About One Improvement of Protocol DHCPV6

Papuna QARCHAVA*
Guram ASANISHVILI**

Abstract

Present article discusses the existing addressing methods in the IPv6 network. Idea about one improvement of the DHCPv6 protocol is presented. In the improved model the quantity of packages which are necessary to dynamic assignment of the IPv6 address and other necessary parameters of a configuration to the device decreased to a half. It also becomes simpler detection of the neighbor of devices. Changes in the database improves l the protocol performance, as well as fragmentation of the database structure improves system security.

Keywords: Address allocation, DHCPv6, EUI-64, IPv6, Network

Introduction

21st century greatly differs in technological achievements. Global network occupies an important role in person's life. People communicate with each other, do business, plan their own rest and so on with the help of global network. With technology development producers aspire to make devices with the possibility of communication in a network. There were new devices, and old got new possibilities. And also there was new software, which simplified daily communication.

Each device with the possibility of communication in a network needs its own unique identifier. As such identifier, there was the IPv4 protocol (IP protocol version 4) for many years. In the IPv4 protocol, 32 digit double value is used for the identification of devices. Two methods are defined for addressing the devices: statically, which means allocation of static IPv4 addresses for devices carried out by the administrator of a network, and dynamically, which means allocation of dynamically IPv4 addresses for devices carried out by the network service (DHCP server). It exists specially for this purpose in the network.

At the end of the last century when devices noticeably fell in price the people could get the computer and a number of devices have been considerably greater than the addresses which can give Ipv4. This can lead to the problems of communication, which became the reason of exhaustion of IPv4 addresses. To avoid this exhaustion, Ipv4 protocol was renewed in to IPv6 (IP protocol of version 6). IPv6 uses a 128-bit address, allowing 2^{128}, or approximately 3.4×10^{38} addresses, or more than 7.9×10^{28} times as many as IPv4, which uses 32-bit addresses and provides approximately **4.3 billion addresses** Similar to IPv4 protocol, two methods are defined in IPv6 protocol for addressing:

- Statically ("regular ", EUI-64[2]);
- Dynamically (DHCP, SLAAC[3])

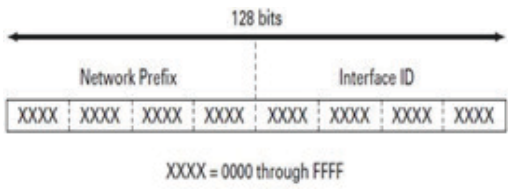

Figure 1. *IPv6 address format*

The method of (statically) "regular" addressing means that allocation of IPv6 of addresses for devices is carried out by the administrator.

Extended Unique Identifier (EUI), as per RFC2373, allows a host to assign itself a unique 64-Bit IP Version 6 interface identifier (EUI-64). This feature is a key benefit over IPv4, as it eliminates the need of manual configuration or DHCP as in the world of IPv4. The IPv6 EUI-64 format address is obtained through the 48-bit MAC address. The Mac address is first separated into two 24-bits, with one being OUI (Organizationally Unique Identifier) and the other being NIC specific. The 16-bit 0xFFFE is then inserted between these two 24-bits for the 64-bit EUI address. IEEE has chosen FFFE as a reserved value which can only appear in EUI-

* Assist. Prof. Dr. Department of Computer Science, Ivane Javakhishvili Tbilisi State University, Tbilisi, Georgia
E-mail: papuna.karchava@tsu.ge
** Mast. St. Department of Computer Science, Ivane Javakhishvili Tbilisi State University, Tbilisi, Georgia
E-mail: guga.asani@gmail.com

[1] The existing addressing method, which means simple allocation of IPv6 of the address

[2] EUI - Extended Unique Identifier. This method of static addressing appeared in IPv6 protocol

[3] SLAAC - Stateless Address Auto Configuration. This method of dynamic addressing appeared in IPv6 protocol

64 generated from the EUI-48 MAC address (Figure 2).

The method of (dynamically) SLAAC addressing means that the device can dynamically appoint itself to the IPv6 address without the aid of

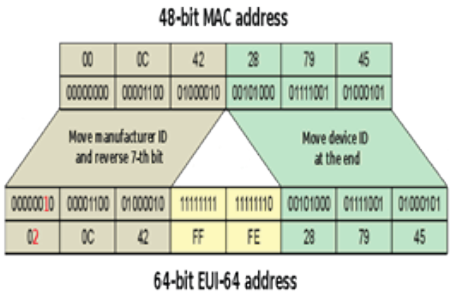

Figure 2. *Receiving the second part of IPv6 address from MAC address 000C.4228.7945 of device*

DHCP server. When connected to an IPv6 network us-ing the ND (Neighbor Discovery) Protocol via Internet ICMPv6 (Control Message Protocol version 6) router discovers messages. When first connected to a network, a host sends a link-local router solicitation multicast request for its configuration parameters; routers respond to such a request with a router advertisement packet that contains Internet Layer configuration parameters. If IPv6 stateless address auto configuration is unsuitable for an application, a network may use stateful configuration with the Dynamic Host Configuration Protocol version 6 (DHCPv6) or hosts may be configured manually using static methods. Routers present a special case of requirements for address configuration as they often are sources of auto confi-guration information, such as router and prefix advertisements. Stateless configuration of routers can be achieved with a special router renumbering protocol.

The method of (dynamically) DHCP ("regular") addressing means that the device can dynamically receive the IPv6 address from the DHCP server.

Our further discussion will concern more only to methods of addressing of EUI-64 and DHCP.

For receiving dynamically IPv6 address, the device with the DHCP server should exchange four messages (SOLICIT, ADVERTISE, REQUEST and REPLY) (Figure 3). After receiving the IPv6 address the device before starting to use this IPv6 address checks communication with this address (using utility ping) to check if this IPv6 address was assigned to other device. If it gets answer, this means that the IPv6 address is assigned to some device and it starts to undergo anew all procedure to receive IPv6 address.

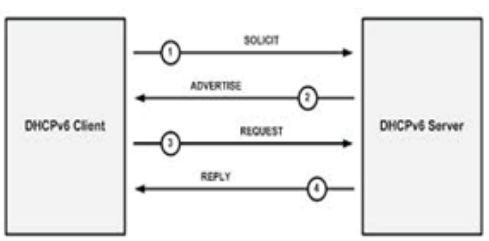

Figure 3. *The principle of working DHCP protocol*

Otherwise it begins communication in a network using this address. In a big network the messages which must carry between the device and the DHCP server for receiving IPv6 addresses noticeably load capacity of a network.

Methodology

The idea of authors concerning the DHCP protocol improvement will take place in the following requirements:

1. The DHCP protocol for dynamic addressing of devices (on demand) can use both a regular method and the EUI-64 method. The choice depends on the user.

2. The database will use three tables: 1) table for original DHCP method; 2) table for DHCP-EUI-64 method and 3) table for MAC address.(Figure 4).

There are fields in all tables for uniquely iden-tifying ID. This will help in the search, convict search features; for the MAC address; for address of the device. In addition, in table DHCP-EUI64, there are fields for Link-Local of the address and time of sending (ToS)

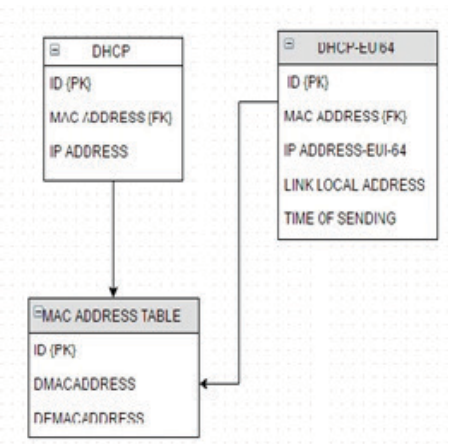

Figure 4. *Database structure*

Possibly these two requirements will improve the capacity of a network. In accuracy, the quantity of the message which is necessary for dynamic receiving IPv6 of the address decreases twice.

Really, if the MAC address of the device of needing IPv6 of the address to awake to be present at the message generated by this DHCP device (as it was in DHCPv4), with the help of this MAC of the address DHCP, the server can easily generate for the IPv6 EUI-64 device the address and from received DHCP SOLICIT massage it can take IPv6 Link-Local the address. Then they will be brought in local database (IPv6 EUI-64, IPv6 Link-Local and MAC) and sent back to the device only IPv6 EUI-64 the address. Thus, uniqueness of IPv6 of the address follows from uniqueness of the MAC address of the device. And also for the device of received IPv6 the address is not present need will check existence for it the allocated IPv6 of the address at other device and it can begin at once communication in a network and it is not necessary to use the DAD (Duplicate Address Detection) protocol. Besides, as the DHCP server in local database will combine dynamically allocated ("regular" and EUI-64) addresses together with the device MAC address, it is possible to assign everything on the DHCP server a duty when obtaining the requirement on dynamically allocation of IPv6 of the address will check existence of the MAC address in

Journal of Technical Science and Technologies; ISSN 2298-0032; Volume 4, Issue 1, 2015

the DHCP database. If in the DHCP database. There is no corresponding MAC address than it will allocate ("regular" or EUI-64) the address. In the presence of the corresponding MAC address from the DHCP database record will be erased correspondingly. After intervention of the manager for such MAC address only legal device can receive IPv6 the address.

From the aforesaid follows that as it is observed uniqueness of IPv6 of the address and in the DHCP database uniqueness of the MAC address will be guaranteed, only the 2nd message will be sufficient for receiving dynamic IPv6 of the address ("regular" or EUI-64).

Using in a network the improved DHCP models of the protocol offered by author's detection of neighbors becomes simpler. As it is known for detection of neighbors in a network the NDP protocol is used. With its help for device detection by the set IPv6 by the address, it is necessary to send the message to multicast network for those devices whose IPv6 of the address coincide set IPv6 the address on the last 16 bits. Number of such IPv6 of addresses sets in 2^{16}. After detection of the corresponding IPv6 of the address reciprocal unicast message settles.

It is obvious that if all devices in a network only dynamic IPv6 EUI-64 of the address, a task og detection of neighbors is simple. The solution to a problem of detection of the neighbor is consolidated to extraction from address MAC IPv6 the address of the device and generating from IPv6 of the address IPv6 Link-Local of the address.

If in a network there is an availability of both dynamic IPv6 EUI-64 of the address and dynamic "regular" addresses, having the improved DHCP protocol the device can contact on a straight line the DHCP server and the corresponding message to ask about stays in local database for IPv6 of the address MAC set by it the address and IPv6 Link-Local the device address (for what it is sufficient one unicast the message). At existence to the corresponding IPv6 to the record DHCP address the server can on a straight line answer the device (one unicast the message is necessary) and send it the MAC address and IPv6 Link-Local the device address.

Result

From all aforesaid, using the improved DHCP protocol follows:

• The uniqueness of IPv6 EUI-64 of the address is proved;

• For receiving dynamic IPv6 of the address ("regular" or EUI-64 a method) instead of 4 messages (as usual) only 2 messages are enough (DHCP SOLICIT and DHCP ADVERTISE);

• For detection of neighbors there are enough 2 unicast of the message instead of multicast message (for 2^{16} devices) and one unicast of the message;

For realization of improvement of the DHCP protocol offered by authors require the following changes:

1. The DHCP database will be fragmented on some tables to improve and optimize work speed and security.

2. At the DHCP protocol should be present methods of receiving IPv6 EUI-64 of the address from the device MAC address. And also method of search of the necessary record (by MAC address or by IPv6 address);

3. DHCP should guarantee uniqueness of MAC addresses in the DHCP database i.e. for each MAC address must exist exactly one record of the IPv6 address (which is derived by "regular" or EUI-64 method);

And there are some changes in message DHCP format:

1. In the DHCP format of the message there should be a bit which will point to a method of allocation of dynamic IPv6 of the address ("regular" or EUI-64);

2. In the DHCP format of the message there should be a MAC address of the device of needing IPv6 the address (if it there is not present);

3. In the DHCP format of the return message

• If it is sent as the answer to messages for allocation of IPv6 of the address, that is a field for the corresponding IPv6 of the address;

• If it is sent as the answer to messages of detection of neighbors, there should be two fields: for the MAC address and for IPv6 Link-Local of the address of the device;

4. If in advance it will be known that devices use only dynamic IPv6 EUI-64 addresses, devices need one method: for extraction with address MAC IPv6 EUI-64 the address of the device; IPv6 Link-Local the address it can take from received DHCP SOLICIT massage.

At existence in a network of several DHCP servers it is possible to synchronize their local DHCP databases and to form the uniform DHCP database.

Conclusion

• Simplified and improved addressing method for communication between devices.

• Due to a decrease in starting messages between the device and the server the speed of the start of communication is doubled.

• There is no use of an additional protocol for the detection of duplicate IPv6 addresses.

• MAC address centralized database, which speeds up the discovery of neighboring devices.

References

CCNA Routing and Switching 200-120 Official Cert Guide Library By Wendell Odom (2013)

IPv6 Fundamentals: A Straightforward Approach to Understanding IPv6 by Rick Graziani (2012)

McFarland, S. Sambi, M., Sharma, N. Hooda, S. (2011). IPv6 for Enterprise Networks.