Leap Second to be Added in 2015!

Whitham D. Reeve

Introduction: Leap seconds are inevitable because of the way time is defined worldwide, but that has not stopped the news media from getting hysterical about it [USAToday]. The last leap second was introduced 30 June 2012 and the next one will be 30 June 2015. I wrote about the 2012 event in [Reeve-1] and have repeated some of the information from that article below. I also explored some of the problems and solutions associated with keeping proper time in amateur radio astronomy in [Reeve-2, Reeve-3].

Leap seconds are used only when needed as determined from measurements. A leap second is added or subtracted every so often to keep Universal Time (UT, in particular, UT1) and Coordinated Universal Time (UTC), synchronized within less than ±0.9 second. The UT time scale is based on Earth's rotation rate, which changes slightly over time, sometimes it speeds up but most often it slows down, and the leap second compensates for this variation.

Embedded in UT is the mean astronomical second, which is defined as 1/86 400 of the mean solar day. It is determined by precise measurements. On the other hand, UTC, which is the legal basis for timekeeping and the time reference used in most countries, is an atomic time scale based on the emissions frequency of cesium atoms when certain electrons change state. Embedded in UTC is the definition of the second, which is 9 192 631 770 periods of the radiation emitted from cesium 133 when it is under specified environmental conditions (a frequency of about 9.193 GHz).

2015 Leap Second: The International Earth Rotation and Reference Systems Service (IERS) issues Bulletin C every six months to announce either a time step in UTC (leap second) or to confirm that there will be no time step at the next preferred date. The preferred time and dates for leap second insertion or deletion are midnight 30 June and 31 December but 31 March and 30 September also may be used if necessary to stay within the 0.9 second difference requirement mentioned above. IERS published Bulletin C49 on 5 January 2015 announcing a positive leap second in June 2015 with the following sequence of the UTC second markers (see also figure 1):

2015 June 30   23h 59m 59s
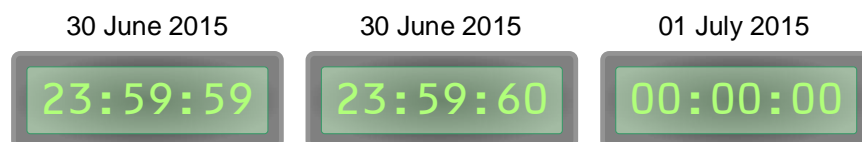2015 June 30   23h 59m 60s
2015 July 1   0h 0m 0s

Fig. 1 ~ A leap second will be inserted to retard UTC at the end of June 2015. The clock shown here is conceptual and based on the UTC time scale, so the leap second will be added at different local times depending on the user's time zone. It is unlikely that any real clock will show the digits "60" in the seconds field as shown here. (Image © 2015 W. Reeve)

All leap seconds to date have been positive. Thus, the difference between International Atomic Time (TAI) and UTC has increased over time. With the next leap second, the difference will be

From 2012 July 1, 0h UTC, to 2015 July 1, 0h UTC: UTC – TAI = –35 s
From 2015 July 1, 0h UTC, until further notice: UTC – TAI = –36 s

Conclusions: Exactly three years after the insertion of a leap second at midnight on 30 June 2012 another leap second will be added to the list. In keeping with the tradition promoted by an alarmist news media, many time users worldwide will be restocking their underground shelters with canned chili, bottled water and flashlight batteries. Meanwhile, the Sun will continue to rise in the east and set in the west as it has since the beginning of time as we know it.

References:
[Reeve-1]   Reeve, W., Is Time Broken (Or, Will It Be Y2K All Over Again), Radio Astronomy, July-August 2012
[Reeve-2]   Reeve, W., Time Differences in Charted Solar Observations at High Frequencies, Radio Astronomy, July-August 2012
[Reeve-3]   Reeve, W., Maintain Your Time, Radio Astronomy, May-June 2012
[USAToday]   Griffin, A., *Computer chaos feared over 2015's leap second* (http://www.usatoday.com/story/tech/2015/01/08/computer-chaos-feares/21433363/)
[IERS]   Bulletin C49, International Earth Rotation and Reference Systems Service, 5 January 2015 (http://hpiers.obspm.fr/iers/bul/bulc/bulletinc.dat)

Document information

Author: Whitham D. Reeve

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