IPv4 – Configuring your system

Training for Afghan System Administrators

Minimum requirements to connect a system to a network

The absolute minimum is that the system has an IP address in the same network (i.e. also the same subnet) like the systems it wants to communicate with (local area network / LAN). In the real world, this is only helpful if you want to build a LAN that is also physically separated from other networks, especially the internet. High security LANs are designed like that (air gap)

If you want to be able to also reach other networks (or the internet), you need a gateway (= a router) which will re-route all packets whose destination is not part of the LAN to the remote network, or another gateway / router (if the gateway itself can't reach the target directly)

If you also want to be able to use (human readable) domains like, e.g. "www.google.com", then you also need the IP address of a DNS / name server (either inside your own LAN, or a public one on the internet (e.g. 8.8.8.8 by Google)

Automatically setting an IP address with DHCP

If your network has a DHCP server, all you need to do is usually turn on your computer and wait until the DHCP server gives you an IP address, a default gateway and a list of nameservers (DNS). If this does not work, depending on the DHCP client (dhclient, dhcpcd, pump), you should try to first release the old lease and then manually request a new one.

Example for dhclient:

– sudo dhclient eth0 -r

release the old lease for eth0

– sudo dhclient eth0

request a new lease for eth0

Manually setting IP address

For **ad-hoc setting of an IP address**, there are two utilities "*ifconfig*" and "*ip*". While "*ip*" has a much bigger functionality, some older systems or other UNIXoid systems only offer "*ifconfig*". Changes will be lost on reboot.

For **permanently setting a fixed IP address**, on Debian / Ubuntu systems, you need to edit the file "*/etc/network/interfaces*" and then restart the "*/etc/init.d/networking*" init script. On RedHat / CentOS systems, the config file is "*/etc/sysconfig/network-scripts/ifcfg-eth0*" (or eth1...) and the init script is "/etc/init.d/network" (the syntax of the config files is slightly different from Debian as well). Changes will survive a reboot.

On other distributions, the name and location of the config file and / or init script can be slightly different, as is the syntax of the config file. However, with some looking around and with the help of on-board documentation (and the internet if you have access), an experienced sys admin will be able to find the proper files and make the necessary changes.

Using ifconfig

Viewing settings:

    – ifconfig   # list current settings for all interfaces

    – ifconfig eth0   # list current settings for eth0

Enabling / disabling interfaces:

    – ifconfig eth0 down   # disable eth0

    – ifconfig eth0 up   # enable eth0

Set IP address:

    – ifconfig eth0 123.123.123.123 netmask 255.255.255.0   # set eth0 to this address/mask

    – ifconfig eth0:1 234.234.234.234 netmask 255.255.255.0   # add virtual interface

    – ifconfig eth0:1 del 234.234.234.234   # remove virtual interface

Using ip

Viewing settings:
  - ip addr show   # list current settings for all interfaces
  - Ip addr show eth0   # list current settings for eth0

Enabling / disabling interfaces:
  - ip link set eth0 down   # disable eth0
  - ip link set eth0 up   # enable eth0

Set IP address:
  - ip addr add 123.123.123.123/24 dev eth0   # set eth0 to this address/mask
  - ip addr del 234.234.234.234/24 dev eth0   # unset eth0's ip address

All commands work with IPv6 as well!

Settings routes with "route"

Like before, there are two utilities for this: "route" and "ip" (and like before, some older systems will have route but not ip).

Using route:

- route
  # show the current routing table
- route add default gw 123.123.123.123
  # set 123.123.123.123 as default gateway
- route add -host 234.234.234.234 gw 123.123.123.123
  # makes 123.... the gateway for the host 234....234
- route add -net 234.234.234.0/24 gw 123.123.123.123
  # makes 123.... the gateway for the network 234......0/24

All commands can be undone by replacing "add" with "del".

All commands work for IPv6 as well.

Settings routes with "ip"

- ip route show

    # show the current routing table

- ip route add default via 123.123.123.123

    # make 123.123.123.123 the default gateway for all non-local addresses

- ip route add 234.234.234.234 via 123.123.123.123

    # make 123.123.123.123 the gateway for traffic to the host 234.234.234.234

- ip route add 234.234.234.0/24 via 123.123.123.123

    # make 123.123.123.123 the gateway for traffic to the 234.234.234.0/24 network

All commands can be undone by replacing "add" with "del".

All commands work for IPv6 as well.

Setting nameservers

DNS / name servers are set on most Linux / UNIX systems by editing the "/etc/resolv.conf" file. A typical entry looks like:

– nameserver 8.8.8.8

You can (and should) add more than 1 DNS server to this file, in case the first does not respond. Just add another similar line with a IP address for another nameserver.

Sample config: /etc/network/interfaces (Debian)

This file describes the network interfaces available on your system

and how to activate them. For more information, see interfaces(5).

The loopback network interface

auto lo

iface lo inet loopback

The primary network interface

allow-hotplug eth0

iface eth0 inet static

  address 123.123.123.123

  netmask 255.255.255.0

  network 123.123.123.0

  broadcast 123.123.123.255

  gateway 123.123.123.1

Sample config: /etc/sysconfig/networking/devices/ifcfg-eth0 (RedHat)

DEVICE=eth0

HWADDR=00:50:56:09:33:10

IPV6INIT=yes

ONBOOT=yes

TYPE=Ethernet

UUID="bb1ec9ef-1315-4fae-995e-16e3e500604e"

IPADDR=123.123.123.123

NETMASK=255.255.255.0

GATEWAY=123.123.123.1

DNS1=8.8.8.8

DNS2=8.8.4.4

Troubleshooting network problems

i. Try to ping a foreign host, first using the FQDN (domain name), then using the IP address
   - Pinging the FQDN works: YEAH, ALL GOOD!
   - Pinging the FQDN does not work, but pinging the IP does → proceed with iv.
   - None works → proceed with ii.

ii. Check if the interface has a valid IP address
   - If yes, proceed with step ii.
   - If no, either set one manually or try to renew DHCP lease

iii. Check if the routing table has a default route set
   - If yes, proceed with step iv.
   - If no, set the default route by hand

iv. Check if nameservers are set in /etc/resolv.conf
   - If yes, try another nameserver (change order of the ones listed in resolv.conf) and ping again
   - If no, enter a valid DNS server and go back to step i.

v. If still not successful in pinging an IP address, check all cables, etc. If problem persists, try using another computer to make sure that the other systems (gateway, DNS, etc work fine)