

Building GSI, FV3, WRF etc. via Docker

The NWP models have a fairly complex dependent application stack. To use *GSI*, a massively parallel computational data assimilation code, as an example, we have a large dependency on a message passing interface (MPI) implementation (e.g. [OpenMPI](#)), and [NetCDF](#). NetCDF has a dependency on HDF5, HDF5 on *zlib*, etc. All of these need a C/C++/fortran compiler for building. Figuring out and understanding these dependencies and learning to debug build issues can take a really long time for a scientist to master.

Docker allows for the ability to run applications in prebuilt containers on any Linux machine with Docker installed (or even Mac OS X and Windows via [Boot 2Docker](#)).



Purpose

This is for code development purposes only , not for production run.

• Install Docker on your computer

please refer to <https://www.docker.com/community-edition> for Docker installation on Linux, Mac and Windows.



Docker Installation

Docker works perfectly on Linux and Mac, I have tried Docker on Windows, but still have some issues.

Check if the docker is installed

check docker installation

```
[xinzhang@mdf-rtr-9 ~]$ docker version
Client:
 Version:      17.03.1-ce
 API version:  1.27
 Go version:   go1.7.5
 Git commit:   c6d412e
 Built:        Mon Mar 27 17:05:44 2017
 OS/Arch:      linux/amd64

Server:
 Version:      17.03.1-ce
 API version:  1.27 (minimum version 1.12)
 Go version:   go1.7.5
 Git commit:   c6d412e
 Built:        Mon Mar 27 17:05:44 2017
 OS/Arch:      linux/amd64
 Experimental: false
```

list all images

```
[xinzhang@mdf-rtr-9 ~]$ docker images
```

• Pull Docker images from <https://hub.docker.com/>

I already built three Docker images with gnu compiler v5.4, v6.2 and v7.1 respectively, which include most necessary libraries and tools (Jasper, JPEG, PNG, ZLIB SZIP, NetCDF, HDF5, PNETCDF, UDUNITS2, XERCES, NCO, CDO , GRIB-API, ESMF, MPI) to build NWP models and softwares.

To pull/checkout the default docker image (gnu compiler v5.4) :

pull the default docker image

```
[xinzhang@mdf-rtr-9 ~]$ docker pull xinzhang8noaa/common_libs
Using default tag: latest
latest: Pulling from xinzhang8noaa/common_libs
bd97b43c27e3: Already exists
6960dc1aba18: Already exists
2b61829b0db5: Already exists
1f88dc826b14: Already exists
73b3859b1e43: Already exists
c294df930c56: Pull complete
c975eeee8eb6: Pull complete
1395f791a807: Pull complete
a73c66160c97: Pull complete
4abaf3b2d76e: Pull complete
Digest: sha256:704838ae42fb1eb852f25fd43db2dd550dd06f186ceb7a4113028a373bc2bdaf
Status: Downloaded newer image for xinzhang8noaa/common_libs:latest

[xinzhang@mdf-rtr-9 ~]$ docker images
```

REPOSITORY	TAG	IMAGE ID	CREATED	SIZE
xinzhang8noaa/common_libs	latest	6bf0a048145e	23 hours ago	766 MB

To pull/checkout the docker images with gnu compiler v6.2 and v7.1

pull docker images gnu6.2 or gnu7.1

```
[xinzhang@mdf-rtr-9 ~]$ docker pull xinzhang8noaa/common_libs:gnu6.2
gnu6.2: Pulling from xinzhang8noaa/common_libs
bd97b43c27e3: Already exists
6960dc1aba18: Already exists
2b61829b0db5: Already exists
1f88dc826b14: Already exists
73b3859b1e43: Already exists
b75c3b94a1cf: Pull complete
141017c22703: Pull complete
d44b3ff99d83: Pull complete
a2c8fc9c7788: Pull complete
754b053765e8: Pull complete
Digest: sha256:9ee55a00b965a1acalb99d64ec5f5fc54c9a6e914e9bbd61c1173dbad0be93d5
Status: Downloaded newer image for xinzhang8noaa/common_libs:gnu6.2

[xinzhang@mdf-rtr-9 ~]$ docker pull xinzhang8noaa/common_libs:gnu7.1
gnu7.1: Pulling from xinzhang8noaa/common_libs
bd97b43c27e3: Already exists
6960dc1aba18: Already exists
2b61829b0db5: Already exists
1f88dc826b14: Already exists
73b3859b1e43: Already exists
55d564d09a2f: Pull complete
89ed4fa37517: Pull complete
11e7d0a132fd: Pull complete
0a489fc7cafb: Pull complete
ba4c1b1b5d62: Pull complete
Digest: sha256:e272f1aa43fb284e29e1ebdf0dd382b3764c8cbfecc11939e4bf7976df0c9c67
Status: Downloaded newer image for xinzhang8noaa/common_libs:gnu7.1

[xinzhang@mdf-rtr-9 ~]$ docker images
```

REPOSITORY	TAG	IMAGE ID	CREATED	SIZE
xinzhang8noaa/common_libs	latest	6bf0a048145e	24 hours ago	766 MB
xinzhang8noaa/common_libs	gnu6.2	741d56075f12	2 days ago	2.39 GB
xinzhang8noaa/common_libs	gnu7.1	94b51b858306	2 days ago	1.94 GB

• Checkout the GSI code from Bitbucket

Please follow the below steps to check out the GSI branch for gnu compiler

check out GSI gnu branch

```
[xinzhang@mdf-rtr-9 tmp]$ git clone git@bitbucket.org:jcsda/gsi.git
Cloning into 'gsi'...
remote: Counting objects: 43561, done.
remote: Compressing objects: 100% (15761/15761), done.
remote: Total 43561 (delta 27452), reused 43216 (delta 27145)
Receiving objects: 100% (43561/43561), 935.00 MiB | 11.42 MiB/s, done.
Resolving deltas: 100% (27452/27452), done.

[xinzhang@mdf-rtr-9 tmp]$ cd gsi/

[xinzhang@mdf-rtr-9 gsi]$ git submodule init
Submodule 'fix' (git@bitbucket.org:jcsda/fix) registered for path 'fix'
Submodule 'libsrc' (git@bitbucket.org:jcsda/external-libs) registered for path 'libsrc'

[xinzhang@mdf-rtr-9 gsi]$ git submodule update
Cloning into 'fix'...
remote: Counting objects: 332, done.
remote: Compressing objects: 100% (235/235), done.
remote: Total 332 (delta 102), reused 320 (delta 96)
Receiving objects: 100% (332/332), 961.58 MiB | 20.47 MiB/s, done.
Resolving deltas: 100% (102/102), done.
Submodule path 'fix': checked out 'd13e5a23dde538ceefedc39746b029878ee6ff60'
Cloning into 'libsrc'...
remote: Counting objects: 892, done.
remote: Compressing objects: 100% (626/626), done.
remote: Total 892 (delta 260), reused 892 (delta 260)
Receiving objects: 100% (892/892), 5.54 MiB | 0 bytes/s, done.
Resolving deltas: 100% (260/260), done.
Submodule path 'libsrc': checked out '8fa69e1fd011b658de6cd2e9f08cflad77566f4f'

[xinzhang@mdf-rtr-9 gsi]$ git fetch && git checkout gnu_pgi_port
Branch gnu_pgi_port set up to track remote branch gnu_pgi_port from origin.
Switched to a new branch 'gnu_pgi_port'
```

• Building and running GSI in Docker image

Suppose you have a GSI directory, which includes the GSI codes, we are going to start the docker and mount the GSI directory into the container.

Use docker images with gnu compiler v6.2 as example:

run docker

```
[xinzhang@mdf-rtr-9 gsi]$ pwd
/home/xinzhang/jedi/gsi

[xinzhang@mdf-rtr-9 tmp]$ id
uid=1000(xinzhang) gid=1001(xinzhang) groups=1001(xinzhang),1000(docker) context=unconfined_u:unconfined_r:unconfined_t:s0-s0:c0.c1023

[xinzhang@mdf-rtr-9 gsi]$ docker run -it --rm --name GSI --user 1000:1001 -v /home/xinzhang/jedi/gsi:/gsi -w /gsi xinzhang8noaa/common_libs:gnu6.2
groups: cannot find name for group ID 1001
I have no name!@27fe216a4aed:/gsi$ ls -la
total 84
drwxrwxr-x. 13 1000 1001 243 Jun 19 17:16 .
drwxr-xr-x. 1 root root 57 Jun 19 17:33 ..
drwxrwxr-x. 9 1000 1001 196 Jun 19 17:16 .git
-rw-rw-r--. 1 1000 1001 104 Jun 19 17:12 .gitmodules
-rw-rw-r--. 1 1000 1001 7566 Jun 19 17:12 CMakeLists.txt
-rw-rw-r--. 1 1000 1001 7124 Jun 19 17:12 README.cmake
-rw-rw-r--. 1 1000 1001 1470 Jun 19 17:16 bitbucket-pipelines.yml
drwxrwxr-x. 3 1000 1001 21 Jun 19 17:12 cmake
```

```
drwxrwxr-x. 12 1000 1001 167 Jun 19 17:12 core-libs
drwxrwxr-x. 4 1000 1001 51 Jun 19 17:12 doc
drwxrwxr-x. 4 1000 1001 12288 Jun 19 17:15 fix
drwxrwxr-x. 3 1000 1001 17 Jun 19 17:12 lib
drwxrwxr-x. 11 1000 1001 160 Jun 19 17:15 libsrc
drwxrwxr-x. 3 1000 1001 4096 Jun 19 17:12 scripts
drwxrwxr-x. 3 1000 1001 20480 Jun 19 17:16 src
drwxrwxr-x. 4 1000 1001 161 Jun 19 17:12 unit-tests
drwxrwxr-x. 24 1000 1001 4096 Jun 19 17:12 util
```

```
I have no name!@27fe216a4aed:/gsi$ mpifort -v
Using built-in specs.
COLLECT_GCC=/usr/bin/gfortran
COLLECT_LTO_WRAPPER=/usr/libexec/gcc/x86_64-pc-linux-gnu/6.2.0/lto-wrapper
Target: x86_64-pc-linux-gnu
Configured with: ./configure --prefix=/usr
Thread model: posix
gcc version 6.2.0 (GCC)
```

```
I have no name!@27fe216a4aed:/gsi$ mpifort -showme
gfortran -I/usr/local/include -pthread -I/usr/local/lib -Wl,-rpath -Wl,/usr/local/lib -Wl,--enable-new-dtags -L
/usr/local/lib -lmpi_usempif08 -lmpi_usempi_ignore_tkr -lmpi_mpifh -lmpi
```

```
I have no name!@27fe216a4aed:/gsi$ ls -al /usr/local/lib/
total 201932
drwxr-xr-x. 6 root root 8192 Jun 17 06:10 .
drwxr-xr-x. 12 root root 136 Jun 17 06:10 ..
drwxr-xr-x. 4 root root 40 Jun 17 06:04 cmake
-rw-r--r--. 1 root root 5371 Jun 17 06:10 esmf.mk
lrwxrwxrwx. 1 root root 12 Jun 17 06:01 libblas.so -> libblas.so.3
lrwxrwxrwx. 1 root root 16 Jun 17 06:01 libblas.so.3 -> libblas.so.3.7.0
-rw-r--r--. 1 root root 360392 Jun 17 05:59 libblas.so.3.7.0
-rw-r--r--. 1 root root 80456684 Jun 17 06:10 libesmf.a
-rwxr-xr-x. 1 root root 20399568 Jun 17 06:10 libesmf.so
-rwxr-xr-x. 1 root root 21956400 Jun 17 06:10 libesmf_fullylinked.so
-rw-r--r--. 1 root root 962740 Jun 17 06:10 libfreetype.a
-rw-r--r--. 1 root root 1773048 Jun 17 06:05 libgrib_api.so
-rw-r--r--. 1 root root 120328 Jun 17 06:05 libgrib_api_f77.so
-rw-r--r--. 1 root root 154424 Jun 17 06:05 libgrib_api_f90.so
-rw-r--r--. 1 root root 6896232 Jun 17 06:10 libhdf5.a
-rwxr-xr-x. 1 root root 956 Jun 17 06:03 libhdf5.la
-rw-r--r--. 1 root root 2837 Jun 17 06:03 libhdf5.settings
lrwxrwxrwx. 1 root root 17 Jun 17 06:03 libhdf5.so -> libhdf5.so.10.2.0
lrwxrwxrwx. 1 root root 17 Jun 17 06:03 libhdf5.so.10 -> libhdf5.so.10.2.0
-rwxr-xr-x. 1 root root 3314752 Jun 17 06:03 libhdf5.so.10.2.0
-rw-r--r--. 1 root root 891156 Jun 17 06:10 libhdf5_cpp.a
-rwxr-xr-x. 1 root root 1037 Jun 17 06:03 libhdf5_cpp.la
lrwxrwxrwx. 1 root root 21 Jun 17 06:03 libhdf5_cpp.so -> libhdf5_cpp.so.12.0.0
lrwxrwxrwx. 1 root root 21 Jun 17 06:03 libhdf5_cpp.so.12 -> libhdf5_cpp.so.12.0.0
-rwxr-xr-x. 1 root root 528248 Jun 17 06:03 libhdf5_cpp.so.12.0.0
-rw-r--r--. 1 root root 445112 Jun 17 06:10 libhdf5_fortran.a
-rwxr-xr-x. 1 root root 1133 Jun 17 06:03 libhdf5_fortran.la
lrwxrwxrwx. 1 root root 25 Jun 17 06:03 libhdf5_fortran.so -> libhdf5_fortran.so.10.0.3
lrwxrwxrwx. 1 root root 25 Jun 17 06:03 libhdf5_fortran.so.10 -> libhdf5_fortran.so.10.0.3
-rwxr-xr-x. 1 root root 367960 Jun 17 06:03 libhdf5_fortran.so.10.0.3
-rw-r--r--. 1 root root 211428 Jun 17 06:10 libhdf5_hl.a
-rwxr-xr-x. 1 root root 1003 Jun 17 06:03 libhdf5_hl.la
lrwxrwxrwx. 1 root root 20 Jun 17 06:03 libhdf5_hl.so -> libhdf5_hl.so.10.1.0
lrwxrwxrwx. 1 root root 20 Jun 17 06:03 libhdf5_hl.so.10 -> libhdf5_hl.so.10.1.0
-rwxr-xr-x. 1 root root 149408 Jun 17 06:03 libhdf5_hl.so.10.1.0
-rw-r--r--. 1 root root 16024 Jun 17 06:10 libhdf5_hl_cpp.a
-rwxr-xr-x. 1 root root 1117 Jun 17 06:03 libhdf5_hl_cpp.la
lrwxrwxrwx. 1 root root 24 Jun 17 06:03 libhdf5_hl_cpp.so -> libhdf5_hl_cpp.so.11.1.0
lrwxrwxrwx. 1 root root 24 Jun 17 06:03 libhdf5_hl_cpp.so.11 -> libhdf5_hl_cpp.so.11.1.0
-rwxr-xr-x. 1 root root 20736 Jun 17 06:03 libhdf5_hl_cpp.so.11.1.0
-rw-r--r--. 1 root root 127736 Jun 17 06:10 libhdf5hl_fortran.a
-rwxr-xr-x. 1 root root 1210 Jun 17 06:03 libhdf5hl_fortran.la
lrwxrwxrwx. 1 root root 27 Jun 17 06:03 libhdf5hl_fortran.so -> libhdf5hl_fortran.so.10.0.3
lrwxrwxrwx. 1 root root 27 Jun 17 06:03 libhdf5hl_fortran.so.10 -> libhdf5hl_fortran.so.10.0.3
-rwxr-xr-x. 1 root root 116080 Jun 17 06:03 libhdf5hl_fortran.so.10.0.3
```

-rw-r--r--.	1	root	root	641292	Jun	17	06:10	libjasper.a
-rwxr-xr-x.	1	root	root	961	Jun	17	05:59	libjasper.la
lrwxrwxrwx.	1	root	root	18	Jun	17	05:59	libjasper.so -> libjasper.so.1.0.0
lrwxrwxrwx.	1	root	root	18	Jun	17	05:59	libjasper.so.1 -> libjasper.so.1.0.0
-rwxr-xr-x.	1	root	root	483192	Jun	17	05:59	libjasper.so.1.0.0
-rw-r--r--.	1	root	root	431748	Jun	17	06:10	libjpeg.a
-rwxr-xr-x.	1	root	root	917	Jun	17	05:59	libjpeg.la
lrwxrwxrwx.	1	root	root	16	Jun	17	05:59	libjpeg.so -> libjpeg.so.9.2.0
lrwxrwxrwx.	1	root	root	16	Jun	17	05:59	libjpeg.so.9 -> libjpeg.so.9.2.0
-rwxr-xr-x.	1	root	root	355576	Jun	17	05:59	libjpeg.so.9.2.0
lrwxrwxrwx.	1	root	root	14	Jun	17	06:01	liblapack.so -> liblapack.so.3
lrwxrwxrwx.	1	root	root	18	Jun	17	06:01	liblapack.so.3 -> liblapack.so.3.7.0
-rw-r--r--.	1	root	root	6902440	Jun	17	06:00	liblapack.so.3.7.0
-rwxr-xr-x.	5	root	root	992	Jun	17	05:57	libmca_common_sm.la
lrwxrwxrwx.	1	root	root	27	Jun	17	05:57	libmca_common_sm.so -> libmca_common_sm.so.20.10.0
lrwxrwxrwx.	1	root	root	27	Jun	17	05:57	libmca_common_sm.so.20 -> libmca_common_sm.so.20.10.0
-rwxr-xr-x.	5	root	root	12920	Jun	17	05:57	libmca_common_sm.so.20.10.0
-rwxr-xr-x.	5	root	root	997	Jun	17	05:57	libmpi.la
lrwxrwxrwx.	1	root	root	17	Jun	17	05:57	libmpi.so -> libmpi.so.20.10.0
lrwxrwxrwx.	1	root	root	17	Jun	17	05:57	libmpi.so.20 -> libmpi.so.20.10.0
-rwxr-xr-x.	5	root	root	1193128	Jun	17	05:57	libmpi.so.20.10.0
-rwxr-xr-x.	5	root	root	1073	Jun	17	05:57	libmpi_cxx.la
lrwxrwxrwx.	1	root	root	21	Jun	17	05:57	libmpi_cxx.so -> libmpi_cxx.so.20.10.0
lrwxrwxrwx.	1	root	root	21	Jun	17	05:57	libmpi_cxx.so.20 -> libmpi_cxx.so.20.10.0
-rwxr-xr-x.	5	root	root	140560	Jun	17	05:57	libmpi_cxx.so.20.10.0
-rwxr-xr-x.	5	root	root	1157	Jun	17	05:57	libmpi_mpifh.la
lrwxrwxrwx.	1	root	root	23	Jun	17	05:57	libmpi_mpifh.so -> libmpi_mpifh.so.20.10.0
lrwxrwxrwx.	1	root	root	23	Jun	17	05:57	libmpi_mpifh.so.20 -> libmpi_mpifh.so.20.10.0
-rwxr-xr-x.	5	root	root	557160	Jun	17	05:57	libmpi_mpifh.so.20.10.0
-rwxr-xr-x.	5	root	root	1170	Jun	17	05:57	libmpi_usempi_ignore_tkr.la
lrwxrwxrwx.	1	root	root	35	Jun	17	05:57	libmpi_usempi_ignore_tkr.so -> libmpi_usempi_ignore_tkr.so.20.10.0
lrwxrwxrwx.	1	root	root	35	Jun	17	05:57	libmpi_usempi_ignore_tkr.so.20 -> libmpi_usempi_ignore_tkr.so.20.10.0
-rwxr-xr-x.	5	root	root	32600	Jun	17	05:57	libmpi_usempi_ignore_tkr.so.20.10.0
-rwxr-xr-x.	5	root	root	1208	Jun	17	05:57	libmpi_usempif08.la
lrwxrwxrwx.	1	root	root	27	Jun	17	05:57	libmpi_usempif08.so -> libmpi_usempif08.so.20.10.0
lrwxrwxrwx.	1	root	root	27	Jun	17	05:57	libmpi_usempif08.so.20 -> libmpi_usempif08.so.20.10.0
-rwxr-xr-x.	5	root	root	272192	Jun	17	05:57	libmpi_usempif08.so.20.10.0
-rw-r--r--.	1	root	root	771	Jun	17	06:03	libnetcdf.settings
lrwxrwxrwx.	1	root	root	15	Jun	17	06:04	libnetcdf.so -> libnetcdf.so.11
lrwxrwxrwx.	1	root	root	19	Jun	17	06:04	libnetcdf.so.11 -> libnetcdf.so.11.4.0
-rw-r--r--.	1	root	root	1611296	Jun	17	06:03	libnetcdf.so.11.4.0
-rw-r--r--.	1	root	root	936354	Jun	17	06:10	libnetcdf.a
-rwxr-xr-x.	1	root	root	971	Jun	17	06:04	libnetcdf.la
lrwxrwxrwx.	1	root	root	19	Jun	17	06:04	libnetcdf.so -> libnetcdf.so.6.1.1
lrwxrwxrwx.	1	root	root	19	Jun	17	06:04	libnetcdf.so.6 -> libnetcdf.so.6.1.1
-rwxr-xr-x.	1	root	root	771656	Jun	17	06:04	libnetcdf.so.6.1.1
-rwxr-xr-x.	5	root	root	968	Jun	17	05:57	libompitrace.la
lrwxrwxrwx.	1	root	root	23	Jun	17	05:57	libompitrace.so -> libompitrace.so.20.10.0
lrwxrwxrwx.	1	root	root	23	Jun	17	05:57	libompitrace.so.20 -> libompitrace.so.20.10.0
-rwxr-xr-x.	5	root	root	19240	Jun	17	05:57	libompitrace.so.20.10.0
-rwxr-xr-x.	5	root	root	967	Jun	17	05:57	libopen-pal.la
lrwxrwxrwx.	1	root	root	22	Jun	17	05:57	libopen-pal.so -> libopen-pal.so.20.10.0
lrwxrwxrwx.	1	root	root	22	Jun	17	05:57	libopen-pal.so.20 -> libopen-pal.so.20.10.0
-rwxr-xr-x.	5	root	root	1417392	Jun	17	05:57	libopen-pal.so.20.10.0
-rwxr-xr-x.	5	root	root	997	Jun	17	05:57	libopen-rte.la
lrwxrwxrwx.	1	root	root	22	Jun	17	05:57	libopen-rte.so -> libopen-rte.so.20.10.0
lrwxrwxrwx.	1	root	root	22	Jun	17	05:57	libopen-rte.so.20 -> libopen-rte.so.20.10.0
-rwxr-xr-x.	5	root	root	587992	Jun	17	05:57	libopen-rte.so.20.10.0
-rwxr-xr-x.	5	root	root	1040	Jun	17	05:57	liboshmem.la
lrwxrwxrwx.	1	root	root	20	Jun	17	05:57	liboshmem.so -> liboshmem.so.20.10.0
lrwxrwxrwx.	1	root	root	20	Jun	17	05:57	liboshmem.so.20 -> liboshmem.so.20.10.0
-rwxr-xr-x.	5	root	root	639184	Jun	17	05:57	liboshmem.so.20.10.0
-rw-r--r--.	1	root	root	11421980	Jun	17	06:10	libpnetcdf.a
-rw-r--r--.	1	root	root	11421980	Jun	17	05:59	libpnetcdf.so
drwxr-xr-x.	2	root	root	58	Jun	17	05:59	libpng
lrwxrwxrwx.	1	root	root	10	Jun	17	05:59	libpng.a -> libpng14.a
lrwxrwxrwx.	1	root	root	11	Jun	17	05:59	libpng.so -> libpng14.so
-rw-r--r--.	1	root	root	275508	Jun	17	06:10	libpng14.a
lrwxrwxrwx.	1	root	root	14	Jun	17	05:59	libpng14.so -> libpng14.so.14

```

lrwxrwxrwx. 1 root root      19 Jun 17 05:59 libpng14.so.14 -> libpng14.so.14.19.0
-rw-r--r--. 1 root root 213624 Jun 17 05:59 libpng14.so.14.19.0
-rw-r--r--. 1 root root   71082 Jun 17 06:10 libsz.a
-rw-r--r--. 1 root root   60776 Jun 17 05:59 libsz.so
-rw-r--r--. 1 root root   71082 Jun 17 06:10 libszip.a
lrwxrwxrwx. 1 root root      14 Jun 17 05:59 libszip.so -> libszip.so.2.1
-rw-r--r--. 1 root root   60776 Jun 17 05:59 libszip.so.2.1
-rw-r--r--. 1 root root  411744 Jun 17 06:00 libtmglib.so
-rw-r--r--. 1 root root  145944 Jun 17 05:59 libudunits2.so
-rwxr-xr-x. 1 root root  6551168 Jun 17 06:02 libxerces-c-3.1.so
-rw-r--r--. 1 root root 18924714 Jun 17 06:10 libxerces-c.a
-rwxr-xr-x. 1 root root    1040 Jun 17 06:02 libxerces-c.la
lrwxrwxrwx. 1 root root      18 Jun 17 06:02 libxerces-c.so -> libxerces-c-3.1.so
-rw-r--r--. 1 root root  145594 Jun 17 06:10 libz.a
lrwxrwxrwx. 1 root root       9 Jun 17 05:59 libz.so -> libz.so.1
lrwxrwxrwx. 1 root root      14 Jun 17 05:59 libz.so.1 -> libz.so.1.2.11
-rw-r--r--. 1 root root  118424 Jun 17 05:59 libz.so.1.2.11
-rwxr-xr-x. 5 root root   83524 Jun 17 05:57 mpi.mod
-rwxr-xr-x. 5 root root    247 Jun 17 05:57 mpi_ext.mod
-rwxr-xr-x. 5 root root  155091 Jun 17 05:57 mpi_f08.mod
-rwxr-xr-x. 5 root root   1617 Jun 17 05:57 mpi_f08_callbacks.mod
-rwxr-xr-x. 5 root root    259 Jun 17 05:57 mpi_f08_ext.mod
-rwxr-xr-x. 5 root root  50346 Jun 17 05:57 mpi_f08_interfaces.mod
-rwxr-xr-x. 5 root root   2012 Jun 17 05:57 mpi_f08_interfaces_callbacks.mod
-rwxr-xr-x. 5 root root   9690 Jun 17 05:57 mpi_f08_types.mod
drwxr-xr-x. 2 root root    8192 Jun 19 16:53 openmpi
drwxr-xr-x. 2 root root   4096 Jun 17 06:05 pkgconfig
-rwxr-xr-x. 5 root root  49396 Jun 17 05:57 pmpi_f08_interfaces.mod

```

```

I have no name!@27fe216a4aed:/gsi$ env |grep LD_LIBRARY_PATH
LD_LIBRARY_PATH=/opt/lib64:/usr/local/lib

```



docker run options

```

I have no name!@27fe216a4aed:/gsi$ docker run -it --rm --name GSI --user 1000:1001 -v /home/xinzhang/jedi
/gsi:/gsi -w /gsi xinzhang8noaa/common_libs:gnu6.2

```

```

groups: cannot find name for group ID 1001

```

```

I have no name!@27fe216a4aed:/gsi$

```

This command will start a isolated Linux session with all the libraries, tools needed to compile, run GSI. please ignore "groups: cannot find name for group ID 1001" and "I have no name!", as the container Linux does not have your account info.

- **-it : interactive session**
- **--rm: the container will be delete once you exit from the session**
- **--name GSI : session name**
- **-v /home/xinzhang/jedi/gsi:/gsi : mount the current directory as /gsi in container**
- **--user 1000:1001 : file access permission in container, it sets the same as the user's account on host machine. Using 'id' to check the uid and gid**
- **-w /gsi: starting directory**

We activate a docker image which include all libraries and tools needed for building GSI, WRF and FV3 etc. and the GSI directory is mounted as /gsi directory in the image.

Then, we can start to compile GSI.

compile GSI

```

I have no name!@7a59fc1a0829:/gsi$ mkdir build

```

```

I have no name!@7a59fc1a0829:/gsi$ cd build/

```

```

I have no name!@7a59fc1a0829:/gsi/build$ export FC=mpifort

```

```

I have no name!@7a59fc1a0829:/gsi/build$ cmake -DBUILD_CORELIBS=ON -DUSE_WRF=OFF -DBUILD_GLOBAL=ON ..

```

```

-- The C compiler identification is GNU 6.2.0
-- The CXX compiler identification is GNU 6.2.0
-- Check for working C compiler: /usr/bin/cc
-- Check for working C compiler: /usr/bin/cc -- works
-- Detecting C compiler ABI info
-- Detecting C compiler ABI info - done
-- Detecting C compile features
-- Detecting C compile features - done
-- Check for working CXX compiler: /usr/bin/c++
-- Check for working CXX compiler: /usr/bin/c++ -- works
-- Detecting CXX compiler ABI info
-- Detecting CXX compiler ABI info - done
-- Detecting CXX compile features
-- Detecting CXX compile features - done
-- The Fortran compiler identification is GNU 6.2.0
-- Check for working Fortran compiler: /usr/bin/gfortran
-- Check for working Fortran compiler: /usr/bin/gfortran -- works
-- Detecting Fortran compiler ABI info
-- Detecting Fortran compiler ABI info - done
-- Checking whether /usr/bin/gfortran supports Fortran 90
-- Checking whether /usr/bin/gfortran supports Fortran 90 -- yes
Setting paths for Generic System
/gsi
Setting GNU flags
Setting GNU Compiler Flags
-- Found MPI_C: /usr/local/lib/libmpi.so
-- Found MPI_CXX: /usr/local/lib/libmpi_cxx.so;/usr/local/lib/libmpi.so
-- Found MPI_Fortran: /usr/local/lib/libmpi_usempif08.so;/usr/local/lib/libmpi_usempi_ignore_tkr.so;/usr/local/lib/libmpi_mpifh.so;/usr/local/lib/libmpi.so
-- Found NetCDF: /usr/local/lib/libnetcdf.so;/usr/local/lib/libnetcdf.so
-- Found HDF5: /usr/local/lib/libhdf5.so;/usr/local/lib/libsz.so;/usr/lib/x86_64-linux-gnu/libdl.so;/usr/lib/x86_64-linux-gnu/libm.so;/usr/local/lib/libhdf5_hl.so;/usr/local/lib/libhdf5.so;/usr/local/lib/libsz.so;/usr/local/lib/libz.so;/usr/lib/x86_64-linux-gnu/libdl.so;/usr/lib/x86_64-linux-gnu/libm.so;/usr/local/lib/libhdf5hl_fortran.so;/usr/local/lib/libhdf5_hl.so;/usr/local/lib/libhdf5_fortran.so;/usr/local/lib/libhdf5.so;/usr/local/lib/libsz.so;/usr/local/lib/libz.so;/usr/lib/x86_64-linux-gnu/libdl.so;/usr/lib/x86_64-linux-gnu/libm.so (found version "1.8.17")
-- Found CURL: /usr/lib/x86_64-linux-gnu/libcurl.so (found version "7.47.0")
trying to find lapack
-- Looking for Fortran sgemm
-- Looking for Fortran sgemm - found
-- Looking for pthread.h
-- Looking for pthread.h - found
-- Looking for pthread_create
-- Looking for pthread_create - not found
-- Looking for pthread_create in pthreads
-- Looking for pthread_create in pthreads - not found
-- Looking for pthread_create in pthread
-- Looking for pthread_create in pthread - found
-- Found Threads: TRUE
-- A library with BLAS API found.
-- Looking for Fortran cheev
-- Looking for Fortran cheev - found
-- A library with LAPACK API found.
setting values for corelibs
in core-libs
in enkf
-- A library with BLAS API found.
-- A library with LAPACK API found.
-- Configuring done
-- Generating done
-- Build files have been written to: /gsi/build

```

```

I have no name!@7a59fc1a0829:/gsi/build$ nproc
8

```

```

I have no name!@7a59fc1a0829:/gsi/build$ make -j4
Scanning dependencies of target bufrlib_prm
Scanning dependencies of target bacio_v2.0.1
Scanning dependencies of target copy

```

```
[ 0%] Generating ../../include/bufrlib.prm
Scanning dependencies of target crtm_v2.2.3
[ 0%] Built target copy
[ 0%] Building Fortran object core-libs/bacio/CMakeFiles/bacio_v2.0.1.dir/_/_/libsrc/bacio/baciof.f.o
[ 0%] Building Fortran object core-libs/bacio/CMakeFiles/bacio_v2.0.1.dir/_/_/libsrc/bacio/bafrio.f.o
[ 0%] Built target bufrlib_prm
[ 0%] Building Fortran object core-libs/bacio/CMake.....
.....
.....
[100%] Linking Fortran executable ../../bin/enkf_gfs.x
[100%] Built target enkf_gfs.x

I have no name!@7a59fcla0829:/gsi/build$ ls -al bin/gsi_global.x
-rwxr-xr-x. 1 1000 1001 38298632 Jun 19 18:03 bin/gsi_global.x
```

If you have another directory in you host machine, which includes a GSI test case, for example : `/home/xinzhang/jedi/gsitest`, you can mount the test case directory as well:

```
docker run -it --rm --name GSI --user 1000:1001 -v /home/xinzhang/jedi/gsi:/gsi -v /home/xinzhang/jedi/gsitest:/gsitest -w /gsi xinzhang8noaa/common libs:gnu6.2
```

Related articles

- Build JEDI environment with Docker
- Building Docker image of GoCD-agent for JEDI
- Building GSI, FV3, WRF etc. via Docker
- Docker development environment for GSI and FV3