How to Calculate the Hexadecimal Value for DHCP Option 2 (time offset)

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Contents

Introduction

This document describes the procedure used in order to calculate the hexadecimal value for the time offset DHCP Option 2 when DHCP pools are configured in Cisco routers. This option is particularly important in cable environments.

The DHCP configurations option is available in many Cisco platforms, in particular in uBR7200, and all the other uBRs. Cisco routers that run a Cisco IOS® release of 12.0(1)T or later have the ability to act as DHCP servers.

When you use the Cisco IOS DHCP server, the time offset value for a particular time zone is specified as an unsigned 32 bit hexadecimal value.

There is a common misconception about the difference between the time offset and Network Time Protocol (NTP). NTP is used by machines on the Internet in order to synchronize with the UTC timescale. The acronym UTC is an English–French mixture for Coordinated Universal Time (or its equivalent Temps Universel Coordonne) in order to make it language independent. UTC is more precise than GMT because UTC measures time based on an atomic clock. Time offset is based on Greenwich Mean Time (GMT) which defines a second as 1/86400 of a day, which is not 100 percent accurate.

Prerequisites

Requirements

There are no specific requirements for this document.

Components Used

This document is not restricted to specific software and hardware versions.

The information in this document was created from the devices in a specific lab environment. All of the devices used in this document started with a cleared (default) configuration. If your network is live, make sure

that you understand the potential impact of any command.

Conventions

Refer to Cisco Technical Tips Conventions for more information on document conventions.

Examples of How to Calculate the Hexadecimal Value of Time Offset

In these examples:

Symbol	Meaning
*	Multiplication
/	Division
^	Power

First Example

If a cable modem is used in a region that is GMT +11 hours, the appropriate value is calculated with these steps:

1. The number of seconds equivalent to 11 hours = 11 hours * (60 minutes / hour) * (60 seconds / minute) = 39600 seconds.
2. With a scientific calculator or a tool, such as the calculator application included with Microsoft Windows, convert 39600 to a hexadecimal value. This is 9AB0.
3. The value placed in the DHCP pool configuration now becomes option 2 hex 0000.9AB0.

Second Example

If a cable modem is used in a region that is GMT – 4 hours. In this case, the negative value changes the procedure. The appropriate value is calculated with these steps:

Note: 1hr = (60 minutes / hour) * (60 seconds / minute) = 3600 sec

1. The number of seconds equivalent to – 4 hours = – 4 hours * (3600 second/hr) = – 14400 seconds.
2. In order to convert –14400 to an unsigned 32 bit value, perform this operation: 2^32 means 2 to the power of 32 = 4294967296. Then, 2^32 – 14400 = 4294967296 – 14400 = 4294952896. This step is required because option 2 is 32 bits long.
3. With a scientific calculator, or a tool such as the calculator application included with Microsoft Windows, convert 4294952896 to a hexadecimal value. This is FFFFC7C0.
4. The value placed in the DHCP pool configuration now becomes option 2 hex FFFF.C7C0.

Third Example

This example is the same as the previous but step 2 is done in the scientific calculator from Microsoft Windows, without the need to calculate 2^32

Standard Pacific time is GMT –8. This is a simpler way to calculate GMT with negative values:

1. The number of seconds equivalent to – 8 hours = – 8 hours * (3600 seconds / hr) = – 28800 seconds.

2. With a scientific calculator, enter the number –28800 in the calculator with decimal values. The (–) sign is very important. In order to get the negative sign in front, press the **+/–** key.
3. Choose **Hex**. This gives you FFFFFFFFFFFF8F80. This is because, by default, the calculator has **Qword** enabled.
4. In order to get rid of the extra Fs, choose **Dword**. This produces the value FFFF8F80. If you do not have this option in your calculator, use only the first eight digits from right to left.
5. The value placed in the DHCP pool configuration now becomes option 2 hex FFFF.8F80.

Table of Conversion of Different Offset Times into Hexadecimal

This table gives the conversion of the different time zones around the world. The hexadecimal values are set to have a fixed length of 32 bits as specified in Option 2 of the DHCP RFC 2132. For a world timezone map, refer to World Time Zone Map ⬐ .

GMT offset (in hr)	GMT offset in seconds	GMT offset in Hexadecimal
0	0	0000.0000
+1	3600	0000.0E10
+2	7200	0000.1C20
+3	10800	0000.2A30
+4	14400	0000.3840
+5	18000	0000.4650
+6	21600	0000.5460
+7	25200	0000.6270
+8	28800	0000.7080
+9	32400	0000.7E90
+10	36000	0000.8CA0
+11	39600	0000.9AB0
+12	43200	0000.A8CD
–1	–3600	FFFF.F1F0
–2	–7200	FFFF.E3E0
–3	–10800	FFFF.D5D0
–4	–14400	FFFF.C7CD
–5	–18000	FFFF.B9B0
–6	–21600	FFFF.ABA0
–7	–25200	FFFF.9D90
–8	–28800	FFFF.8F80
–9	–32400	FFFF.8170
–10	–36000	FFFF.7360
–11	–39600	FFFF.6550

Related Information

- **Configuring DHCP, ToD, TFTP services on Cisco's CMTS: All−In−One Configuration**
- **World Time Zone Map**
- **Technical Support & Documentation − Cisco Systems**

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