CESM Tutorial

NCAR Climate and Global Dynamics Laboratory

CESM 2.1.1

CESM1.2.x and previous (see earlier tutorials)

NCAR is sponsored by the National Science Foundation

Outline

- **The CESM webpage**

- **Creating & Running a Case**

- **Getting More Help**

CESM Web Page
http://www.cesm.ucar.edu

CESM 2.1.1 Web Page

http://www.cesm.ucar.edu/models/cesm2

Downloading the code.

NCAR | COMMUNITY EARTH SYSTEM MODEL
UCAR | CESM ™

ABOUT   HELP   SEARCH ...

ADMINISTRATION ▾   WORKING GROUPS ▾   MODELS ▾   EVENTS ▾

CESM Models / CESM Supported Releases / CESM2 / Downloading CESM2 Release Code

DOWNLOADING CESM2 RELEASE CODE

1. Read these instructions: CESM2 Quickstart Guide

2. Download the current release code:

```
git clone -b release-cesm2.1.1 https://github.com/ESCOMP/cesm.git
cd cesm
./manage_externals/checkout_externals
```

For downloading previous versions of CESM2, please see Downloading CESM2

3. Register for Online Help: DiscussCESM Forums Registration

4. Sign-up for E-mail Notifications: CCSM Participants Mailman Registration

CESM2 QUICKLINKS
Quick Start Guide

Downloading The Code

Scientifically Validated Configurations

> Prognostic Components

CESM Software Engineering

RELATED INFORMATION
Data Management & Distribution Plan

Development Project Policies & Terms of Use

DiscussCESM Forums Bulletin Board

Publication / Acknowledgment Information

CESM2 Copyright

CESM Support Policy

CESM2 Included Packages Copyright

CESM PROJECT
The CESM project is supported primarily by the National Science Foundation (NSF). Administration of the CESM is maintained by the Climate and Global Dynamics Laboratory (CGD)

Overview of Directories
(after initial model download)

CESM Download

```
~/cesm
$CESMROOT
├── components
│   ├── aquap
│   ├── cam
│   ├── cice
│   ├── cism
│   ├── clm
│   ├── mosart
│   ├── pop
│   ├── rtm
│   └── ww3
└── cime/scripts
    create_newcase
```

← **The CESM root contains of 2 important directories: components and cime**

← **Code for all the components, etc…**

Where is the coupler???

Coupling Infrastructure for Modeling Earth (CIME)
(new python-based CESM infrastructure)

Infrastructure
PUBLIC Open Source Github
Repository

Science code
Restricted or Public
Repositories

**Paradigm for
DOE, NOAA, NSF
Infrastructure
Collaborations**

Driver-Coupler
Data Models
Scripts
System/Unit
testing
Mapping Utilities

CESM

MPAS/WRF

DOE/ACME

ESPC and/or
NOAA/NEMS
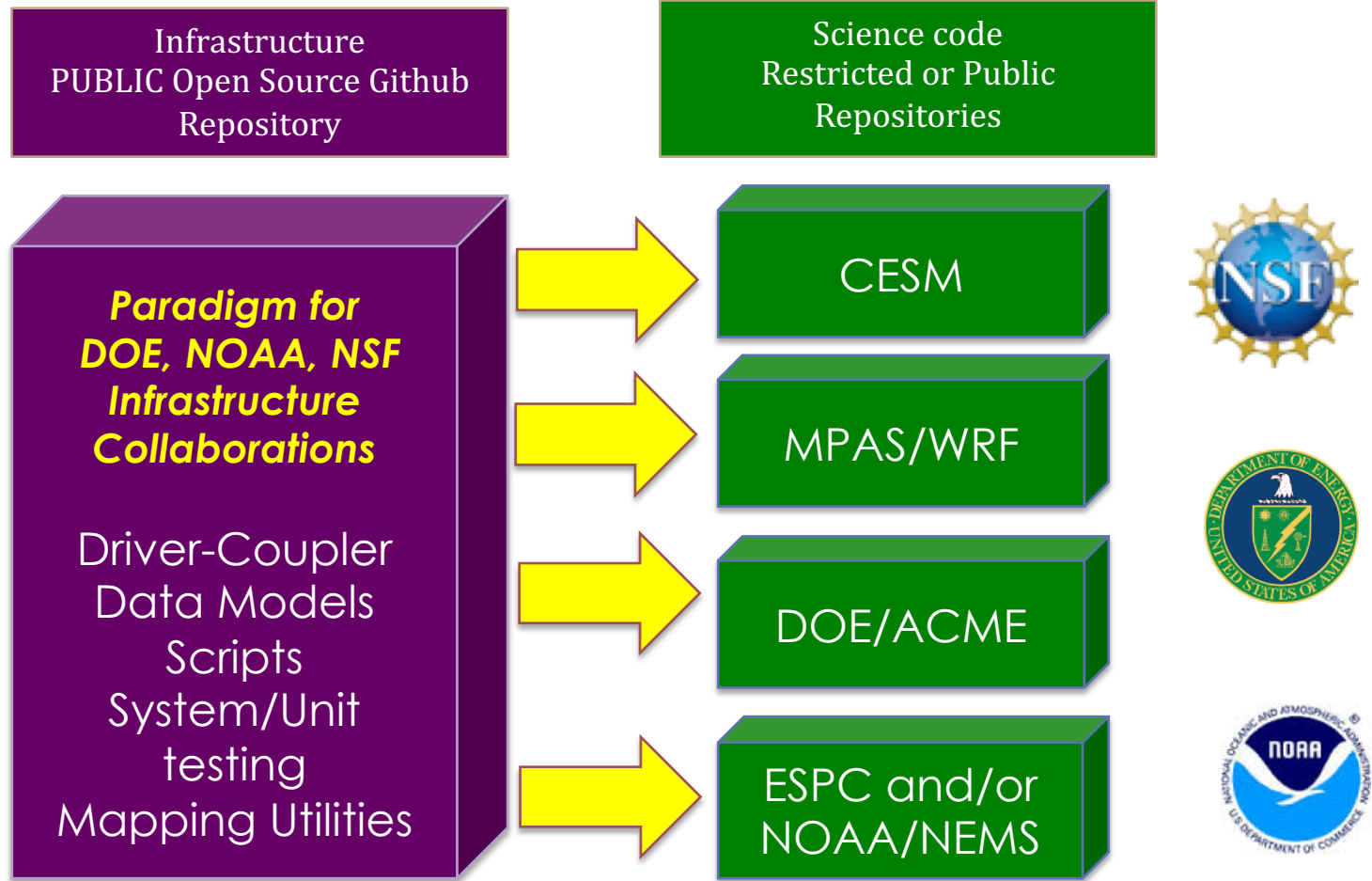
addresses needs of multiple efforts

Current CESM Coupling – data components permit flexible activation/deactivation of feedbacks
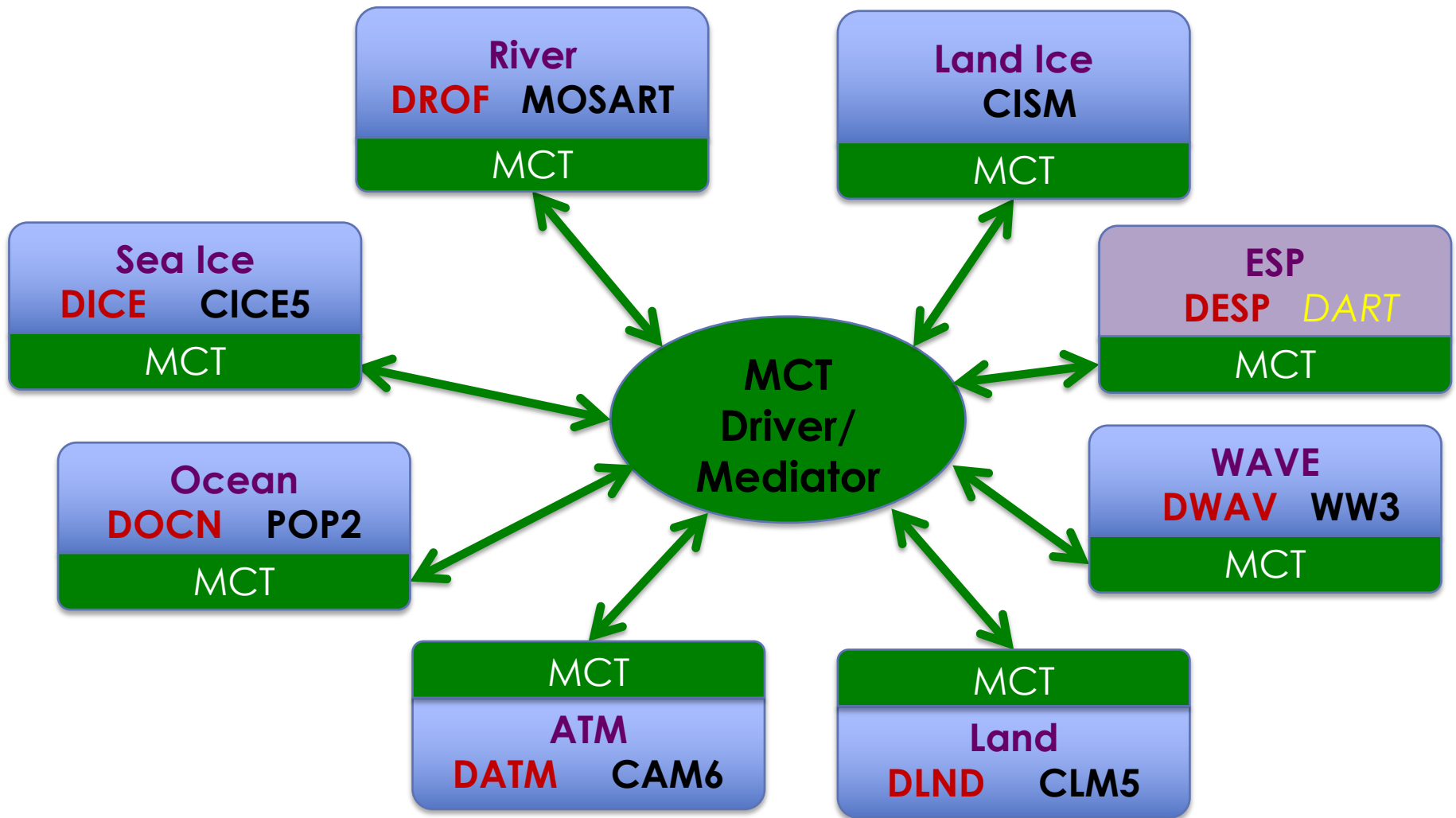
Overview of Directories
(+ inputdata directory)

INPUTDATA Directory

/glade/p/cesm/cseg/inputdata
$DIN_LOC_ROOT

| share | cpl | atm | lnd | ocn | ice | glc | wav | rof |

CESM Download

~/cesm2
$CESMROOT

components

cime/scripts
create_newcase

aquap

cam

cice

cism

clm

mosart
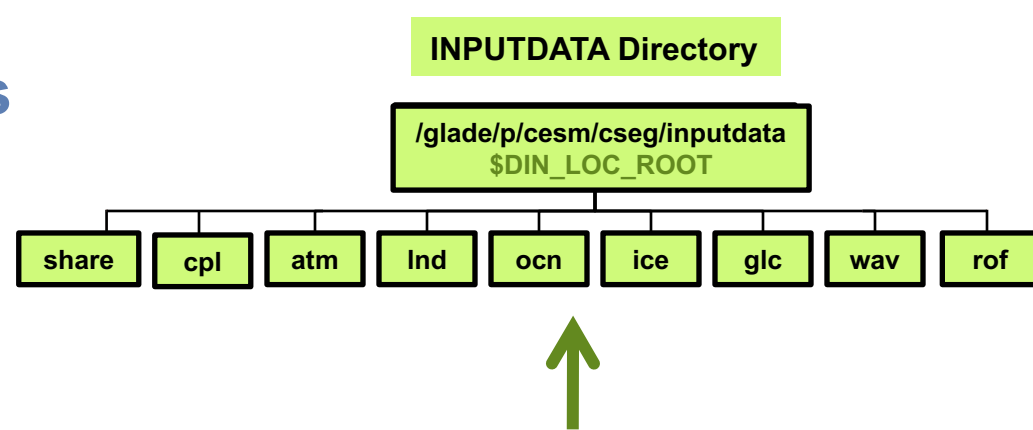
pop

rtm

ww3

Inputdata directory $DIN_LOC_ROOT
contains all input data required to run the model

- on **supported machines** - populated inputdata already exists
- on **non-supported machines** - need to create inputdata directory root

- **Ideally directory is shared by a group of users to save disc space**

- **To download input data: use the script check_input_data**
  - **downloads only the data needed**
  - **puts the data in the proper subdirectories**
  - **Do NOT download input data manually (ie. by using svn co)**

Porting

- **On supported machines -** no porting is necessary

- **On new machines** – porting needs to be done

Porting details are outside the scope of this tutorial

User's Guide

Porting and Validating CESM on a new platform

Work Flow: Super Quick Start

CESM can be run with a set of 4 commands

Set of commands to build and run the model on a supported machine

```
# one time step
mkdir ~/cases

# go into scripts directory into the source code download
cd /glade/p/cesm/tutorial/cesm2.1.1_tutorial/cime/scripts

# (1) create a new case in the directory "cases" in your home directory
./create_newcase --case ~/cases/b.day1.0 --res f09_g17 --compset B1850

# go into the case you just created in the last step
cd ~/cases/b.day1.0

# (2) invoke case.setup
./case.setup

# (3) build the executable
qcmd -- ./case.build

# (4) submit your run to the batch queue
./case.submit
```

(1)
(2)
(3)
(4)

It is that easy !

Overview of Directories
(+ before create_newcase)

INPUTDATA Directory

/glade/p/cesm/cseg/inputdata
$DIN_LOC_ROOT

| share | cpl | atm | lnd | ocn | ice | glc | wav | rof |

CESM Download

~/cesm2
$CESMROOT

| components | | cime/scripts
create_newcase |

← **This is the script you need to create a new case**

- aquap
- cam
- cice
- cism
- clm
- mosart
- pop
- rtm
- ww3

Work Flow: Super Quick Start

Set of commands to build and run the model on a supported machine

```
# go into scripts directory into the source code download
cd /glade/p/cesm/tutorial/cesm2.1.1_tutorial/cime/scripts

# (1) create a new case in the directory "cases" in your home directory
./create_newcase --case ~/cases/b.day1.0 --res f09_g17 --compset B1850

# go into the case you just created in the last step
cd ~/cases/b.day1.0/

# (2) invoke case.setup
./case.setup

# (3) build the executable
qcmd -- ./case.build

# (4) submit your run to the batch queue
./case.submit
```
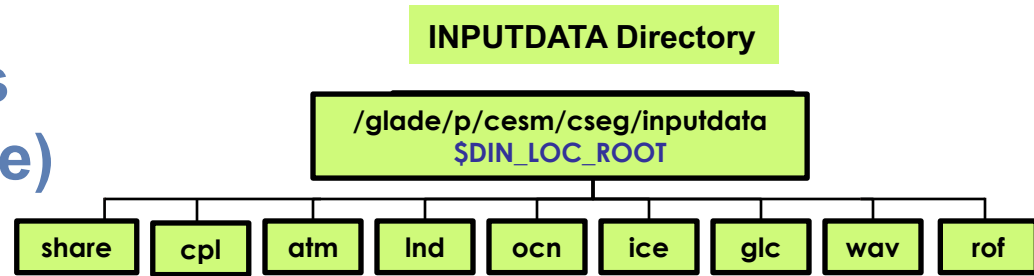
(1) Create a new case

In the scripts directory, create_newcase is the tool that generates a new case.

create_newcase requires 3 arguments

What is the casename ?

Which resolution?

Which model configuration ?
Which set of components ?

Which machine are you running on?
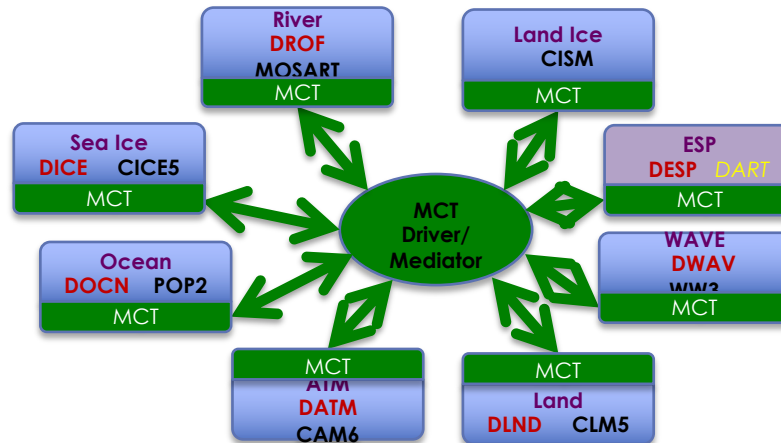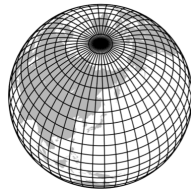
(1) create_newcase arguments

create_newcase requires 3 arguments

create_newcase --case ~/cases/b.day1.0 --res f09_g17 --compset B1850

(1) create_newcase arguments

create_newcase requires 3 arguments

create_newcase **--case ~/cases/b.day1.0** –res f09_g17 --compset B1850

What is the casename ?

case specifies the name and location of the case being created
~/cases/b.day1.0

(1) create_newcase arguments

create_newcase requires 3 arguments

create_newcase --case ~/cases/b.day1.0 --res f09_g17 --compset B1850

Which resolution?

res specifies the **model resolution** (or grid)

New grid naming convention

Each model resolution can be specified by its alias, short name and long name.

Example of equivalent alias, short name and long name:
- **alias: f09_g17 (atm/lnd_ocn/ice)**
- **short name: f09_g17**
- **long name =**
a%0.9x1.25_l%0.9x1.25_oi%gx1v7_r%r05_g%gland4_w%ww3a_m%gx1v7

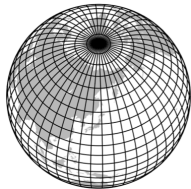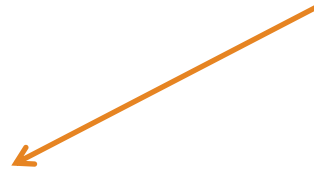| atm | lnd | ocn/ice | river | lnd-ice | wave | land-ocean mask |

(1) create_newcase arguments

create_newcase requires 3 arguments

create_newcase --case ~/cases/b.day1.0 --res f09_g17 --compset B1850

Which component set ?

compset specifies the "component set"

Component set specifies component models, forcing scenarios and physics options for those models

New compset naming convention

Each model compset can be specified by its alias, short name and long name.

Example of equivalent alias, short name and long name:

- alias: B1850
- long name =
  1850_CAM60_CLM50%BGC_CICE_POP2%ECO_MOSART_CISM2%NOEVOLVE_WW3_BGC%BDRD

| time | atm | lnd | ice | ocn | river | lnd-ice | wave | BGC scenario |

About env_*.xml files

- **env_*.xml contains variables used by scripts -- some can be changed by the user**
  - **env_archive.xml:** short-term archiving
  - **env_batch.xml:** contains batch job information like project, wallclock time, etc.
  - **env_build.xml:** specifies build information
  - **env_case.xml:** set by create_newcase and cannot be modified
  - **env_mach_pes.xml :** specifies layout of components
  - **env_mach_specific.xml:** compiler, other machine information
  - **env_run.xml :** sets run time information (such as length of run, frequency of restarts, …)
    - **User interacts with this file most frequently**

- **Here's a snippet of the env_run.xml file**

```
<!--"sets the run length in conjunction with STOP_N and STOP_DATE, valid values: none,never,nst
eps,nstep,nseconds,nsecond,nminutes,nminute,nhours,nhour,ndays,nday,nmonths,nmonth,nyears,nyea
r,date,ifdays0,end (char) " -->
<entry id="STOP_OPTION"   value="ndays"  />

<!--"sets the run length in conjunction with STOP_OPTION and STOP_DATE (integer) " -->
<entry id="STOP_N"   value="5"  />
```
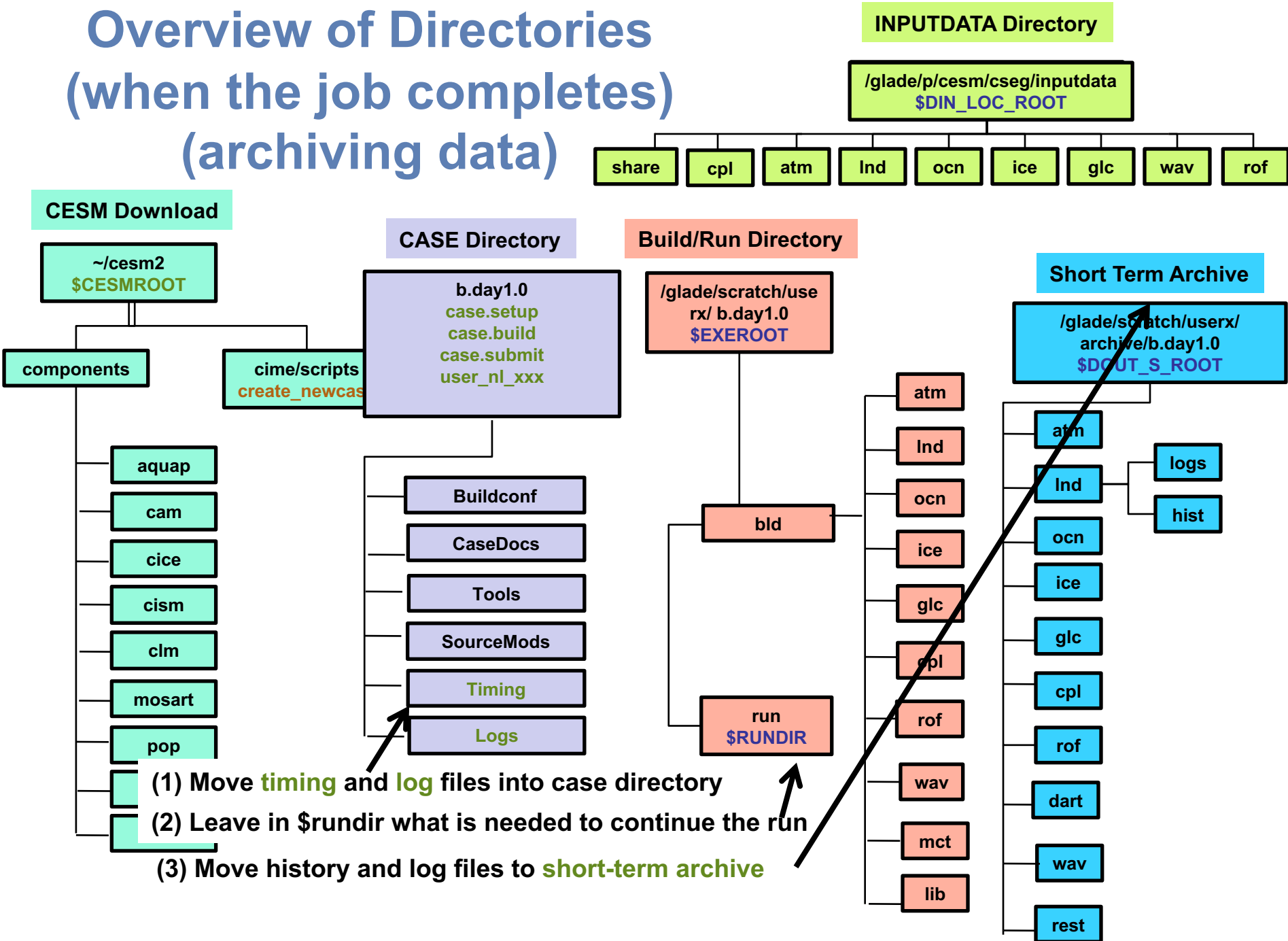
CESM will run for 5 days

"id" - variable name

"value" – variable value

- **To modify a variable in an xml file – use ** xmlchange **
  - **./xmlchange STOP_N=20**

Overview of Directories (when the job completes) (archiving data)

INPUTDATA Directory

/glade/p/cesm/cseg/inputdata
$DIN_LOC_ROOT

- share
- cpl
- atm
- lnd
- ocn
- ice
- glc
- wav
- rof

CESM Download

~/cesm2
$CESMROOT

- components
- cime/scripts
  create_newcas

components
- aquap
- cam
- cice
- cism
- clm
- mosart
- pop

CASE Directory

b.day1.0
case.setup
case.build
case.submit
user_nl_xxx

- Buildconf
- CaseDocs
- Tools
- SourceMods
- Timing
- Logs

Build/Run Directory

/glade/scratch/userx/ b.day1.0
$EXEROOT

- bld
  - atm
  - lnd
  - ocn
  - ice
  - glc
  - cpl
  - rof
  - wav
  - mct
  - lib
- run
  $RUNDIR

Short Term Archive

/glade/scratch/userx/
archive/b.day1.0
$DOUT_S_ROOT

- atm
- lnd
  - logs
  - hist
- ocn
- ice
- glc
- cpl
- rof
- dart
- wav
- rest

(1) Move **timing** and **log** files into case directory

(2) Leave in $rundir what is needed to continue the run

(3) Move history and log files to **short-term archive**

More Information/Getting Help

CESM Bulletin Board: http://bb.cgd.ucar.edu/

CESM Compsets and Grids

1850_CAM60_CLM50%BGC-CROP_ CICE_POP2%ECO_MOSART_ CISM2%NOEVOLVE_WW3_BGC%BDRD

1. 1850 fully-coupled (B1850) control with biogeochemistry.

2. 20th century fully-coupled (BHIST) with biogeochemistry and evolving ice sheets.

3. 1850 fully-coupled (BW1850) control with WACCM atmosphere and no biogeochemistry.

4. 1850 standalone CAM (F1850) control without biogeochemistry.

2000_CAM60%WCSC_CLM50%BGC-CROP_ CICE%PRES_DOCN%DOM_MOSART_ CISM2%NOEVOLVE_SWAV

1. 1850 fully-coupled (B1850) control with biogeochemistry.

2. 20th century fully-coupled (BHIST) with biogeochemistry and evolving ice sheets.

3. 2000 standalone CAM (FWsc2000) control with WACCM atmosphere, specified chemistry.

4. 1850 standalone CAM (F1850) control without biogeochemistry.

a%0.9x1.25_l%0.9x1.25_oi%gx1v7_
r%r05_g%gland4_w%ww3a_m%gx1v7

1. 1.9x2.25_gx1v7 (f19_g17)

2. 0.9x1.25_gx1v7 (f09_g17)

3. T62_gx3v7 (T62_g37)

4. ne120np4_tx0.1v2 (ne120_t12)