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        Dynamic Host Configuration Protocol (DHCP) Domain Search Option

Status of this Memo

   This document specifies an Internet standards track protocol for the
   Internet community, and requests discussion and suggestions for
   improvements. Please refer to the current edition of the "Internet
   Official Protocol Standards" (STD 1) for the standardization state
   and status of this protocol. Distribution of this memo is unlimited.

Abstract

   This document defines a new Dynamic Host Configuration Protocol
   (DHCP) option which is passed from the DHCP Server to the DHCP Client
   to specify the domain search list used when resolving hostnames using
   DNS.

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1. Introduction

   The Dynamic Host Configuration Protocol (DHCP) [RFC2131] provides a
   mechanism for host configuration. [RFC2132] and [RFC2937] allow DHCP
   servers to pass name service configuration information to DHCP
   clients. In some circumstances, it is useful for the DHCP client to
   be configured with the domain search list. This document defines a
   new DHCP option which is passed from the DHCP Server to the DHCP
   Client to specify the domain search list used when resolving
   hostnames with DNS. This option applies only to DNS and does not
   apply to other name resolution mechanisms.

1.1. Terminology

   This document uses the following terms:

   DHCP client
        A DHCP client or "client" is an Internet host using DHCP to
        obtain configuration parameters such as a network address.
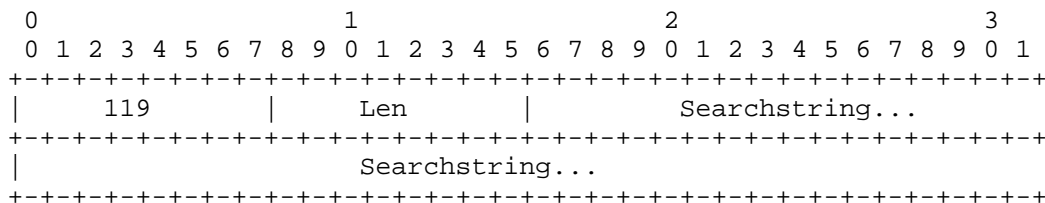
   DHCP server
        A DHCP server or "server" is an Internet host that returns
        configuration parameters to DHCP clients.

1.2. Requirements Language

   The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT",
   "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this
   document are to be interpreted as described in "Key words for use in
   RFCs to Indicate Requirement Levels" [RFC2119].

2. Domain Search Option Format

   The code for this option is 119.

```
    0                   1                   2                   3
    0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1
   +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
   |     119       |     Len       |         Searchstring...
   +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
   |                     Searchstring...
   +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

   In the above diagram, Searchstring is a string specifying the
   searchlist. If the length of the searchlist exceeds the maximum
   permissible within a single option (255 octets), then multiple
   options MAY be used, as described in "Encoding Long Options in the
   Dynamic Host Configuration Protocol (DHCPv4)" [RFC3396].

   To enable the searchlist to be encoded compactly, searchstrings in
   the searchlist MUST be concatenated and encoded using the technique
   described in section 4.1.4 of "Domain Names - Implementation And
   Specification" [RFC1035]. In this scheme, an entire domain name or a
   list of labels at the end of a domain name is replaced with a pointer
   to a prior occurrence of the same name. Despite its complexity, this
   technique is valuable since the space available for encoding DHCP
   options is limited, and it is likely that a domain searchstring will
   contain repeated instances of the same domain name. Thus the DNS
   name compression is both useful and likely to be effective.

   For use in this specification, the pointer refers to the offset
   within the data portion of the DHCP option (not including the
   preceding DHCP option code byte or DHCP option length byte).

   If multiple Domain Search Options are present, then the data portions
   of all the Domain Search Options are concatenated together as
   specified in "Encoding Long DHCP Options in the Dynamic Host
   Configuration Protocol (DHCPv4)" [RFC3396] and the pointer indicates
   an offset within the complete aggregate block of data.

3. Example

   Below is an example encoding of a search list consisting of
   "eng.apple.com." and "marketing.apple.com.":

   +---+---+---+---+---+---+---+---+---+---+---+
   |119| 9 | 3 |'e'|'n'|'g'| 5 |'a'|'p'|'p'|'l'|
   +---+---+---+---+---+---+---+---+---+---+---+

   +---+---+---+---+---+---+---+---+---+---+---+
   |119| 9 |'e'| 3 |'c'|'o'|'m'| 0 | 9 |'m'|'a'|
   +---+---+---+---+---+---+---+---+---+---+---+

   +---+---+---+---+---+---+---+---+---+---+---+
   |119| 9 |'r'|'k'|'e'|'t'|'i'|'n'|'g'|xC0|x04|
   +---+---+---+---+---+---+---+---+---+---+---+

   Note:

   i.   The encoding has been split (for this example) into three
         Domain Search Options. All Domain Search Options are logically
         concatenated into one block of data before being interpreted by
         the client.

   ii.   The encoding of "eng.apple.com." ends with a zero, the null
         root label, to mark the end of the name, as required by RFC
         1035.

iii. The encoding of "marketing" (for "marketing.apple.com.") ends
      with the two-octet compression pointer C004 (hex), which points
      to offset 4 in the complete aggregated block of Domain Search
      Option data, where another validly encoded domain name can be
      found to complete the name ("apple.com.").

Every search domain name must end either with a zero or with a two-
octet compression pointer. If the receiver is part-way through
decoding a search domain name when it reaches the end of the complete
aggregated block of the searchlist option data, without finding a
zero or a valid two-octet compression pointer, then the partially
read name MUST be discarded as invalid.

4. Security Considerations

   Potential attacks on DHCP are discussed in section 7 of the DHCP
   protocol specification [RFC2131], as well as in the DHCP
   authentication specification [RFC3118]. In particular, using the
   domain search option, a rogue DHCP server might be able to redirect
   traffic to another site.

   For example, a user requesting a connection to "myhost", expecting to
   reach "myhost.bigco.com" might instead be directed to
   "myhost.roguedomain.com". Note that support for DNSSEC [RFC2535]
   will not avert this attack, since the resource records for
   "myhost.roguedomain.com" might be legitimately signed. This makes
   the domain search option a more fruitful avenue of attack for a rogue
   DHCP server than providing an illegitimate DNS server option
   (described in [RFC2132]).

   The degree to which a host is vulnerable to attack via an invalid
   domain search option is determined in part by DNS resolver behavior.
   [RFC1535] discusses security weaknesses related to implicit as well
   as explicit domain searchlists, and provides recommendations relating
   to resolver searchlist processing. [RFC1536] section 6 also
   addresses this vulnerability, and recommends that resolvers:

   [1]   Use searchlists only when explicitly specified; no implicit
         searchlists should be used.

   [2]   Resolve a name that contains any dots by first trying it as an
         FQDN and if that fails, with the local domain name (or
         searchlist if specified) appended.

   [3]   Resolve a name containing no dots by appending with the
         searchlist right away, but once again, no implicit searchlists
         should be used.

In order to minimize potential vulnerabilities it is recommended
that:

[a]   Hosts implementing the domain search option SHOULD also
        implement the searchlist recommendations of [RFC1536], section
        6.

[b]   Where DNS parameters such as the domain searchlist or DNS
        servers have been manually configured, these parameters SHOULD
        NOT be overridden by DHCP.

[c]   Domain search option implementations MAY require DHCP
        authentication [RFC3118] prior to accepting a domain search
        option.

5. Normative References

    [RFC1035]   Mockapetris, P., "Domain Names - Implementation and
                Specification", STD 13, RFC 1035, November 1987.

    [RFC1536]   Kumar, A., Postel, J., Neuman, C., Danzig, P. and S.
                Miller, "Common DNS Implementation Errors and Suggested
                Fixes", RFC 1536, October 1993.

    [RFC2119]   Bradner, S., "Key words for use in RFCs to Indicate
                Requirement Levels", BCP 14, RFC 2119, March 1997.

    [RFC2131]   Droms, R., "Dynamic Host Configuration Protocol", RFC
                2131, March 1997.

    [RFC3118]   Droms, R. and W. Arbaugh, "Authentication for DHCP
                Messages", RFC 3118, June 2001.

    [RFC3396]   Lemon, T. and S. Cheshire, "Encoding Long Options in the
                Dynamic Host Configuration Protocol (DHCPv4)", RFC 3396,
                November 2002.

6. Informative References

    [RFC1535]   Gavron, E., "A Security Problem and Proposed Correction
                With Widely Deployed DNS Software", RFC 1535, October
                1993.

    [RFC2132]   Alexander, S. and R. Droms, "DHCP Options and BOOTP
                Vendor Extensions", RFC 2132, March 1997.

   [RFC2535]   Eastlake, D., "Domain Name System Security Extensions",
                RFC 2535, March 1999.

   [RFC2937]   Smith, C., "The Name Service Search Option for DHCP", RFC
                2937, September 2000.

7. IANA Considerations

   The IANA has assigned DHCP option code 119 to the Domain Search
   Option.

8. Acknowledgments

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Acknowledgement