The UTC problem and its solution

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DATA (IDATE(I,15),I=1,2),DATS(15) / 1972,  1, 10D0 /
DATA (IDATE(I,16),I=1,2),DATS(16) / 1972,  7, 11D0 /
DATA (IDATE(I,17),I=1,2),DATS(17) / 1973,  1, 12D0 /
DATA (IDATE(I,18),I=1,2),DATS(18) / 1974,  1, 13D0 /
DATA (IDATE(I,19),I=1,2),DATS(19) / 1975,  1, 14D0 /
DATA (IDATE(I,20),I=1,2),DATS(20) / 1976,  1, 15D0 /
DATA (IDATE(I,21),I=1,2),DATS(21) / 1977,  1, 16D0 /
DATA (IDATE(I,22),I=1,2),DATS(22) / 1978,  1, 17D0 /
DATA (IDATE(I,23),I=1,2),DATS(23) / 1979,  1, 18D0 /
DATA (IDATE(I,24),I=1,2),DATS(24) / 1980,  1, 19D0 /
DATA (IDATE(I,25),I=1,2),DATS(25) / 1981,  7, 20D0 /
DATA (IDATE(I,26),I=1,2),DATS(26) / 1982,  7, 21D0 /
DATA (IDATE(I,27),I=1,2),DATS(27) / 1983,  7, 22D0 /
DATA (IDATE(I,28),I=1,2),DATS(28) / 1985,  7, 23D0 /
DATA (IDATE(I,29),I=1,2),DATS(29) / 1988,  1, 24D0 /
DATA (IDATE(I,30),I=1,2),DATS(30) / 1990,  1, 25D0 /
DATA (IDATE(I,31),I=1,2),DATS(31) / 1991,  1, 26D0 /
DATA (IDATE(I,32),I=1,2),DATS(32) / 1992,  7, 27D0 /
DATA (IDATE(I,33),I=1,2),DATS(33) / 1993,  7, 28D0 /
DATA (IDATE(I,34),I=1,2),DATS(34) / 1994,  7, 29D0 /
DATA (IDATE(I,35),I=1,2),DATS(35) / 1996,  1, 30D0 /
DATA (IDATE(I,36),I=1,2),DATS(36) / 1997,  7, 31D0 /
DATA (IDATE(I,37),I=1,2),DATS(37) / 1999,  1, 32D0 /
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UTC: the view of users

- If you ask UTC users, overwhelming numbers say “It ain’t bust: don’t fix it!”
- However, a few influential users say that leap seconds are an unacceptable inconvenience and want them to cease.
- Whose views should prevail?

Introduction

- UTC currently links all of these:
  - High-precision time
  - civil time
  - UT1 (to 0.1s)
- Most discussion has been about weakening or eliminating the link between civil time and UT1.
- This presentation proposes relaxing the link between civil time and high precision.
- But leaving things as they are for the time being remains an attractive option.

The future of UTC

- In the long term, UTC as presently defined is **not** sustainable because of the gathering pace of leap seconds. In this sense, UTC **is** bust.
- And there is no technical fix:
  - Smaller leaps, more often: more inconvenience.
  - Larger leaps, occasionally: mayhem.
  - Change of SI second: unacceptable.
  - Break the link with UT1?…
- So UTC must at some point cease (or be replaced).

No more leap seconds?

- There are many applications that implicitly assume that UTC is approximately UT1…
  - astro-navigation
  - architects' shadow calculations
  - amateur telescope pointing

  …and who knows what else?
- Existing software, some written decades ago, would need to be changed. The cost is unknown and potentially unaffordable.
- The need for software changes will in many cases not come to light until it is too late: the first time UT1-UTC exceeds 0.9s or 1s for instance.

The dilemma

- UTC can’t survive for ever…
- …but freezing it now will cause trouble, expense and resentment.

The problem and its solution

- UTC is an attempt to make one time scale do two rather incompatible jobs:
  - provide access to highly accurate time
  - provide an approximation to UT1
- One answer is to provide two separate time scales for the respective purposes:
  - TAI (e.g. via GPS) for *high accuracy* applications
  - a new service providing *an approximation to* UT1

The proposed UT1 service

- We have new technology: the Internet. With it the IERS can provide an NTP server (and maybe even a clock face on a Web page)
- Such a service would provide a *predicted* UT1, nominally to 0.1s but in practice better.
- It would be a continuous time scale, arguably a better basis for civil time-of-day than UTC.

The three time scales

- TAI: the one high-accuracy time scale
  - Current UTC applications requiring this accuracy migrate to TAI.
  - Precise relationship with UT1 (where relevant) managed at the application level.
- New approximate UT1 service
  - Recommended basis for everyday civil timekeeping, consistent with many countries' laws, which still specify "mean time".
- UTC
  - To continue until all users have had time to migrate but then to cease completely.

UTC life expectancy

- We need to distinguish UTC the time scale from UTC the name! To many users, a change to the definition means that it isn't UTC any more.
- If UTC is to go, it is reasonable to insist that no new UTC applications be developed from now on.
- Some of the existing ones will last 25-50 years, the lifetime of a major groundbased telescope.
- UTC should be supported until at least 2025: 5 years or even 10 years is **not long enough**.

Nomenclature

- We already have too many sorts of Universal Time and we should resist the temptation to add "UTC_{2000}", "UT1C" etc. because it will confuse people even more.
- For high-accuracy applications, TAI should be used, rather than some new frozen, leap-less UTC, because the jump of 32s will immediately expose any misuse and misunderstanding.
- Calling the new approximate UT1 time scale "Global Mean Time" would be a popular choice.