware could look like: **00:40:96:00:11:22**, Where 00:40:96 is the OUI for Cisco and 00:11:22 is the serial address for this hardware.

Now we need another 16 bits of information to pad out our address:
At this point we insert FFFE in the middle of the address:

00:44:96:**FF:FE**:00:11:22

Another piece of information encoded in the EUI-64 scheme is the universal/local bit, the 7th bit in the address gets flipped if the address was generated locally, and stays the same if the address was assigned using DHCP.
After applying the universal/local bit:

0**2**:44:96:FF:FE:00:11:22

Combining the Address we have generated (**0244:96FF:FE00:1122**) with the network prefix (**1122:0000:CE:2323**) we now get:

1122:0000:CE:2323:0244:96FF:FE00:1122/64

And shorthand for this address would be: **1122::CE:2323:244:96FF:FE00:1122/64**

After we have generated a EUI-64 compliant address we move onto DAD.

Duplicate Address Detection (DAD):

To ensure that all the hosts addresses are unique on a link they run a Duplicate Address Detection Algorithm before assigning it to an interface. To check for duplicate addressing a node joins a unicast group and sends a solicitation message to its neighbours and if a duplicate address is identified then a neighbour advertisement is sent back to the node, the state of the address is set to DUPLICATE and the address will not be used. If there are no advertisement responses in the unicast group the node will use the address. When the node has obtained an address the node has IP-level connectivity, and the next steps are performed by the hosts.

Router Advertisement:

Routers are necessary for SLAAC, if no routers are present the autoconfiguration will be stateful. Router advertisements are sent as a response to a router solicitation messages which are sent out at system startup so that the host can autoconfigure without waiting for a scheduled advertisement message. They can also send out router advertisements periodically to each configured interface of the multicast group so that neighbours can learn a default router address.

Question 2

As can be seen in Table 1 and the graph on page 3, we have a node originally starting out on the WiFi network as it offers the highest Quality of Service (QoS), at time 5 we can see that 3G has a higher QoS than Wifi (0.77 > 0.62) and the node proceeds to initiate a handoff from WiFi to 3G. For the rest of the example the optimal network remains 3G.

Table 1: Example of Quality of Service (QoS) differences over time on WiFi and 3G networks											
Time	Throughput WiFi (Mb/s)	Throughput 3G (Mb/s)	Delay WiFi (ms)	Delay 3G (ms)	Throughput WiFi normalized	Throughput 3G normalized	Delay WiFi normalized	Delay 3G normalized	QoS WiFi	QoS 3G	optimal
1	20	3	10	50	0.652173913	0	1	0	0.8260869565	0	WiFi
2	15	5	12	40	0.4347826087	0.08888888889	0.75	0.3333333333	0.5923913043	0.2111111111	WiFi
3	12	10	13	35	0.3043478261	0.3111111111	0.625	0.5	0.464673913	0.4055555556	WiFi
4	18	8	14	25	0.5652173913	0.2222222222	0.5	0.8333333333	0.5326086957	0.5277777778	WiFi
5	25	15	15	20	0.8695652174	0.5333333333	0.375	1	0.6222826087	0.7666666667	3G
6	28	22	14	22	1	0.8444444444	0.5	0.9333333333	0.75	0.8888888889	3G
7	20	17	15	21	0.652173913	0.6222222222	0.375	0.9666666667	0.5135869565	0.7944444444	3G
8	14	12	18	23	0.3913043478	0.4	0	0.9	0.1956521739	0.65	3G
9	10	21	10	24	0.2173913043	0.8	1	0.8666666667	0.6086956522	0.8333333333	3G
10	5	25.5	10	30	0	1	1	0.6666666667	0.5	0.8333333333	3G