GeoNet: Building Science Gateway Alliances for the GeoHazard Community

Ugo Becciani, Eva Sciacca, Alessandro Costa, Fabio Vitello
Astrophysical Observatory of Catania
Istituto Nazionale di Astrofisica
Catania, Italy
ugo.becciani@oact.inaf.it

Mel Krokos, Derek Rust, Malcolm Whitworth
School of Creative Technologies
School of Earth and Environmental Sciences
University of Portsmouth
Portsmouth, United Kingdom

Alessandro Tibaldi
Department of Earth and Environmental Sciences
Università Degli Studi Milano-Bicocca
Italy

Paraskevi Nomikou
Department of Geology and Geoenvironment
Ethniko Kai Kapodistriako Panepistimio Athinon
Greece

Abstract

Science Gateway (SG) technology supports web-based information systems offering scientific communities mechanisms for customised and easy access to data collections, computational tools and collaborative services on large-scale Distributed Computing Infrastructures (DCIs) [1, 2]. More importantly any low-level details of the underlying e-infrastructures are hidden appropriately so that end-users are not required to install anything on their personal desktops or mobile devices, and independently of the geographical location DCIs can be accessed in order to run applications and services on them.

Typically, realizing a single SG for a scientific community is sufficient assuming that its needs in terms of applications and services are homogeneous. Nevertheless to cater for large-scale diverse scientific communities Science Gateway Alliances (SGAs) are necessary requiring extra functionalities, e.g. common sign in, open sharing of data and applications across widely distributed e-infrastructures. StarNet [3] is an SGA built to support the needs of the Astrophysics community and other satellite communities (e.g. Nuclear Physics) which has successfully prototyped and tested a number of challenging applications.

We report on initial efforts on repurposing StarNet for building a spin-off SGA (called GeoNet) to support the Geohazard Community (GHC). The GHC routinely deals with a multitude of diverse data (e.g. images and maps from field measurements) that need to be processed via complex pipelines to get an insight into natural (e.g. ash from a volcano) and man-made (e.g. dust from landfill sites) phenomena and thus map relevant geo-hazard zones and alert levels. To support recent scientific advances sophisticated SGAs are required underpinned by innovative networking, data and computing intensive tools and services for processing and visualisation in exploring highly heterogeneous, complex datasets.

The vision for GeoNet is to address complex scientific problems dealing with state of the art simulations of volcanic ash dispersion [4], study of geological structures on active faults for seismic hazards [5], analysis of landslides for hydrogeological hazards, collection of volcanic deposits and structures for volcanic hazards, study of underwater volcanoes [6] and simulation of eruptions, and collection of morphological, geological and geochemical datasets for underwater volcanic hazards. We expect to leverage similarities between use-cases, e.g. in the data analytics and organisation domains, so that GeoNet will not only offer community-wide solutions but will also work towards bridging the gap with adjacent communities.

We are developing a prototype ecosystem by integrating and adapting StarNet components as necessary within an open space containing workflows and applications, to advance use of cloud technologies in order to facilitate application development and deployment including application usage as SaaS, PaaS, IaaS. Although StarNet already contains several core services for data organisation and management these need adaptation to handle GHC data sources. Furthermore core services for processing data through complex workflows also have to be adapted for GHC needs as they require non-trivial processing pipelines, e.g. innovative visualizations for quick exploration of regions surrounding volcanic areas to interpret regional volcanic settings. The ultimate vision is to build novel mechanisms for seamless glueing of customised gateways enabling deployment of a fully federated approach to applications, services and e-infrastructure layers.

Keywords— DCIs, Federated Science Gateways, Big Data, Complex Scientific Workflows, GeoHazards.

REFERENCES

[1] S. Shahand, *Science gateways for Biomedical Big Data Analysis*. PhD thesis, 2015 (http://hdl.handle.net/11245/1.490613)

[2] Kacsuk, Péter, ed. Science Gateways for Distributed Computing Infrastructures: Development framework and exploitation by scientific user communities. Springer, 2014. (ISBN 978-3-319-11268-8)

[3] StarNet web site: http://www.oact.inaf.it/STARnet/

[4] Mastin, L. G., et al. "A multidisciplinary effort to assign realistic source parameters to models of volcanic ash-cloud transport and dispersion during eruptions." Journal of Volcanology and Geothermal Research 186.1 (2009): 10-21.

[5] Cloetingh, Sierd, Alessandro Tibaldi, and Evgenii Burov. "Coupled Deep Earth and surface processes and their impact on geohazards." Global and Planetary Change 90 (2012): 1-19.

[6] Nomikou, Paraskevi, et al. "Submarine volcanoes along the Aegean volcanic arc." *Tectonophysics* 597 (2013): 123-146.