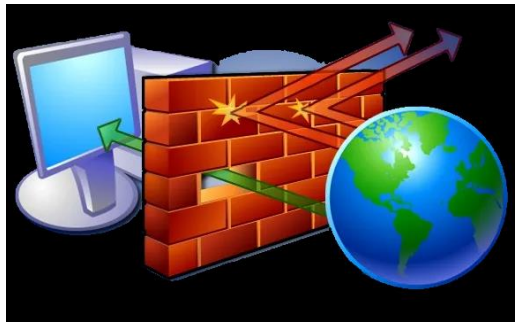
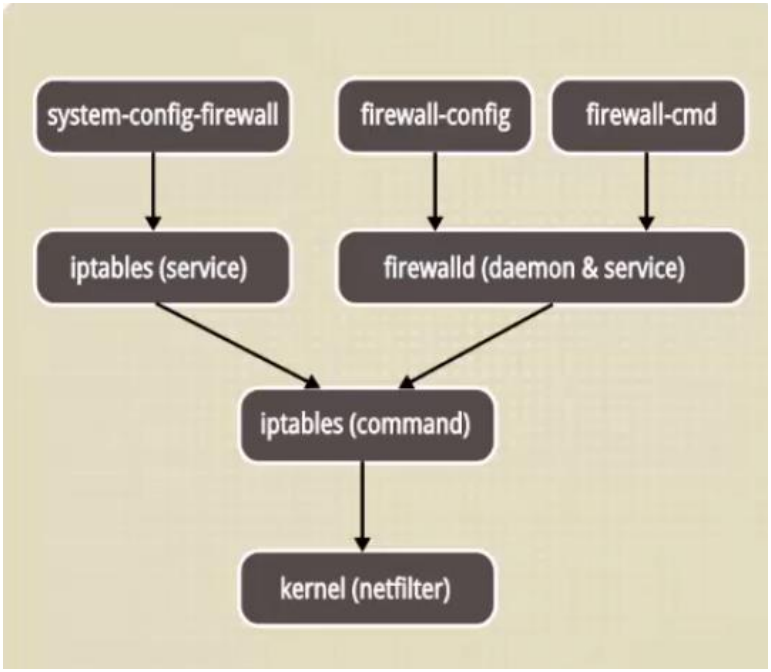
Firewall in RHE7

- **What Is firewalld?**
  - Firewalld is the firewall daemon.
  - It provides a dynamically managed firewall
  - Uses support for network/firewall “zones” to assign a level of trust to a network and its associated connections, interfaces or sources.
  - Still iptables underneath
  - Major features:
    - Real time rule changes without interruption
    - Zones to simplify and segregate configuration
    - Separate network traffic & rules by interface and zone
    - GUI that works
    - System configs in /usr/lib/firewalld/*
    - Custom configs in /etc/firewalld/*
    - Daemon runs in user space
    - Protocol independent: IPv4 & IPv6





- **Understanding firewall**
  - A *firewall* is a way to protect machines from any unwanted traffic from outside.
  - It enables users to control incoming network traffic on host machines by defining a set of *firewall rules*.
  - These rules are used to sort the incoming traffic and either block it or allow through.
  - firewalld is a firewall service daemon that provides a dynamic customizable host-based firewall

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- Turning on firewalld

  $ sudo systemctl start firewalld.service

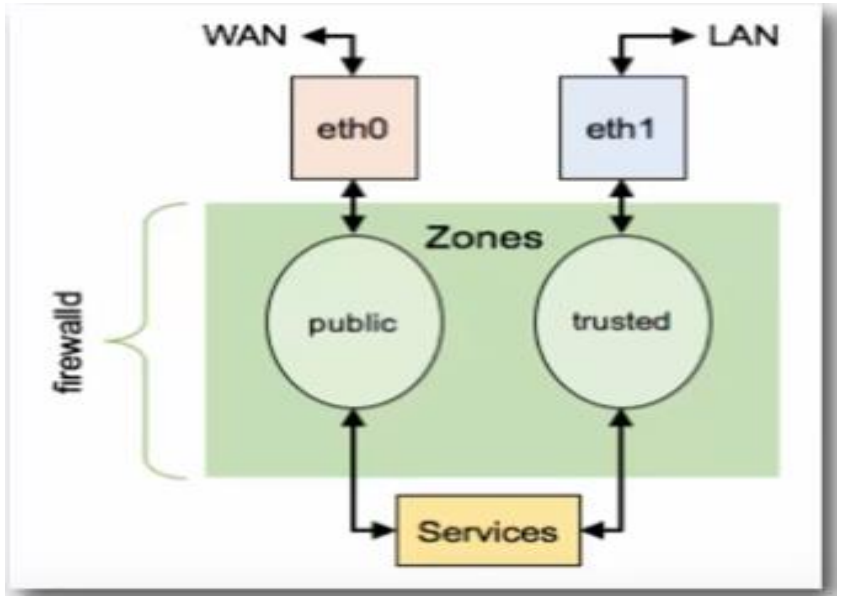
  We can verify that the service is running and reachable by typing:

  $ firewall-cmd --state

  Output:

  running

  This indicates that our firewall is up and running with the default



- Zones:
  - Manages groups of rules.
  - firewalld uses the concepts of zones and services, that simplify the traffic management.
  - Zones dictate what traffic should be allowed – Based on level of trust in connected network(s) – Based on origin of packet.

  - Network interfaces are assigned a zone.
  - A firewall zone defines the trust level for a connection, interface or source address binding.
  - This is a one to many relation, which means that a connection, interface or source can only be part of one zone, but a zone can be used for many network connections, interfaces and sources.
  - There are pre-defined zones provided by firewalld.

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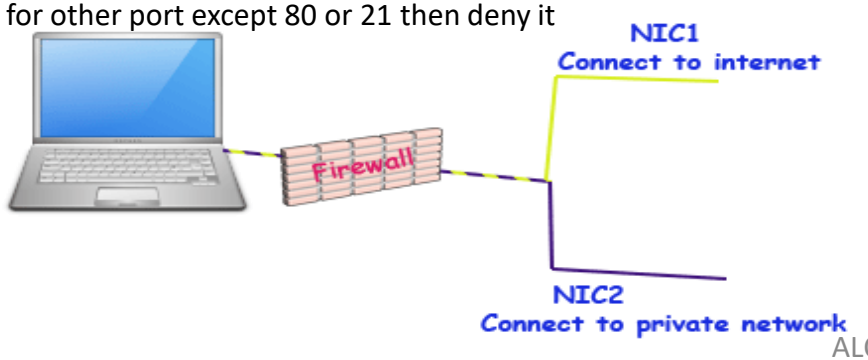
Zones:

- For easier management firewalld categorizes the incoming traffic in Zone based on interface and source address.
- Zones are created to handle the similar traffic separately.
  - For example, a server with two LAN cards, first LAN card is connected with public network (such as internet) and second LAN card is connected with private network. Server has following security requirements :-
    - Open HTTP port (80) and block all remaining ports for public network.
    - Open FTP port (21) and block all remaining ports for private network.

Without Zone concept

- If packet is coming for port 80 then check from where it is coming. If it is coming from public network, allow it. If it is coming from private network, deny it.
- If packet is coming for port 21 then check from where it is coming. If it is coming from public network, deny it. If it is coming from private network, allow it.
- If packet is coming for other port except 80 or 21 then deny it



Default Pre-Defined Zones

- **drop** Drop all incoming traffic unless related to outgoing traffic (do not even respond with ICMP errors).
- **block** Reject all incoming traffic unless related to outgoing traffic.
- **dmz** Reject incoming traffic unless related to outgoing traffic or matching the ssh pre-defined service.
- **external** Reject incoming traffic unless related to outgoing traffic or matching the ssh pre-defined service. Outgoing IPv4 traffic forwarded through this zone is masqueraded to look like it originated from the IPv4 address of the outgoing network interface.
- **public** Reject incoming traffic unless related to outgoing traffic or matching the ssh, or dhcpv6-client pre-defined services. The default zone for newly-added network interfaces.
- **work** Reject incoming traffic unless related to outgoing traffic or matching the ssh, ipp-client, ordhcpv6-client predefined services.
- **internal** Reject incoming traffic unless related to outgoing traffic or matching the ssh, mdns, ipp-client, samba-client, or dhcpv6-client pre-defined services.
- **home** Same as internal
- **trusted** Allow all incoming traffic.

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- Zone concept allows us to divide incoming traffic based on NICs.
- Since first NIC is connected with public network and second NIC is connected with private network, we can create two separate zones; public zone for first NIC and private zone for second NIC.
- Assign first NIC in public zone and second NIC in private zone

Rules in public zone

If packet is coming for port 80, allow it. If packet is not coming for port 80, deny it.

Rules in private zone

If packet is coming for port 21, allow it. If packet is not coming for port 21, deny it.

for other port except 80 or 21 then deny it

We can see managing firewall with zone is much easier than without zone

Firewall in RHE7

- Exploring Zones

  We can see which zone is currently selected as the default by typing:

  $ firewall-cmd --get-default-zone

  output *public*

  Since we haven't given firewalld any commands to deviate from the default zone, and none of our interfaces are configured to bind to another zone, that zone will also be the only "active" zone (the zone that is controlling the traffic for our interfaces).

  We can verify that by typing:

  $ firewall-cmd --get-active-zones

  output *public interfaces: eth0 eth1*

  Here, we can see that we have two network interfaces being controlled by the firewall (eth0 and eth1). They are both currently being managed according to the rules defined for the public zone.

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- **Examining Alternate Zones**

  Now we have a good idea about the configuration for the default and active zone. We can find out informati about other zones as well.

  To get a list of the available zones, type:

  $ *firewall-cmd --getzones*

  output *block dmz drop external home internal public trusted work*

  We can see the specific configuration associated with a zone by including the --zone= parameter in our --list-all command:

  $ firewall-cmd --zone=home --list-all

  output

  home

  interfaces:

  sources:

  services: dhcpv6-client ipp-client mdns samba-client ssh

  ports:

  masquerade: no

  forward-ports:

  icmp-blocks:

  rich rules:

  You can output all of the zone definitions by using the --list-all-zones option. You will probably want to pipe the output into a pager for easier viewing:

  $ firewall-cmd --list-all-zones | less

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- **Changing Zones**

You can transition an interface between zones during a session by using the --zone= parameter in combination with the –change-interface= parameter. As with all commands that modify the firewall, you will need to use sudo.

For instance, we can transition our eth0 interface to the "home" zone by typing this:

$ sudo firewall-cmd --zone=home --change-interface=eth0

output ***success***

Checking Zones

$ firewall-cmd --get-active-zones

Output:

home

interfaces: eth0

public

interfaces: eth1

If the firewall is completely restarted, the interface will revert to the default zone:

$ sudo systemctl restart firewalld.service

$ firewall-cmd --get-active-zones

output

public

interfaces: eth0 eth1

Firewall in RHE7

- **Setting the Default Zone**
  - If all of your interfaces can best be handled by a single zone, it's probably easier to just select the best default zone and then use that for your configuration.
  - You can change the default zone with the --set-default-zone= parameter. This will immediately change any interface that had fallen back on the default to the new zone:

    $ sudo firewall-cmd --set-default-zone=home

output

home

interfaces: eth0 eth1

- **Making Permanent Zone Changes**
  - Modify the zone for the connection in network manager

    nmcli conn modify <iface> connection.zone <zone>
  - Modify zone for the connection in firewalld

    firewall-cmd --zone=home --change-interface=eth0 --permanent
  - Optional - restart the network and firewalld service

    systemctl restart network.service

Firewall in RHE7

- **Making Changes Permanent**
  - Any zone or rule change can be designated as either permanent or immediate.
  - If a parameter is added or modified, by default, the behavior of the currently running firewall is modified.
  - At the next boot, the old rules will be reverted.
  - Most firewall-cmd operations can take the permanent flag to indicate that the non-ephemeral firewall should be targeted.
  - This will affect the rule set that is reloaded upon boot.
  - This separation means that you can test rules in your active firewall instance and then reload if there are problems**.**

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- **Firewall Services**
  - **Services** are sets of firewall rules to open ports associated with a particular application or system service.
  - The easiest method is to add the services or ports you need to the zones you are using.
  - You can get a list of the available services with the --get-services option:

    $ firewallcmd getservices

output

RHSatellite6 amandaclient bacula baculaclient dhcp dhcpv6 dhcpv6-client dns ftp highavailability http https imaps ipp ipp-client ipsec kerberos kpasswd ldap ldaps libvirt libvirttls mdns mountd ms-wbt mysql nfs ntp openvpn pmcd pmproxy pmwebapi pmwebapis pop3s postgresql proxydhcp radius rpcbind samba sambaclient smtp ssh telnet tftp tftp-client transmissionclient vncserver wbemhttps

Firewall in RHE7

- **Firewall Service Definitions**
  - Each service is defined by it's associated .xml file within the /usr/lib/firewalld/services directory. For instance, the SSH service is defined like this: /usr/lib/firewalld/services/ssh.xml

```
<?xml version="1.0" encoding="utf8"?>
 <service>
    <short>SSH</short>
    <description>Secure Shell (SSH) is a protocol for logging into and executing comm
    ands on remote machines. It provides secure encrypted communications. If you p
    lan on accessing your machine remotely via SSH over a firewalled interface, enabl
    e this option. You need the openssh
    server package installed for this option to be useful.</description>
        <port protocol="tcp" port="22"/>
</service>
```

  - You can create your own service definitions. The easiest way is to copy & edit an existing service definition. The service you create will take definition the name of the .xml definition file.

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- **Activating Services**
  - You can enable a service for a zone using the --add-service= parameter. The operation will target the default zone or whatever zone is specified by the --zone= parameter.
  - For instance, if we are running a web server serving conventional HTTP traffic, we can allow this traffic for interfaces in our "public" zone for this session by ty

    $ sudo firewall-cmd zone=public --add-service=http
  - You can leave out the --zone= if you wish to modify the default zone. We can verify the operation was successful by using the --list-all or --list-services operations:

    $ firewall-cmd --zone=public --list-services

output

dhcpv6client http ssh ping

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- **Activating Services... Permanently**
  - Once you have tested that everything is working as it should, you will probably want to modify the permanent firewall rules so that your service will still be available after a reboot.
  - We can make our "public" zone change permanent by typing:

    $ sudo firewallcmd zone=public permanent addservice=http
  - You can verify that this was successful by adding the --permanent flag to the --listservices operation. You need to be root for any permanent operations:

    $ sudo firewallcmd zone=public permanent listservices

  output

  dhcpv6client http ssh

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- **Individual Firewall Rules**
  - If you do not wish to create a new service or modify an existing one, you can open up individual ports in your firewall on an individual basis.
  - For instance, if our application runs on port 5000 and uses TCP, we could add this to the "public" zone for this session using the --add-port= parameter. Protocols can be either tcp or udp:

    $ sudo firewall-cmd zone=public --add-port=5000/tcp
  - We can verify that this was successful using the --list-ports operation:

    $ firewall-cmd --list-ports

  output:

  5000/tcp

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- **Individual Firewall Rules cont'd.**
  - It is also possible to specify a sequential range of ports by separating the beginning and ending port in the range with a dash.
  - For instance, if our application uses UDP ports 4990 to 4999, we could open these up on "public" by typing

$ sudo firewall-cmd --zone=public --add-port=4990-4999/udp

  - After testing, we would likely want to add these to the permanent firewall. You can do that by typing:

$ sudo firewall-cmd --zone=public --permanent --add-port=5000/tcp

$ sudo firewall-cmd --zone=public --permanent --add-port=4990-4999/udp

$ sudo firewall-cmd --zone=public --permanent --list-ports

output

success

success

4990-4999/udp 5000/tcp

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Additional Firewall Functions

IP Masquerading

$ firewall-cmd --zone=public –query-masquerade

$ firewall-cmd --zone=public –add-masquerade

After enabling masquerading, you can set up port forwarding

$ firewall-cmd --zone=public --add-forward-port=port=22:proto=tcp:toport=3753

Or address forwarding

$ firewall-cmd --zone=external –add-forward-port=port=22:proto=tcp:toaddr=192.0.2.55

Or both port & address forwarding

$ firewall-cmd --zone=external --add-forward-port=port=22:proto=tcp:toport=2055:toaddr=192.0.2.55