18CSC302J (Computer Networks Lab) Lab session -Study of IPV6 Addressing &Subnetting

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IPv6 uses 16-byte hexadecimal number fields separated by colons (:) to represent the 128-bit addressing format that makes the address representation less cumbersome and error-prone. Here is an example of a valid IPv6 address: 2001:db8:130F:0000:0000:09C0:876A:130B.

Additionally, to shorten the IPv6 address and make the address easier to represent, IPv6 uses the following conventions:

• Leading zeroes in the address field are optional and can be compressed

• A pair of colons (::) represents successive fields of zero. However, a pair of colons is allowed only once in a valid IPv6 address.

An address parser can easily identify the number of missing zeros in an IPv6 address by separating the two parts of the address and filling in the 0s until the 128-bit address is complete. However, if two double colons are placed in the same address, then there is no way to identify the size of each block of zeros. The use of the double colon makes many IPv6 addresses very small.

In IPv6 there are references to prefixes which, in IPv4 terms, loosely equate to subnets. The IPv6 prefix is made up of the left-most bits and acts as the network identifier. The IPv6 prefix is represented using the IPv6-prefix or prefix-length format just like an IPv4 address is represented in the classless interdomain routing (CIDR) notation.

The /prefix-length variable is a decimal value that indicates the number of high-order contiguous bits of the address that form the prefix, which is the network portion of the address. For example: 2001:db8:8086:6502::/64 is an acceptable IPv6 prefix. If the address ends in a double colon, the trailing double colon can be omitted. So, the same address can be written as 2001:db8:8086:6502/64. In either case, the prefix length is written as a decimal number 64 and represents the left-most bits of the IPv6 address. A similar address in IPv4 would be xxx.xxx.xxx.xxx/16.

The IPv6 is eight groupings of numbers, and is divided into three parts:

•   Network address – the three first groupings of numbers (first 48 bits) in the subnet mask

•   Subnet address – the fourth group of numbers (the 49th to 64th bits) in the subnet mask

•   Device address – the last four groups of number (the last 64 bits) in the subnet mask

For example, in the IPv6 address 2001:db8:abcd:0012:0000:0000:0000:0000, the network address is 2001:db8:abcd. The subnet address is 12 (using the short form notation and eliminating the leading zeroes). Together, these two parts of the address are the IPv6 prefix. The device address in this example is 0000:0000:0000:0000.

Each device in the network has a unique device address. But, the network address and subnet address portions of the IPv6 address are the same for every device in the network. So, the first four groupings of numbers in every IPv6 address remain constant, and the last four groupings of numbers vary with each device.

The prefix-length specifies a range of devices. It is expressed as a slash (/), followed by an integer between 1 through 128. For example, a prefix-length of /64 specified like this: 2001:db8:abcd:0012::/64 tells the system to divide the network into 64 subnetworks. Each subnetwork contains 1/64th of the devices on the network.

For example, an address 2001:db8:abcd:0012::0/80 means that the prefix length is of 80 bits. The device range in this subnet now becomes 2001:db8:abcd:0012:0000:0000:0000:0000 to 2001:db8:abcd:0012:0000:ffff:ffff:ffff.