ECE 358 Assignment 1

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May 21, 2016

1. Suppose we are given some integer $m > 1$, which parameterizes the m-bit ID's of our Chord DHT. Then, consider an instance of the DHT that is the following:

   - A peer at 0
   - A peer at 2^{m-1}
   - A peer at $2^m - 1$

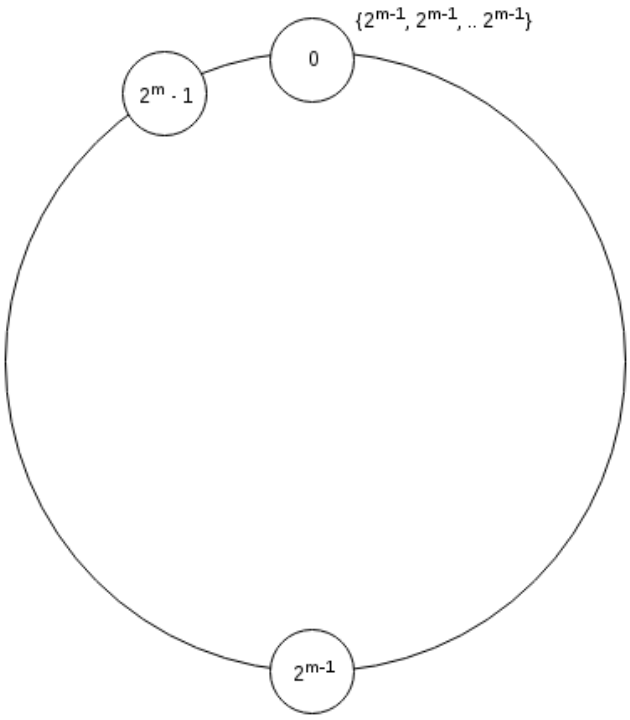

Figure 1: Configuration of Chord

As we can see from Figure 1, the finger table for peer 0 contains all 2^{m-1}. This is because $FT_p[i] = succ(p + 2^{i-1}), i \in [1, m]$ so

$$FT_0[i] = succ(0 + 2^{i-1}), i \in [1, m]$$

This ranges from $succ(0+2^0)$ to $succ(0+2^{m-1})$ which both have values of peer 2^{m-1} since there are no peers between peer 0 and peer 2^{m-1}. Hence, the finger table values of peer 0 are all 2^{m-1}.

Now, consider $lookup(2^m-1)$ at peer 0. We know that the next hop will always be peer 2^{m-1}. In this situation, $p=0$, $q=2^{m-1}$, $k=2^m-1$. We can see that there are no peers between p and q. However, there is one peer between p and k. Therefore, we can draw the following contradiction from the original claim:

$$q-p \geq (k-p)/2$$
$$0 \geq \frac{1}{2}$$

By the principle of contradiction, it is shown for all $m>1$, there exists some configuration that disproves $q-p \geq (k-p)/2$.

2. (a) $\underline{N_2}$

	Binary Form	Dot Decimal Notation
IP Address	00000001.00000010.00000011.00000100	1.2.3.4
Subnet Mask	11111111.11111111.11111111.11110000	255.255.255.240
After Mask	00000001.00000010.00000011.00000000	1.2.3.0

We see that address 1.2.3.4 does not lie in N_1 as the post-mask value is not 1.2.3.160.

	Binary Form	Dot Decimal Notation
IP Address	00000001.00000010.00000011.00000100	1.2.3.4
Subnet Mask	11111111.11111111.11111111.00000000	255.255.255.0
After Mask	00000001.00000010.00000011.00000000	1.2.3.0

We see that address 1.2.3.4 does lie in N_2 as the post-mask value is 1.2.3.0.

(b) $\underline{N_2}$

	Binary Form	Dot Decimal Notation
IP Address	00000001.00000010.00000011.11000011	1.2.3.195
Subnet Mask	11111111.11111111.11111111.11110000	255.255.255.240
After Mask	00000001.00000010.00000011.11000000	1.2.3.192

We see that address 1.2.3.195 does not lie in N_1 as the post-mask value is not 1.2.3.160.

	Binary Form	Dot Decimal Notation
IP Address	00000001.00000010.00000011.11000011	1.2.3.195
Subnet Mask	11111111.11111111.11111111.00000000	255.255.255.0
After Mask	00000001.00000010.00000011.00000000	1.2.3.0

We see that address 1.2.3.195 does lie in N_2 as the post-mask value is 1.2.3.0.

(c) Both

	Binary Form	Dot Decimal Notation
IP Address	00000001.00000010.00000011.10101011	1.2.3.171
Subnet Mask	11111111.11111111.11111111.11110000	255.255.255.240
After Mask	00000001.00000010.00000011.10100000	1.2.3.160

We see that address 1.2.3.171 does does lie in N_1 as the post-mask value is 1.2.3.160.

	Binary Form	Dot Decimal Notation
IP Address	00000001.00000010.00000011.10101011	1.2.3.171
Subnet Mask	11111111.11111111.11111111.00000000	255.255.255.0
After Mask	00000001.00000010.00000011.00000000	1.2.3.0

We see that address 1.2.3.171 does lie in N_2 as the post-mask value is 1.2.3.0.