IAF EARTH OBSERVATION SYMPOSIUM (B1)
Interactive Presentations - IAF EARTH OBSERVATION SYMPOSIUM (IP)

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POLYTOPE: EXTRACTING FEATURES FROM LARGE-SCALE DATACUBES

Abstract

As part of the EU's ambitious Destination Earth initiative, the European Center for Medium Range Weather Forecasts (ECMWF) is building the Digital Twin Engine, a new software infrastructure designed to efficiently handle the petabytes of data produced daily by large-scale earth systems digital twins.

One important component of the Digital Twin Engine is the Polytope software. This software implements ECMWF's novel feature extraction algorithm, which uses concepts of higher-dimensional computational geometry to efficiently retrieve arbitrary user-specified shapes from high-dimensional datacubes. When this task is performed server-side, in-situ with the data, Polytope can reduce data sizes by several orders of magnitude and return tailored analysis-ready data to users. We combine this feature extraction mechanism with the capability to directly jump to specified byte ranges in a data store, which thus allows us to minimise I/O in the system to the bare minimum required to serve user-specified requests.

In this paper, we describe the Polytope software and its latest developments before highlighting how this software can be used to address the challenges related to growing data sizes faced by the Earth Observation and Weather Forecasting communities in large-scale projects such as the Destination Earth initiative.