TAI and the access to GPS time and other GNSS time scales

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Access to GNSS time in Circular T

5 - Relations of UTC and TAI with GPS time and GLONASS time.

[*UTC-GPS time*] = -13 s + C_0, [*TAI-GPS time*] = 19 s + C_0, global uncertainty is of order 10 ns.
[*UTC-GLONASS time*] = 0 s + C_1, [*TAI-GLONASS time*] = 32 s + C_1, global uncertainty is of order hundreds ns.

The C_0 values are obtained using the values [*UTC-UTC(OP)*] and the GPS data taken at the Paris Observatory, corrected for IGS precise orbits, clocks and ionosphere maps. The C_1 values are obtained using the values [*UTC-UTC(VSL)*] and the GLONASS data taken at the NMi Van Swinden Laboratorium (VSL). N_0 and N_1 are the numbers of measurements. The standard deviations σ_0 and σ_1 characterize the dispersion of individual measurements. The actual uncertainty of user's access to GPS and GLONASS times may differ from these values.
For this circular, σ_0 = 2.0 ns, σ_1 = 26.6 ns

Date 2004	0h UTC	MJD	C_0/ns	N_0	C_1/ns	N_1
JAN	30	53034	0.2	43	205.5	29
JAN	31	53035	-1.8	43	200.2	0
FEB	1	53036	-1.0	42	197.1	0
FEB	2	53037	1.2	40	195.0	5
FEB	3	53038	4.7	42	195.7	55
FEB	4	53039	6.3	43	204.9	49
FEB	5	53040	4.4	42	192.5	63
FEB	6	53041	1.0	42	173.2	60
FEB	7	53042	0.8	43	168.0	75
FEB	8	53043	-0.8	43	176.7	71
FEB	9	53044	-3.1	43	170.2	76
FEB	10	53045	-3.0	42	165.6	81
FEB	11	53046	-6.9	42	182.4	56
FEB	12	53047	-6.6	43	199.5	58
FEB	13	53048	-4.4	44	208.0	63
FEB	14	53049	-1.6	44	204.7	65
FEB	15	53050	-3.1	44	199.4	46
FEB	16	53051	-3.6	45	185.3	65
FEB	17	53052	-0.8	42	170.4	40
FEB	18	53053	2.4	42	168.2	35
FEB	19	53054	5.4	40	184.9	71
FEB	20	53055	4.9	42	201.9	58
FEB	21	53056	3.7	41	212.1	69
FEB	22	53057	2.2	42	205.4	59
FEB	23	53058	0.1	40	214.6	22
FEB	24	53059	0.7	40	217.3	72
FEB	25	53060	1.0	40	209.7	80
FEB	26	53061	-3.7	39	215.6	69
FEB	27	53062	-5.9	42	226.4	60
FEB	28	53063	-8.2	41	222.6	29
FEB	29	53064	-8.2	40	219.9	39

Access to GNSS time in Circular T

- GPS time
  - Presently via OP (BNM-SYRTE): C/A data corrected for IGS precise ephemerides, clocks and ionosphere maps. RMS of individual measurements is 2 ns.
  - Potential problems (ns level):
    - Single-point access => not robust, not redundant
    - Possible time-varying offsets (iono maps)???
    - But no change planned in the very near future
- GLONASS time
  - Presently via VSL multi-channel dual-frequency receiver. RMS of individual measurements is about 30 ns.
- Possibly other GNSS time scales in the future

Access to GPS time with time receivers

- What realization do you access with GPS time receivers?
  - If one uses broadcast ephemerides and clocks => realization by GPS Control center
  - If one uses IGS ephemerides and clocks => realization by IGS
  - In CirT:
    - until February 2004: IGS realization of GPS time (no significant bias)
    - starting March 2004: New IGS time (significant bias to GPS time) added correction needed to recover GPS time (will be accounted for)

- What is needed?

Studies on the use of "GPS time"

- Possible options:
  - Use multiple access => pb of weighting and of compatibility between [UTC(k)-"GPSt"] - [UTC(l)-"GPSt"] and [UTC(k)-UTC(l)]
  - Take advantage of the very good short term stability of IGS time to change the time link computation method

    from Common View: [UTC(k)-UTC(l)]

    to using IGSt: $[UTC(k)-UTC(l)]_{IGS} = [UTC(k)-IGSt] - [UTC(l)-IGSt]$
    - Should improve the measurement uncertainty of time links.
    - [UTC-IGSt] directly obtained.
    - Pb of compatibility of $[UTC(k)-UTC(l)]_{IGS}$ with $[UTC(k)-UTC(l)]_{TW}$

      But this is a pending problem anyway!
- This is subject for future studies, not immediate actions