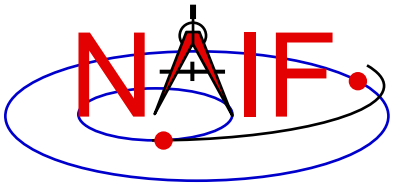
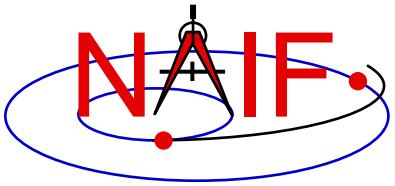


Navigation and Ancillary Information Facility

Time Conversion and Time Formats

June 2019



Time Systems and Kernels

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- Time inputs to and outputs from user's programs are usually strings representing epochs in these three time systems:
  - Ephemeris Time (*ET*, also referred to as Barycentric Dynamical Time, *TDB*)
  - Coordinated Universal Time (*UTC*). This is the default for calendar strings.
  - Spacecraft Clock (*SCLK*)
- Time stamps in kernel files, and time inputs to and outputs from SPICE routines reading kernel data and computing derived geometry, are double precision numbers representing epochs in these two time systems:
  - Numeric Ephemeris Time (TDB), expressed as ephemeris seconds past J2000
    - » J2000 = 2000 Jan 1 12:00:00 TDB
  - Encoded Spacecraft Clock, expressed as clock ticks since the clock start
- SPICE provides routines to convert between these string and numeric representations.
- A time string used as an argument in a SPICE API must be provided in quotes.
  - Fortran, Matlab and IDL: use single quotes
  - C: use double quotes

Converting Time Strings

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- **UTC, TDB, or TDT (TT) String to numeric Ephemeris Time**
  - **STR2ET (*string*, ET)**
    - » **Converts virtually any time string format known to the SPICE Time subsystem, excepting SCLK.**
    - » **Examples of acceptable string inputs:**

      '1996-12-18T12:28:28' **'1978/03/12 23:28:59.29'** **'Mar 2, 1993 11:18:17.287 p.m. PDT'**
      '1995-008T18:28:12' **'1993-321//12:28:28.287'**
      '2451515.2981 JD' **' jd 2451700.05 TDB'**
      '1988-08-13, 12:29:48 TDB' **'1992 June 13, 12:29:48 TDT'**

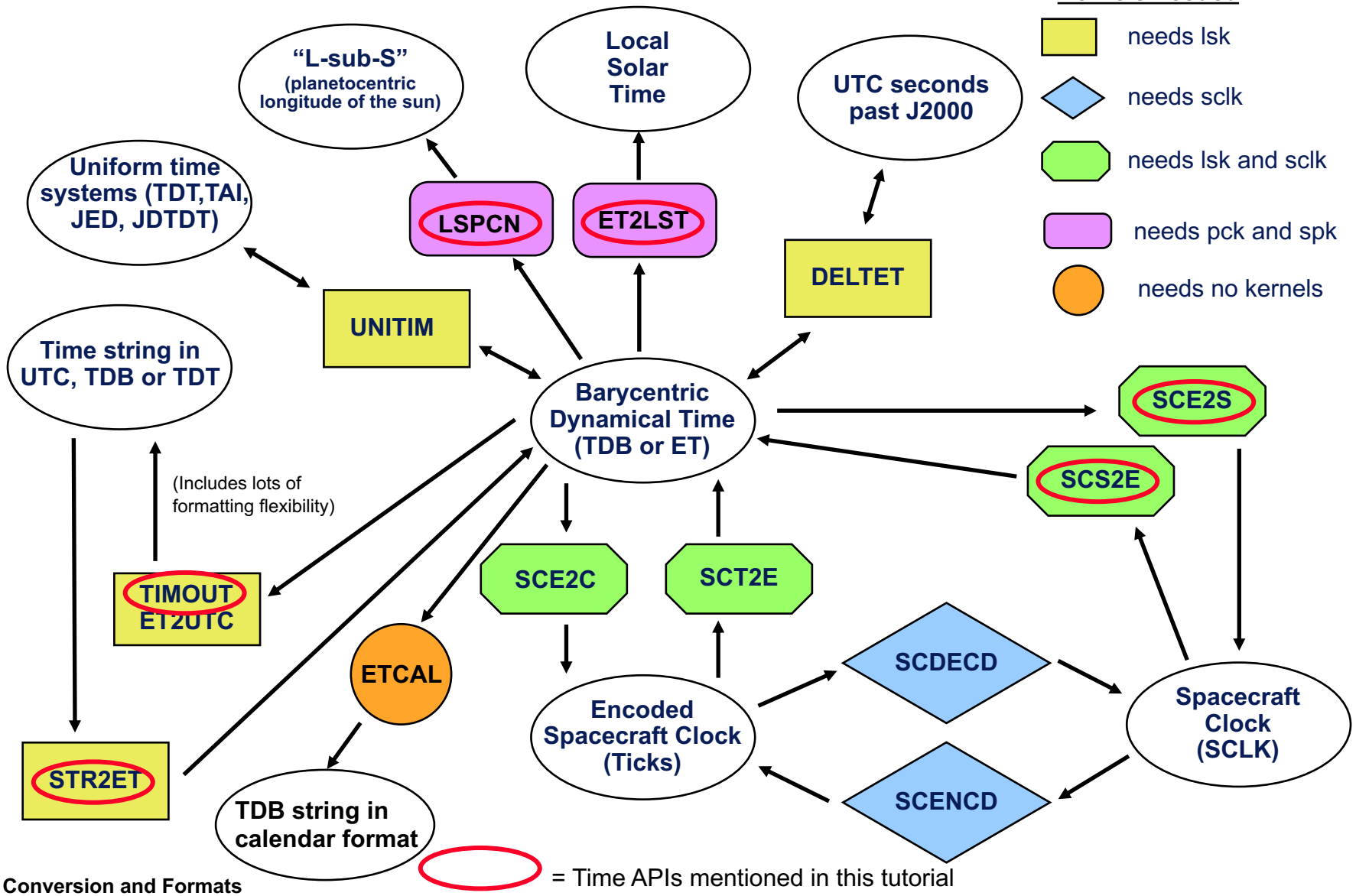
      These example inputs all use the single quote required by Fortran, IDL and Mice APIs. Use double quotes for C APIs.
    - » **Requires the LSK kernel**

- **Spacecraft Clock String to numeric Ephemeris Time**
  - **SCS2E (*scid*, *string*, ET)**
    - » **Converts SCLK strings consistent with SCLK parameters.**
    - » **Examples of acceptable clock string inputs:**
      - **'5/65439:18:513' (VGR1)**
      - **'946814430.172' (MRO)**
      - **'1/0344476949-27365' (MSL)**
    - » **Requires a SCLK kernel and the LSK kernel**

Converting Numeric Times

Navigation and Ancillary Information Facility

- **Numeric Ephemeris Time to a string, where the format is Calendar, DOY or Julian Date, and the time system is *UTC*, *TDB* or *TDT***
  - **TIMOUT (*et*, *fmtpic*, STRING)**
    - » ***fmtpic* is an output time string format specification, giving the user great flexibility in setting the appearance of the output time string and the time system used (*UTC*, *TDB*, *TDT*).**
      - **See the next slide for examples of format pictures to produce a variety of output time strings**
      - **See the TIMOUT header for complete format picture syntax**
      - **The module TPICTR may be useful in constructing a format picture specification from a sample time string**
    - » **Requires LSK Kernel**
- **Numeric Ephemeris Time to Spacecraft Clock String**
  - **SCE2S (*scid*, *et*, SCLKCH)**
    - » **Requires the LSK and a SCLK kernel**
    - » **Output SCLK string examples:**

```
1/05812:00:001       (Voyager 1 and 2)
1/1487147147.203     (Cassini, MRO)
1/0101519975.65186   (MEX, VEX, Rosetta)
```

Principal Time System Interfaces