Objective 3: Exploitation of Earth System Models

ESGF in next 3 years

Sébastien Denvil (CNRS-IPSL)
Michael Lautenshlager (DKRZ)
Charles Doutriaux (LLNL)
Phil Kershaw (CEDA)

The one year horizon
- **Continue the CMIP6 operation effort**
- **Engage with the compute node challenges**

The three years horizon
- **The challenge of systems evolution (Public cloud, object store)**
- **The current ESGF was designed 10+ years ago**

What is the CDNOT ?

A CMIP Data Node Operations Team has been appointed by the WGCM Infrastructure Panel (WIP) and include representatives from groups responsible for CMIP data nodes.

What is the CDNOT ?

Providing formal input to the WIP with regard to data node operations, resource issues, and other concerns related to meeting WIP requirements.

Providing formal input to any software providers as to software requirements and constraints arising from the operational environment/experience.

Maintaining documentation outlining the required resources, configuration and mandatory access services on a data node.

Agreeing how to configure federation-level services and service nodes to support WIP requirements.

Where necessary, establishing a timetable and methodology for federation-wide software migrations, upgrades or configuration changes.

What is the CDNOT ?

Drafting and maintaining guidelines describing how the CMIP data management plans should be implemented on data nodes (e.g. to cover how identifiers should be obtained and used, metadata requirements, quality control and the addition and removal of data with versioning).

Monitoring for compliance the implementation of the CMIP data management plans across the federation, and providing feedback to the WIP.

Progress this year

- ~60 persons on the CDNOT mailing list
- ~52 teleconference call this year
    - One slot EU/US
    - One slot EU/Australia/Asia
- Defined 5 data challenges (nickname DC1 → DC5)
    - From low complexity to high complexity
    - DC5 only is on production
- 01/2018 → 04/2018 Ready on test
- 05/2018 → 06/2018 CMIP6 data on production
- 07/2018 → 12/2018 Documentation and outreach

CMIP6 Guide

1)ESGF stack installation & upgrade, Authors: Prashanth, Reviewers: Hans

2)Validation with ESGF test suite, Authors: Sébastien G., Reviewers: Hans

3)Configuring data/metadata publication on the data node, Authors: Sasha, Ag, Martina, Reviewers: Sergey, Kate

4)Configuring data publication on the index node, Authors: Sasha, Reviewers: Sébastien

5)Configuring CoG, Authors: Luca, Reviewers: Sébastien

6)Configuring data access on the data node, Authors: Sasha, Reviewers: Eric

7)(Optional) Checking and fixing CMIP time coordinate, Authors: Guillaume, Reviewers: Ruth

8)(Optional) Running PrePARE standalone, Authors: Guillaume, Reviewers: Serguey

9)Preparing directory structure and files organization to fulfill CMIP6, Authors: Guillaume, Reviewers: Sergey, Clare Richards

10)Publishing a CMIP6 dataset for the first time, Authors: Guillaume, Katharina, Sasha, Reviewers: Sergey, Kate

11)Describe datasets issues and errata using the errata service, Authors: Guillaume, Atef, Reviewers: Laurent, Kate

12)Unpublish data (before new version is ready), Authors: Sasha, Reviewers: Laurent, Clare, Sergey

13)Publishing a new version of a CMIP6 dataset, Authors: Guillaume, Katharina, Reviewers: Sergey, Kate

14)ESGF data usage metrics through the esgf-dashboard, Authors: Alessandra, Maria, Reviewers: Laurent, Clare

Registration/Participation status

- 44 institutions/consortia have officially registered for CMIP6

- 101 models/source_id's are registered

- List of groups (with expressed intent) who have not yet registered (missing in red)

- List of groups who made data available

- List of groups who should have data available early 2019

ACCESS-ESM (Australia)	CESS-THU (China),	HadGEM3 (UK)	MRI-AGCM3 (Japan)
AWI-CM (Germany)	CMCC (Italy)	INM (Russia)	NICAM (Japan)
BCC (China)	CNRM (France)	IITM-ESM (India)	NorESM (Norway)
BESM (Brazil)	EC-Earth3 (Europe)	IPSL-CM6 (France)	NUIST (China)
BNU (China)	EMAC (Germany)	K-ACE (Republic of Korea)	TaiESM (Taiwan)
CAMS-CMS (China)	FGOALS (China)	MIROC-CGCM (Japan)	UKESM (UK)
CanESM (Canada)	FIO (China)	MIROC-ESM (Japan)	VRESM (South Africa/Australia)
CasESM (China)	GFDL (USA)	MPI-ESM (Germany)	
CESM2 (USA)	GISS (USA)	MRI-ESM2 (Japan)	

Compute Services

Certification & Challenges

Preserving ESGF Brand

- Needed to protect ESGF reputation: worked with XC committee to solve this issue: Certification

- Operator Certification
  - Ensure service/operator is sound, reviewed, tested and documented

- Server Certification
  - Ensure user experience will be reasonable
  - Compatible with other servers (can talk to each other)
  - Core set of functionalities

- Hybrid systems:
  - Non-certified server can still host certified operators but ESGF cannot be blamed for glitches
  - Certified Server can host non-certified operators, but ESGF cannot be blamed for results from these services

Compute Challenge

- There's a need to assure community and developers that CWT is up to the task -> Compute Challenge

- The 2018 ESGF F2F devises a comprehensive set of rules for a "Compute Challenge" that will CWT work

LLNL (Jason Boutte)

- Develop and maintain container-based "compute-node", ready to be used as "standard" ESGF compute node deployment

- Develop and maintain **Python-based compute API** as well as API standards themselves (in conjunction with rest of CWT of course)

- New UI for workflows

- Certification CLI

- New Server for production
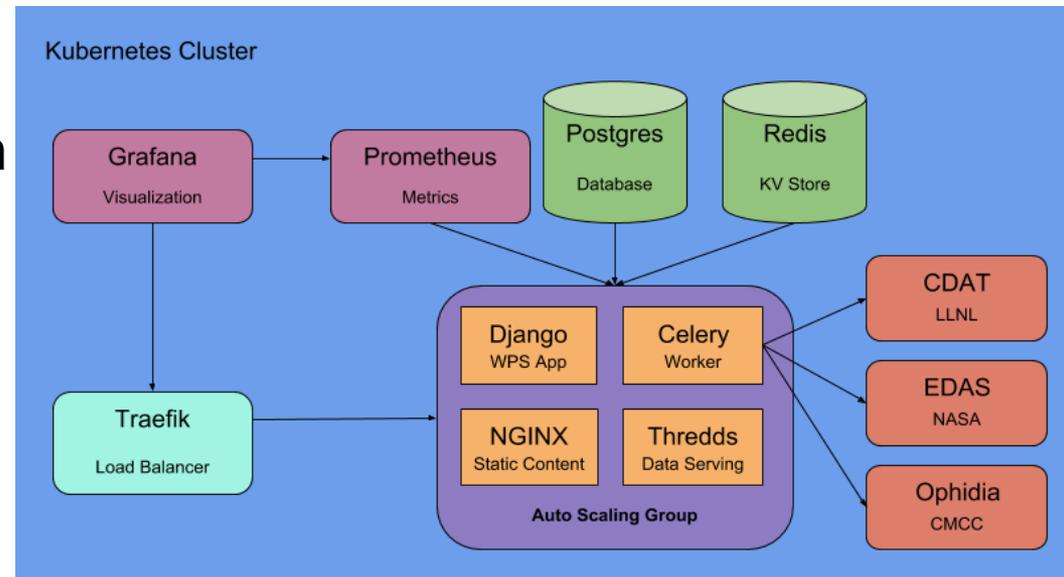
Actual Implementation

- LLNL is developing first cut of certification script

- CWT will review request and recommend favorable candidates to ESGF XC at F2F. Fast track possible on case-by-case basis

- ESGF main website will list every official server and operators

Take Home

- Rich Ecosystem; Many Backends

- New Technologies Incorporated

- Certification Process

- Compute Challenge

Cross-cutting Themes – Cloud computing

- General considerations
  - Cloud can simplify some of the maintenance and operational aspects of an infrastructure
  - Elastic and on-demand capabilities of public cloud
  - Data distribution, hosting and operational resilience advantages
  - Public cloud is expensive for long term storage of hot or warm data
  - Some public cloud provide public data hosting programmes which could be leveraged e.g. NOAA Big Data Project

- Public cloud and data centres in ESGF
  - Some organisations have arrangements with public cloud for hosting e.g. NASA with AWS
  - Examples using GKE – GFDL, CEDA (CMIP for Copernicus), …
  - Some centres in ESGF are running private and community (on-premise) clouds (JASMIN, NCI)
  - Object storage is (currently) incompatible/untested with ESGF publishing software and data storage interfaces - netCDF files on POSIX filesystem served over HTTP with TDS.

Aspects of architecture for discussion

1) <u>Management of Installation and Deployment</u>

2) <u>Vocabulary Management and Data Modelling</u>

3) Publishing and Quality Control

4) <u>Federated Search and replication of search metadata</u>

5) Data Replication

6) Federated identity management and access control

7) Data Services

8) Data Download and client-side issues

9) Computation

Management of Installation and Deployment: proposals

- Container-based system developed by the Container WT
  - This should support deployment scenarios ranging from full container orchestration (Kubernetes) to simpler single node deployments with Docker Compose

- ESGF Installer
  - Separate deployment mechanism is needed for sites not able to support container based solution

- Migrate to a collection of Conda environments for management of software package dependencies.
  - Collections could be used to allow customisation for different scenarios. e.g. a specific environment would be needed for running the Publisher that does not need packages used by other components in the installation
  - This approach would be compatible with the containerised and standard Installer set-ups

Vocabulary Management and Data Modelling: proposals

- Promote widespread use of a standard **vocabulary service**(s) in ESGF to provide a canonical reference for DRS controlled vocabularies and terms in ESGF projects

- Build on work to centralise vocabulary services
  - As a reference point for all software in ESGF that uses vocabularies in any way
  - Centralisation not necessarily federation-wide in all cases but project-specific as needed
  - Use proven and established standards for representation of vocabulary metadata, e.g. JSON-LD for serialisation
  - Provide standard easy to use APIs together with client packages in required languages

Federated Search: proposals

- Adopt OpenSearch as the search API for ESGF. This supports the concept of different vocabularies of search terms for different datasets. It supports the concept of collections. It is being used in the EO community and has an EO profile.
  - Using a standard API will facilitate interoperability with other systems

- Make new user interface for search and make as a standalone application

- Address version issues with replication – using SolrCloud or handle system?