5.1 FIREWALL AND INTRUSION PREVENTION SYSTEM (IPS)

An intrusion prevention system (IPS) is a form of network security that works to detect and prevent identified threats. Intrusion prevention systems continuously monitor your network, looking for possible malicious incidents and capturing information about them. The IPS reports these events to system administrators and takes preventative action, such as closing access points and configuring firewalls to prevent future attacks. IPS solutions can also be used to identify issues with corporate security policies, deterring employees and network guests from violating the rules these policies contain.

Intrusion prevention systems work by scanning all network traffic. There are a number of different threats that an IPS is designed to prevent, including:

- Denial of Service (DoS) attack
- Distributed Denial of Service (DDoS) attack
- Various types of exploits
- Worms
- Viruses

The IPS performs real-time packet inspection, deeply inspecting every packet that travels across the network. If any malicious or suspicious packets are detected, the IPS will carry out one of the following actions:

- Terminate the TCP session that has been exploited and block the offending source IP address or user account from accessing any application, target hosts or other network resources unethically.
- Reprogram or reconfigure the firewall to prevent a similar attack occurring in the future.
- Remove or replace any malicious content that remains on the network following an attack. This is done by repackaging payloads, removing header information and removing any infected attachments from file or email servers.

Types of Prevention

An intrusion prevention system is typically configured to use a number of different approaches to protect the network from unauthorized access. These include:

- **Signature-Based** - The signature-based approach uses predefined signatures of well-known network threats. When an attack is initiated that matches one of these signatures or patterns, the system takes necessary action.
    - **Anomaly-Based -** The anomaly-based approach monitors for any abnormal or unexpected behavior on the network. If an anomaly is detected, the system blocks access to the target host immediately.
    - **Policy-Based** - This approach requires administrators to configure security policies according to organizational security policies and the network infrastructure. When an activity occurs that violates a security policy, an alert is triggered and sent to the system administrators.

FIREWALL

A firewall is a network security device that prevents unauthorized access to a network. It monitors both incoming and outgoing traffic using a predefined set of security to detect and prevent threats.

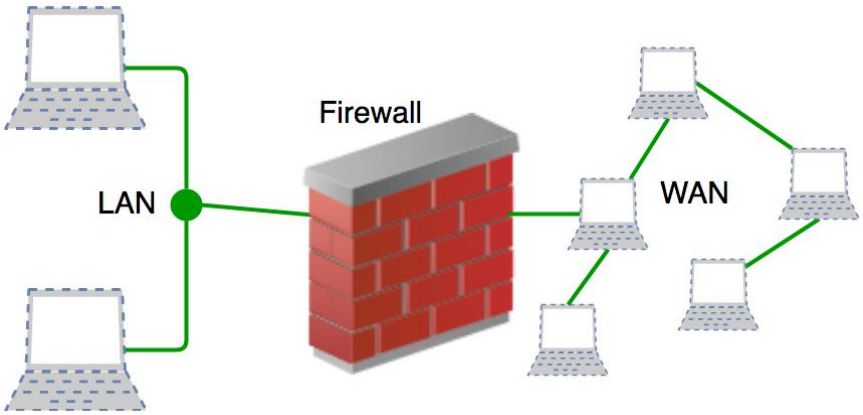
What is Firewall?

A firewall is a network security device, either hardware or software-based, which monitors all incoming and outgoing traffic and based on a defined set of security rules accepts, rejects, or drops that specific traffic.

- ***Accept:*** *allow the traffic*
- ***Reject:*** *block the traffic but reply with an "unreachable error"*
- ***Drop :*** *block the traffic with no reply*

A firewall is a type of network security device that filters incoming and outgoing network traffic with security policies that have previously been set up inside an organization. A firewall

is essentially the wall that separates a private internal network from the open Internet at its very basic level.



History and Need for Firewall

Before Firewalls, network security was performed by Access Control Lists (ACLs) residing on routers. ACLs are rules that determine whether network access should be granted or denied to specific IP address. But ACLs cannot determine the nature of the packet it is blocking. Also, ACL alone does not have the capacity to keep threats out of the network. Hence, the Firewall was introduced. Connectivity to the Internet is no longer optional for organizations. However, accessing the Internet provides benefits to the organization; it also enables the outside world to interact with the internal network of the organization. This creates a threat to the organization. In order to secure the internal network from unauthorized traffic, we need a Firewall.

Working of Firewall

Firewall match the network traffic against the rule set defined in its table. Once the rule is matched, associate action is applied to the network traffic. For example, Rules are defined as any employee from Human Resources department cannot access the data from code server and at the same time another rule is defined like system administrator can access the data from both Human Resource and technical department. Rules can be defined on the firewall based on the

necessity and security policies of the organization. From the perspective of a server, network traffic can be either outgoing or incoming.

Firewall maintains a distinct set of rules for both the cases. Mostly the outgoing traffic, originated from the server itself, allowed to pass. Still, setting a rule on outgoing traffic is always better in order to achieve more security and prevent unwanted communication. Incoming traffic is treated differently. Most traffic which reaches on the firewall is one of these three major Transport Layer protocols- TCP, UDP or ICMP. All these types have a source address and destination address. Also, TCP and UDP have port numbers. ICMP uses *type code* instead of port number which identifies purpose of that packet.

Default policy: It is very difficult to explicitly cover every possible rule on the firewall. For this reason, the firewall must always have a default policy. Default policy only consists of action (accept, reject or drop). Suppose no rule is defined about SSH connection to the server on the firewall. So, it will follow the default policy. If default policy on the firewall is set to *accept*, then any computer outside of your office can establish an SSH connection to the server. Therefore, setting default policy as *drop* (or reject) is always a good practice.