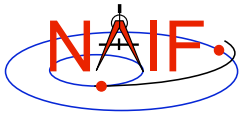


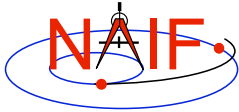
Porting Kernels

November 2005



Porting Issues - 1

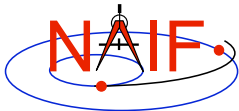
- **Data formats vary across platforms, so data files from one platform may not be usable on another.**
 - **Binary data formats:** different platforms use different bit patterns to represent numbers (and possibly characters).
 - **Text formats:** different platforms use different mechanisms to represent “lines” in text files.
 - Usually a “line terminator character sequence” indicates end-of-line.
- **We say two platforms have “compatible” binary (text) formats if they use the same binary data (text) representations.**
 - We also say that a file is “native” if its format is that used on a given host system.
- **The Toolkit has some ability to read data files from incompatible platforms:**
 - Usually binary SPK, CK, or PCK kernels from one system can be read on another, incompatible system (e.g. any pair of PC, Mac, Sun).
 - For CSPICE and Icy, text kernels from one system can be usually be read on another, incompatible system (e.g. any pair of PC, Mac, Sun).
 - Where the Toolkit supports the reading of incompatible files, binary transfer means (e.g. sftp) may be used.



Porting Issues - 2

Navigation and Ancillary Information Facility

- **The Toolkit cannot read certain data files from incompatible platforms:**
 - DAS-based files, such as ESQ E-kernels or plate model kernels
 - Transfer format kernels of any type
 - Older versions of the Toolkit have limited or no ability to read incompatible (non-native) kernels.
- **When the Toolkit cannot read incompatible kernels, conversions are required to make kernels usable:**
 - For text files, file transfer using ftp ASCII mode will perform required format conversion on the fly. Web browsers often can 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 dos2unix and unix2dos must be used.
 - For binary kernels, SPICE tools may be used to convert files to and from SPICE transfer format; this is an ASCII format that may be transferred in the same way as other ASCII files.

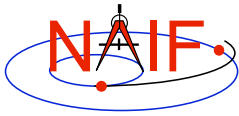


Compatible Environments for Text Kernels

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Since text kernels are only text files...

| | <u>Groupings of Text Compatible Environments</u> | <u>End of line indicator</u> |
|---|-------------------------------------------------------------------|----------------------------------------------|
| 1 | PC using Windows or NT | <CR><LF> |
| 2 | Unix PC with LINUX Alpha with Digital Unix Macintosh OSX | <LF> |
| 4 | Alpha with Open VMS (both D-float and G-float) VAX/VMS | Line length count is recorded in file system |



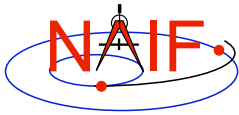
Compatible Environments for Binary Kernels

Navigation and Ancillary Information Facility

| | <u>Groupings of Binary Compatible Environments</u> | <u>Binary Representation</u> |
|---|----------------------------------------------------|-------------------------------|
| 1 | PC/ Windows PC/Linux DEC Unix | IEEE - Little endian |
| 2 | Sun HP Mac | IEEE - Big endian |
| 3 | Alpha/Open VMS VAX/VMS | DEC G-float or DEC D-float |

Porting Kernels

5



Porting Summary

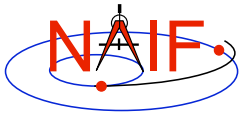
Navigation and Ancillary Information Facility

| | Compatible Environments | Incompatible Environments (not including VMS as one of the environments) | | | VAX and Alpha using Open VMS |
|---------------------------|----------------------------------------|-------------------------------------------------------------------------------|-------------------------------------------------------------------------------|-------------------------------------------------------------------------------|-------------------------------------------------------------------------------|
| | All Toolkit Versions | Toolkit Version N0051 or Earlier | Toolkit Version N0052* or Later | CSPICE and Icy Toolkits Version N0060* or Later | All Toolkit Versions |
| Text Kernels | Use ftp in either binary or ASCII mode | Use ftp in ASCII mode | Use ftp in ASCII mode | Use ftp in ASCII or binary mode. | Use ftp in ASCII mode |
| Binary Kernels Except ESQ | Use ftp in binary mode | 1) Use toxfr 2) ftp the transfer format file in ASCII mode 3) Use tobin | Use ftp in binary mode or Use the 3 steps on the left | Use ftp in binary mode or Use the 3 steps on the left | 1) Use toxfr 2) ftp the transfer format file in ASCII mode 3) Use tobin |
| EK/ESQ | Use ftp in binary mode | 1) Use toxfr 2) ftp the transfer format file in ASCII mode 3) Use tobin | 1) Use toxfr 2) ftp the transfer format file in ASCII mode 3) Use tobin | 1) Use toxfr 2) ftp the transfer format file in ASCII mode 3) Use tobin | 1) Use toxfr 2) ftp the transfer format file in ASCII mode 3) Use tobin |

*SPICE Toolkit Version N0052 was released February, 2002
SPICE Toolkit Version N0060 was released January, 2006

Porting Kernels

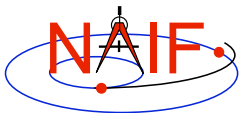
6



Language Compatibility

Navigation and Ancillary Information Facility

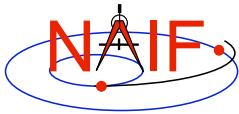
- The C, FORTRAN, and IDL SPICE Toolkits possess the same kernel read and write attributes.
 - This applies whether using a pre-Version N0052 or a post-Version N0052 Toolkit.
 - This applies whether using “transfer” format to port a binary kernel, or the new N0052 kernel reader modules to do on-the-fly translation of data in a binary kernel.



Porting Rules - 1

Navigation and Ancillary Information Facility

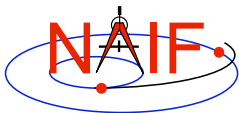
- **Never** transfer any type of **binary** kernel using ftp's ASCII mode.
 - The line terminator conversion intended for pure text files will corrupt the binary data.
- You may safely use the binary mode of ftp when moving binary or text kernels between **compatible** computing environments.
 - Use an ftp client or use an Internet browser with ftp://.....
 - Can also use AFS, NFS or unix cp, scp, or sftp



Porting Rules - 2

Navigation and Ancillary Information Facility

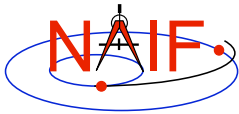
- **Starting with the N0060 release, the CSPICE and Icy Toolkits can read non-native text kernels.**
 - Users may move text kernels between incompatible environments using binary means (e.g. ftp, sftp, cp, scp, afs) when using CSPICE or Icy on the destination platform.
- **Caution: SPICE “transfer format” kernels can not be ported using binary means.**



Porting Rules - 3

Navigation and Ancillary Information Facility

- **Porting text kernels between incompatible environments when using FORTRAN, and porting “transfer format” files no matter what platforms are being used, requires care. sftp and scp perform pure binary data transfers.**
 - **Simple commands to convert line terminator**
 - » **Use Unix commands:**
 - » dos2unix, unix2dos
 - » **Or use Perl:**
 - Dos->Unix
`perl -pi -e 's/\015\012/\012/' file_name`
 - Unix->Dos
`perl -pi -e 's/\012/\015\012/' file_name`



Porting Rules - 4

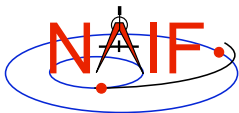
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- **NAIF recommends against the use of email to transfer kernels...**

...unless tests prove successful using the same conditions/computers intended for current use.

Possible problem causes:

- 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 either with zip, or gzip (or stuffit) to the file then send the compressed file as an email attachment.

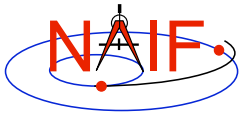


Porting Binary Kernels - Caveats (1)

Navigation and Ancillary Information Facility

Using version N0052 Toolkit or later

- This process is really not “porting” the file; rather it is run-time interpretation of non-native binary files.
- 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 not use the SPICE Toolkit's “commnt” or “spacit” programs, or any other means, to write information into the comment area, or to delete information from the comment area.
 - You cannot append additional data to the kernel.
- Run-time conversion does not work for E-kernel (ESQ) files.
 - More generally, it does not yet work for any file built upon the SPICE “DAS” architecture.
- This process will not work when a VAX is the source or destination machine
 - No plans to add this capability.

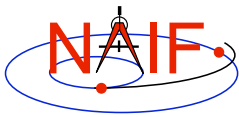


Porting Binary Kernels - Allowed Operations (1)

Navigation and Ancillary Information Facility

Using version N0052 Toolkit or later

- You may “load” and read both non-native and native binary kernels in the same runtime instance
- You may merge any combination of native and non-native SPK files
 - The resultant, merged SPK file will be in native format

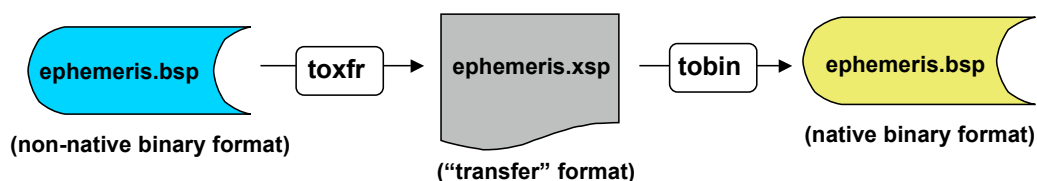


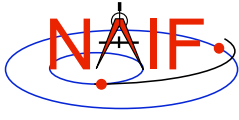
Porting Binary Kernels - Allowed Operations (2)

Navigation and Ancillary Information Facility

Using version N0052 Toolkit or later

- You can convert a non-native binary file to native binary format by going through the binary-to-transfer-to-binary conversion process using NAIF Toolkit utilities “toxfr” and “tobin”
 - Converting to native binary format will speed up read access
 - This simple, two-step process takes place on one machine
 - » See flow chart below:





Future Plans for Porting Kernels

Navigation and Ancillary Information Facility

- **NAIF does not anticipate further revising FORTRAN (SPICELIB) text kernel readers to process non-native (incompatible) text kernels.**
 - As of Toolkit version N0057, the `FURNISH` loader checks the line terminator, signaling an error on non-native text kernels.
- **NAIF does anticipate extending the ability to use non-native binary files to EK (ESQ) files.**
 - More generally, NAIF will extend non-native read to any SPICE file based on the “DAS” architecture.
- **NAIF does not plan to extend the ability to use non-native binary files to any situation involving any VAX computer or a DEC Alpha computer using VMS.**
 - Users must continue to use the SPICE “transfer format” process when using these environments.