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**The Extended Remote Boot Option for DHCPv4**  
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Abstract

Single TFTP [2] server for huge number of diskless clients is prone to single point of failure. So, Multiple TFTP servers are needed for high availability. Moreover, some of the clients need multiple bootfiles for boot up. This document provides a new DHCPv4 option for clients to obtain information about multiple TFTP [2] servers and bootfiles.

## **1. Introduction**

DHCPv4 (Dynamic Host Configuration Protocol Version for IPv4) provides a framework for passing configuration information to hosts on an IPv4 network. However, DHCPv4 does not provide a way to send more than one TFTP server address and bootfile names. This document defines a new option to provide more than one TFTP server and bootfile names. This option is required for clients, which are

booting over a network and require more than one file to be downloaded and executed. The multiple TFTP servers are needed for high availability. Network booting is widely used mechanism for

booting up of the clients, because of their advantages; softwares will be in central server and requires maintenance at only one location rather than maintaining individual systems separately. Also, switching between different operating systems becomes easy when network booting is being used. The additional boot files may be used as supporting software for the boot image. Different Operating System vendors use different way of handling this.

## 2. Requirements

The keywords MUST, MUST NOT, REQUIRED, SHALL, SHALL NOT, SHOULD, SHOULD NOT, RECOMMENDED, MAY, and OPTIONAL, when they appear in this document, are to be interpreted as described in [RFC 2119](#) [3]

## 3. Terminology

This document uses terminology specific to DHCPv4 as defined in "Terminology" section of the DHCPv4 specification [1].

## 4. Extended Remote Boot Option

The Extended Remote Boot Option is used to carry the parameters needed for remote boot of the DHCPv4 [1] clients. Using the information provided by this option, the clients will be able to bootp up.

The format of the Remote Boot Option is as shown below:

Code	Len	Extended Remote Boot Information Field				
TBD	N	r1	r2	r3	r4	rN

The length N gives the total number of octets in the Extended Remote Boot Information Field. The length N should be at least 4 bytes.

r1, r2 .. rN are Remote Boot Information suboptions which contain information needed for boot up of the clients. They should be listed in the increasing order of preferences.

The Remote Boot Information suboption is explained in the [Section 5](#).

## 5. Remote Boot Information suboption

The DHCP server uses the Remote Boot Information suboption to convey the client about the TFTP Server [4] names and list of boot files needed for booting of the clients. The clients are supposed to contact the TFTP Server, obtain the boot files one by one and boot up using these files.

The format of the Remote Boot Information suboption is as shown below:

Code	Len	Remote Boot Information Field				
+-----+	+-----+	+-----+	+-----+	+-----+	+-----+	+-----+
1	N	ts	f1	f2	f3	fN
+-----+	+-----+	+-----+	+-----+	+-----+	+-----+	+-----+

The length N gives the total number of octets in the Remote Boot Information Field. The length N should be at least 2 bytes.

'ts' field consists of either TFTP server name (option 66) [5] or the TFTP Server Address suboption suboption represented in the Opt/Length/Value tuples. The format of the TFTP Server Address suboption is given below:

Code	Len	TFTP Server address			
+-----+-----+-----+-----+-----+					
1	n	a1	a2	a3	a4
+-----+-----+-----+-----+-----+					

The TFTP Server Address suboption gives IPv4 address of the one of the TFTP Server available for the client. a1, a2, a3 and a4 refer the quadrants of the IPv4 address of TFTP Server address in the network byte order. The length of the option will be 4 octets.

f1, f2 ... fN are sequence of Bootfile name (option 67) [5] represented in the Opt/Length/Value tuples.

If Bootfile name option is not following the TFTP Server name/address suboption, then, bootfiles corresponding to the TFTP server specified in the 'ts' field defaults to the boot file names from the previous Remote Boot Information suboption which has non empty 'fn' fields.

Thus, TFTP server name/address and Bootfile name are sent as suboption to Remote Boot Information option here.

If multiple boot files are provided by the server, then, they should appear in the order of their execution in the client. The first appearing Bootfile name should be downloaded and executed first for boot up, then the next and so on.

## 6. Precedence of the options

This specification recommends the following precedence for the various remote boot options, including the ones specified in [5].

Option name/Field name	Precedence
-----	-----
Extended Remote Boot Option	Highest
options 66 and 67 [5]	Medium
'sname' and 'fname' [1]	Lowest

Thus, if Extended Remote Boot Option is received by the client and 'sname' and 'file' fields are not overloaded, the client MUST ignore the 'sname' and 'file' fields. If TFTP server name/address and/or Bootfile name are received in the reply the server, along with the

Extended Remote Boot Option, then, the client MUST ignore TFTP server name/address and/or Bootfile name options.

## **7. Server behavior**

If the server receives the request for TFTP server name and/or Bootfile name along with the Extended Remote Boot Option, the server SHOULD ignore the TFTP server name and/or Bootfile name option and reply back with Extended Remote Boot Option.

When the DHCP server is replying back with Extended Remote Boot Option, the 'sname' and 'file' field SHOULD be used to overload the options.

If the length of any of these options exceed the maximum permissible within a single option (254 octets), then they MUST be represented in the DHCP message as specified in [\[2\]](#).

## **8. Client behavior**

The client MUST NOT request for TFTP server name and/or Bootfile name along with the Extended Remote Boot Option.

## **9. Security Considerations**

The Remote Boot Option may be used by an intruder DHCPv4 server to provide to cause DHCPv4 clients to contact rogue TFTP server (or) to send invalid file names. This will make booting up of DHCP clients to fail. This will have a greater impact, if the clients are running some time critical applications. It has a direct impact on the security of the networks, if the clients are running any security applications.

To avoid attacks through this option, the DHCP client SHOULD use authentication mechanism for DHCP [\[6\]](#).

## **10. IANA Considerations**

IANA is requested to assign an option code to the following options from the option-code space defined for public DHCP Options in [RFC 2939](#) [\[7\]](#).

Option Name	Value	Described in
Extended Remote Boot Option	tbd	<a href="#">Section 4</a>

## **11. Acknowledgements**

Thanks to Barr Hibbs and Bernie Volz for the valuable comments on this work.

## **12. Normative References**

[1] Droms, R., "Dynamic Host Configuration Protocol", [RFC 2131](#), March

1997.

- [2] T. Lemon, S. Cheshire, Encoding Long Options in the Dynamic Host Configuration Protocol (DHCPv4), [RFC 3396](#), November 2002.



- [3] Bradner, S., "Key words for use in RFCs to Indicate Requirement Levels", [BCP 14](#), [RFC 2119](#), March 1997.

### **13. Informative References**

- [4] K. Sollins, The TFTP Protocol (Revision 2), [RFC 1350](#), July 1992.
- [5] Alexander, S. and R. Droms, "DHCP options and BOOTP Vendor Extensions", [RFC 2132](#), March 1997.
- [6] Droms, R. and W. Arbaugh, "Authentication for DHCP Messages", [RFC 3118](#), June 2001.
- [7] R. Droms, Procedures and IANA Guidelines for Definition of New DHCP Options and Message Types, [RFC 2939](#), September 2000.

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