O3AS

10. O3AS

Description

The assessment of ozone depletion is an important task for Climate and Environment studies because the ozone layer in the stratosphere plays an important role for the protection from harmful UV radiation. After the discovery of the ozone hole in 1985, scientists all over the world got worried about the resulting dangers. Soon after, substances that destroy the ozone layer were prohibited with the adoption of the Montreal Protocol, which got ratified unanimously by the United Nations (UN) in 1986. Since then monitoring and projecting stratospheric ozone is mandated by the UN Environment Programme (UNEP) to safeguard a healthy planet which results in the publication of reports on the Scientific Assessment of Ozone Depletion. Thus, regularly many climate models are used to project future climate and ozone change, producing huge amounts of data that are analysed for key metrics.

To establish a reliable ozone analysis climate scientists need a tool that will help to generate and reliably reproduce figures of high quality. The Ozone assessment service (O3AS) is developed within the European Open Science Cloud (EOSC) Synergy project to assist scientists to visualise ozone data from large climate models. The climate model output is mainly from the Chemistry-Climate Model Initiative (CCMI) project (now: https://blogs.reading.ac.uk/ccmi/ccmi-1/, in the future: http://blogs.reading.ac.uk/ccmi/ccmi-phase-two/), with monthly model output from 1960 to 2100 of about 100 different model realisations. The recent 2018 quadrennial global assessment of ozone depletion (https://www.esrl.noaa.gov/csl/assessments/ozone/2018/) consists of six chapters and five appendices with about 25 people actively working on each chapter and a multitude of people working in support of the preparation of the document.

The service aims to analyze available ozone data from climate models and produce key metrics. Those key metrics help policy makers to judge if measures implemented to protect the stratospheric ozone layer are working. Here, we present a framework to efficiently work and explore ozone projections, including the calculation of key metrics.

Architecture

Figure 32 shows the architecture of the O3AS technical service. The O3AS service is split into several actions and components:

1. A user configures his/her request in the Web Application (currently in development).

2. This request is passed to O3AS service via the O3AS REST API call.

3. O3AS service processes the request, where the pre-processed data (aka skimmed data) is accessed via WebDav and OIDC.

4. In order to produce skimmed data, regular tasks are running on the HPC to copy primary data and perform data preparation (e.g. data reduction and parameter unification).
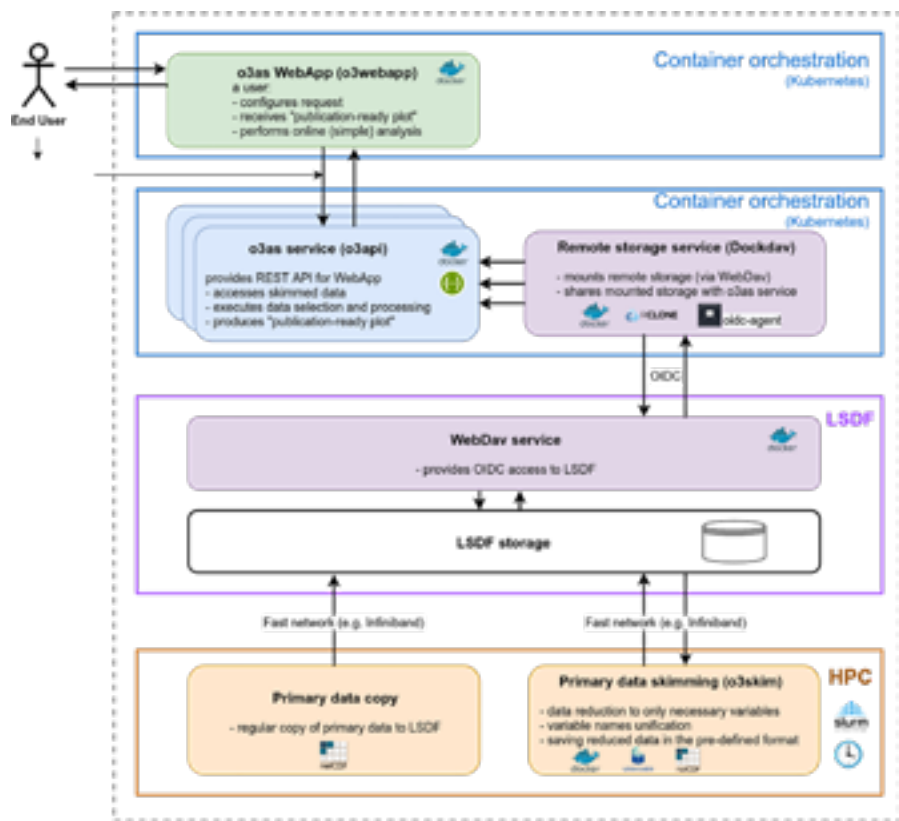

Figure 32 - Architecture of the O3AS Thematic Service

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EOSC Services

The O3AS thematic service depends on several services that are provided By EOSC. The EOSC OIDC EGI Check-in shall be used to access the advanced features of the service, i.e. the plotting of advanced figures and saving the plotted data points for further analysis. Under the hood to access data on the data server LSDF the OIDC-agent is used for mounting using WebDAV-HTTP authentication. In order to perform the data reduction/skimming in the HPC environment the udocker tool is a vital part for running containers in environments where root access is not available. Finally for the deployment of the service resources, the Infrastructure Manager is used to start a Kubernetes cluster at one of the EOSC cloud providers for the project's Docker containers. To summarize, O3AS it is integrating the following services listed in the EOSC marketplace:

- EOSC OIDC providers, e.g. EGI Check-In: to access certain functionalities of the service.
- Infrastructure Manager: To deploy service components on EOSC cloud resources.
- EOSC cloud resources: to offer O3AS service for users in a timely manner.

Apart from these services we also use the following tools developed in EOSC-related projects:

- OIDC-Agent: To mount data servers using WebDAV - HTTP authentication.
- udocker: To run the code for data skimming in the HPC environment.

Service Endpoint

The O3as service entry point is o3as.data.kit.edu. The portal provides basic information about the service, contacts, where to look for further detailed documentation, source code, Docker Hub, and, of course, a link to the deployed service (figure 33).
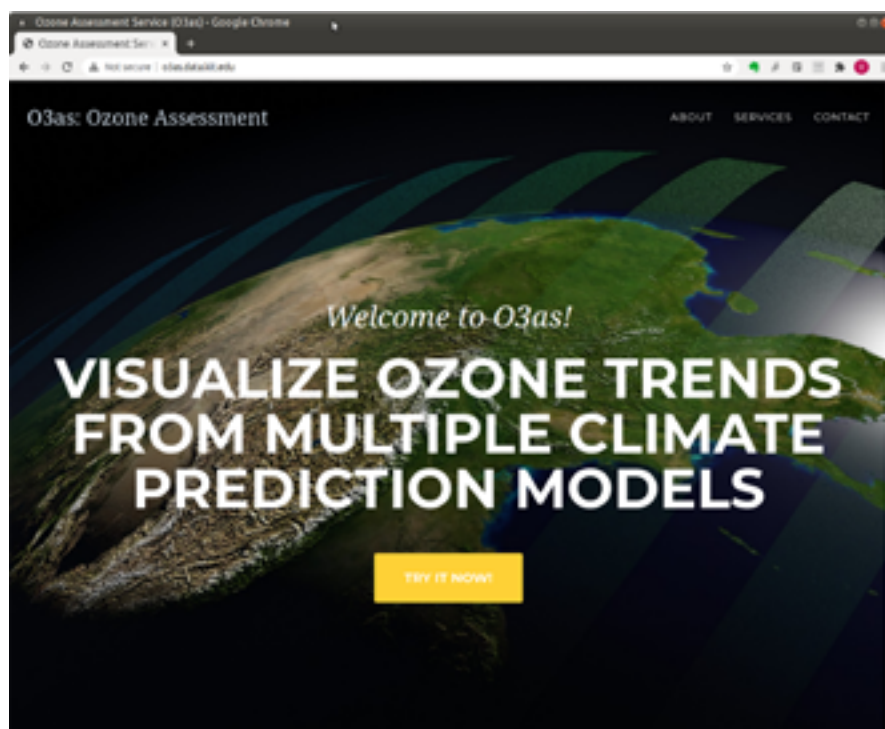

Figure 33 - O3AS entry portal

It currently directs a user to the o3api component (figure 34), which accepts user requests and delivers plots of interest for Ozone assessment. It runs in the Kubernetes cluster deployed at one of the EOSC-SYNERGY cloud providers (CESGA) via the Infrastructure Manager. One other component, o3skim runs regularly on the HPC system of KIT, ForHLR2, to reduce the raw Ozone data to the parameters of interest for the Ozone assessment. The reduced data are made available to o3api. In the ongoing development, we will add another part of the service, the web application (o3webapp), where users may customise their requests in a more friendly way. Researchers, who are members of o3as.data.kit.edu Virtual Organization, after authenticating via EGI Check-In will get advanced functionality of the service (e.g. receiving data points corresponding to the request, perform basic analysis of the data).
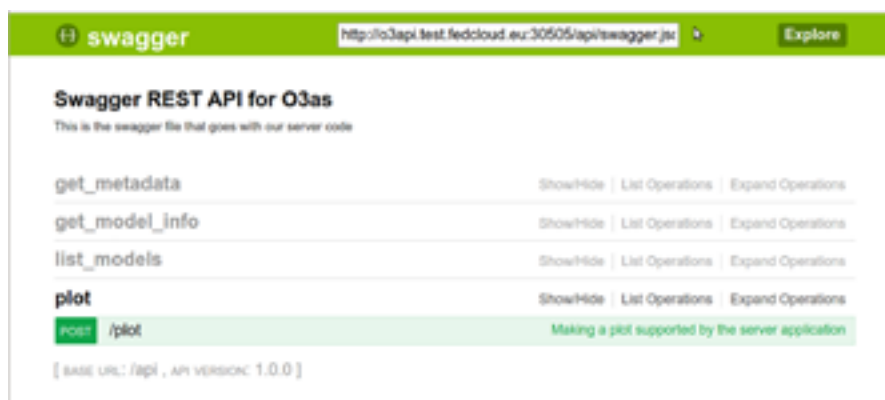

Figure 34 - o3api component is ready to accept user requests and deliver scientific plots for Ozone assessment

Demonstration Video

The video presentation of O3AS service, which can be found at the link below, describes the problem climate scientists deal with in the case of Ozone assessment, and the solution offered by O3AS service. It demonstrates the current status of the service, how one can access it and use it, and planned upgrades. In particular, we show how the original Ozone raw data are reduced to the parameters of interest, how the service can be deployed by means of the Infrastructure manager and started in the Kubernetes cluster, and what functionality is available for users, e.g. how to configure the requests and receive plots of interest. The video also presents public weblinks for further exploration of the service.

Click the image to view the video