



Recommended Operation for Switches Running Relay Agent and Option 82

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Document Revision Log

Revision	Sections	Remarks	Date	Author
0.1		First released review copy	6/8/2004	Ken Coley

1 Introduction

1.1 Scope of Document

The purpose of the document is to document the DHCP Option 82 process and provide guidance for switch vendors to provide a design compatible with the EtherNet/IP protocol. This document is not intended to act as a formal requirements document. Please refer to RFC 3046 for specific Implementation issues.

1.2 Definitions

DHCP –	Dynamic Host Configuration Protocol, a mechanism for an end device to request its IP address.
Client –	Device making a DHCP request (end node)
Relay Agent –	A device which takes the standard multicast DHCP request packet and directs it to a specific DHCP server (usually via a Unicast message)
Server –	Device generating the reply to a DHCP request. Generally, the server uses the requesters MAC address to do a table look up in order to provide an IP address.

1.3 Future Revisions of the Recommendations

This document represents “V1.0” of the Functionality Recommendations. Further revisions of the document are anticipated as work progresses in the Implementor’s Workshop and other ODVA SIGs.

1.4 Overview of the DHCP process

The process for a client to obtain its IP address via DHCP address from a server is as follows:

- 1) Client generates a DHCP request message via UDP broadcast
- 2) Servers listen for this request message
- 3) Servers respond with a DHCP reply and a valid IP addresses
- 4) Servers may respond with a random address or one based on a MAC address table lookup
- 5) Servers may “lease” the address for a specific time period or hand them out with infinite lease.

2 DHCP Option 82

DHCP Option 82 provides a mechanism for generating IP addresses based on location the client device is in the network. Information about its location can be sent along with the request to the server. The DHCP server makes a decision on what IP should be assigned based on this information. In order to implement DHCP Option 82, the network must have the following equipment:

- 1) Standard DHCP client
- 2) Switch or router implementing Relay Agent with Option 82 support
- 3) DHCP server with Option 82 Support

An example configuration is shown in Figure 1 below:

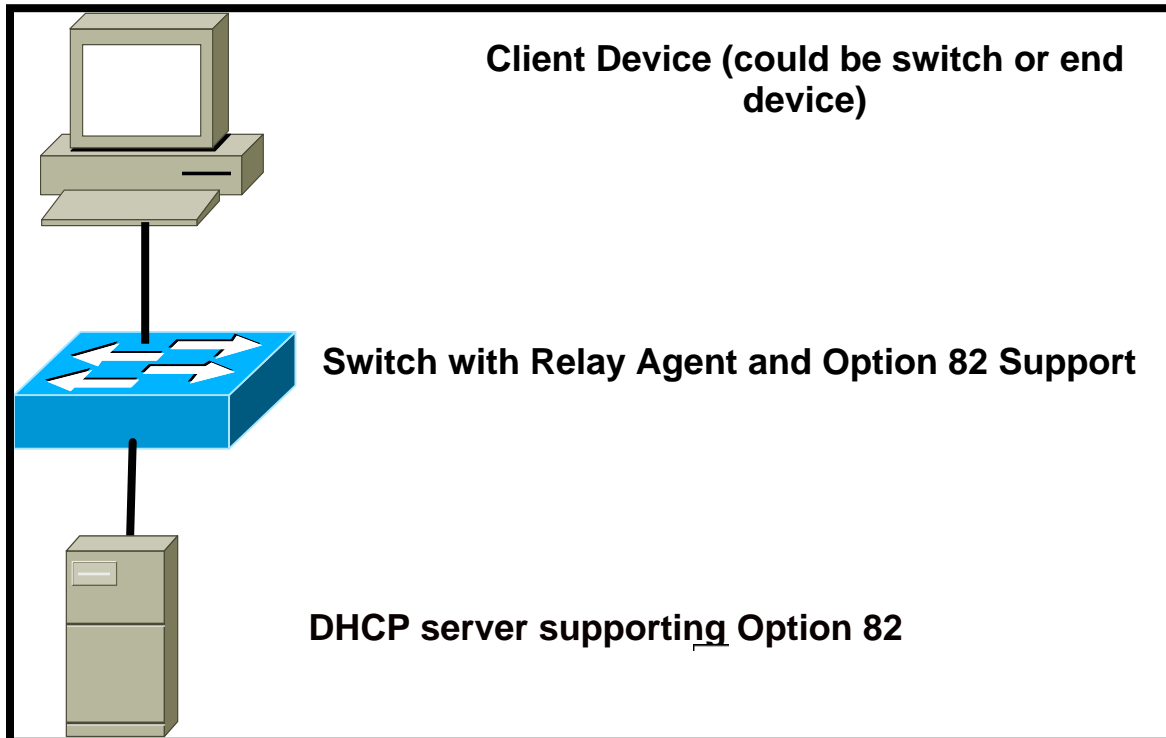


Figure 1, Example DHCP Option 82 enabled network

The DHCP relay agent and Option 82 are defined in RFC 3046. Relay Agent Information option is inserted by the DHCP relay agent when forwarding client-originated DHCP packets to a DHCP server. Servers recognizing the Relay Agent Information option may use the Information to implement IP address or other parameter assignment policies. Switch or Router (as the DHCP relay agent) intercepting the DHCP requests, appends the circuit ID + remote ID into the option 82 fields and forwards the request message to DHCP server.

The format of Relay Agent Option 82 options:

Sub-Option	Sub Value
1. Circuit ID	Contains info identifying port location that request is coming in on.
2. Remote ID	Not Used, currently the MAC address of the Relay Agent
3. GiAddr	Gateway IP Address of the Relay Agent. Part of the normal DHCP message.

Figure 2: DHCP Option 82 Fields

Circuit ID

The Circuit ID field generally contains information describing the port location that the DHCP request is coming in from. It may contain additional information that helps describe which IP address should be assigned out, such as the VLAN ID. This value must be unique for a particular switch or router that is providing the Relay Agent function. The value must also stay the same if modules are installed or removed in the Switch or Router that implements the Relay Agent. Therefore, having subfields representing the Module, Slot and Port is highly recommended.

Remote ID

The Remote ID field is intended to carry information describing the device at the remote end of the link. However, in Ethernet systems, this is typically the MAC address of the Relay Agent. This is not particularly useful since the MAC address would change if the Relay Agent was every replaced. Building a DHCP server database using the MAC address of the Relay Agent would require that the table be rebuilt every time one of the Relay Agents was replaced. Some vendors have modified this field to use the IP address of the Relay Agent or some other string describing the Relay Agent. This field must be unique to the entire network.

GiAddr

The GiAddr (or Gateway Address) field is part of the normal DHCP message. It contains the IP address of the Relay Agent. Since IP addresses must be unique, this field is unique for the entire network.

By combining the GiAddr and the Circuit ID, a network wide unique string can be created. This string can be used for table lookup in the DHCP server. We called this string a pseudo MAC address, since most DHCP servers do a MAC to IP mapping in their databases.

Relay Agent's Inbound Operations

The following steps should be performed by the DHCP Relay Agent inbound:

- 1) Intercept all multicast based DHCPDISCOVER or DHCPREQUEST messages
- 2) Prevent multicast flooding to local access ports
- 3) Determine if the Relay Agent and Option 82 fields are already filled in
- 4) Skip the next still if they are
- 5) Fill in CID, RID, and the appropriate Relay Agent fields such as GiAddr
- 6) Send the message to the DHCP server via Unicast message

DHCP Server Actions

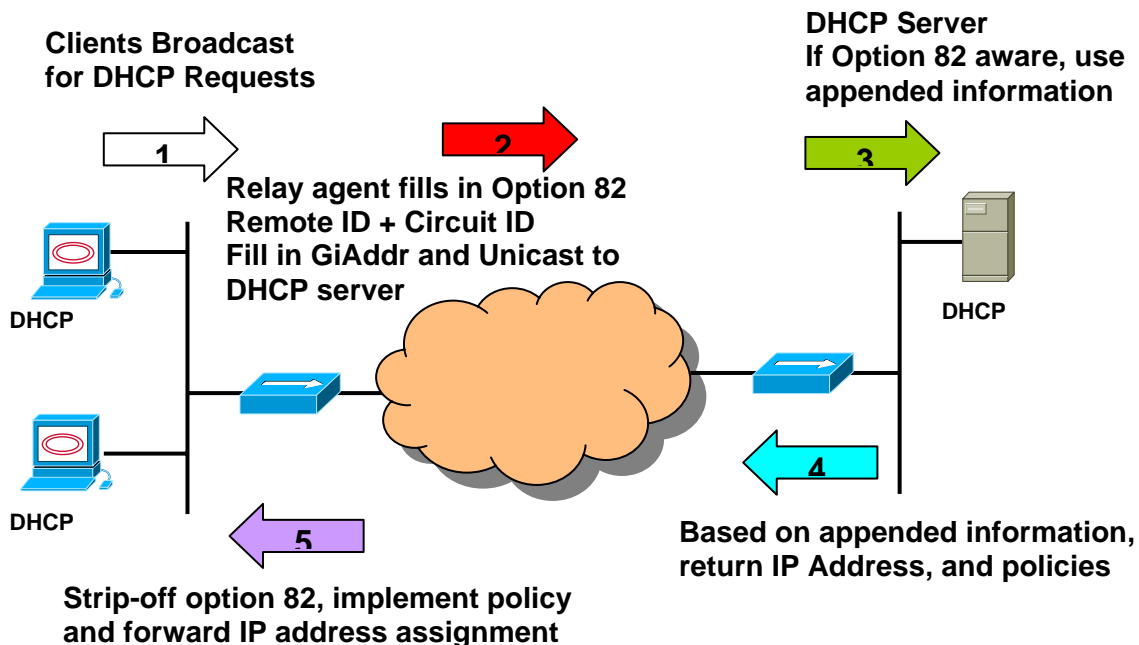
The following actions should be performed by the DHCP server when receiving a DHCPDISCOVER or DHCPREQUEST message with Option 82 set:

- 1) Store all message fields temporarily
- 2) Create the pseudo MAC address by concatenating the CID field onto the GiAddr field.
- 3) Perform a Table look up using this pseudo MAC address
- 4) Place the IP address in the DHCPREPLY message and restore correct fields
- 5) Unicast the DHCPREPLY message back to the Relay Agent

Relay Agent's Outbound Operations

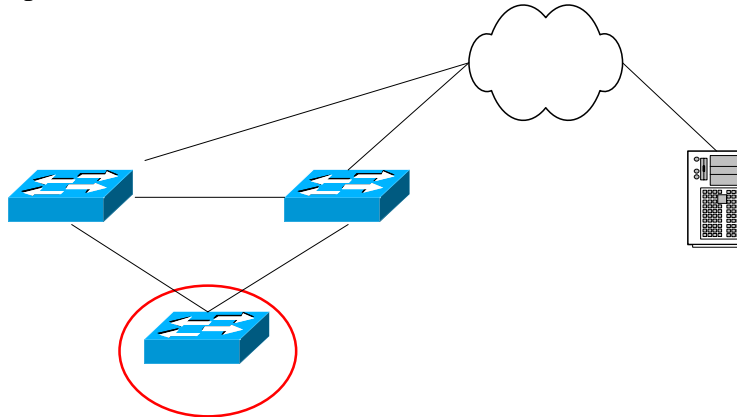
The following steps should be performed by the DHCP Relay Agent outbound in response to a DHCPREPLY message:

- 1) Remove the Option 82 fields
- 2) Direct the Unicast DHCPREPLY message to the appropriate requesting host.



Switch replacement using DHCP Option 82 implementations in a redundant environment.

In the below diagram, Switch C is faulty and needs to be replaced. The network supports DHCP Option 82.



If Switch A suffers a fault as well, this means that there must be redundant entries for Switch C in the DHCP Server that show the redundant path going from Switch C a to Switch B. This is to make sure that IP addresses are distributed correctly. Switch C will transmit its DHCP request on the particular uplink that is in forwarding state via STP. However, based on topology changes, that uplink can either be port 6 or port 7. Therefore an entry in the DHCP server table must be present for Switch A port 7 and Switch B port 6. Both of these entries will contain the same IP address for Switch C.

Current Switches supporting DHCP Option 82

- Cisco Switches
 - 2950, 2955, 2970, 3550, 3560, 3750, 4500, 6500
- Hirschmann Switches
 - Mice2K/Mice3K, RS2xx/xx, RS2-16M, MACH3000

Current DHCP Servers supporting DHCP Option 82

- Cisco Network Registrar (CNR)
- Infoblox
- Lucent QIP
- Microsoft 2003 Server (Still under test)
- Weird Solutions
- ISC Linux DHCP Server

192.168.10.10

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For more information on DHCP, see **DHCP A guide to Dynamic TCP/IP Network Configuration** by Berry Kercheval, Prentice Hall Publishing.

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