# Extra Reading – Week 4

## 1. Introduction to IP Addressing and Subnetting

* IP Addressing: An IP address is a unique 32-bit identifier assigned to each device on a TCP/IP network, enabling devices to communicate effectively. It's typically represented in dotted-decimal format, such as 192.168.123.132.
* Subnetting: Subnetting involves dividing a larger network into smaller, manageable sub-networks (subnets). This practice enhances network performance and security by limiting broadcast traffic and organizing devices into logical groups.

## 2. Structure of an IP Address

* Binary Representation: An IP address consists of 32 bits, divided into four 8-bit sections called octets. Each octet is converted to decimal, separated by periods, forming the dotted-decimal format.
* Network and Host Portions: The IP address is divided into two parts:
* Network Address: Identifies the specific network.
* Host Address: Identifies the specific device within that network.

## 3. Subnet Masks

* Purpose: A subnet mask determines which portion of an IP address refers to the network and which part refers to the host. It helps in identifying the network and host portions of an IP address.
* Example: For the IP address 192.168.123.132 with a subnet mask of 255.255.255.0, the first 24 bits (the number of ones in the subnet mask) are identified as the network address, and the last 8 bits are identified as the host address.

## 4. Subnetting Process

* Determining Subnet Requirements: Assess the number of required subnets and hosts per subnet to determine the appropriate subnet mask.
* Calculating Subnets: Use the subnet mask to calculate the number of available subnets and hosts. The formula involves determining the number of bits borrowed from the host portion to create additional subnets.
* Assigning Subnet Addresses: Assign unique network addresses to each subnet, ensuring no overlap and efficient utilization of IP address space.

## 5. Special IP Address Ranges

* Private Addresses: Certain IP address ranges are reserved for private networks and are not routable on the public internet:
* 10.0.0.0 – 10.255.255.255
* 172.16.0.0 – 172.31.255.255
* 192.168.0.0 – 192.168.255.255
* Loopback Address: The address 127.0.0.1 is reserved for loopback, allowing a device to communicate with itself.
* Broadcast Address: An IP address with a host portion that is all ones, used to send data to all devices on a network.

## 6. Practical Considerations

* Address Planning: Careful planning of IP address allocation and subnetting is crucial to avoid address conflicts and ensure efficient network operation.
* Subnetting Tools: Utilize subnet calculators and tools to assist in determining appropriate subnet masks and IP address ranges.
* Documentation: Maintain detailed records of IP address assignments and subnet configurations for network management and troubleshooting.