Grandstream Networks, Inc.

DHCP Options Guide

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SUPPORTED DEVICES

Following table shows Grandstream products supporting DHCP Options:

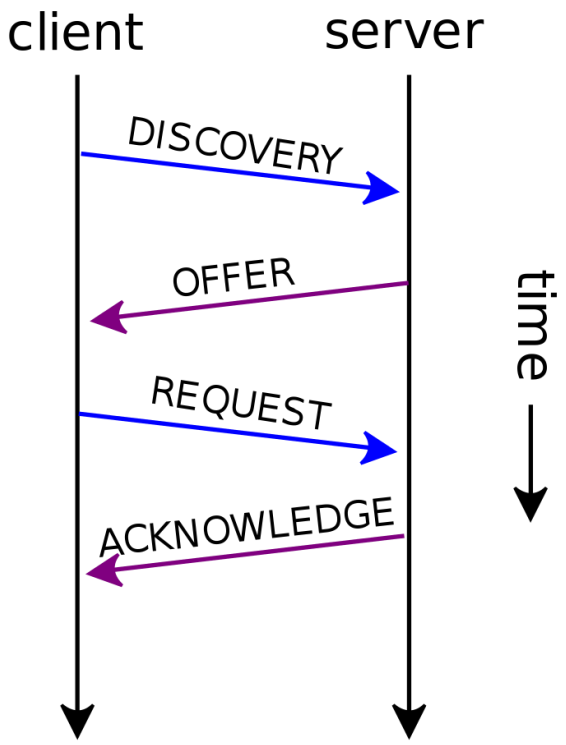
DHCP Options	Grandstream Models												
	GXP16XX	GXP17XX	GXP21XX	GVC320X	GAC2500	GXV32XX	GXW400X	GXW42XX	HT70X	HT8XX	HT50X	DP750	DP715
Option 2	✓	✓	✓	✓	✓	✓	✗	✓	✓	✓	✗	✓	✓
Option 12	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Option 42	✓	✓	✓	✓	✓	✓	✗	✓	✓	✓	✗	✓	✓
Option 43	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Option 60	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Option 66	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Option 120	✓	✓	✓	✓	✓	✓	✗	✗	✓	✓	✗	✓	✗
Option 125	✓	✓	✗	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Option 132	✗	✗	✗	✗	✗	✓	✗	✗	✗	✗	✗	✗	✗
Option 133	✗	✗	✗	✗	✗	✓	✗	✗	✗	✗	✗	✗	✗
Option 150	✓	✓	✓	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗
Option 160	✓	✓	✓	✓	✓	✗	✓	✗	✓	✓	✓	✓	✓
Option 242	✗	✗	✗	✓	✓	✓	✗	✗	✗	✗	✗	✗	✗

INTRODUCTION

Dynamic Host Configuration Protocol (DHCP) is a standardized network protocol used on Internet Protocol (IP) networks for dynamically distributing network configuration parameters, such as IP addresses for interfaces and services. With DHCP, network devices request IP addresses and networking parameters automatically from a DHCP server, reducing the need for a network administrator or a user to configure these settings manually.

DHCP servers can be configured to provide optional data that fully configures TCP/IP on a client. Some of the most common DHCP option types configured and distributed by the DHCP server during leases include default gateway, router, DNS, and WINS parameters.

This guide describes advanced DHCP options supported on Grandstream products. Administrators can use these DHCP options for easy setup, to provide specific configuration per device model, synchronize time with NTP servers, configure ACS server URL on devices and more…



ENVIRONMENT SETUP

This chapter provides steps to setup a minimal test environment to run DHCP options described in this guide. In this guide, we will use isc-dhcp-server on an Ubuntu 12 machine with static IP 192.168.1.11. Administrators can use other Windows or Linux based DHCP servers at their convenience.

Note: This chapter can be skipped if a DHCP server supporting customizing options is already setup.

Step 1: Install DHCP Server

1. Launch a Linux terminal.
2. Login as root by typing **sudo su**
3. Download and install DHCP server using following command: **apt-get install isc-dhcp-server**

```
root@admin:/# apt-get install isc-dhcp-server
```

Figure 1: Installing isc-dhcp-server

Step 2: DHCP Server Basic Configuration

There are two main files to be configured:

/etc/default/isc-dhcp-server (specify network interface to use for DHCP server)

/etc/dhcp/dhcpd.conf (all DHCP Options in this guide can be defined in dhcpd.conf file)

1. Enter **nano /etc/default/isc-dhcp-server** to edit **isc-dhcp-server** file

```
# nano /etc/default/isc-dhcp-server
```

Figure 2: isc-dhcp-server file

2. Replace **eth0** with the network interface to use for DHCP server.

```
  GNU nano 2.2.6        File: /etc/default/isc-dhcp-server

# Defaults for dhcp initscript
# sourced by /etc/init.d/dhcp
# installed at /etc/default/isc-dhcp-server by the maintainer scripts

#
# This is a POSIX shell fragment
#

# On what interfaces should the DHCP server (dhcpd) serve DHCP requests?
#       Separate multiple interfaces with spaces, e.g. "eth0 eth1".
INTERFACES="eth0"

^G Get Help  ^O WriteOut  ^R Read File ^Y Prev Page ^K Cut Text  ^C Cur Pos
^X Exit      ^J Justify   ^W Where Is  ^V Next Page ^U UnCut Text^T To Spell
```

Figure 3: Edit isc-dhcp-server file

3. Save and exit the file using **Ctrl+X**
4. Enter **nano /etc/dhcp/dhcpd.conf** to edit **dhcpd.conf** file

```
root@admin:/# nano /etc/dhcp/dhcpd.conf
```

Figure 4: "dhcpd.conf" file

5. Configure DHCP server with basic options including *subnet*¸ *netmask*¸ *range*…
   Screenshot below shows an example of configuration; in this example DHCP server will provide clients IP addresses from range 192.168.1.10 to 192.168.1.200. The server will lease an IP address for 180 seconds if no specific time frame requested by the client; otherwise, maximum (allowed) lease is 7200 seconds. DHCP server will also advise clients to use 255.255.255.0 as subnet mask, 192.168.1.10 as router/gateway, 192.168.1.1 and 192.168.1.2 as DNS servers.

```
# Sample configuration file for ISC dhcpd for Debian
#
# Attention: If /etc/ltsp/dhcpd.conf exists, that will be used as
# configuration file instead of this file.

    authoritative;
    default-lease-time 180;
    max-lease-time 7200;
    option routers 192.168.1.10;
    option domain-name-servers 192.168.1.1, 192.168.1.2;
    option domain-name "EMEA.com";

   subnet 192.168.1.0 netmask 255.255.255.0 {
    range 192.168.1.10 192.168.1.200;
    }


^G Get Help  ^O WriteOut  ^R Read File ^Y Prev Page ^K Cut Text  ^C Cur Pos
^X Exit      ^J Justify   ^W Where Is  ^V Next Page ^U UnCut Text^T To Spell
```

Figure 5: "dhcpd.conf"

6. Restart DHCP server

Start and Stop DHCP service

```
service isc-dhcp-server restart
service isc-dhcp-server start
service isc-dhcp-server stop
```

Figure 6: Restart/Start/Stop Services

DHCP OPTIONS

DHCP Option 42 (NTP Server)

Description

DHCP option 42 specifies a list of NTP servers available to the client by IP address.
Please refer to RFC2132 for more details.

Example

```
option ntp-servers 192.168.1.12;
```

Figure 7: DHCP Option 42

Screenshots

Below screenshots of DHCP Discover/Offer for Option 42.

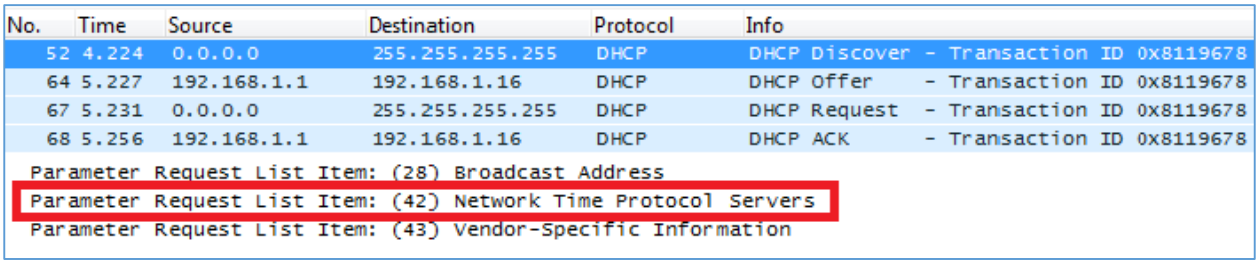


Figure 8: DHCP Discover Request for Option 42

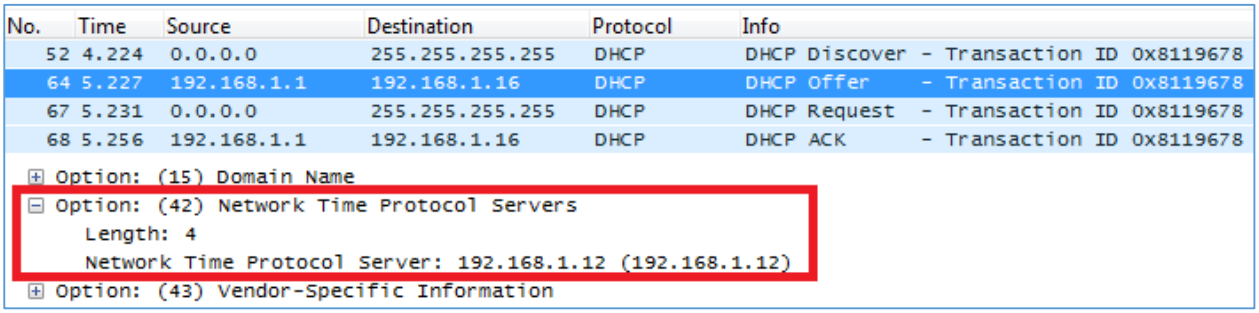


Figure 9: DHCP Offer Reply for the Option 42

DHCP Option 2 (Time Offset)

Description

DHCP option 2 informs the client about the time zone offset (in seconds).
A positive offset indicates a location east of the zero meridian and a negative offset indicates a location west of the zero meridian.
Please refer to RFC2132 for more details.

Example

```
option time-offset 3600;
```

Figure 10: DHCP Option 2

In above example, GMT+1 was set as an offset value
(one hour * 60 minutes/hour * 60 seconds/minute) = 3600.

To set Pacific Standard Time (GMT-8). This field would be filled with “-28800”.
(Eight hours * 60 minutes/hour * 60 seconds/minute).

Screenshots

Below screenshots of DHCP Discover/Offer for Option 2

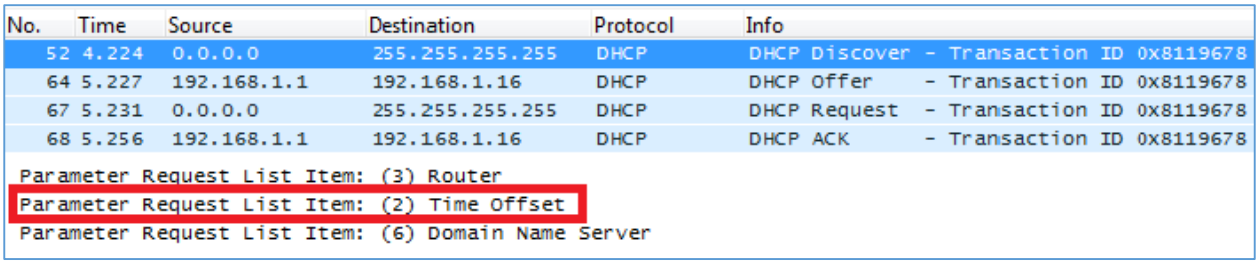


Figure 11: DHCP Discover Request for Option 2

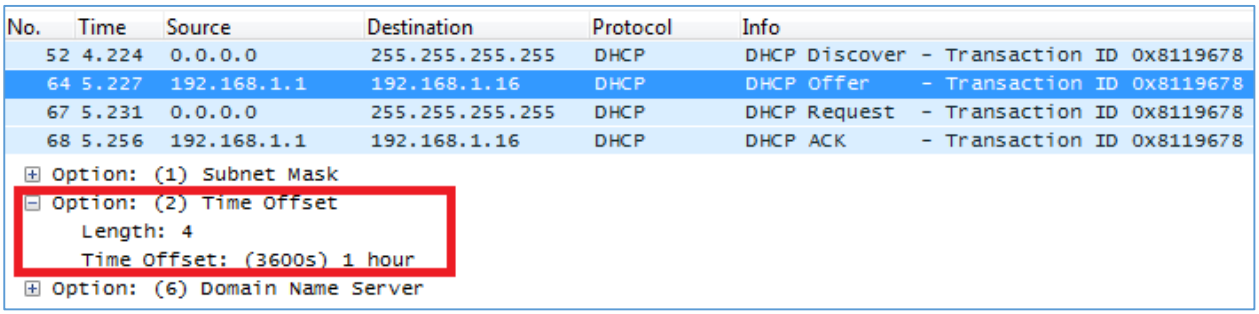


Figure 12: DHCP Offer Reply for the Option 2

DHCP Option 66 (TFTP Server Name)

Description

DHCP option 66 provides the IP address or the hostname of a single provisioning server where devices will be redirected to get their configuration files. Without this DHCP option, a manual configuration is requested on each phone the first time it boots.

Please refer to RFC2132/RFC5859 for more details.

Please refer to below link to learn how to how to provision Grandstream devices:

http://www.grandstream.com/sites/default/files/Resources/gs_provisioning_guide.pdf

Example

```
option tftp-server-name "192.168.1.18";
option tftp-server-name "http://192.168.1.18";
```

Figure 13: DHCP Option 66

If **http://** is not specified, default TFTP protocol is used for configured server.

Screenshots

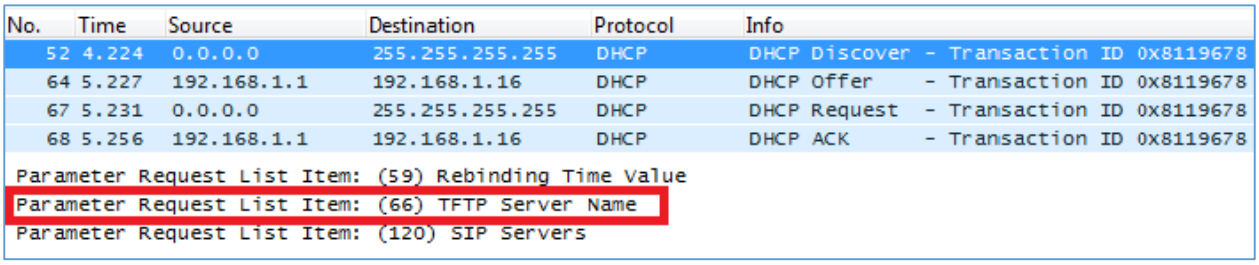


Figure 14: DHCP Discover Request for Option 66

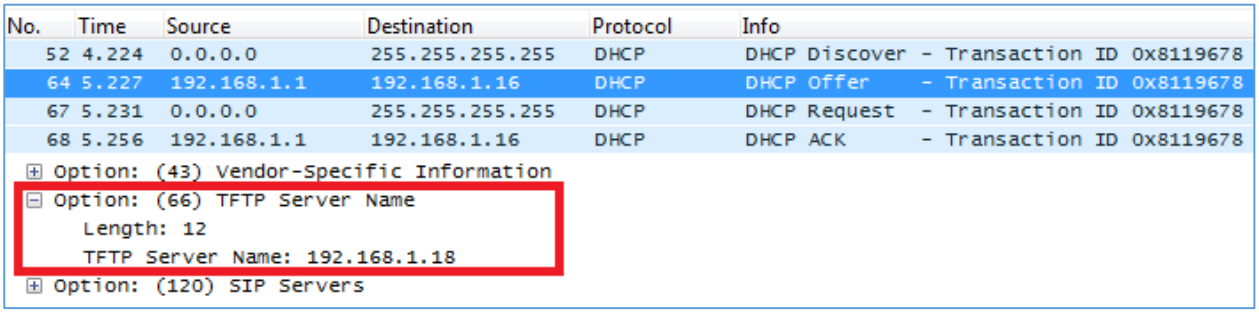


Figure 15: DHCP Offer Reply for the Option 66

DHCP Option 43 (Vendor Specific Information)

Description

This option is used by clients and servers to exchange vendor-specific information.
DHCP server can send one or more vendor specific parameters to clients, encoded in the form **option_code/value_length/value** in hexadecimal format.
Please refer to RFC2132 for more details.

Example

In following example, DHCP server is configured to send CWMP information (ACS URL http://192.168.1.18) encapsulated in option 43.

```
option vendor-encapsulated-options 01:13:68:74:74:70:3A:2F:2F:31:39:32:2E:31:36:38:2E:31:2E:31:38;
```

Figure 16: DHCP Option 43

Above DHCP option 43 contains the following:
0x01 (CWMP option for ACS URL)
0x13 (hex of decimal 19 = length of the URL)
19 bytes forming the URL in hexadecimal format (http://192.168.1.18)

Screenshots

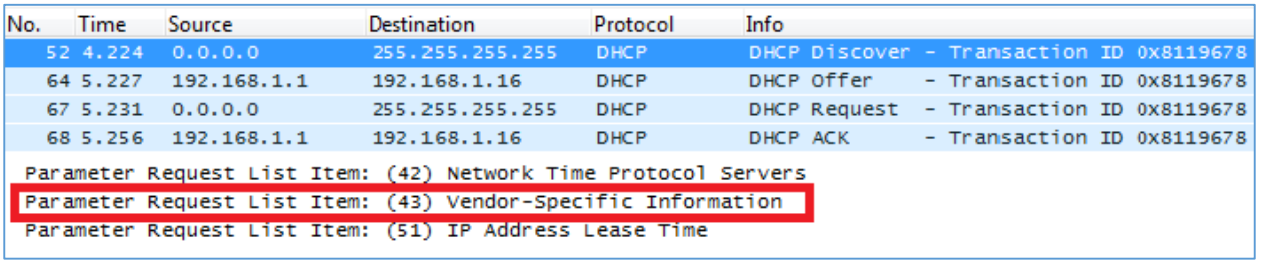


Figure 17: DHCP Discover Request for Option 43

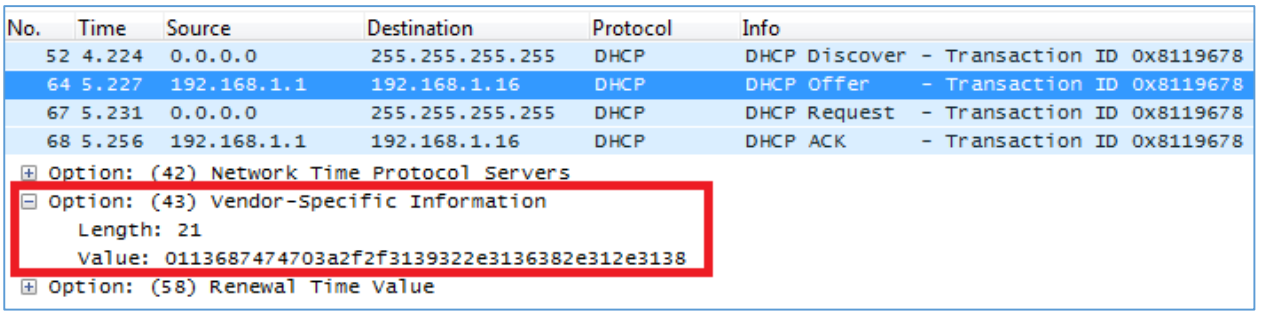


Figure 18: DHCP Offer Reply for the Option 43

DHCP Option 12 (Host Name)

Description

This option specifies the name of the client.

Option 12 is used to identify the client's name against the DHCP server in order to make special configuration from the server side, this is similar to option 60 and 125.

Please refer to RFC1533/RFC2132 for more details

Screenshots

Below screenshot is taken from GXP2170, the value of Option 12 can be modified from the WebGUI under **Network Settings > Basic Settings**.

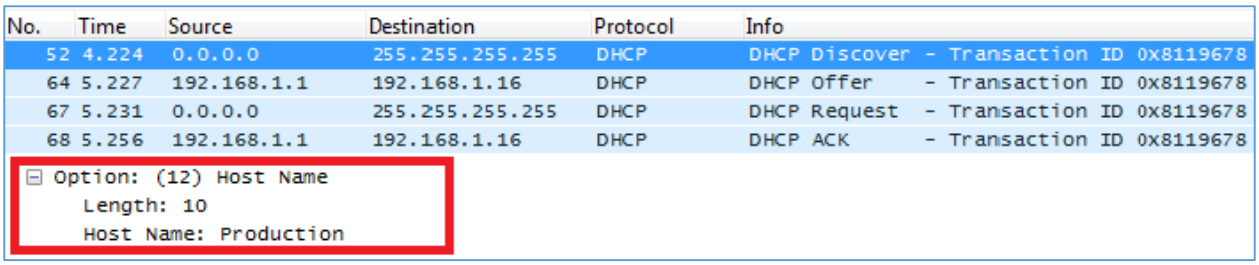


Figure 19: DHCP Discover Advertisement for Option 12

DHCP Option 60 (Vendor Class Identifier)

Description

Option 60 is used by clients to optionally identify the vendor type and configuration of a DHCP client. When using multiple devices from different vendors, DHCP server can provide specific configuration for each client based on received Option 60.

Please refer to RFC1533/RFC2132 for more details.

Example

In following example, option 60 is configured to identify GXP2170 with its value “Grandstream GXP2170 dslforum.org”.

If option 60 received matches the one configured, GXP2170 phones will get option 66 (tftp-server-name) with value 192.168.1.20. For all other clients, they will get option 66 with value 192.168.1.18

```
option time-offset 3600;
option tftp-server-name "192.168.1.18";

if  ( substring (option vendor-class-identifier, 0, 32)  = "Grandstream GXP2170 dslforum.org")
{
 option tftp-server-name "192.168.1.20";
}
```

Figure 20: DHCP Option 60

Note: 32 is the number of digits that “Grandstream GXP2170 dslforum.org” contains.

Screenshots

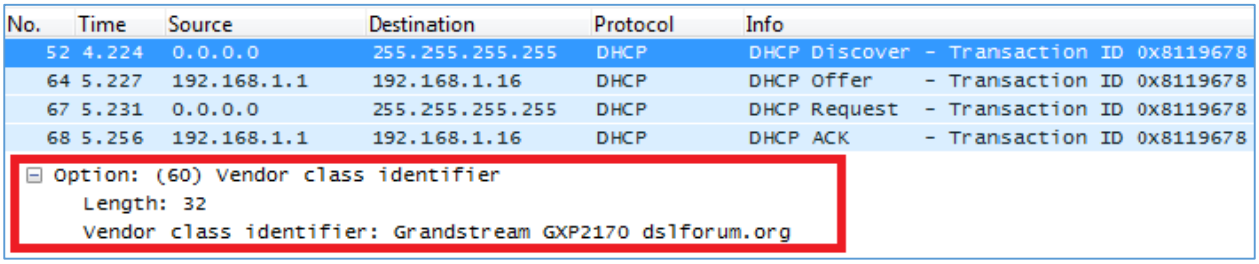


Figure 21: DHCP Discover Advertisement for Option 60

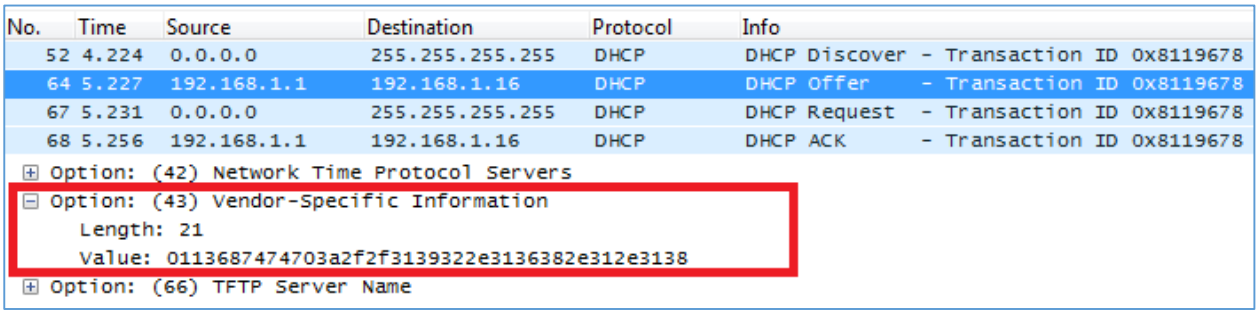


Figure 22: DHCP Offer Reply for Option 60

DHCP Option 120 (SIP Server)

Description

The option is used to provide SIP server IP address or FQDN to SIP clients.

Please refer to RFC3361 for more details.

Example

```
option sip-servers code 120 = { integer 8, ip-address};
option sip-servers 1 192.168.1.17;
```

Figure 23: DHCP Option 120

Screenshots

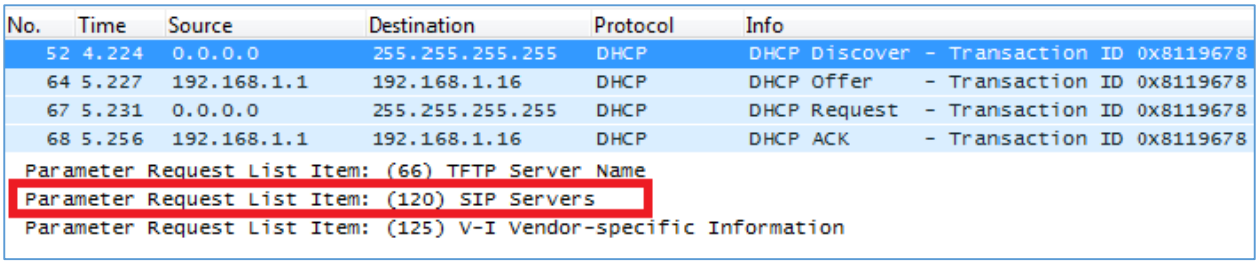


Figure 24: DHCP Discover Request for Option 120

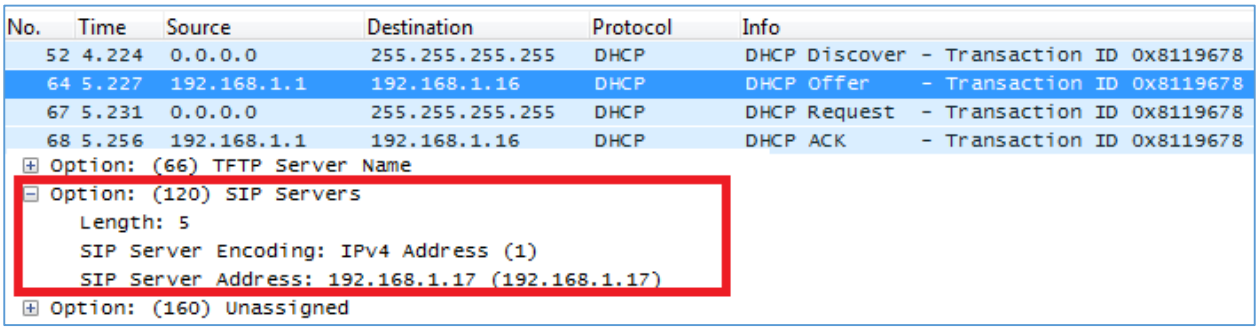


Figure 25: DHCP Offer Reply for Option 120

DHCP Option 125 (Vendor-Identifying Vendor Options)

Description

DHCP clients may use this option to identify the vendor that manufactured the hardware on which the client is running the software in use in a unique way.
Option 125 is similar to option 12 & 60 but advertising more parameters of a device:

- **DeviceManufacturerOUI**
- **DeviceSerialNumber** (Grandstream products set DeviceSerialNumber with MAC address)
- **DeviceProductClass**

Please refer to RFC3925 for more details.

Screenshots

During DHCP initiation, **DHCP Discover/DHCP Request** including option 125 are sent from client, the server checks **V-I Vendor-specific information**, if matching configured values, specific configuration will be provided to client, otherwise, common configuration is provided to client.

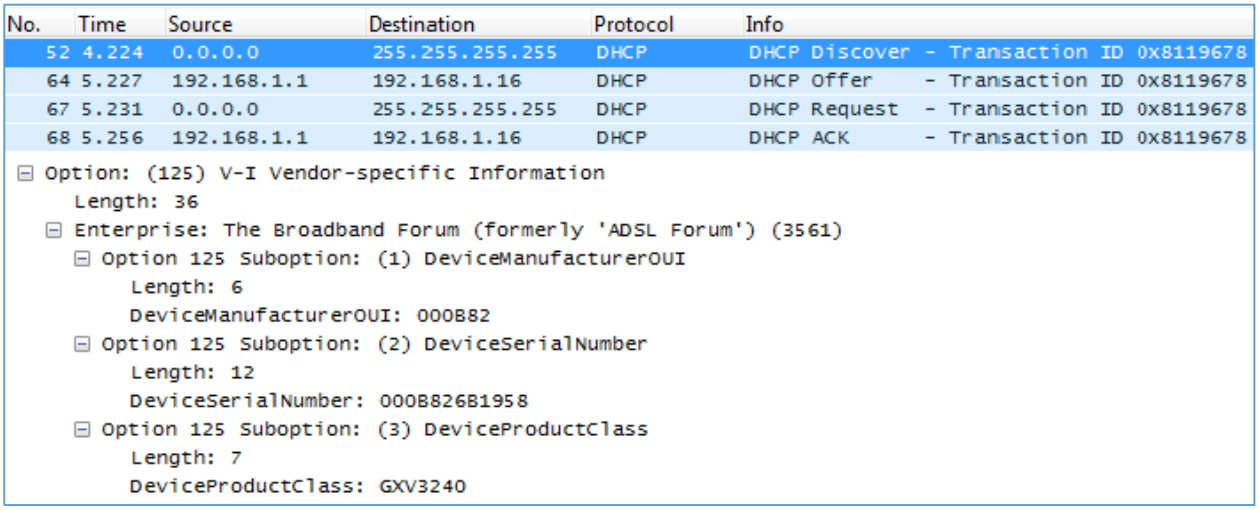


Figure 26: DHCP Discover Advertisement for Option 125

Advertised information in above option 125 are:

- DeviceManufacturerOUI = **000b82**
- DeviceSerialNumber = DeviceMACaddress = **000b82XXXXXX**
- DeviceProductClass = **GXV3240**

DHCP Option 132 (Vlan ID)

Description

This option allows to assign a VLAN ID tag to devices during booting stage/DHCP renewal.
Please refer to RFC4578 / IEEE_802.1Q *for more details.*

Example

```
option vlan-id code 132 = text;
option vlan-id "20";
```

Figure 27: DHCP Option 132

Screenshots

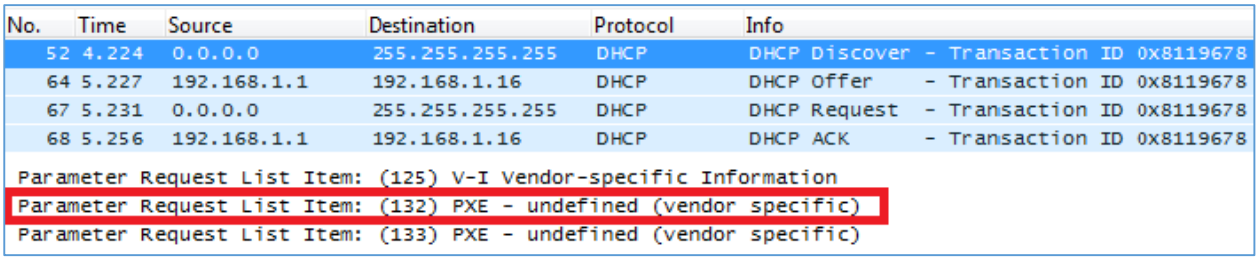


Figure 28: DHCP Discover Request for Option 132

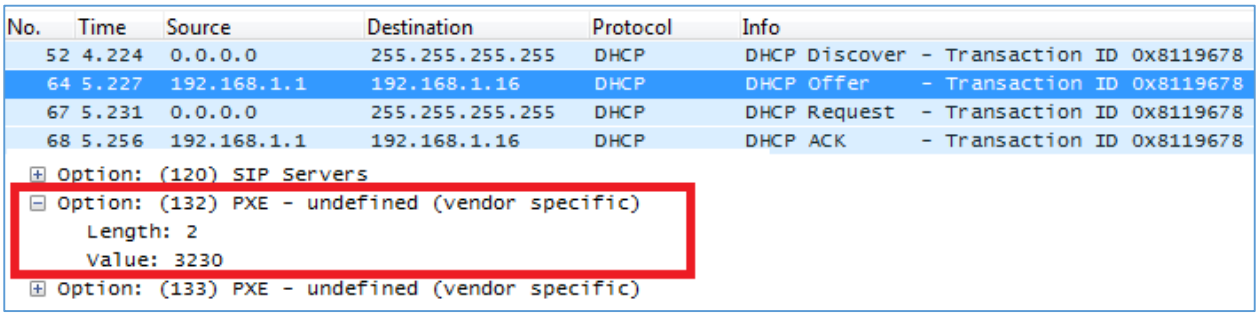


Figure 29: DHCP Offer Reply for Option 132

In above screenshot, value 3230 is 20 (vlan-id) converted from text to hexadecimal.
Note: After getting VLAN ID from DHCP server and finishing DHCP process, the device will send a second DHCP discover its new assigned VLAN tag to get an IP address on the VLAN range.

DHCP Option 133 (QoS priority level)

Description

This option assigns the priority within an Ethernet frame header when using VLAN tag, it specifies a priority value between 0 and 7 to differentiate the traffic priority.
Please refer to RFC4578 / IEEE_P802.1p *for more details*

Example

```
option vlan-qos code 133 = text;
option vlan-qos "5";
```

Figure 30: DHCP Option 133

Screenshots

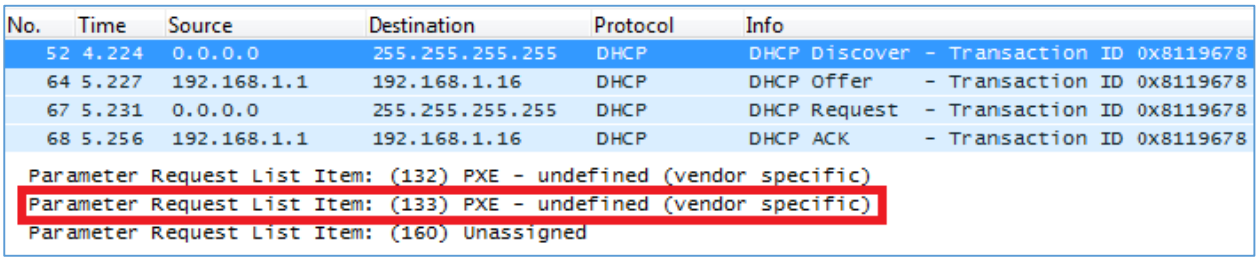


Figure 31: DHCP Discover Request for Option 133

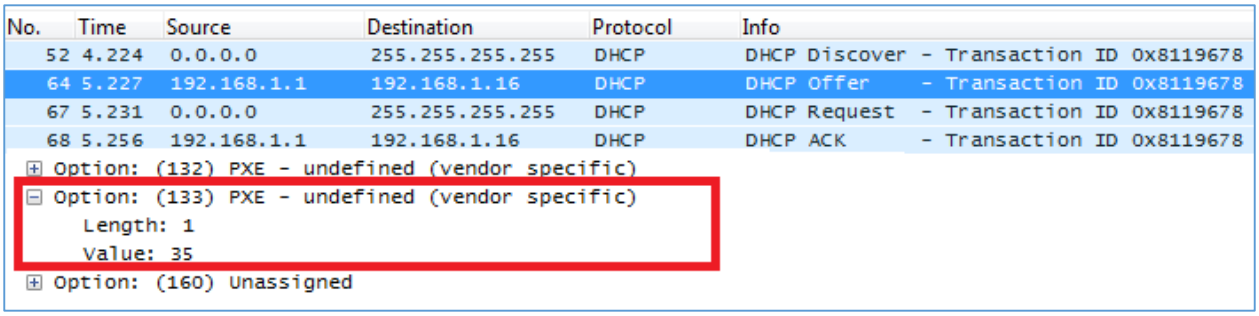


Figure 32: DHCP Offer Reply for Option 133

In above screenshot, value 35 is 5 (priority level) converted from text to hexadecimal.

DHCP Option 150 (TFTP Servers List)

Description

DHCP option 150 provides one or more IP addresses of TFTP server(s) where devices will be redirected to download their configuration files. Without this DHCP option, a manual configuration is requested on each phone the first time it boots.

Please refer to RFC5859 for more details.

Please refer to below link to learn how to how to provision Grandstream devices:

http://www.grandstream.com/sites/default/files/Resources/gs_provisioning_guide.pdf

Example

```
option option-150 code 150 = ip-address;
option option-150 192.168.1.18;
```

Figure 33: DHCP Option 150

Screenshots

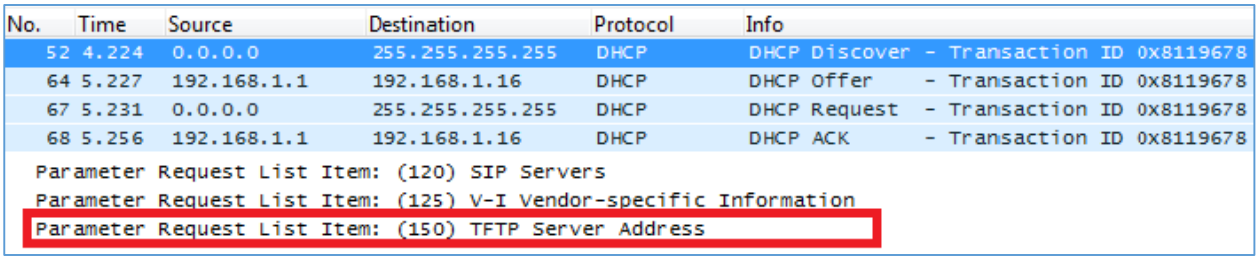


Figure 34: DHCP Discover Request for Option 150

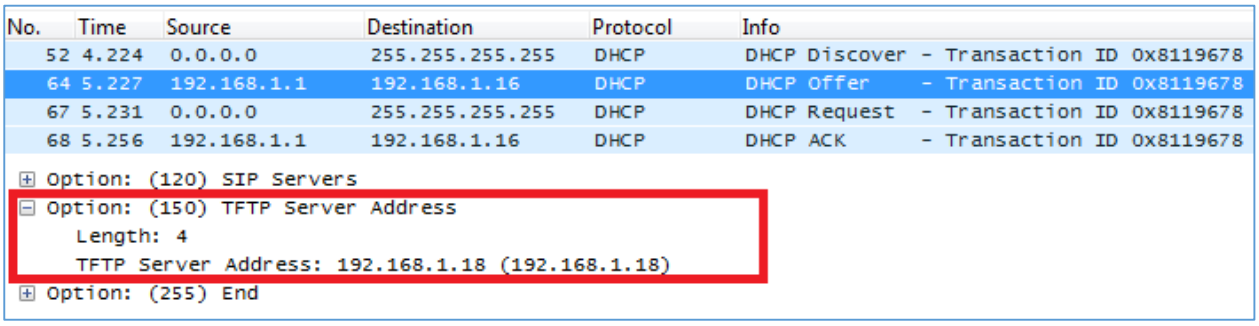


Figure 35: DHCP Offer Reply for Option 150

DHCP Option 160 (Configuration Server Address)

Description

Similar to option 66, DHCP option 160 can provide one or more configuration server(s) to clients to get automatically provisioned. Without this DHCP option, a manual configuration is requested on each phone the first time it boots.

Example

```
option option-160 code 160 = text;
option option-160 "tftp://192.168.1.12";
```

Figure 36: DHCP Option 160

Screenshots

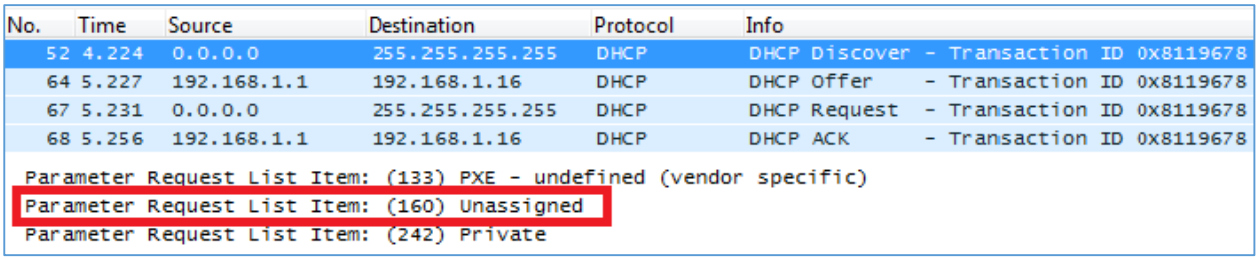


Figure 37: DHCP Discover Request for Option 160

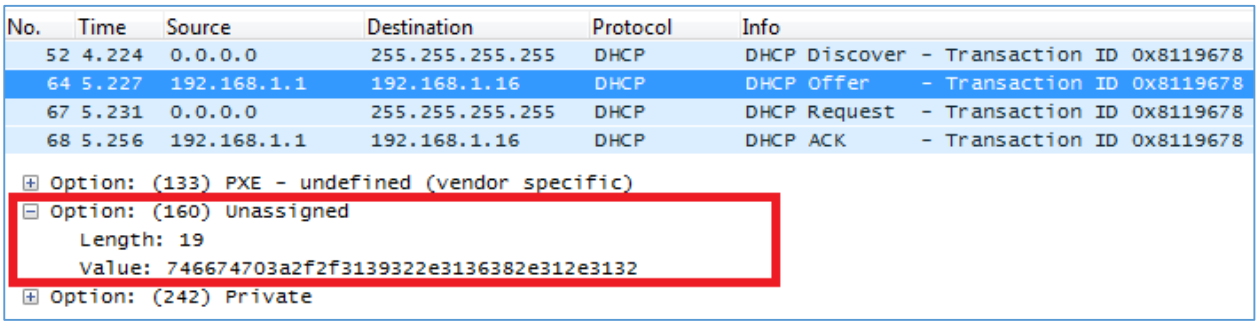


Figure 38: DHCP Offer Reply for Option 160

In above screenshot, the value of the TFTP server was converted to hexadecimal. The phone contacts this IP address to get provisioned after receiving TFTP server value.

DHCP Option 242 (Avaya IP Phones)

Description

Once this option enabled, the phone will use configuration info issued by DHCP sever.

Option 242 can include following parameters:

- MC IP address
- VLAN configuration
- HTTP server, Proxy
- Transport Protocol

Example

```
option option-242 code 242 = string;
option option-242 "MCIPADD=192.168.1.30,HTTPSRVR=192.168.1.31";
```

Figure 39: DHCP Option 242

Screenshots

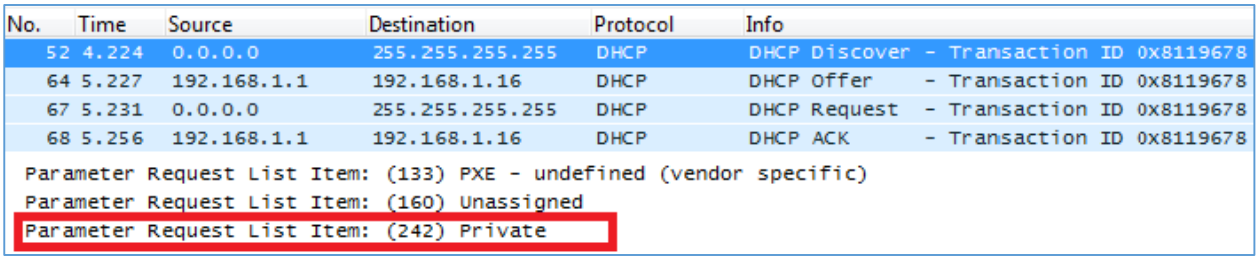


Figure 40: DHCP Discover Request for Option 242

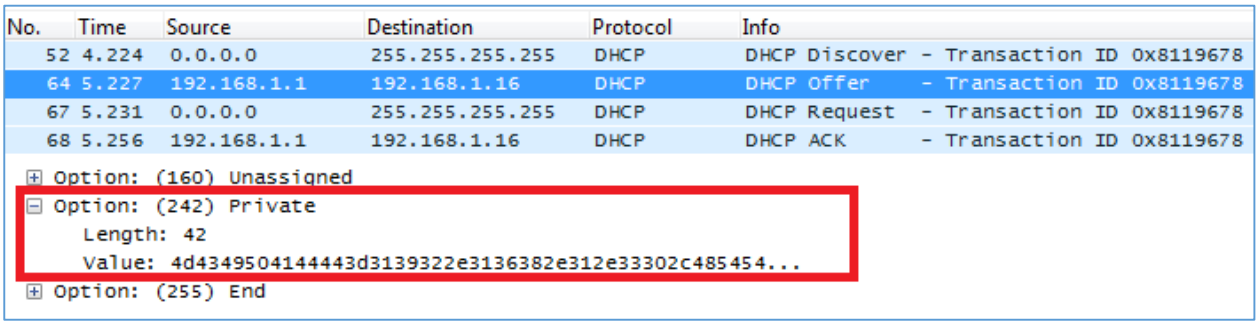


Figure 41: DHCP Offer Reply for Option 242

In above screenshot, MCIPADD and HTTPSRVR are converted to hexadecimal.