              Dynamic Host Configuration Protocol (DHCP) Options for
                    Broadcast and Multicast Control Servers

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
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Abstract

   This document defines new options to discover the Broadcast and
   Multicast Service (BCMCS) controller in an IP network. BCMCS is
   being developed for Third generation (3G) cellular telephone
   networks. Users of the service interact with a controller in the
   network via the Mobile Node (MN) to derive information required to
   receive Broadcast and Multicast Service. Dynamic Host Configuration
   Protocol can be used to configure the MN to access a particular
   controller. This document defines the related options and option
   codes.

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1. Motivation

    Dynamic Host Configuration Protocol [RFC2131] and [RFC3315] can be
    used to configure various non-IP address type of parameters. These
    parameters are required for normal operation of various services that
    are offered over an IP network.

    Broadcast and Multicast Service (BCMCS) is one such service that is
    being standardized in various mobile wireless standard bodies such as
    Third Generation Partnership Project 2 (3GPP2), Open Mobile Alliance
    (OMA), and 3GPP. A description of the BCMCS as defined in 3GPP2 can
    be found in [BCMCS].

    While DHCP already defines many options for device configuration, no
    option exists for configuring a mobile device to use BCMCS. This
    memo defines extensions for both DHCPv4 and DHCPv6 so that DHCP can
    be used to provide necessary configuration information to a mobile
    device about the BCMCS controllers.

    DHCP is being used in 3GPP2, to assist Mobile Nodes (MNs) with the
    discovery of the BCMCS Controller in a mobile operator's IP network.
    The BCMCS includes a controller component that is responsible for
    managing the service via interaction with the MN and other network
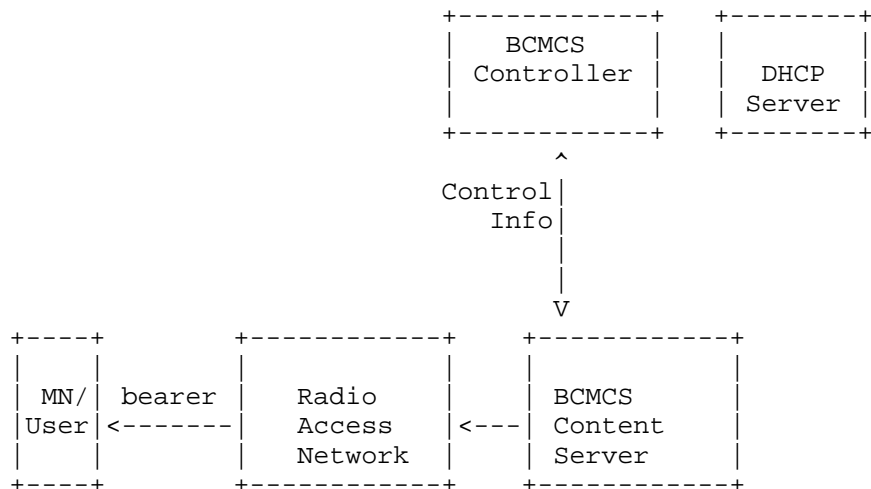   entities. In this document, we will call this a BCMCS controller.

An overview of the 3GPP2 BCMCS architecture is given in the next
section. It provides enough information to understand the basics of
the 3GPP2 BCMCS operation. Readers are encouraged to find a more
detailed description in [BCMCS].

As described in [BCMCS], the MNs are required to know the IPv4 or the
IPv6 address of the BCMCS controller entity so that they can download
all the necessary information about a desired broadcast and/or a
multicast program. In a roaming environment, static configuration of
the BCMCS controller's IP address becomes unrealistic. Therefore,
DHCP is considered to be a method to dynamically configure the MNs
with the IP address or the fully qualified domain name (FQDN) of the
BCMCS controller in the 3G cellular telephone networks.

In order to allow the MNs to discover the BCMCS controllers, the MNs
request the appropriate option codes from the DHCP server. The DHCP
servers need to return the corresponding configuration options that
carry either BCMCS controller's IP address or FQDN based on
configuration. This document defines the necessary options and
option codes.

2. Overview of the 3GPP2 BCMCS Network

The Broadcast and Multicast Service architecture in a 3G cellular
telephone network such as 3GPP2 has the following model:

```
                        +------------+   +--------+
                        |   BCMCS    |   |        |
                        | Controller |   |  DHCP  |
                        |            |   | Server |
                        +------------+   +--------+
                              ^
                        Control|
                           Info|
                               |
                               |
                               V
     +----+         +------------+    +------------+
     |    |         |            |    |            |
     | MN/|  bearer |    Radio   |    |  BCMCS     |
     |User|<--------|    Access  |<---|  Content   |
     |    |         |    Network |    |  Server    |
     +----+         +------------+    +------------+
```

Note that this figure is shown here for a basic understanding of how
Broadcast and Multicast Service works in a 3G cellular telephone
network. The network elements except MN/user and the DHCP server are
not relevant to the text in this document.

The MN interacts with the BCMCS Controller to request broadcast/
multicast program information from the network (e.g., scheduled time,
multicast IP address, port numbers). The MN may also be
authenticated by the BCMCS Controller while downloading the relevant
program-security-related information (such as encryption key). These
interactions may happen via HTTP and XML as defined in [BCMCS].
There may be more than one BCMCS controller in the network. The MN
should discover the appropriate BCMCS controller to request the
relevant program information. For details of Broadcast and Multicast
Service operation in 3GPP2, see [BCMCS].

3. Terminology

   The keywords "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT",
   "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this
   document are to be interpreted as described in RFC 2119 [RFC2119].

4. Broadcast and Multicast Service Controller Options

   This section defines the configuration option for the BCMCS
   controller of the Broadcast and Multicast Service.

4.1. Broadcast and Multicast Service Controller Domain Name List for
      DHCPv4

   The general format of the BCMCS Controller Domain list option for
   DHCPv4 is as follows:

```
        Code  Len  FQDN(s) of BCMCS Controller
       +-----+-----+-----+-----+-----+-----+-----+--
       | 88  |  n  | s1  | s2  | s3  | s4  | s5  | ...
       +-----+-----+-----+-----+-----+-----+-----+--
```

   The option MAY contain multiple domain names, but these domain names
   SHOULD be used to construct Service Record (SRV) lookups as specified
   in [BCMCS], rather than querying for different A records. The client
   can try any or ALL of the domain names to construct the SRV lookups.
   The list of domain names MAY contain the domain name of the access
   provider and its partner networks that also offer Broadcast and
   Multicast Service.

   As an example, the access provider may have one or more partners or
   resellers often termed as MVNOs (Mobile Virtual Network Operators)
   for Broadcast and Multicast Service. In this case, the access
   provider should be able to use the same DHCP option to send multiple
   of those domain names (MVNOs). To illustrate this further, let's
   assume that the access provider (operator) has a reseller agreement
   with two MVNOs: mvno1 and mvno2. Therefore, the Broadcast and

Multicast Service Controller Domain Name list for the DHCPv4 option
will contain three domain names: operator.com, mvno1.com, and
mvno2.com. Upon receiving this option, the BCMCS client may choose
to use one of the domain names to fetch the appropriate BCMCS
controller address (based on user's preference or configuration). If
no preferred domain name is found in the received list, the client
should use a default setting, e.g., use the first one in the list.

If the length of the domain list exceeds the maximum permissible
length within a single option (254 octets), then the domain list MUST
be represented in the DHCPv4 message as specified in [RFC3396]. An
example case when two controller domain names, example.com and
example.net, are returned will be:

```
+----+----+----+----+----+----+----+----+----+----+----+
| 88 | 26 | 7  | 'e'| 'x'| 'a'| 'm'| 'p'| 'l'| 'e'| 3  |
+----+----+----+----+----+----+----+----+----+----+----+
+----+----+----+----+----+----+----+----+----+----+----+
|'c' |'o' | 'm'| 0  | 7  | 'e'| 'x'| 'a'| 'm'| 'p'| 'l'|
+----+----+----+----+----+----+----+----+----+----+----+
+----+----+----+----+----+----+
|'e' | 3  | 'n'| 'e'| 't'| 0  |
+----+----+----+----+----+----+
```

4.2.   Broadcast and Multicast Service Controller Domain Name List Option
       for DHCPv6

The semantics and content of the DHCPv6 encoding of this option are
exactly the same as the encoding described in the previous section,
other than necessary differences between the way options are encoded
in DHCPv4 and DHCPv6.

Specifically, the DHCPv6 option for the BCMCS Control Server Domain
Names has the following format:

```
 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
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|      OPTION_BCMCS_SERVER_D     |        option-length          |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|          BCMCS Control Server Domain Name List                |
|                            ...                                |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```
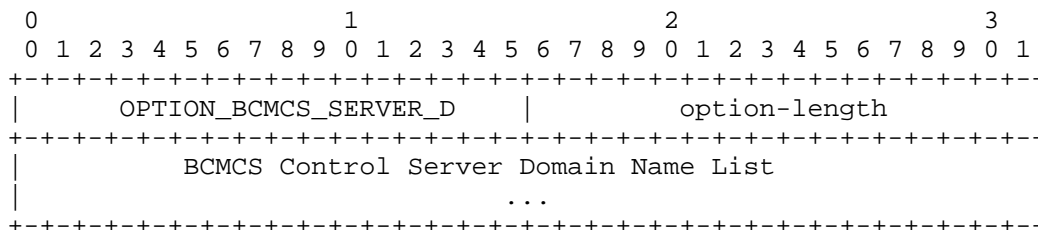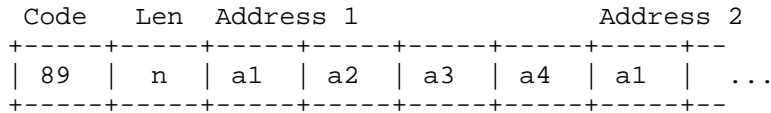
option-code: OPTION_BCMCS_SERVER_D (33).

option-length: Length of the 'BCMCS Control Server Domain Name List'
field in octets; variable.

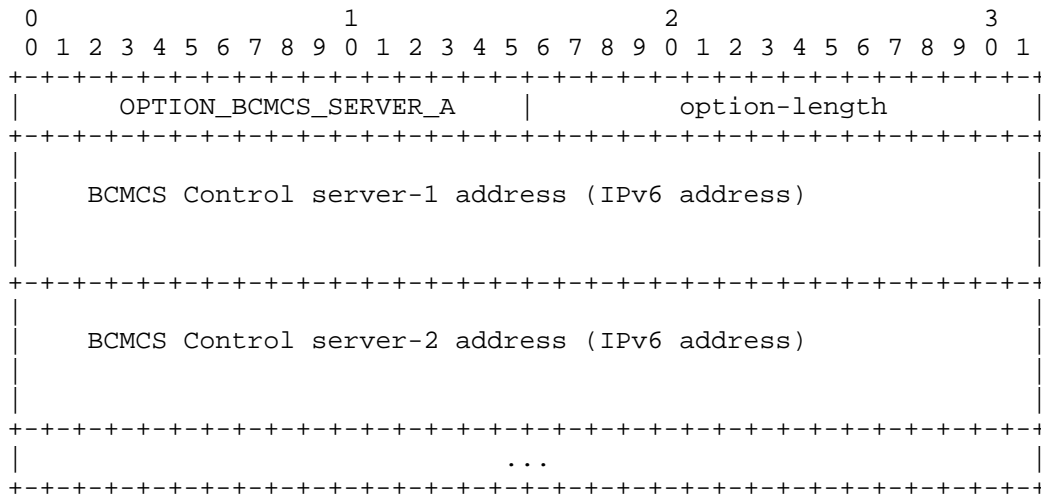BCMCS Control Server Domain Name List: Identical format as in Section 4.1 (except the Code and Len fields).

4.3. Broadcast and Multicast Service Controller IPv4 Address Option for DHCPv4

The Length byte (Len) is followed by a list of IPv4 addresses indicating BCMCS controller IPv4 addresses. The BCMCS controllers MUST be listed in order of preference. Its minimum length is 4, and the length MUST be a multiple of 4. The DHCPv4 option for this encoding has the following format:

```
    Code   Len  Address 1              Address 2
   +-----+-----+-----+-----+-----+-----+-----+--
   | 89  |  n  | a1  | a2  | a3  | a4  | a1  |  ...
   +-----+-----+-----+-----+-----+-----+-----+--
```

4.4. Broadcast and Multicast Service Controller IPv6 Address Option for DHCPv6

This DHCPv6 option MUST carry one or more 128-bit IPv6 address(es) of the BCMCS Controller in an operator's network.

```
 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
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|       OPTION_BCMCS_SERVER_A    |           option-length       |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                                                               |
|     BCMCS Control server-1 address (IPv6 address)             |
|                                                               |
|                                                               |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                                                               |
|     BCMCS Control server-2 address (IPv6 address)             |
|                                                               |
|                                                               |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                              ...                              |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

option-code: OPTION_BCMCS_SERVER_A (34).

option-length: Length of the 'BCMCS Control Server IPv6 address' field in octets; variable.

4.5. Consideration for Client Operation

   For DHCPv4, the client MAY request either or both of the BCMCS
   Controller Domain Name List and the IPv4 Address options in the
   Parameter Request List option (code 55) as defined in [RFC2132].

   For DHCPv6, the client MAY request either or both of the BCMCS
   Controller Domain Name List and the IPv6 Address options in the
   Options Request Option (ORO) as described in [RFC3315].

   If the client receives both the BCMCS Controller Domain Name List and
   IPv6 or IPv4 Address options, it SHOULD use the Domain Name List
   option. In this case, the client SHOULD NOT use the BCMCS Controller
   IPv6 or IPv4 Address option unless the server(s) in the BCMCS
   Controller Domain Name List cannot be resolved or reached.

4.6. Consideration for Server Operation

   A server MAY send a client either the BCMCS Controller Domain Name
   List Option or the BCMCS Controller IPv6 Address/IPv4 Address options
   if the server is configured to do so.

   If a client requests both the options and the server is configured
   with both types of information, the server MAY send the client only
   one of the options if it is configured to do so. In this case, the
   server SHOULD send the BCMCS Controller Domain Name List option.

   A server configured with the BCMCS Controller IPv6 or IPv4 Address
   information MUST send a client the BCMCS Controller IPv6 or IPv4
   Address option if that client requested only the BCMCS Controller
   IPv6 or IPv4 Address option and not the BCMCS Controller Domain Name
   List option in the ORO or Parameter Request List option.

   If a client requests for the BCMCS Controller IPv6 or IPv4 Address
   option and the server is configured only with the domain name(s), the
   server MUST return the Domain Name List and vice versa.

   The domain names MUST be concatenated and encoded using the technique
   described in Section 3.3 of "Domain Names - Implementation and
   Specification" [RFC1035]. DNS name compression MUST NOT be used.

The following table summarizes the server's response:

```
    Client sends in ORO/
    Parameter Request List   Domain Name List        IPv6/IPv4 Address
    _____

    Neither option           SHOULD                  MAY
    Domain Name List         MUST                    MAY
    IPv6/IPv4 Address        MAY                     MUST
    Both options             SHOULD                  MAY
```

5. Security Considerations

   This document does not introduce any new security concerns beyond
   those specified in the basic DHCP [RFC2131] and DHCPv6 [RFC3315]
   specifications. In the absence of message integrity protection for
   these options, an attacker could modify the option values to divert
   requests for broadcast service.

6. IANA Considerations

   The following option codes for Broadcast and Multicast Service
   Controller option have been assigned by IANA:

   1. The BCMCS Controller Domain Name list (Section 4.1) has been
   assigned a value of 88 from the DHCPv4 option space.

   2. The BCMCS Controller Domain Name list (Section 4.2) has been
   assigned a value of 33 from the DHCPv6 option space, and a name of
   OPTION_BCMCS_SERVER_D.

   3. The BCMCS Controller IPv4 Address option (Section 4.3) has been
   assigned a value of 89 from the DHCPv4 option space.

   4. The BCMCS Controller IPv6 Address option (Section 4.4) has been
   assigned a value of 34 from the DHCPv6 option space, and a name of
   OPTION_BCMCS_SERVER_A.

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   Venaas.

8. Normative References

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   [RFC3396]   Lemon, T. and S. Cheshire, "Encoding Long Options in the
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Authors' Addresses

   Kuntal Chowdhury
   Starent Networks
   30 International Place
   Tewksbury, MA   01876
   US

   Phone: +1 214-550-1416
   EMail: kchowdhury@starentnetworks.com

   Parviz Yegani
   Cisco Systems
   3625 Cisco Way
   San Jose, CA   95134
   US

   Phone: +1 408-832-5729
   EMail: pyegani@cisco.com

   Lila Madour
   Ericsson
   8400, Decarie Blvd
   Town of Mount Royal, Quebec   H4P 2N2
   CANADA

   Phone: +1 514-345-7900
   EMail: Lila.Madour@ericsson.com

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