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Google Will Help You Manage the 2016 Leap Second December 2016

Our day is one rotation of the Earth about its axis. We call this a 'solar day.' We break up the solar day into 24 hours. Each hour contains 60 minutes, and each minute contains 60 seconds. Thus, there are 86,400 seconds in a day.



Each second is timed very accurately by a cesium atomic clock. This timing is used to determine UTC, or Universal Coordinated Time, upon which the world runs.

However, the Earth wobbles. The Earth's rotation is affected by actions such as tides in the oceans and the movement of magma beneath the Earth's crust. These actions cause variations in the length of the solar day, typically slowing it down slightly.

To account for the variation, one second is added on occasion to UTC time to synchronize it with the true solar day. This second is called a leap second. Leap seconds began in 1972 and are now administered by the International Earth Rotation and Reference Systems Service (IERS).

However, leap seconds do not occur with regular frequency. They cannot be predicted because of irregularities in the Earth's rotation. In the past 40 years or so, about 25 leap seconds have been added to our clocks. Nine leap seconds were added in the eight years from 1972 to 1979. However, no leap seconds were added in the seven years from 1999 to 2005. The last leap second was added on June 30, 2015.

There has never been a time when a leap second was subtracted from UTC. The earth is indeed slowing down.

Leap seconds generally are announced six months in advance to give everyone time to prepare. They always occur at the end of June or the end of December. Adding an additional second can wreak havoc with many applications and operating systems that depend upon systems being tightly synchronized.

A leap second will be added this year just after midnight on December 31, 2016. Most Internet-connected devices get their time from NTP (Network Time Protocol) servers. NTP is an open-source technology used all over the world.

For this coming leap second, Google is here to help. Google runs its own NTP servers and uses them to ease its systems through leap seconds. Rather than adding a second at midnight (leading to an improper time of 23:59:60), Google uses a 'smeared time' technique. Its NTP servers run their clocks 0.0014 percent slower for ten hours before the leap second takes place and for ten hours afterwards. Google has been using its 'smeared time' technique since a leap second occurred in December 2008.

Enterprises running virtual-machine instances on Google's Compute Engine and those using Google APIs must keep their systems synchronized with Google's slightly slower clocks during the twenty-hour adjustment period. Client systems also will have to use Google's time to work with its servers.

In addition to those working with Google's services, Google is encouraging everyone to use its NTP servers for free. Users can do this by configuring their network settings to use time.google.com as their NTP server.

Google isn't the only one to smear time. Amazon and Microsoft have done this in the past. In fact, the big cloud companies are planning to smear the second over a 24-hour period. Google plans to use this longer time period for the next leap second to align itself with the other companies. Though there is no date yet for the next leap second, Google anticipates that it will occur in 2018.

Acknowledgements

Information for this article was taken from the following sources:

2015 – The Year of the Leap Second, *Availability Digest*, February 2015.

2016 is 1 second longer: Google can help you cope, *InfoWorld*, December 1, 2016.