Middleware for Earth System Data

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PDSW-DISC, 2016-11-15

esiwace
CENTRE OF EXCELLENCE IN SIMULATION OF WEATHER AND CLIMATE IN EUROPE

Outline

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Introduction

Challenges in the domain of climate/weather

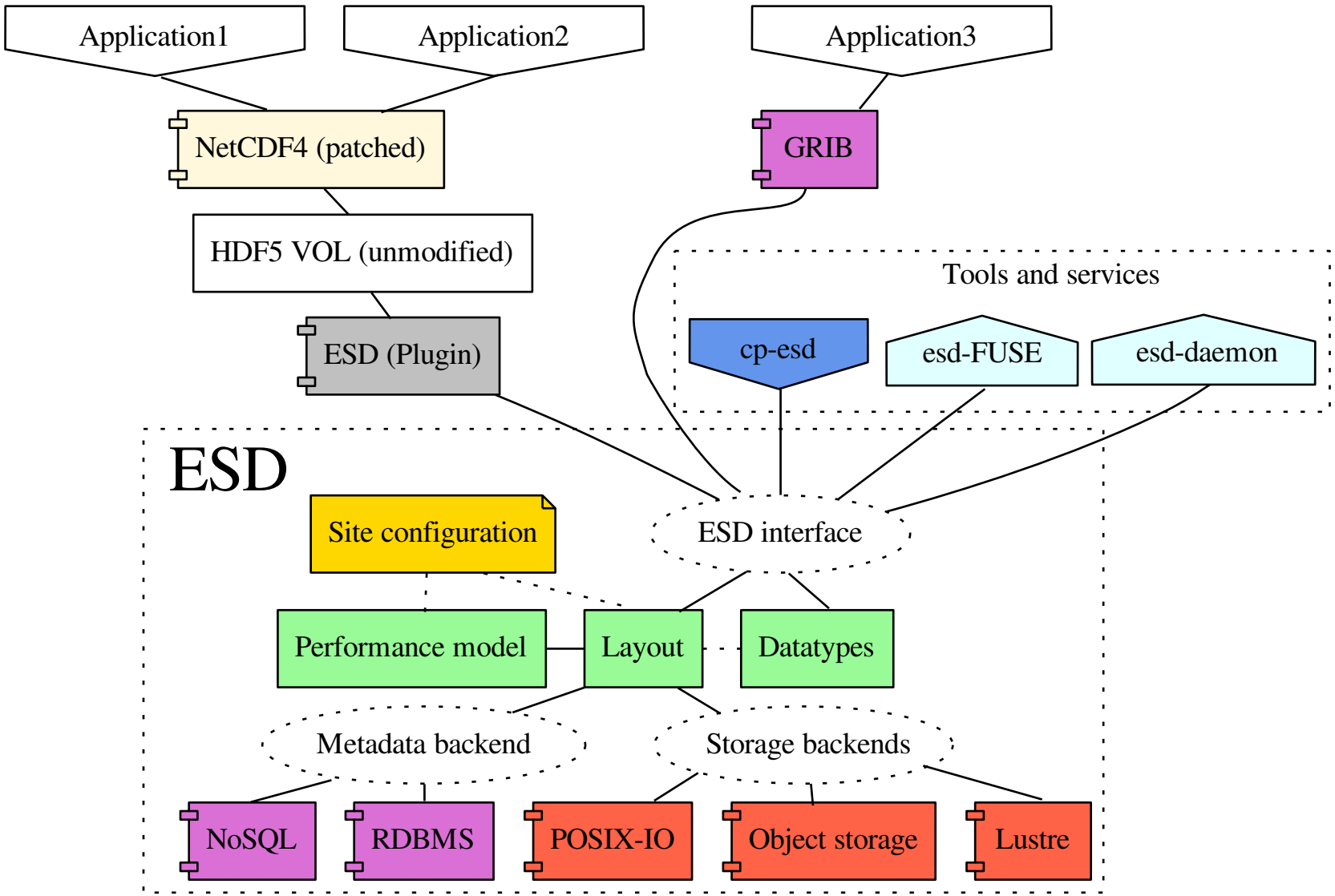
- High data volume and velocity
- Data management practice does not scale
  - e.g., hierarchical namespaces does not reflect use cases
  - Scientists spend quite some time to define the namespace
- Suboptimal performance (& perf. portability) of data formats
  - Tuning for NetCDF, HDF5 and GRIB necessary
  - Scientists worry about interoperability
- Data conversion is often needed
  - Especially between NetCDF and GRIB
  - To combine data from multiple experiments, time steps, ...
- External data services to share data in the community
  - (Scientific) metadata is provided by databases

Approach

Design Goals of the Earth System Data Middleware

1. Understand application data structures and scientific metadata
2. Flexible mapping of data to multiple storage backends
3. Placement based on site-configuration + performance model
4. Site-specific optimized data layout schemes
5. Relaxed access semantics, tailored to scientific data generation
6. A configurable namespace based on scientific metadata

Architecture



Benefits

- Expose/access the same data via different APIs
- Independent and lock-free writes from parallel applications
- No fixed storage layout[1]
- Less performance tuning from users needed
- Exploit characteristics of different storage technology
- Multiple layouts of one data structure optimize access patterns
- Flexible namespace (similar to MP3 library)

[1] To achieve portability, we provide commands to create platform-independent file formats on the site's boundary/long-term archive.

Roadmap

- Done: Example HDF5 VOL (for understanding)
- 75%: HDF5 plugin for Seagate Object Store technology
- Done: High-level design
- 75%: Log-structured file mapping for POSIX backend
- Next: Datatypes, one storage backend, manual layout
- Q4 2017: Prototype for the system architecture
- Q4 2018: Production version with mappings for different sites

The ESiWACE project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No **675191**

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