

Agrodat.hu: Big Data solutions to support precision agriculture

Precíziós mezőgazdaság támogatása Big Data megoldásokkal

Dr. LOVAS Róbert (MTA SZTAKI)

Dr. ÉLŐ Gábor (Széchenyi István Egyetem)

KOPLÁNYI Krisztián (eNET Internetkutató és Tanácsadó Kft.)

GARAI György (Hewlett-Packard Informatikai Kft.)

Main objective: Establish an agricultural **knowledge centre** and decision support system

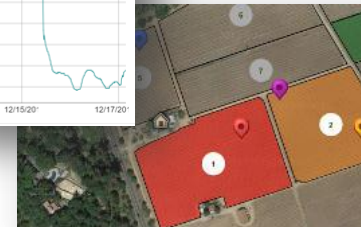
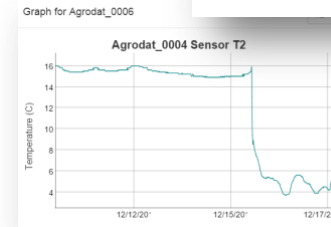
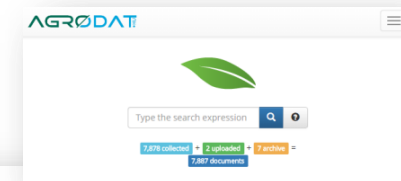
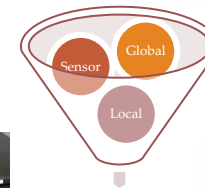
- based on data gathered by an innovative, **complex sensor** system and from international open repositories
- relying on **big data, cloud,** and **HPC** technologies to support precision agriculture.

Duration: 2014-2017

Budget: 2.4 Mrd HUF (appr. 8 MEUR)

URL: www.agrodat.hu

Consortium:





Environmental sensors

These sensors measure relative humidity, air temperature or vapor pressure. Light sensors determine the intensity of photosynthetically active radiation. The values correlate closely with photosynthetic activity and vegetation growth. Leaf wetness sensors are designed to detect wetness and ice formation on leaf surfaces. The data is useful for forecasting plant diseases and determining spraying actions.

Soil sensors

Soil sensors measure volumetric water content, electric conductivity, soil temperature and carbon-dioxide concentration. Water content refers to the water available for plants. Electric conductivity correlates with salt content, influencing plant growth. This data can be used for planning irrigation, forecasting plant diseases, and assessing soil respiration.

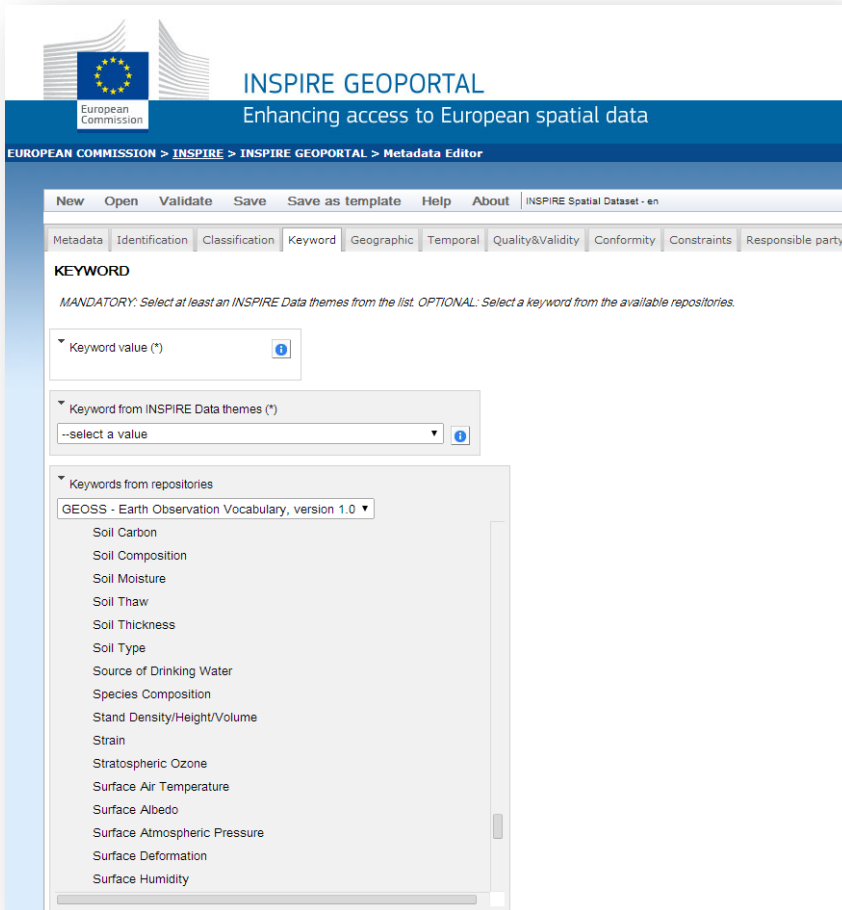


Environmental sensors

Air temperature at 10 and 200 cm	range:-40 - + 60 °C accuracy: ±1 °C
Relative humidity at 10 and 200 cm	range: 0-100% RH accuracy: ±2%
Precipitation at 200 cm	range: from 0 mm accuracy: 0,5 mm
Wind direction	range: 0 - 359°
Wind speed	range: 0 – 51 m/s
Photosynthetically active radiation at 200 cm	range: 0-1100 W/m2 accuracy: ±5%
Leaf wetness at 100 cm (FDR probe)	mV output at 3V excitation

Soil sensors

Soil temperature at 5, 20, 40, 60, 80 cm	range:-40 - + 60 °C accuracy: ±1 °C
Soil humidity (FDR probe) at 5, 20, 40, 60, 80 cm	range: 0-100% VWC accuracy: ±15%
Soil water potential	calculated in kPa (pF)
Salt content in soil water (by electric conductivity)	range: 0 – 23 dS/m accuracy: ±10%
Soil CO ₂ concentration at 50 cm (NDIR probe)	range: 0..5% accuracy: ±5%



INSPIRE GEOPORTAL
Enhancing access to European spatial data

EUROPEAN COMMISSION > INSPIRE > INSPIRE GEOPORTAL > Metadata Editor

New Open Validate Save Save as template Help About | INSPIRE Spatial Dataset - en

Metadata Identification Classification **Keyword** Geographic Temporal Quality&Validity Conformity Constraints Responsible party

KEYWORD

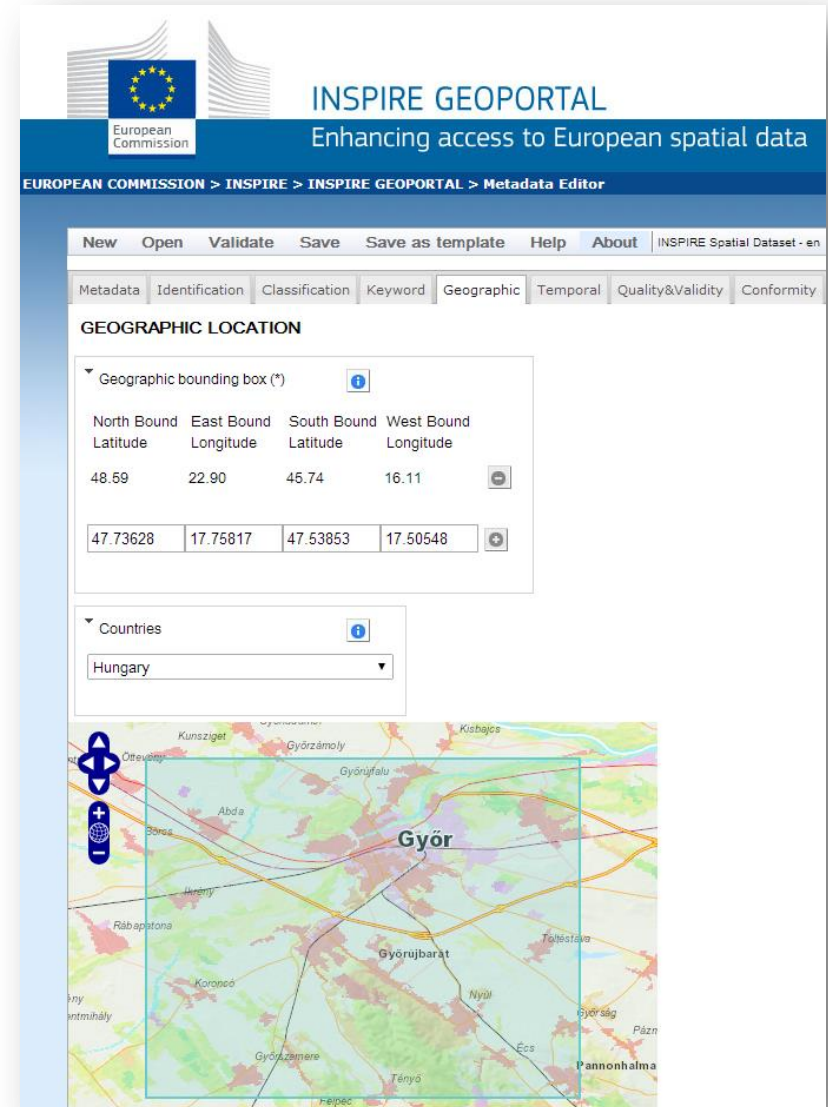
MANDATORY: Select at least an INSPIRE Data themes from the list. OPTIONAL: Select a keyword from the available repositories.

Keyword value (*)

Keyword from INSPIRE Data themes (*)

Keywords from repositories

- GEOSS - Earth Observation Vocabulary, version 1.0
 - Soil Carbon
 - Soil Composition
 - Soil Moisture
 - Soil Thaw
 - Soil Thickness
 - Soil Type
 - Source of Drinking Water
 - Species Composition
 - Stand Density/Height/Volume
 - Strain
 - Stratospheric Ozone
 - Surface Air Temperature
 - Surface Albedo
 - Surface Atmospheric Pressure
 - Surface Deformation
 - Surface Humidity



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Metadata Identification Classification Keyword **Geographic** Temporal Quality&Validity Conformity

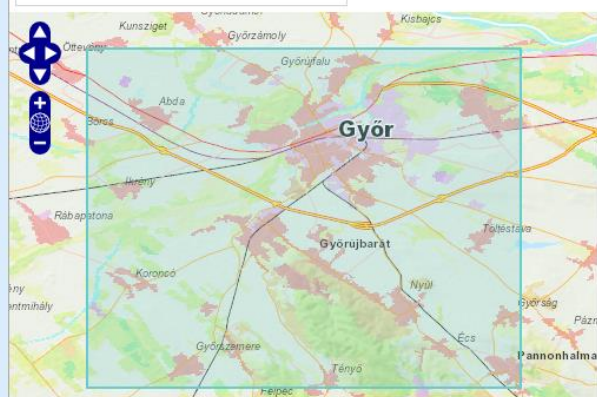
GEOGRAPHIC LOCATION

Geographic bounding box (*)

North Bound Latitude	East Bound Longitude	South Bound Latitude	West Bound Longitude
48.59	22.90	45.74	16.11
47.73628	17.75817	47.53853	17.50548

Countries

Hungary



- NoSQL database in the cloud:



AgroDat.hu HPC and Big Data center in numbers

- 844 CPU Core
- 5274 GB Memory
- 564 TB solid state and spinning storage
- 21504 CUDA Core (GPGPU)
- 488 Xeon Phi Core

Network

- 40 Gb Infiniband for HPC
- 10 Gb copper for general usage
- 1 Gb copper for management network
- 8/16 Gb fiber channel for SAN
- Connected to HBONE/Geant

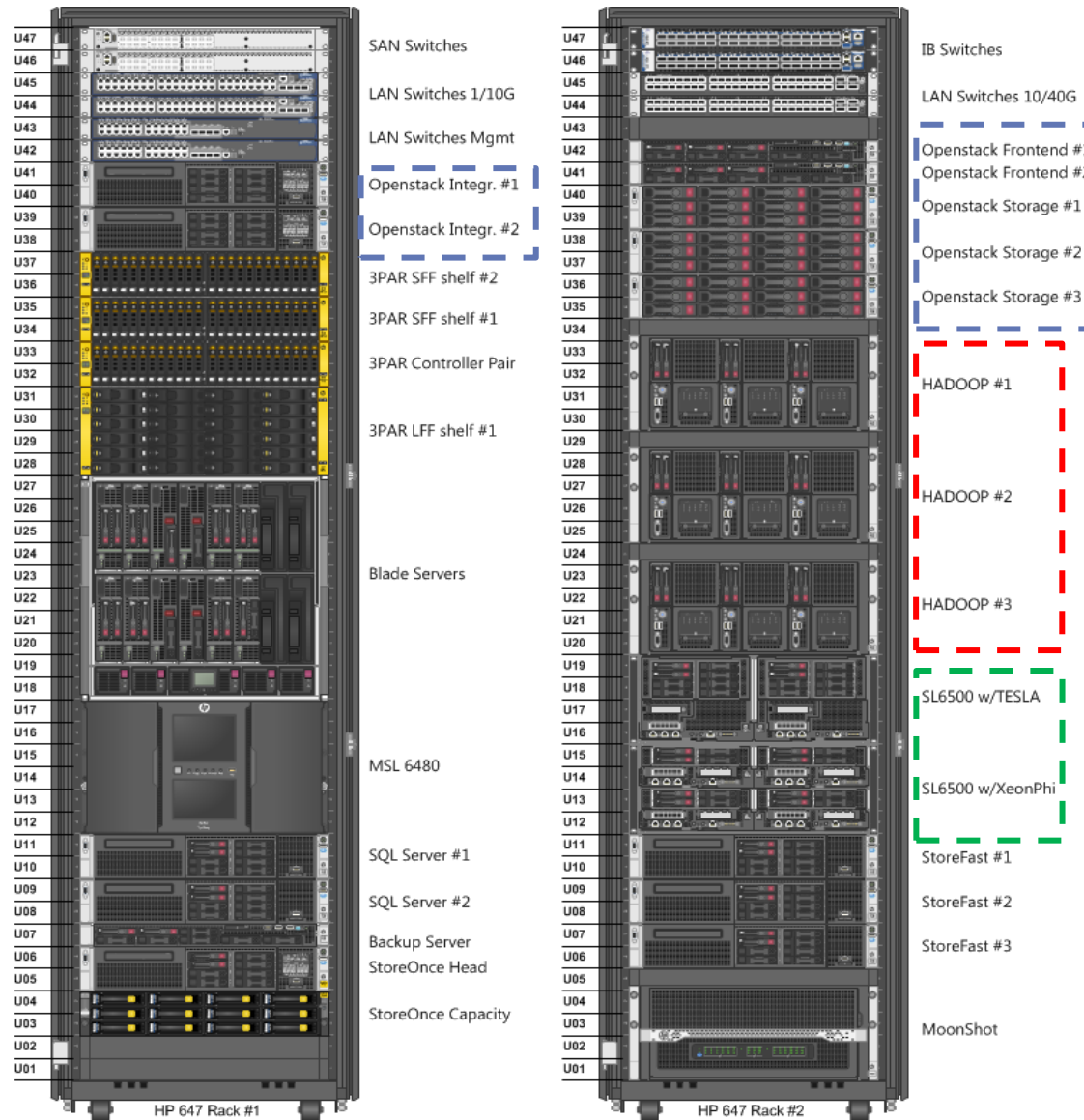
Cloud middleware

- **OpenStack with Ironic**



Power consumption

- 8-16 kW





EU FP7 agINFRA project

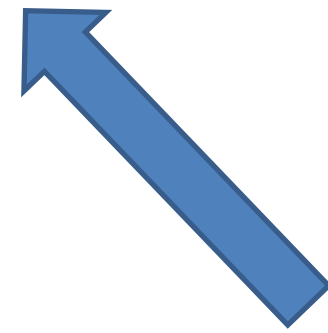
Objectives

- Develop open and interoperable e-infrastructure and services
- Support efficient federation and sharing of research results
- Increase interoperability between agricultural and other data resources
- Promote trust in the sharing of research datasets (open data)
- Foster preparedness to manage and exploit large-volume data aggregations



Some special features

- Application of Linked Data principles and methods
- Capability to handle various metadata standards
- Broad range of research information (publications and data)
- Inclusion of the Common European Research Information Format (CERIF)
- Support of research / professional networking (AgriVIVO)
- Open APIs for enhancing existing tools and services
- Grid / Cloud services for heavy data management tasks





agINFRA consortium & facts

*Leader of Integrated Services
workpackage*

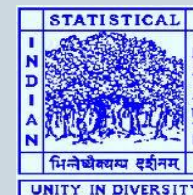
Technical



Universidad
de Alcalá



Content



Dissemination



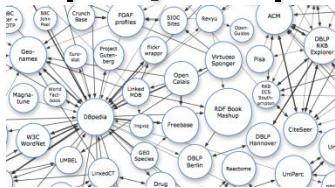
Users

EU FP7 agINFRA project
Duration: 2011-2015
Budget: 4.5 MEUR
URL: www.aginfra.eu



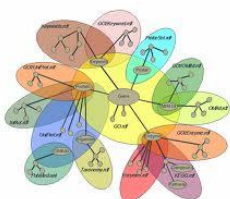
agINFRA values: scientific data must be

A | Open | Must be open and interlinked



NOT subject to barriers, based on standard formats and avoiding building data silos due to lack of interrelatedness and ad-hoc APIs.

B | Meaningful | Must be meaningful through explicit semantics



Reusing the semantics already provided in mature terminologies and ontologies that are exposed and interlinked through the Web.

C | Reliable | Must be reliable, traceable and accessible



Any kind of research objects can be stored in the data infrastructure, and there are NO barriers to expressing relations between these objects to capture the context of research activities.

D | Actionable | Must be actionable via services that empower research



Data is not useful without flexible and adaptable services that allow researchers to act on the data in the ways they need.



Results → new CIARD RING



A directory of information services and datasets in agriculture

- Home
- All info services
- Datasets
- Software
- Participants
- Open AGRigate
- Networks
- Indexing criteria
- About
- How to
- Linked Data

What is the RING

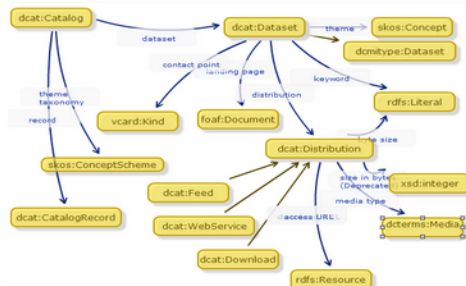
A directory of information services and datasets in agriculture. [\[read more >>\]](#)

All providers of agricultural information are invited to register their services and datasets on this portal: [see how](#)



view map of services

New data model



New services

Total: **1037** [RSS](#)

CRA RSS news feed
 Consiglio per la Ricerca e la sperimentazione in Agricoltura (CRA)
 Agriculture - General/All
 rss news
 Added on: 16/12/2014 - 4:24pm

Soil Monitoring Software
 Consiglio per la Ricerca e la sperimentazione in Agricoltura (CRA) - Centro di ricerca per l'Agrobiologia e la Pedologia (ABP)
 Agriculture - General/All
 Engineering, Technology and Research
 soil profiles
 geographical layers
 Added on: 16/12/2014 - 4:12pm

[more](#)

New datasets

Total: **279** [RSS](#)

CRA RSS news feed
 Consiglio per la Ricerca e la sperimentazione in Agricoltura (CRA)
 Agriculture - General/All
 rss news
 Added on: 16/12/2014 - 4:24pm

National Soil Database representative Soil Systems geography
 Consiglio per la Ricerca e la sperimentazione in Agricoltura (CRA) - Centro di ricerca per l'Agrobiologia e la Pedologia (ABP)
 Agriculture - General/All
 soil profiles
 soil maps
 Added on: 16/12/2014 - 4:00pm

[more](#)

New providers

Total: **498** [RSS](#)

Consiglio per la Ricerca e la sperimentazione in Agricoltura (CRA)
 Non-profit research organization
 Italy
 16/12/2014 - 4:21pm

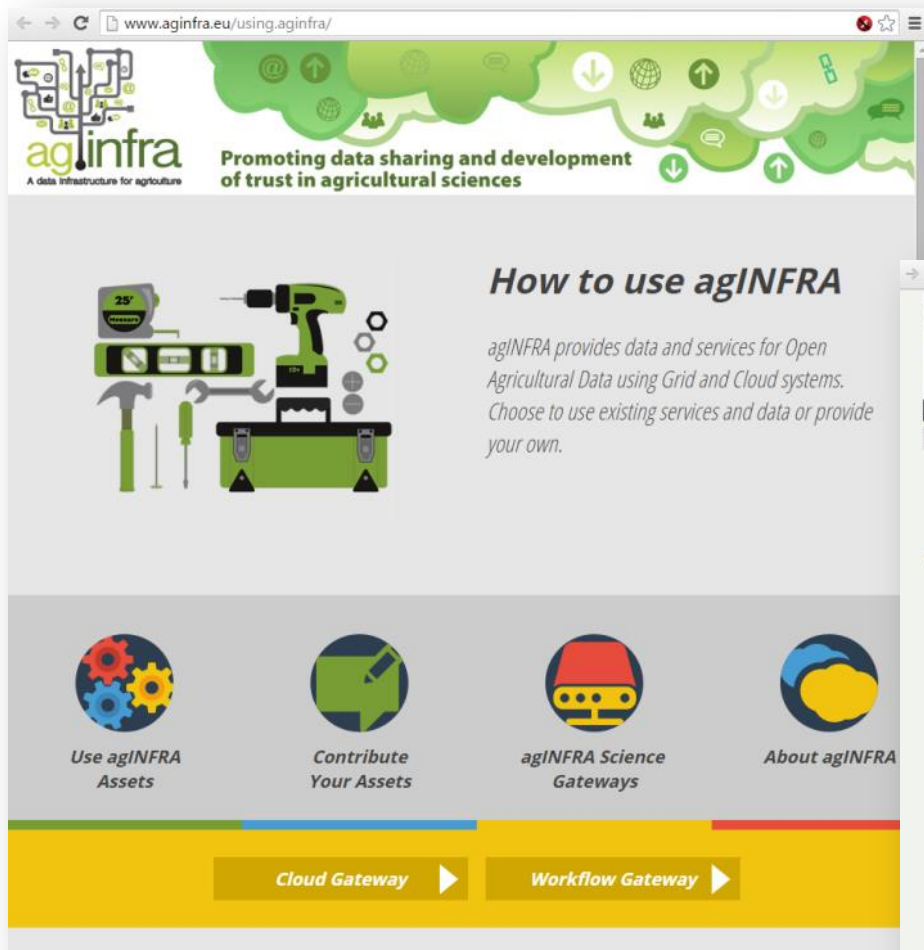
Consiglio per la Ricerca e la sperimentazione in Agricoltura (CRA) -

Distribution by domain






Results → agINFRA workflow gateway



www.aginfra.eu/using.aginfra/


aginfra
A data infrastructure for agriculture

Promoting data sharing and development of trust in agricultural sciences




How to use agINFRA


agINFRA provides data and services for Open Agricultural Data using Grid and Cloud systems. Choose to use existing services and data or provide your own.




Use agINFRA Assets



Contribute Your Assets



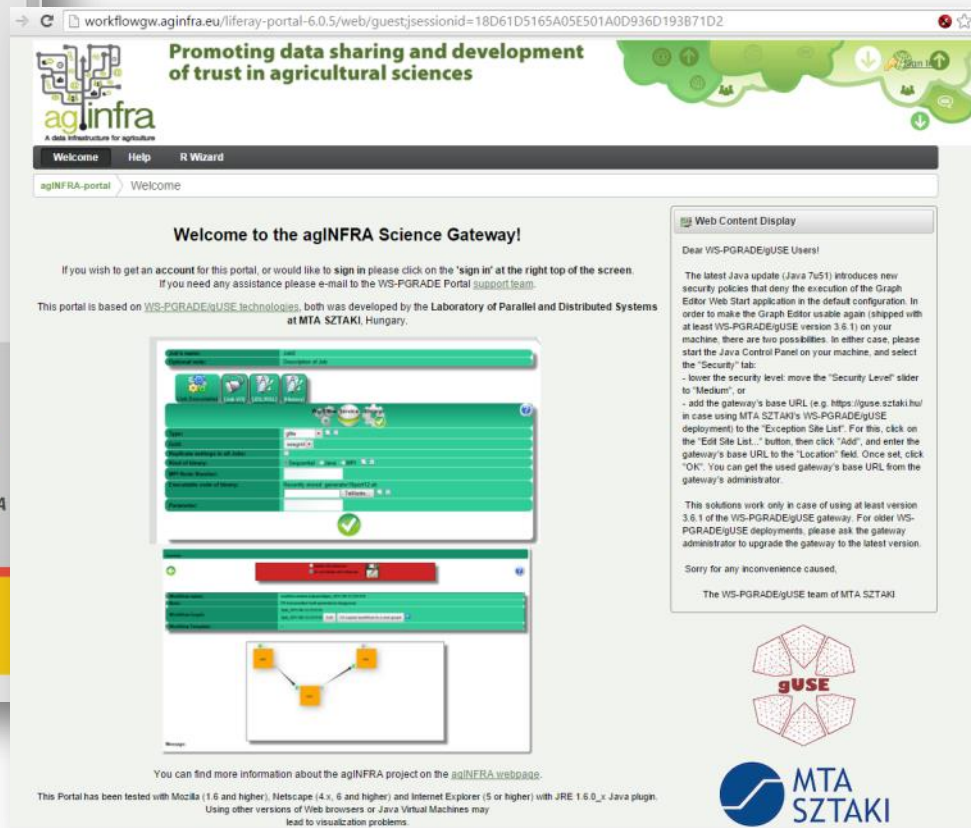
agINFRA Science Gateways



About agINFRA

Cloud Gateway ▶

Workflow Gateway ▶



workflowgw.aginfra.eu/liferay-portal-6.0.5/web/guest?sessionId=18D61D5165A05E501A0D936D193871D2

aginfra
A data infrastructure for agriculture

Welcome Help R Wizard

agINFRA-portal Welcome

Welcome to the agINFRA Science Gateway!

If you wish to get an account for this portal, or would like to sign in please click on the 'sign in' at the right top of the screen. If you need any assistance please e-mail to the [WS-PGRADE Portal support team](#).

This portal is based on [WS-PGRADEigUSE technologies](#), both was developed by the Laboratory of Parallel and Distributed Systems at MTA SZTAKI, Hungary.

Web Content Display

Dear WS-PGRADEigUSE Users!

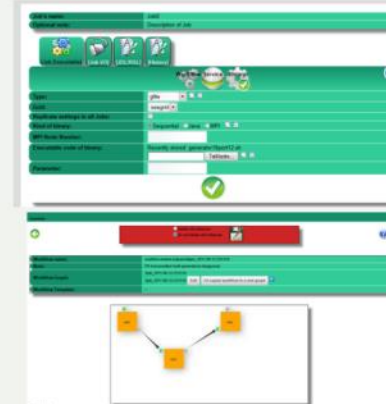
The latest Java update (Java 7u51) introduces new security policies that deny the execution of the Graph Editor Web Start application in the default configuration. In order to make the Graph Editor usable again (shipped with at least WS-PGRADEigUSE version 3.6.1) on your machine, there are two possibilities. In either case, please start the Java Control Panel on your machine, and select the "Security" tab:

- lower the security level: move the "Security Level" slider to "Medium", or
- add the gateway's base URL (e.g. <https://guse.sztaki.hu/>) in case using MTA SZTAKI's WS-PGRADEigUSE deployment) to the "Exception Site List". For this, click on the "Edit Site List..." button, then click "Add", and enter the gateway's base URL to the "Location" field. Once set, click "OK"; you can get the used gateway's base URL from the gateway's administrator.

This solutions work only in case of using at least version 3.6.1 of the WS-PGRADEigUSE gateway. For older WS-PGRADEigUSE deployments, please ask the gateway administrator to upgrade the gateway to the latest version.



Sorry for any inconvenience caused.

The WS-PGRADEigUSE team of MTA SZTAKI

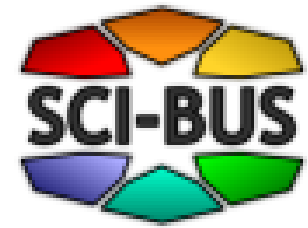


You can find more information about the agINFRA project on the [agINFRA webpage](#).

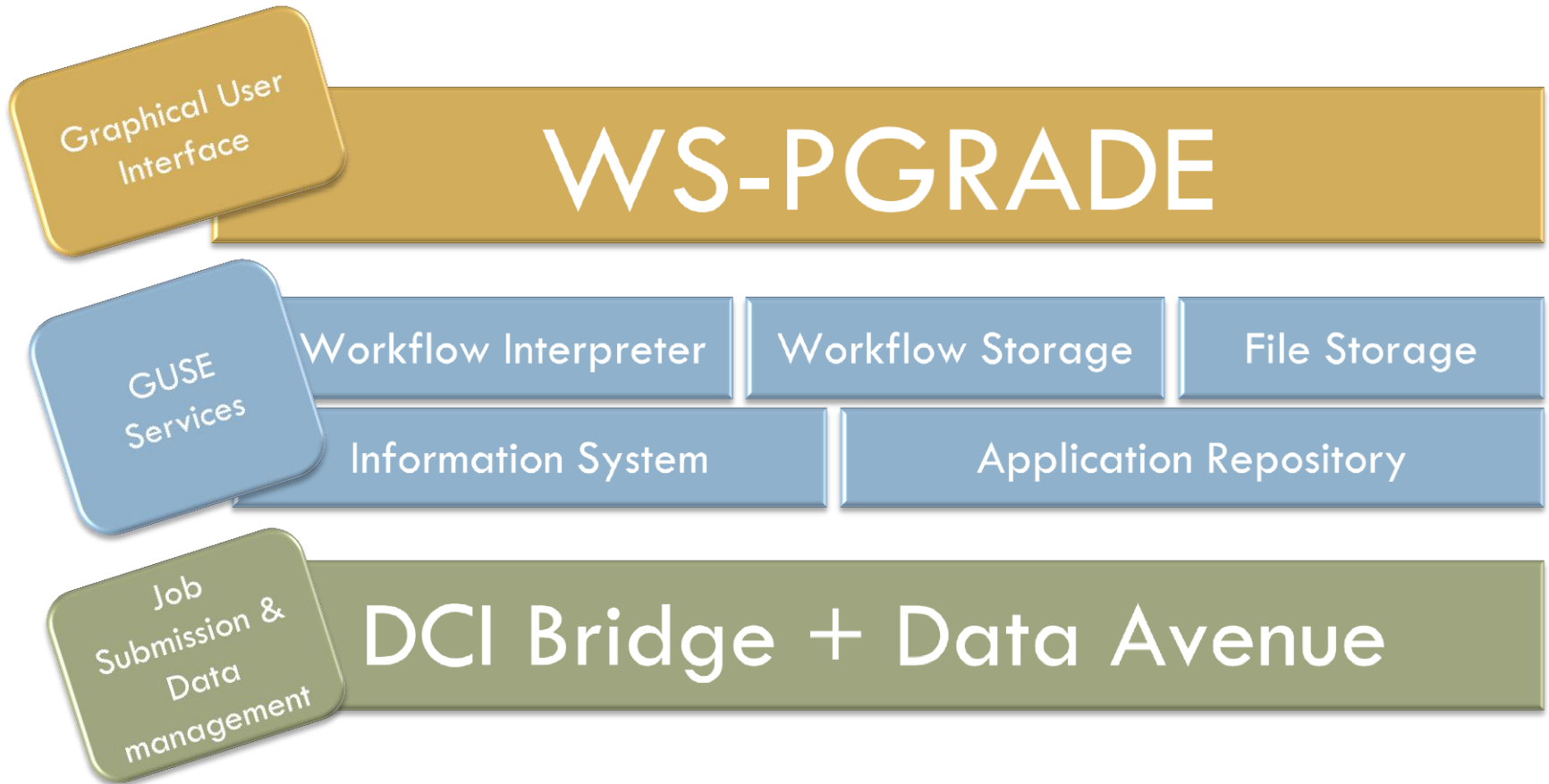
This Portal has been tested with Mozilla (1.6 and higher), Netscape (4.x, 6 and higher) and Internet Explorer (5 or higher) with JRE 1.6.0_x Java plugin. Using other versions of Web browsers or Java Virtual Machines may lead to visualization problems.

Generic gUSE Architecture



11

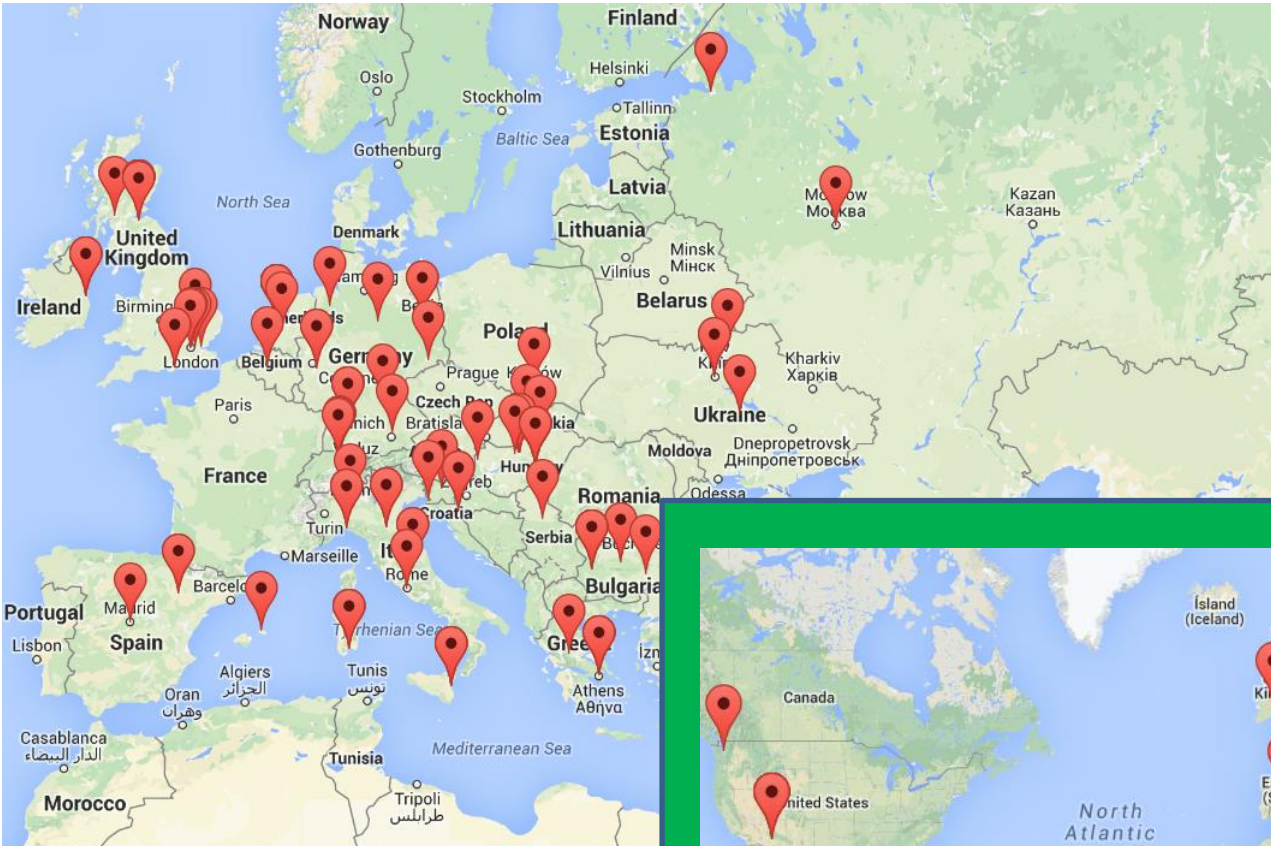


grid and cloud
User Support Environment

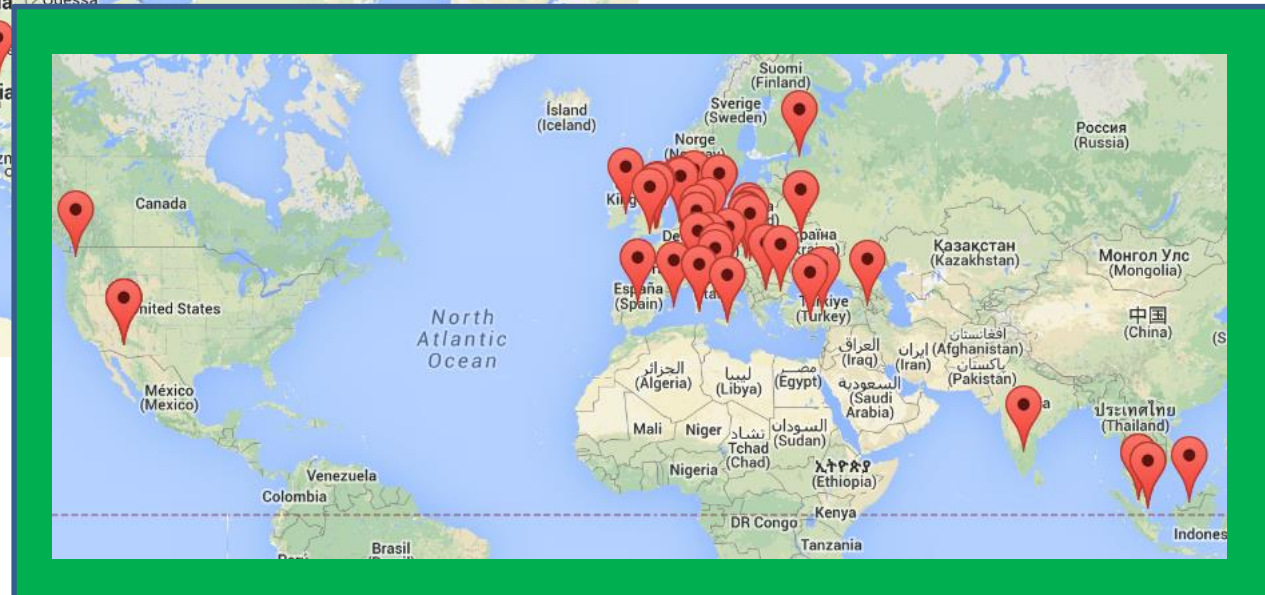
[source: SCI-BUS project]



Impact: gUSE based science gateways

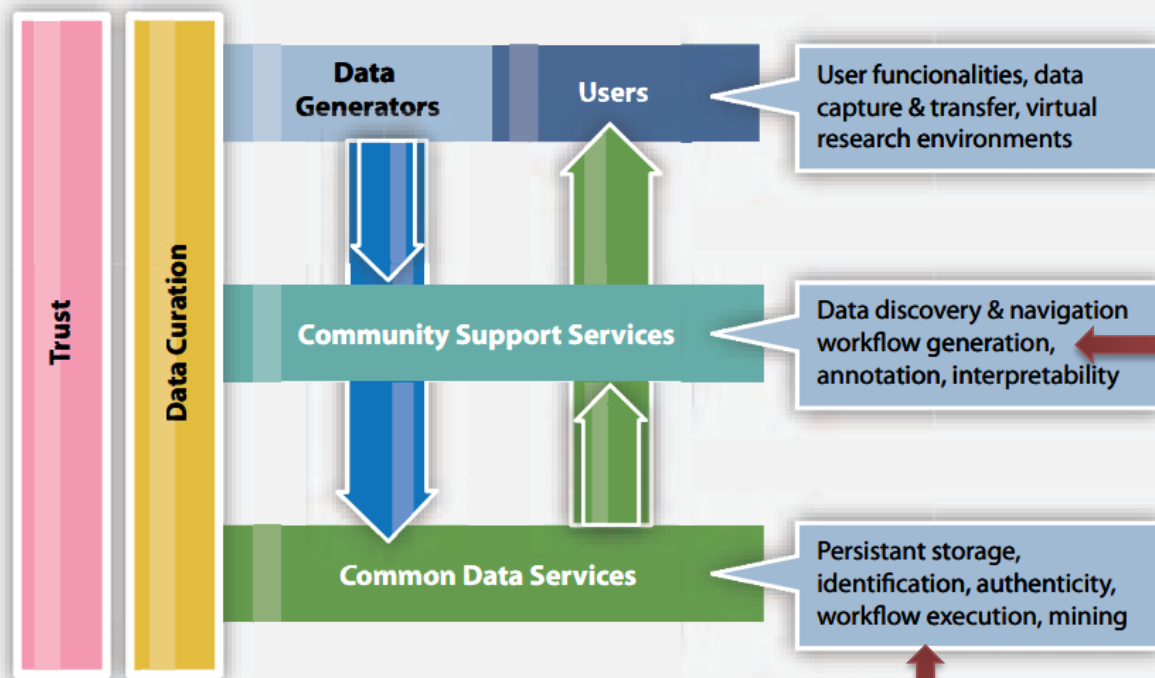


- More than **100** deployments world-wide
- More than **18.000** downloads from sourceforge.net



[source: SCI-BUS project]

The Collaborative Data Infrastructure - a framework for the future



Riding the wave

How Europe can gain from the rising tide of scientific data

Final report of the High Level Expert Group on Scientific Data
A submission to the European Commission

[source: EC]



agINFRA Science Gateway & aggregator for CIARD RING



agINFRA aggregator (Drupal interface)

View Edit

▼ Harvest targets from CIARD R.I.N.G.

Select protocol filter:

Select metadata set filter:

Select data type filter:

Select topic filter:

Select country (using RING URI) filter:

Select country (using Geopolitical ontology URI) filter:

STEP1: Filter targets: *

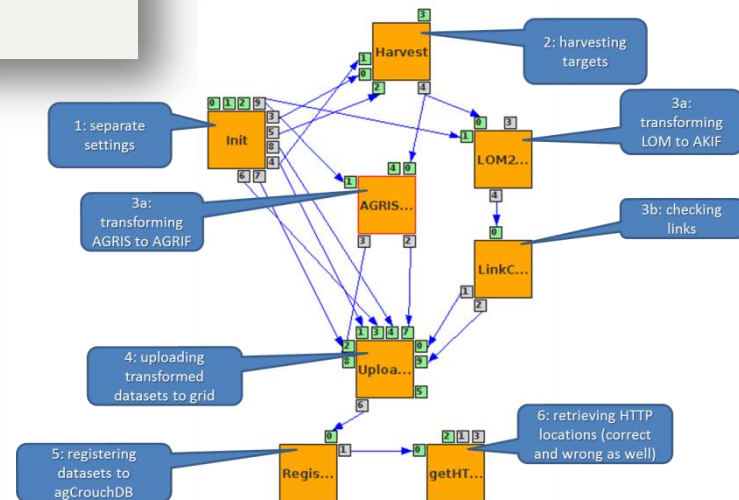
- Educational
- Bibliographic

STEP 2: Select targets matching with the selected filter: *

- Select -

Start harvesting!

► Set target information manually



Further building blocks of knowledge center: AgroVOC & HP Autonomy (IDOL)



The screenshot shows the AGROVOC website interface. At the top, there are language options: english, français, español, العربية, and 中文. The main header features the FAO logo and the text 'AIMS Agricultural Information Management Standards'. Below this is a login section with fields for 'Username:' and 'Password:', a 'LOGIN' button, and a link for 'Forgot your password?'. The main content area is titled 'Home » Vocabularies AGROVOC' and includes a search bar and navigation links for 'Search terms', 'Browse hierarchies', 'About', 'Uses', 'People', 'Access', 'Linked data', 'Web services', 'FAQ', 'Publications', and 'Contact'. A sidebar on the left contains links for 'Home', 'News & Events', 'Vocabularies', 'AGROVOC', 'AgroTagger', 'Ontology Plug-in tool', 'VEST: Vocabularies', 'Metadata', and 'Tools'. The main text describes AGROVOC as a controlled vocabulary covering all areas of interest of the Food and Agriculture Organization (FAO) of the United Nations, including food, nutrition, agriculture, fisheries, forestry, environment etc. It is published by FAO and edited by a community of experts. It also mentions that AGROVOC consists of over 32,000 concepts available in up to 20 languages and is used by researchers, librarians and information managers for indexing, retrieving and organizing data in agricultural information systems and web pages.


[source: FAO]



The screenshot shows the HP IDOL website. At the top is the HP logo. Below it is a navigation menu with 'Our Technology', 'Our Offerings', 'Our Products', and 'Our Work'. A secondary navigation bar includes 'Home', 'Our Products', and 'HP IDOL'. The main heading is 'HP IDOL'. Below the heading is a large image of a woman in a business suit interacting with a glowing globe. Underneath the image is the text: 'Access, understand, and analyze all your data'. The main body of text describes HP IDOL (Intelligent Data Operating Layer) as a next-generation information platform that enables users to extract meaning and act on virtually all forms of information, including unstructured data like audio, video, images, social media, email, and web content, as well as structured data like customer transaction logs. It highlights that IDOL serves as a scalable, secure platform for forming a conceptual and contextual understanding of content, offering far more than simple retrieval. It also mentions that IDOL's meaning-based computing enables users to access and use all critical information for maximum benefit through more than 500 advanced functions. Finally, it notes that legacy data warehouses and business analytics systems analyze business data from ERP, CRM, or SCM systems, and that IDOL can discover relationships between key data to reveal a depth of insight that helps users answer the "why did this happen?" question automatically and proactively.




[source: HP]

Hungarian Academy of Sciences
Institute for Computer Science and Control



Promoting data sharing and development of trust in agricultural sciences

Memorandum of Understanding
Between
the AgroDat.hu project and the agINFRA Consortium

This is an agreement between the "AgroDat.hu project", hereinafter called AgroDat and the agINFRA Consortium, hereinafter called agINFRA

I. PURPOSE & SCOPE

The purpose of this agreement is to define the responsibilities of the partners in promoting data sharing and development of trust in agricultural sciences.

II. BACKGROUND

AgroDat is a research project that aims to integrate agricultural knowledge from complex sensor systems, precision farming systems, and other data sources.



Research Data Sharing without barriers

Home Organisation Working and Interest Groups Plenary Meetings News & Events Early Career Programmes About

TAB ELECTIONS 2014 - MEET THE CANDIDATES Cast your votes!
Fourth Plenary Programme: Recordings, Speaker Profiles and Presentations
Photo Gallery | Cartoons

WORKING GROUPS

- Brokering Governance** (17 members)
Stefano Nativi, Max Craglia, Jay Pearlman
- Data Citation WG** (10 members)
Andreas Rauber, Ari Asmi, Dieter van Uytvenck
- Data Description Registry Interoperability** (47 members)
Amir Aryani, Adrian Burton

INTEREST GROUPS

- Agriculture Data Interest Group (IGAD)** (60 members)
Devika Madalli, Imma Subirats, Johannes Keizer
- Big Data Analytics IG** (75 members)
Morris Riedel, Rahul Ramchandran, Peter Baumann, Kwo-Sen Kuo
- Biodiversity Data Integration IG** (49 members)
Yde de Jong, Nicola Nicolson, Vince Smith, Paul Kirk, Dimitris Koureas

BOF GROUPS

- Active Data Management Plans** (26 members)
David Giaretta, Helen Graves, David Baker
- Data re-use, share your experiences** (17 members)
Odile Hologne
- Sustainability of eResearch / Cyberinfrastructure** (6 members)
Stefanie Kethers, Andrew Treloar

E-Infrastructure for Agriculture: it's time to grow!

Andreas Drakos and Robert Lovas invite you to join the planned Agricultural Sciences Virtual Team

Agriculture-related science domains are gaining more and more attention. Chris Rawlings from Rothamsted Research gave a great, comprehensive overview of the topic at the EGI Community Forum, on the same day that we organized a networking session around the same theme.

What have we learned during the agricultural sciences networking session?

At international level we gave a special focus to the solid results obtained by the FP7 agINFRA project. This project deals with open linked data and high-level integrated services for data management, processing and visualisation of agriculture data with the participation of the



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Is agricultural science ready for Big Data?

The Big Data challenge has reached agricultural sciences and new actions are under preparation. The agINFRA services, already available through the EGI Application Database, are just a first step to cover the growing needs of this community. This is why we are proposing a new Virtual Team to bring together the agriculture research community and EGI resource and technology providers. The VT's main goals are:

- > **Promote sharing of data and services:** Very often the difficulties experienced by this community are due to the lack of information about best practices. The VT will join forces with well-established networks and initiatives as the agINFRA and Agrodat.hu, to support the 'Open AGRI-Gate' campaign, an open agricultural data campaign designed to promote open data, register agriculture-related datasets and data services in one place and make them accessible and reusable by everyone.

- > **Gather special requirements:** The VT will bring together stakeholders on the agricultural field and gather specialised requirements that will serve as base for further collaboration e.g. in H2020.
- > **Sustaining existing solutions:** Sustainability of European projects' results usually depends on users, funding agencies, base technology and solution providers. Since EGI-related activities and sustainability plans might be important for this community as well, the mutual harmonisation, sharing best practices and experiences would be of high value to both EGI and initiatives.

More information

Andreas Drakos, Agro-Know
drakos@agroknow.gr

Robert Lovas, MTA SZTAKI (Hungarian NGI)
Robert.lovas@sztaki.mta.hu

agINFRA : <http://aginfra.eu>
Agrodat.hu : <http://agrodat.hu>

July #16 July 2014



[source: EGI.eu]



Termelők csatlakozását várjuk

Várjuk, a 2015-ös évben kukorica termesztését tervező, innovatív, hosszútávú fejlesztési folyamatban részt venni kívánó gazdák jelentkezését.



A projekt küldetése

Mezőgazdasági tudásközpont és döntéstámogató rendszer megvalósítása innovatív, komplex szenzorrendszer által gyűjtött nagyfelbontású idősoros adatok alapján.



A megvalósító konzorcium

eNET Internetkutató és Tanácsadó Kft. |
Hewlett-Packard Informatikai Kft. | MTA SZTAKI
| Széchenyi István Egyetem