DIstributed colLaboratories Infrastructure on Grid ENabled Technology 4 Science

D4Science: E-Infrastructures for Fisheries Resources Management

D4Science provides production-quality facilities for creating and managing Virtual Research Environments (VREs) based on an e-infrastructure composed of shared computational, storage, data, and service resources. Through this, it enables scientists to organise, retrieve, access, and analyse heterogeneous and widely distributed information in order to generate new knowledge.

D4Science Project Web Site:
http://www.d4science.org/

gCube Web Site:
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The communities

The resulting e-infrastructure makes available data and domain-specific services that are provided by large international organizations, such as the *Food and Agriculture Organization of the United Nations* (FAO), the *WorldFish Center* and *European Space Agency* (ESA), reinforcing the impact and relevance of Europe-wide and global e-infrastructures as unique instruments for supporting science.

D4Science focuses on supporting the construction of VREs serving the two main scenarios* on Fisheries Resources Management, led by the Fisheries department of FAO that require accessing data and knowledge resources of different types, such as databases, repositories of full-text documents, images, maps, ontologies, and thesauri, as well as application and computational resources for performing complex, computationally-demanding activities, such as data analysis, simulation, and knowledge generation processes.

* *D4Science also supports VREs for the thematically neighboring area of the Environmental Monitoring, represented by European Space Agency.*

Knowledge Generation Domains

Fisheries Country Profiles provide focused global information on the state of fisheries in a country-specific format, to enhance decision-making and promoting advocacy in fisheries and, in particular, in the sustainable use and conservation of fish stocks. Despite the standardisation of profiles' structure and content, currently the compilation of reports by country involves manual gathering, processing-in-large, aggregation and editing of continuously evolving data coming from various heterogeneous sources that range from statistical and geospatial databases to document and map repositories. The complexity and cost of this task results in a low frequency of report publishing and updating, failing to meet the scientific community requirements. The D4Science goal is to put into production a system that supports the generation of multi-disciplinary fishery country profile reports, with the possibility of periodically maintaining and publishing them (through ad-hoc on-demand processing). In the long run, facilitating exploitation of a powerful and reliable Grid infrastructure, together with high-level data services, will allow spreading and broadening the requirements that the Fisheries Resources Management communities and might raise for new applications and data handling procedures.

Aquatic Species Assessment is performed by the FAO Fisheries department and the WorldFish Center of CGIAR in collaboration with several other international research groups and in compliance with the guidelines established by the *Ecosystem Approach to Fishery* management (EAF). The procedures require that the problem is analysed from different complementary perspectives and involves researchers from several disciplines (marine biologists, oceanographers, climatologists, geographic information systems experts, socio-economists, fisheries managers, etc.) that collaborate to tackle the various aspects of the endeavor. Currently, scientists produce species assessments by processing statistical models which are based primarily on catch and biologic data, and when available, effort data. The D4Science project intends to develop a framework where key facilities are provided to the scientific community for using the data sources, tools, and computational resources available in the e-infrastructure, in order to produce their species assessments in a productive and efficient manager.

Resources - eInfrastructure

D4Science infrastructure is composed by a vast number of physical and virtual resources. Currently, user-communities' specific resources are provided by the D4Science partners and in the future by other stakeholder organisations within the relevant communities. Eventually, the computational and storage resources will be made available to the EGEE Grid infrastructure layer, while the data and service resources will be registered directly as D4Science sites. Data resources expected to be shared through this e-infrastructure include information objects of a great variety of types, volume, and complexity with rich metadata, such as repositories of textual documents, statistics database, large geographic images collections, ontologies, taxonomies, and metadata specifications.

D4Science concretely contributes to the EGEE infrastructure by extending the PPS infrastructure with 5 gLite sites and through validating the infrastructure, by early adoption of its artefacts and by stressing its services and procedures.

gCube Technology

The D4Science project takes an existing test-bed e-infrastructure (developed by the DILIGENT project) and brings it into production. The empowering mechanism of the infrastructure and the services built on top of it, is the *gCube system*, which consists of a number of operational entities (services, components) and a set of frameworks that allow resource sharing, monitoring, management, discovery and utilisation as well as out-of-the-box Information Retrieval and Knowledge Generation supporting mechanisms (among which multi-domain search and workflow composition and execution).

The management and evolution of this e-infrastructure is designed so that it may be upgraded by periodically deploying more consolidated and extended releases of the gCube software system (developed to support computational, data, and service resources based on the WSRF conceptualisation) and new user-communities' specific resources.

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- Universität Basel (UNIBASEL) Switzerland
- European Space Agency (ESA) France
- The Food and Agriculture Organization of the United Nations (FAO) Italy
- International Center for Living Aquatic Resources Management (WorldFish Center) Malaysia
- 4D SOFT Számítástechnikai Kft (4D SOFT) Hungary

gCube System

... grid for computing

gCube enables cost-effective utilisation of the computational and storage resources of the grid infrastructure, in a landscape of custom processing of structured and unstructured payload

... grid for content

gCube offers a feature-full platform for distributed hosting, management and retrieval of data and information, and a framework for extending state-of-the-art indexing, selection, fusion, extraction, description, annotation, transformation, and presentation of content

... grid for services

gCube eliminates manual deployment overheads, guarantees optimal placement of services within the infrastructure and opens unique opportunities for outsourcing state-of-the-art implementations

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