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This paper presents GARUDA and CHAIN-REDS interoperation objectives and technical challenges involved. CDAC, who is spearheading GARUDA, is the Indian partner of CHAIN-REDS project - one of the objectives of is to achieve a global e-Infrastructure ecosystem that will allow virtual research communities and research groups efficiently access worldwide distributed resources like computing, storage, data, services, tools, and applications. CHAIN-REDS is a FP7 project co-funded by the European Commission aiming indeed at promoting and supporting technological and scientific collaboration across different e-Infrastructures established and operated in various continents, in order to define a path towards a global e-Infrastructure ecosystem that will allow Virtual Research Communities, research groups and even single researchers to access and efficiently use worldwide distributed resources. By means of CHAIN-REDS activities and outcomes both GARUDA and EGI infrastructures can be used by researchers with secure and consistent experience.

GARUDA Grid is built with a Globus Toolkit 4.0.x, Gridway Meta scheduler and support various local resource managers like Torque and LL. The help desk service is powered by RT which allows users to submit and track their queries.

The CHAIN-REDS has deployed a Science Gateway Portal, which interfaces with various distributed infrastructures: Grids, HPC and Cloud. The portal was built with the Catania Science Gateway Framework using the JSAGA implementation of the SAGA standard. The help desk service is handled using GGUS, which allows users to create, issue ticket and track ticket status from creation to final resolution.

The interoperability of GARUDA and CHAIN-REDS consists of two main challenges: (i) job submission interface from CHAIN to GARUDA and vice versa and (ii) integration of GARUDA RT with GGUS. This paper is aimed to address these two challenges.
A JSAGA adaptor deployed at CHAIN-REDS Science Gateway interacts with the WSRF Interface for GridWay Meta scheduler using a component called GridGateWay which provides the virtualization of a grid (accessible through the encapsulated GridWay) through a WS-GRAM service. Currently, the setup is being tested with the job submission from JSAGA to GridGateWay using the well-known bioinformatics software GROMACS. The issues involved were the connectivity, cross certification, resource discovery, data transfer and monitoring.

The aim is also to implement an automatic communication between the GGUS and Garuda RT via the exchange of SOAP messages. GGUS provides different SOAP web services for ticket submission, updating and reading. Currently, the ticket transfer from GGUS to RT has been tested successfully. Further work is in progress - the attachment synchronization and establishing ticket transfer from RT to GGUS.

This paper aims to present interoperability challenges addressed during RT-GGUS integration and JSAGA-GridGateWay integration which can be referred by e-Infrastructure across the world based on Globus toolkit, Gridway and RT can benefit immensely for solving the problems of interoperations among diverse and heterogeneous grids and clouds.

**Summary**

The paper aims to present the challenges addressed during the interoperation of CHAIN-REDS and GARUDA Grid. The challenges involved were connectivity, Middleware support, resource information aggregation, data transfer between the resource elements, monitoring, help desk integration and cross certification. The solutions provided here can help other grid infrastructures that are based on Globus Toolkit, GridWay and RT to interoperate with other grids in the world.

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