Introduction to FRE: The Flexible Modeling System Runtime Environment

Developed at GFDL, 2002-2010, by:

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Introduction to FRE

- The FMS Runtime Environment (FRE) is a toolset for managing experiments from start to finish
  - acquire source code, compile (*fremake*)
  - launch jobs to run models (*frerun*)
  - postprocessing the output (*frepp*)

FRE Consists of:

- XML Model Description File
  - *contains a complete description of one or more experiments*
- Command line utilities read XML file
- CSH script templates
- Standards and conventions for file names and locations

FRE Utilities

- **fresetup**: install FRE into your local directory
- **fremake**: check out code, create/submit compile scripts
- **frerun**: create and submit run scripts
- **frepp**: create and submit postprocessing scripts
- **frestatus**: show status of batch compiles and runs
- **frecheck**: compare regression test runs
- **frepriority**: change batch queue information
- **frelist**: list info about experiments in an xml file
- **freppcheck**: report missing postprocessing files
- **refrepp**: submit jobs to generate missing pp files
- **frescrub**: delete duplicate postprocessing files
- **freconvert**: convert XML to a newer version
- **fredb** and **fredb-pp**: interact with Curator Database

Compiling and Running

fremake -x CM2.1U.xml CM2.1U_Control-1990_E1.M_3A

```
TO SUBMIT:  qsub /home/$USER/testing_fre/CM2.1U_Control-1990_E1.M_3A/exec/
compile_CM2.1U_Control-1990_E1.M_3A.csh
```

qsub compile_CM2.1U_Control-1990_E1.M_3A.csh

```
Your job 2721239 ("compile_CM2.1U_Control-1990_E1.M_3A.csh") has been
submitted
```

qstat -u $USER

```
JOBID   USER  PROJ  JOBNAME                          PE CPUS  CPUMIN  MIN  HOST STATE
2721239 arl   -     compile_CM2.1U_Control-1990_E1  ic.a    8 45/   0    2  ic10     r
```

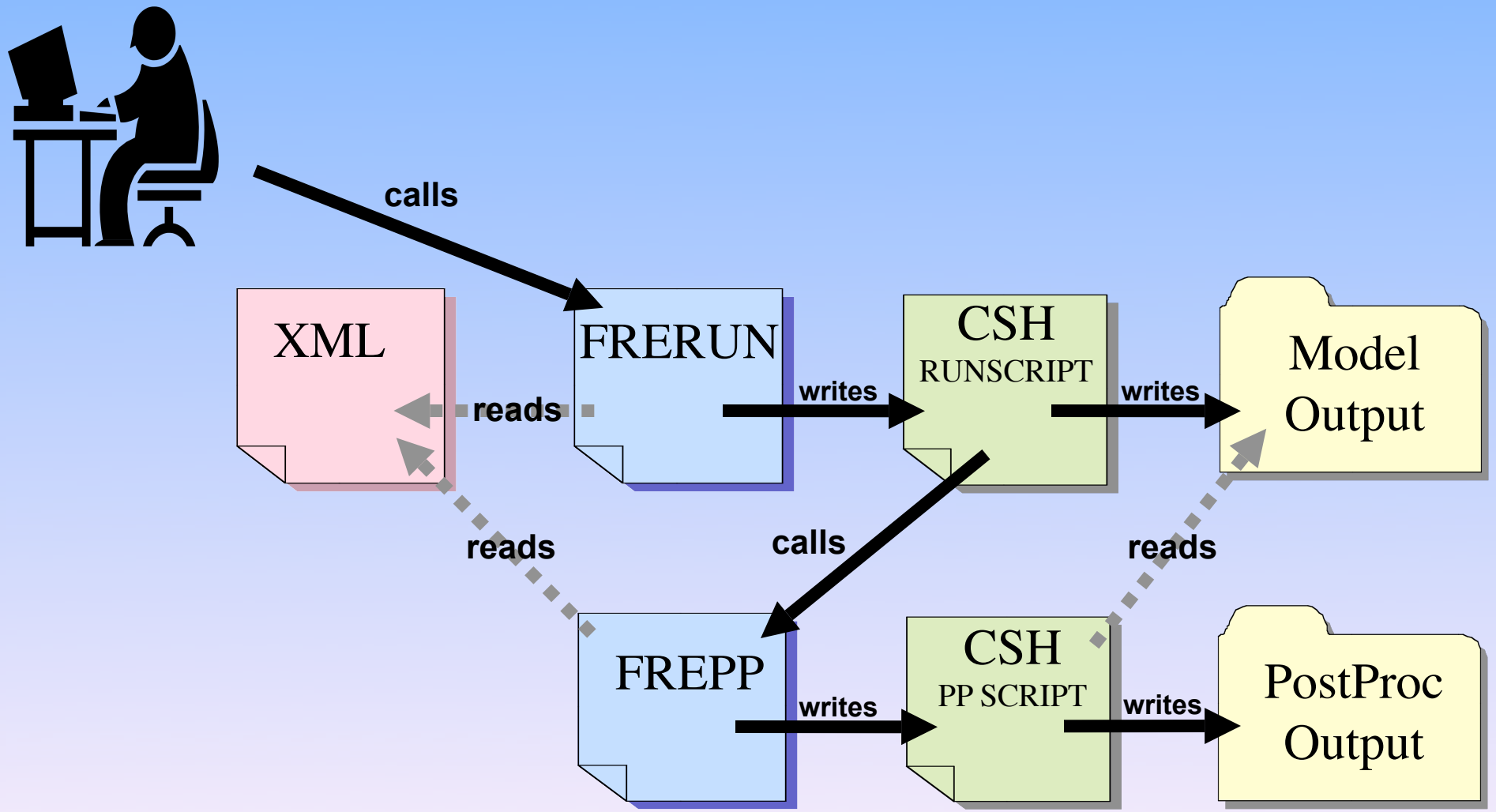
frestatus -x CM2.1U.xml CM2.1U_Control-1990_E1.M_3A

```
NOTE: make succeeded for CM2.1U_Control-1990_E1.M_3A
```

frerun -x CM2.1U.xml CM2.1U_Control-1990_E1.M_3A

```
TO SUBMIT:  qsub /home/arl/testing_fre/CM2.1U_Control-1990_E1.M_3A/scripts/
run/CM2.1U_Control-1990_E1.M_3A
```

The Mechanics of FRE



Archived Output

```
/archive/$USER/fre/CM2.1U_Control-1990_E1.M_3A
|-- ascii
|-- history
|-- restart
|-- analysis
`-- pp
    |-- atmos
    |    |-- ts
    |    |    `-- monthly
    |    |         `-- 5yr
    |    |              |-- atmos.000101-000512.mon.nc.cpio
    |    |              `-- atmos.000601-001012.mon.nc.cpio
    |    `-- av
    |         `-- monthly_5yr
    |              |-- atmos.0001-0005.01.nc
    |              |-- atmos.0001-0005.02.nc
    …              …
```

```
<directory>
  <archive>
    /archive/$USER/fre/$(name)
  </archive>
</directory>
```

Platforms and Sites

- Use "hpcs" or "doe" as a site prefix in the platform name
  - "hpcs.hpcs" or "hpcs.ifort10" or "doe.pathscale"
- Default site at GFDL is “hpcs”
  - <platform name=”hpcs”> is equivalent to <platform name=”hpcs.hpcs”> at GFDL
- Default site at DOE is “doe”
- Please don't use other dots in your platform names; FRE will interpret as site prefix

Placeholder XML Variables

```
$(rootDir)        - value of <directory type="root">
$(root)           - same, can be used without parentheses
$(siteDir)        - directory with site-dependent configuration files
$(suite)          - name of your XML file without path and extension
$(platform)       - value of --platform (default is "hpcs.hpcs" @GFDL)
$(target)         - value of --target (default is "defaultTarget")
$(name)           - experiment name, can be used without parentheses
$(srcDir)         - value of <directory type="src">
$(execDir)        - value of <directory type="exec">
$(scriptsDir)     - value of <directory type="scripts">
$(stdoutDir)      - value of <directory type="stdout">
$(workDir)        - value of <directory type="work">
$(archiveDir)     - value of <directory type="archive">
$(postProcessDir) - value of <directory type="postProcess">
$(analysisDir)    - value of <directory type="analysis">
```

- parentheses required, except cases of backwards compatibility
- order of directory specification enforced!

Placeholder XML Variables

- Define your own with properties:

```
<property name="foo" value="bar"/>

   ... $(foo) ...
```

- Global properties:
  - immediate children of <experimentSuite>
- Platform-dependent properties
  - immediate children of <platform>
- **Please use <property> rather than XML entities when possible**

Environment Variables

- Four will be expanded throughout the xml

```
$HOME
$USER
$FREROOT
$ARCHIVE
```

Directory Customization

```
<setup>
 <platform name="hpcs">
  <directory>
   <root> a reference location </root>
   <src> for FMS source code </src>
   <exec> for object files and executables </exec>
   <scripts> for run and pp scripts </scripts>
   <stdout> for run and pp stdout </stdout>
   <work> a scratch dir where executable is run </work>
   <archive> for model output data </archive>
   <postProcess> for postprocessing output </postProcess>
   <analysis> for analysis figures </analysis>
  </directory>
  ...
```

Directory Defaults

```
root: $FREROOT/xml
src: $(rootDir)/$(name)/src
exec: $(rootDir)/$(name)/$(platform)-$(target)/exec
scripts: $(rootDir)/$(name)/$(platform)-$(target)/scripts
stdout: $(rootDir)/$(name)/$(platform)-$(target)/stdout
work: $TMPDIR/$(name)/$(platform)-$(target)
archive: /archive/$USER/$(name)
postProcess: /archive/$USER/$(name)/pp
analysis: /net2/$USER/analysis/$(name)
```

- frelist can show the directories for an expt

```
frelist -dir -x xmlfile
frelist -dir -x xmlfile expt
```

New mkmf templates

- one template per platform which takes the following options:

REPRO=true

  - if the 'xgrid' namelist contains "make_exchange_reproduce =.true." (will use fltconsistency)

DEBUG=true

  - if the 'target' option contains the "debug" substring

NETCDF=4

  - if the <platform/csh> contains "module load netcdf-4.0.1" or "module load fms.local.12" (otherwise it will default to 3)

- backwards compatible
- if no <mkmfTemplate> tags, FRE will use the default template in your FRE installation
  - eg. $(site).$(platform).mk == hpcs.hpcs.mk

More FRE Information

- http://www.gfdl.noaa.gov/fms
- Contacts
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