Dynamic Host Configuration Protocol (DHCP)
We will use DHCP to dynamically configure network settings for some hosts.

IP, network, netmask, gateway, DNS
IP assignment types:

- Static: Assigned by admin, hosts set themselves.

- Fixed: Assigned by admin, hosts check out from DHCP server.

- Dynamic: Range assigned by admin, host assignments made by server, hosts check out from server.
DHCP

1. Broadcast DHCP DISCOVER

2. Ignore Broadcast

DHCP OFFER IP Address

3. DHCP REQUEST IP Address

4. DHCP ACK

5. leases record

6. leases record

range pool fixed assignments

Other Hosts
DHCP Example

IP Range: 144.38.214.0 - 31
Network: 144.38.214.0
Gateway: 144.38.214.1
Broadcast: 144.38.214.31
DNS: 144.38.214.2, 3
Static servers: 144.38.214.2-12
Fixed clients: 144.38.214.13-22
Dynamic range: 144.38.214.23-30
DHCP - Follow up

authoritative configuration: (man 5 dhcpd.conf)
To DHCP NACK or not to DHCP NACK.

DHCP DISCOVER: Broadcast: (wikipedia article)
  Broadcast to physical network, UDP packet
  Router can be configured to forward
  SRC IP: 0.0.0.0:67
  DST IP: 255.255.255.255:67

DHCP OFFER: Broadcast to physical network, UDP packet
  Router forwards, if necessary
  SRC IP: dhcp.server:67
  DST IP: 255.255.255.255:68

DHCP REQUEST: May be broadcast or unicast.
DHCP ACK: Same as DHCP OFFER
cgl@dhcp:/$ sudo apt-get install isc-dhcp-server
cgl@dhcp:$ sudo apt-get install isc-dhcp-server
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following extra packages will be installed:
    libcap2
Suggested packages:
    isc-dhcp-server-ldap
The following NEW packages will be installed:
    isc-dhcp-server libcap2
0 upgraded, 2 newly installed, 0 to remove and 0 not upgraded.
Need to get 440 kB of archives.
After this operation, 1,067 kB of additional disk space will be used.
Do you want to continue [Y/n]?
cgl@dhcp:/ $ cd /etc/dhcp/
cgl@dhcp:/etc/dhcp$ ls -l
total 16
-rw-r--r-- 1 root root 1791 Apr 10 2012 dhclient.conf
drw-r-xr-x 2 root root 4096 Jan 9 08:36 dhclient-enter-hooks.d
drw-r-xr-x 2 root root 4096 Jan 9 08:36 dhclient-exit-hooks.d
-rw-r--r-- 1 root root 3602 Sep 4 02:46 dhcpd.conf
cgl@dhcp:/etc/dhcp$
cgl@dhcp:/etc/dhcp$ sudo emacs dhcpd.conf
# The ddns-updates-style parameter controls whether or not the server will
# attempt to do a DNS update when a lease is confirmed. We default to the
# behavior of the version 2 packages ('none', since DHCP v2 didn't
# have support for DDNS.)
ddns-update-style none;

# option definitions common to all supported networks...

#### CHANGED
option domain-name "dsutux.us";
option domain-name-servers ns1.dsutux.us, ns2.dsutux.us;
#### CHANGED

default-lease-time 600;
max-lease-time 7200;

# If this DHCP server is the official DHCP server for the local
# network, the authoritative directive should be uncommented.
authoritative;
option domain-name "dsutux.us";
option domain-name-servers ns1.dsutux.us, ns2.dsutux.us;

default-lease-time 600;
max-lease-time 7200;

# If this DHCP server is the official DHCP server for the local
# network, the authoritative directive should be uncommented.

authoritative;

# Use this to send dhcp log messages to a different log file (you also
# have to hack syslog.conf to complete the redirection).
log-facility local7;

# No service will be given on this subnet, but declaring it helps the
# DHCP server to understand the network topology.
log-facility local7;

### ADDED FOR DYNAMIC RANGE

subnet 144.38.214.0 netmask 255.255.255.224 {
  option subnet-mask 255.255.255.224;
  option broadcast-address 144.38.214.31;
  option routers 144.38.214.1;
  range 144.38.214.23 144.38.214.30;
}

### ADDED FOR DYNAMIC RANGE

# No service will be given on this subnet, but declaring it helps the
# DHCP server to understand the network topology.

#subnet 10.152.187.0 netmask 255.255.255.0 {
#
#
# This is a very basic subnet declaration.
cgl@dhcp:/etc/dhcp$ sudo service isc-dhcp-server restart
stop: Unknown instance:
isc-dhcp-server start/running, process 1950
cgl@dhcp:/etc/dhcp$
cgl@dhcp:/etc/dhcp$ cd /var/log

cgl@dhcp:/var/log$ ls -lt | head

total 784
-rw-r----- 1 syslog adm  95435 Jan  9 09:56 syslog
-rw-r----- 1 syslog adm   3871 Jan  9 09:56 auth.log
-rw-r----- 1 syslog adm  79680 Jan  9 09:56 kern.log
-rw-r-r-- 1 root root  303246 Jan  9 09:50 dpkg.log
drwxr-xr-x 2 root root  4096 Jan  9 09:50 upstart
-rw-rw-r-- 1 root utmp  292292 Jan  9 09:50 lastlog
-rw-r-r-- 1 root root  32032 Jan  9 09:50 faillog
-rw-r-r-- 1 root root  18510 Jan  9 09:41 alternatives.log
-rw-rw-r-- 1 root utmp  10368 Jan  9 09:39 wtmp

cgl@dhcp:/var/log$
cgl@dhcp:/var/log$ tail -5 syslog
Jan  9 09:56:06 dhcp dhcpd: Internet Systems Consortium DHCP Server 4.1-ESV-R4
Jan  9 09:56:06 dhcp dhcpd: All rights reserved.
Jan  9 09:56:06 dhcp dhcpd: For info, please visit https://www.isc.org/software/dhcp/
Jan  9 09:56:06 dhcp dhcpd: Wrote 0 leases to leases file.
cgl@dhcp:/var/log$
cgl@dhcp:/var/log$ cd /var/lib/dhcp/
cgl@dhcp:/var/lib/dhcp$ ls -l
    total 8
-rw-r--r-- 1 root  root  0 Jan  9 08:27 dhclient.leases
-rw-r--r-- 1 dhcpd dhcpd 194 Jan  9 09:56 dhcpd.leases
-rw-r--r-- 1 dhcpd dhcpd 194 Jan  9 09:55 dhcpd.leases~
cgl@dhcp:/var/lib/dhcp$
cgl@dhcp:/var/lib/dhcp$ cat dhcpd.leases
# The format of this file is documented in the dhcpd.leases(5) manual page.
# This lease file was written by isc-dhcp-4.1-ESV-R4

server-duid "\000\001\000\001\032a\221\035RT\000\010\000\305";

cgl@dhcp:/var/lib/dhcp$
cgl@dhcp:/var/lib/dhcp$ less /var/log/syslog
Jan 9 09:55:56 dhcp dhcpcd: All rights reserved.
Jan 9 09:55:56 dhcp dhcpcd: For info, please visit https://www.isc.org/software/dhcpc/
Jan 9 09:55:56 dhcp dhcpcd: All rights reserved.
Jan 9 09:55:56 dhcp dhcpcd: For info, please visit https://www.isc.org/software/dhcpc/
Jan 9 09:55:56 dhcp dhcpcd: Wrote 0 leases to leases file.
Jan 9 09:56:06 dhcp kernel: [ 1117.841902] init: isc-dhcp-server main process (1950) killed by TERM signal
Jan 9 09:56:06 dhcp dhcpcd: Internet Systems Consortium DHCP Server 4.1-ESV-R4
Jan 9 09:56:06 dhcp dhcpcd: All rights reserved.
Jan 9 09:56:06 dhcp dhcpcd: For info, please visit https://www.isc.org/software/dhcpc/
Jan 9 09:56:06 dhcp dhcpcd: Internet Systems Consortium DHCP Server 4.1-ESV-R4
Jan 9 09:56:06 dhcp dhcpcd: All rights reserved.
Jan 9 09:56:06 dhcp dhcpcd: For info, please visit https://www.isc.org/software/dhcpc/
Jan 9 09:56:06 dhcp dhcpcd: Wrote 0 leases to leases file.
Waiting for data... (interrupt to abort)
~/courses/git/it3110
^--------------^
cgl@brockhall$ echo "BOOTING DHCP CLIENT MACHINE"
BOOTING DHCP CLIENT MACHINE
~/courses/git/it3110
^--------------^  
cgl@brockhall$
Jan 9 09:55:56 dhcp dhcpcd: For info, please visit https://www.isc.org/software/dhcp/
Jan 9 09:55:56 dhcp dhcpcd: Wrote 0 leases to leases file.
Jan 9 09:56:06 dhcp dhcpcd: Internet Systems Consortium DHCP Server 4.1-ESV-R4
Jan 9 09:56:06 dhcp dhcpcd: All rights reserved.
Jan 9 09:56:06 dhcp dhcpcd: For info, please visit https://www.isc.org/software/dhcp/
Jan 9 09:56:06 dhcp dhcpcd: Wrote 0 leases to leases file.
Jan 9 09:59:19 dhcp dhcpcd: DHCPDISCOVER from 52:54:00:08:00:dd via eth0
Jan 9 09:59:20 dhcp dhcpcd: DHCPoffer on 144.38.214.23 to 52:54:00:08:00:dd (dhcp) via eth0
Jan 9 09:59:20 dhcp dhcpcd: DHCPREQUEST for 144.38.214.23 (144.38.214.12) from 52:54:00:08:00:dd (dhcp) via eth0
Jan 9 09:59:20 dhcp dhcpcd: DHCPACK on 144.38.214.23 to 52:54:00:08:00:dd (dhcp) via eth0

Waiting for data... (interrupt to abort)
cgl@linux1:/var/log$ grep -i 9:59 syslog | grep DHCP
Jan 9 09:59:18 dhcp dhclient: DHCPDISCOVER on eth0 to 255.255.255.255 port 67 interval 3
Jan 9 09:59:19 dhcp dhclient: DHCPREQUEST of 144.38.214.23 on eth0 to 255.255.255.255 port 67
Jan 9 09:59:19 dhcp dhclient: DHCPOFFER of 144.38.214.23 from 144.38.214.12
Jan 9 09:59:20 dhcp dhclient: DHCPACK of 144.38.214.23 from 144.38.214.12

cgl@linux1:/var/log$
cgl@linux1:/var/log$ cd /etc/network/
cgl@linux1:/etc/network$ cat interfaces
# 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
auto eth0
iface eth0 inet dhcp
cgl@linux1:/etc/network$
nameserver 144.38.214.2
nameserver 144.38.214.3
search dsutux.us
cgl@dhcp:/var/lib/dhcp$ cat dhcpdleases
lease 144.38.214.23 {
  starts 4 2014/01/09 17:03:13;
  ends 4 2014/01/09 17:13:13;
  cltt 4 2014/01/09 17:03:13;
  binding state active;
  next binding state free;
  hardware ethernet 52:54:00:08:00:dd;
  client-hostname "linux1";
}
cgl@dhcp:/var/lib/dhcp$
cgl@dhcp:/var/lib/dhcp$
cgl@dhcp:/var/lib/dhcp$
cgl@dhcp:/var/lib/dhcp$
cgl@dhcp:/var/lib/dhcp$
cgl@dhcp:/var/lib/dhcp$
cgl@dhcp:/var/lib/dhcp$
cgl@dhcp:/var/lib/dhcp$
cgl@dhcp:/var/lib/dhcp$
cgl@dhcp:/var/lib/dhcp$
cgl@dhcp:/var/lib/dhcp$
cgl@dhcp:/var/lib/dhcp$
cgl@dhcp:/var/lib/dhcp$
cgl@dhcp:/var/lib/dhcp$
cgl@dhcp:/var/lib/dhcp$
cgl@dhcp:/var/lib/dhcp$
cgl@dhcp:/$ echo "So, linux1 host uses IP from dynamic range"
So, linux1 host uses IP from dynamic range
cgl@dhcp:/$
cgl@dhcp:/$ echo "Now, we'll switch a fixed client to use DHCP"
Now, we'll switch a fixed client to use DHCP
cgl@dhcp:/$
cgl2013@desdemona:~$ city showvm | grep users
users.dsutux.us 128 cordelia 3 2001 52:54:00:08:00:02 c None
1/1 IT3100

cgl2013@desdemona:~$
cgl@dhcp:/$ cd /etc/dhcp/
cgl@dhcp:/etc/dhcp$ sudo emacs dhcpd.conf
option subnet-mask 255.255.255.224;
option broadcast-address 144.38.214.31;
option routers 144.38.214.1;
range 144.38.214.23 144.38.214.30;
}

### ADDED FOR DYNAMIC RANGE

### ADDED FOR FIXED CLIENT
host users {
    hardware ethernet 52:54:00:08:00:02;
    fixed-address 144.38.214.13;
}

### ADDED FOR FIXED CLIENT

# No service will be given on this subnet, but declaring it helps the
# DHCP server to understand the network topology.

#subnet 10.152.187.0 netmask 255.255.255.0 {
#}
cgl@dhcp:/etc/dhcp$ sudo service isc-dhcp-server restart
isc-dhcp-server stop/waiting
isc-dhcp-server start/running, process 2067

cgl@dhcp:/etc/dhcp$
cgl@users:/$ echo "Changing host to use DHCP"
Changing host to use DHCP
cgl@users:/$
cgl@users:/$ cd /etc/network/
cgl@users:/etc/network$ sudo emacs -nw -q interfaces
# The loopback network interface
auto lo
iface lo inet loopback

# The primary network interface
auto eth0
iface eth0 inet static
    address 144.38.214.13
    netmask 255.255.255.224
    network 144.38.214.0
    broadcast 144.38.214.31
    gateway 144.38.214.1
# dns-* options are implemented by the resolvconf package, if installed
dns-nameservers 144.38.214.2 144.38.214.3 144.38.192.2
dns-search dsutux.us
# The loopback network interface
auto lo
iface lo inet loopback

# The primary network interface
auto eth0
iface eth0 inet dhcp
cgl@dhcp:/etc/dhcp$ echo "Server, we monitor syslog"
Server, we monitor syslog
cgl@dhcp:/etc/dhcp$
Jan  9 10:07:15 dhcpp dhcppd: DHCPREQUEST for 144.38.214.23 from 52:54:00:08:00:dd (linux1) via eth0
Jan  9 10:07:15 dhcpp dhcppd: DHCPACK on 144.38.214.23 to 52:54:00:08:00:dd (linux1) via eth0
Jan  9 10:10:28 dhcpp dhcppd: All rights reserved.
Jan  9 10:10:28 dhcpp dhcppd: For info, please visit https://www.isc.org/software/dhcpp/
Jan  9 10:10:28 dhcpp dhcppd: All rights reserved.
Jan  9 10:10:28 dhcpp dhcppd: For info, please visit https://www.isc.org/software/dhcpp/
Jan  9 10:10:28 dhcpp dhcppd: Wrote 0 deleted host decls to leases file.
Jan  9 10:10:28 dhcpp dhcppd: Wrote 0 new dynamic host decls to leases file.
Jan  9 10:11:57 dhcpp dhcppd: DHCPREQUEST for 144.38.214.23 from 52:54:00:08:00:dd (linux1) via eth0
Jan  9 10:11:57 dhcpp dhcppd: DHCPACK on 144.38.214.23 to 52:54:00:08:00:dd (linux1) via eth0
Waiting for data... (interrupt to abort)
cgl@users:/$ sudo bash
root@users:/# ifdown eth0; ifup eth0
cgl@users:/$ sudo bash
root@users:/$ ifdown eth0; ifup eth0
RTNETLINK answers: File exists
ssh stop/waiting
ssh start/running, process 13376
root@users:/$
Jan 9 10:10:28 dhcp dhcpcd: All rights reserved.
Jan 9 10:10:28 dhcp dhcpcd: For info, please visit https://www.isc.org/software/dhcp/
Jan 9 10:10:28 dhcp dhcpcd: All rights reserved.
Jan 9 10:10:28 dhcp dhcpcd: For info, please visit https://www.isc.org/software/dhcp/
Jan 9 10:10:28 dhcp dhcpcd: Wrote 0 deleted host decls to leases file.
Jan 9 10:10:28 dhcp dhcpcd: Wrote 0 new dynamic host decls to leases file.
Jan 9 10:11:57 dhcp dhcpcd: DHCPREQUEST for 144.38.214.23 from 52:54:00:08:00:dd (linux1) via eth0
Jan 9 10:11:57 dhcp dhcpcd: DHCPACK on 144.38.214.23 to 52:54:00:08:00:dd (linux1) via eth0
Jan 9 10:14:09 dhcp dhcpcd: DHCPOFFER on 144.38.214.13 to 52:54:00:08:00:02 via eth0
Jan 9 10:14:09 dhcp dhcpcd: DHCPREQUEST for 144.38.214.13 (144.38.214.12) from 52:54:00:08:00:02 via eth0
Jan 9 10:14:09 dhcp dhcpcd: DHCPACK on 144.38.214.13 to 52:54:00:08:00:02 via eth0

Waiting for data... (interrupt to abort)
cgl@users:/$ ifconfig eth0
eth0  Link encap:Ethernet  HWaddr 52:54:00:08:00:02
     inet addr:144.38.214.13  Bcast:144.38.214.31  Mask:255.255.255.224
     inet6 addr: fe80::5054:ff:fe08:2/64 Scope:Link
     UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
     RX packets:165581 errors:0 dropped:0 overruns:0 frame:0
     TX packets:54118 errors:0 dropped:0 overruns:0 carrier:0
     collisions:0 txqueuelen:1000
     RX bytes:14515165 (14.5 MB)  TX bytes:6610311 (6.6 MB)
     Interrupt:10 Base address:0x4000

cgl@users:/$