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K. Chowdhury
Starent Networks
P. Yegani
Cisco Systems
L. Madour
Ericsson
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Dynamic Host Configuration Protocol (DHCP) Options for Broadcast and Multicast Control Servers

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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.

Table of Contents

1. Motivation	2
2. Overview of the 3GPP2 BCMCS Network	3
3. Terminology	4
4. Broadcast and Multicast Service Controller Options	4
4.1. Broadcast and Multicast Service Controller Domain Name List for DHCPv4	4
4.2. Broadcast and Multicast Service Controller Domain Name List Option for DHCPv6	5
4.3. Broadcast and Multicast Service Controller IPv4 Address Option for DHCPv4	6
4.4. Broadcast and Multicast Service Controller IPv6 Address Option for DHCPv6	6
4.5. Consideration for Client Operation	7
4.6. Consideration for Server Operation	7
5. Security Considerations	8
6. IANA Considerations	8
7. Acknowledgements	8
8. Normative References	9

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.

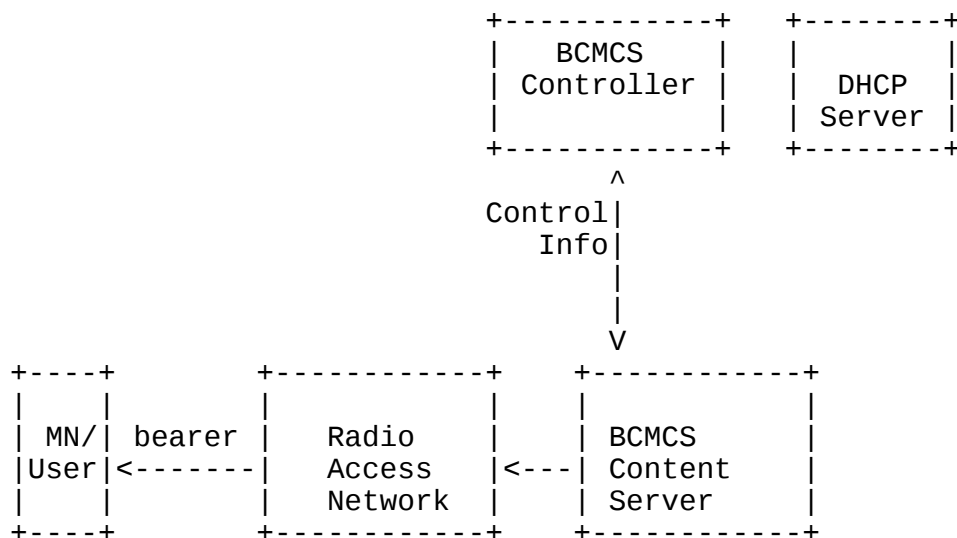
An overview of the 3GPP2 BCMCS architecture is given in the next section. It provides enough information to understand the basics of the 3GPP2 BCMCS operation. Readers are encouraged to find a more detailed description in [BCMCS].

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:



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	2	3	4	5	6	7	8	9
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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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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