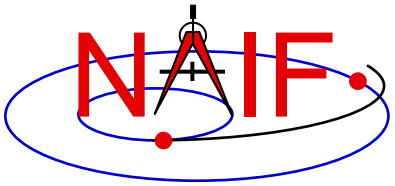

Porting Kernels

April 2023

Porting Issues - 1

Navigation and Ancillary Information Facility

- Data formats vary across platforms, so data files created on platform "X" may not be usable on platform "Y."
  - Binary formats: different platforms use different bit patterns to represent numbers (and possibly characters).
  - Text formats: different platforms use different mechanisms to represent "lines" in text files.
    - Usually a "line terminator character sequence" indicates end-of-line.
- We say two platforms have "compatible" binary or text formats if they use the same binary or text data representations.
- We say that a file is "native" if its format is the same as that of the computer you are using.

Porting Issues - 2

Navigation and Ancillary Information Facility

- Toolkit software can usually read kernels obtained from an incompatible platform
  - Binary SPK, CK, PCK and DSK kernels from one system can always be read on an incompatible system
  - Text kernels from one system can be read on an incompatible system only when using a C, IDL, MATLAB or JNI: not when using Fortran

- See later charts for compatibility matrix

Porting Issues - 3

Navigation and Ancillary Information Facility

- When conversion to native format is required to make the kernel usable (see a later chart), several options are available.
  - Use *bingo* for both binary and text kernels
    - Available only from the NAIF website; not provided in Toolkit packages
  - For text kernels, doing your file download using ftp in ASCII mode will perform the required format conversion on the fly
  - Web browsers often do text format conversion
    - However ASCII mode may not be available – sftp clients usually don't provide it. In such cases other tools such as freeware dos2unix and unix2dos, or bingo from the SPICE utilities page, must be used.
  - For binary kernels, the SPICE *toxfr* and *tobin* tools may be used to convert files to and from SPICE transfer format
    - This is an ASCII-based format that may be transferred in the same way as other ASCII files.

Compatible Environments for Text Kernels

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Since text kernels are only text files…

	Groupings of Text Compatible Environments	End of line indicator
1	PC using Windows or NT	<CR><LF>
2	Unix PC with LINUX Macintosh OSX (Motorola, Intel, or M1 chip)	<LF>

On a Unix/Linux/OSX box you can easily see what kind of line terminator is being used in a text file using the Unix "cat –et" command on your text file.

<CR> tokens will appear as "^M"
<LF> tokens will appear as "$"

Compatible Environments for Binary Kernels

Navigation and Ancillary Information Facility

	Groupings of Binary Compatible Environments	Binary Representation
1	PC/ Windows PC/Linux Mac (Intel and M1 chip)	IEEE - Little endian
2	Sun Old Mac Power PC (Motorola chip, discontinued after 2005)	IEEE - Big endian

Caution Using Email

- **NAIF recommends against the use of email to transfer kernels unless previous tests have already proven successful using the same conditions/computers intended for current use. Possible causes of problems are:**
  - **incompatible binary or text representations (as already discussed).**
  - **an attachment size limit somewhere in the e-mail chain.**
  - **the sender's or recipient's mail client modifies the kernel based on file name or presumed content.**

- **When you must email kernels, compress them either with zip or gzip, then send the compressed file as an email attachment.**

Binary Kernels - Caveats

- **If the kernel you are using is a non-native binary kernel you can *read* this file but you may not *write* data to this file.**
  - **You can read most non-native binary kernels using the automatic run-time conversion capability found in the APIs of modern Toolkits.**
    - » **Exception: non-native DAS-based files (ESQ) created before 2001 cannot be read. They must first be converted to native format.**
  - **You cannot write information into the comment area, or delete information from the comment area.**
  - **You cannot append additional data to the kernel.**

Binary Kernels
Allowed Operations

- You may “load” and read both non-native and native binary kernels in the same runtime instance

- You may merge similar native and non-native files– the resultant, merged file will be in native format.
  - SPKs: using SPKMERGE or DAFCAT
  - CKs: using DAFCAT
  - DSKs: using DLACAT

Text Kernels - Caveats

- **Cutting/pasting complete, or pieces of, data assignments or `\begindata` or `\begintext` markers into a text kernel can cause a problem**
  - **It may result in insertion of non-printing characters or incorrect end-of-line terminations**
  - **This is not a problem for comments, but it is probably best to treat all portions of a text kernel the same**
- **If creating a text kernel by editing an existing one:**
  - **first save a backup copy**
  - **be sure you are starting with a file in native format for the computer you are using: either Unix/Linux/Mac or Windows**
  - **be sure to insert a final end-of-line marker at the end of your last line of data or text**
    - » **Press “return”**