

**A Routemap to Information Nodes and
Gateways (RING)**
for Agricultural Research for Development
(ARD)

Handbook

What is the RING and why it was created
Using the RING portal
Basic concepts and technologies for interoperability

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About this handbook

This handbook provides information on the CIARD RING portal and detailed instructions on how to use it.

In the second part, the handbook gives an overview of standards and technologies for interoperability that are essential for understanding the classifications of services in the RING and for correctly registering new services.

This is the second revision and is last updated on 14 June 2011.

Part 1. The RING

1.1 What is the RING

The RING is a registry of information sources/services in agriculture.

The services registered in the RING are described in details and categorized according to criteria that are relevant to the use of the service and its interoperability (such as metadata standards adopted, subject vocabularies used, technologies used, protocols implemented etc. - see part 2 on interoperability).

The RING facilitates the discovery of sources of agriculture-related information across the world.

Functions of the RING

- to provide a map of accessible information sources with details on standards and technologies used and instructions on how they can be searched and re-used effectively;
- to provide examples of services that show good practices on implementing “interoperability”;
- to provide references to relevant information management standards and tools and to infrastructural services (web services, endpoints) that facilitate their usage;
- to provide instructions for building enhanced integrated services that repackage information in different ways

Fig. 1.1. The RING homepage at <http://ring.ciard.net>

The screenshot shows the CIARD R.I.N.G. homepage. At the top, it says "The CIARD R.I.N.G. A Routemap to Information Nodes and Gateways (RING) for Agricultural Research for Development (ARD)". The CIARD RING logo is on the right. Below the header is a navigation bar with tabs: Home, About the RING, News, Help & FAQ, and Participants. On the left is a sidebar with "RING services" (Registered services, Geographic search, etc.), "How to Standards", and "Member area" (Login, Register). The main content area has a "Welcome to the CIARD R.I.N.G. Portal" section, followed by "A registry of information sources/services in agriculture." with statistics: 155 services/sources and 126 providers. Below this is a pie chart titled "Distribution by type of service" with labels for various service types like OAI harvester, Open Access Journals, etc. On the right, there are sections for "Facilitated by GFAR", "Full feed", "Latest additions" (CIAT BliipTv, CIAT Blog Noticias, CIAT Google Books), and "Information flows" with a diagram showing connections between AgriFeeds, Aginfo News from IAA, and International Water.

Why the RING?

Consumers of agricultural information have complex information needs that require up-to-date information from different sources. They need gateways that give integrated

access to several sources. Managers of information services, who should provide such gateways, have difficulties in identifying relevant sources and in re-using information from them to re-purpose it for their end-users.

The RING was created with the objective of making information sources more easily “discoverable” and to allow other services to re-use and re-package their information to make it accessible in different ways (different browsing and search options, different formats, different channels for different users).

Who uses the RING?

The RING is designed mainly for agricultural information managers and IT professionals. The main objective is to help them provide better information services.

However, the RING was created with the needs of the end-users of agricultural information in mind.

Consumers of agricultural information will benefit from the RING infrastructure to the extent that the RING will be exploited by information service managers in order to: a) create better interoperable sources and b) leverage existing interoperable sources to provide better integrated information systems for their users.

Consumers can also use the RING as a “bookmark” list of agricultural information services.

Expected impact of the RING

The potential impact of the RING is not so much in the collected information itself as in what can be built out of it. Providing structured information on the metadata sets, formats, protocols and vocabularies used in each registered source will facilitate the building of applications like:

- services that offer a common browsing or searching interface to different sources;
- aggregating and harvesting services;
- integrated services providing relations between entities (organizations, projects, experts, documents) through semantic-web technologies;
- services that re-package information and make it available through different channels (text messaging, radio etc.);
- services that interface the different knowledge organization systems (KOS) used by different sources;
- applications providing value-added services like digests, bibliographies, best practices, surveys etc.

The way forward: leveraging the RING Registry to build advanced services

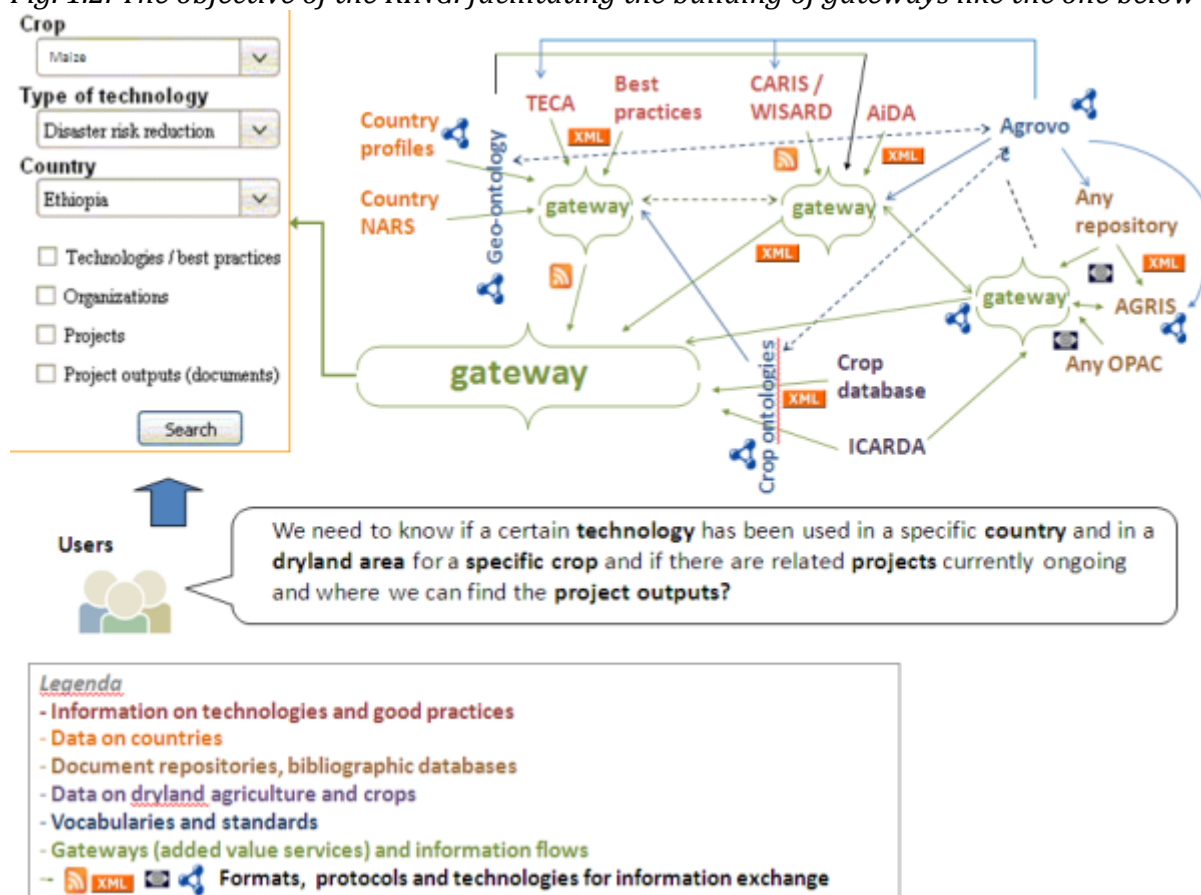
Once the descriptions collected about services is detailed and structured enough, and once the number of registered services is sufficiently large, some advanced services can be built directly on the content of the RING website. Examples of such services are:

- A global harvester of all registered providers of Open Archives
- A viewer/navigator for registered RDF stores
- Thematic aggregators that harvest from registered RSS
- Sample consumers of web services
- Sample programming code on how to implement services

However, the main objective of the RING is not that of providing direct access to information coming from the registered sources / services, but that of providing valuable information and examples to the managers of information systems so that they can provide better access to information.

This is why the advanced services that may be built in the RING are mainly for demonstrative purposes, while the actual services giving access to relevant contents should be provided by the various actors that have a mandate to serve specific stakeholder groups / communities and improve their access to information and knowledge.

Fig. 1.2. The objective of the RING: facilitating the building of gateways like the one below



1.2 What you can do with the RING

Information managers may go to the RING to:

- Look for information sources (RSS feeds, OA archives, RDF stores...) that can be harvested or imported into their systems
- Look for information services (bibliographic databases, search engines, harvesters, aggregators...) to which they can contribute their contents
- Learn more about what others are doing, look at examples and tutorials on how to build better interoperable sources and better added-value services
- Register the services for which they are responsible in order to make them known and facilitate their discovery by other information managers

What you can find / register in the RING

As stated at the beginning, the RING includes information sources and services.

It is important to define what an “information source” is and why in the context of the RING the terms information source and information service are used indifferently: in nowadays information architectures, the distinction between the two is very fluid. This is why the concept of “nodes and gateways” in the RING covers both information sources and information services, that is, both “static” files available in some structured format (like XML or RDF, but also data text files like .csv) and interactive services like search engines and web services. The reason is that both ways of making information available

can be made interoperable and can contribute to improve the accessibility of information on the whole.

In a broader sense, the definition of "service" in this context includes any form of providing information from one server instance (website, mail server, web services, XML archive...) to many clients (browsers, email clients, news readers, parsers, harvesters...).

Examples are:

- RSS feeds
- XML exports of information based on agreed metadata sets (e.g. the AGRIS data providers)
- Open Archive Initiative (OAI) data providers
- OAI harvesters
- services that offer web services for accessing and re-using their information
- RDF stores
- SPARQL engines

See Part 2 on Interoperability for more information on some of the terms used above.

In the following sections you will find instructions and examples on how to use the RING for different purposes.

1.2.1 Search for information sources / services

Services are indexed in the RING according to different criteria.

Content criteria such as

- thematic coverage
- geographic coverage
- content type
- target audience

Technical criteria such as

- standards adopted
- KOS¹ used
- technologies used
- protocols² implemented

Therefore, services / sources can be browsed and searched using different criteria.

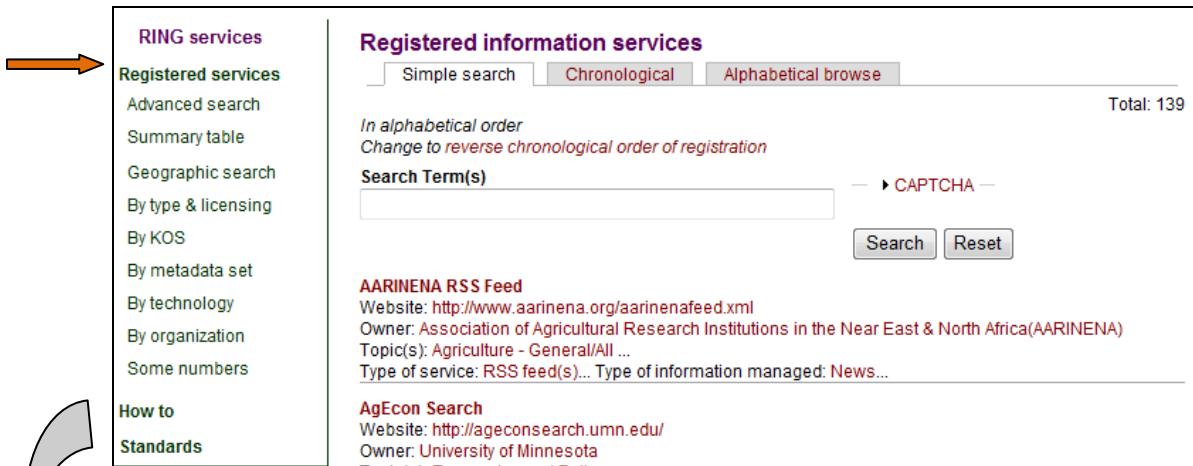
However, it must be noted that not all service providers always submit comprehensive information about their services, which results in some services not showing up under a category they would belong to because they were not indexed under that category by their owners.

The simplest form of search that can be performed in the RING is the simple search under the main "Registered services" navigation link.

Fig. 1.3. Simple search

¹ Knowledge Organization Systems: controlled lists (flat, hierarchical, or organized as an ontology) of terms or concepts, used to organize data according to subject areas, domains, geographic coverage etc. Examples are classifications, subject headings, thesauri, ontologies... See part 2 on Interoperability

² See part 2 on Interoperability



Here is a short summary of all the kinds of searches that can be performed and all the browsing interfaces available in the system:

Fig. 1.4. The main search / browse menu on the left

- RING services**
- Registered services** ← This will display a list of services starting from the latest additions and a simple search box
- Guided search** ← This will display an intuitive search / browse interface allowing to narrow down searches
- Advanced search** ← This will display an advanced search form allowing to search using all the filters in the system
- Summary table** ← This will display services in a table layout allowing to sort by different fields
- Geographic search** ← This will display a page with filtering options by geographic coverage and geographic location
- By type & licensing** ← This allows to browse the directory by service type
- By KOS** ← This allows to browse the directory by KOS (see further below) adopted by the services
- By metadata set** ← This allows to browse the directory by metadata sets adopted by the services
- By technology** ← This allows to browse the directory by technologies (RSS, OAI, RDF...) implemented by the services
- By organization** ← This allows to browse the directory by organizations providing the services
- Some numbers** ← This shows some interesting numbers (for the moment, only on document repositories)
- RDF store**
- How to** ← Under this sub-menu you will find examples and tutorials on how to use standards and technologies
- Standards** ← Under this sub-menu you will find information on metadata set and subject indexing useful "standards"

1.2.1.1 Example: search for sources that you can harvest

Example: an information system manager is building a common search engine on several document repositories on the subject of Fisheries and plans to use the OAI-PMH protocol³ to harvest from all repositories.

In the Advanced search page, in the first section of the form they can limit the search to the domain/subject "Fisheries and Aquaculture" and to the type of service they are looking for: document repositories.

Fig. 1.5. Advanced search: only repositories with documents on Fisheries

³ See Part 2 on Interoperability

In the second section of the page, they can limit the search to services that comply with the technical requirements of the harvesting system: document repositories must use the OAI-PMH protocol to expose their records.

Optionally, they can limit the search to services using a specific KOS, if the common search engine adopts a specific KOS for subject searches (e.g. Agrovoc for all agriculture-related subjects, or the ASFA thesaurus specifically for fisheries).

Fig. 1.6a. Advanced search: only sources exposed through the OAI-PMH protocol and using either Agrovoc or ASFA as KOS for subject indexing

As of the moment when this handbook is prepared (May 2011) the above search would return 2 services, while the same search without the filter for two specific KOS would return 11 services exposing documents on Fisheries through the OAI-PMH protocol.

For more information on technical terms used in the advanced search form, see Part 2 on Interoperability.

Normally, an information manager who looks for sources in the RING is aware of the standards and technologies he has to look for in the system.

For more complex searches, where users want to first filter services according to a criterion and then narrow down their search depending on resulting records, there is a Guided search section:

Fig. 1.6b. Guided or “faceted” search

Guided search

Keyword search

With all of the words ▾

Guided search

Click a term to initiate a search.

<p>Domain</p> <ul style="list-style-type: none"> Agriculture - General/All (79) Natural Resources and Environment (38) Animal Production and Health (36) Plant Production and Protection (33) Farming Practices and Systems (28) Fisheries and Aquaculture (27) <p>Other subjects</p> <ul style="list-style-type: none"> Agriculture - General/All (3) agricultural innovation (2) Livestock (2) 	<ul style="list-style-type: none"> Rural and Social Development (26) Food Security (25) Forestry (25) Engineering, Technology and Research (24) more... <ul style="list-style-type: none"> agricultural research (1) agriculture - general (1) Agroecology (1) 	<p>Service type</p> <ul style="list-style-type: none"> Document Repository (88) OAI provider (48) Local search engine (12) Website (8) OAI harvester (6) RSS feed(s) (3) <p>Information Object</p> <ul style="list-style-type: none"> Documents (DLIOs) (107) News (7) Projects (4) Events (3) Learning objects (3) Experts / Researchers (2) 	<ul style="list-style-type: none"> Bibliographical database (3) Database (3) List of publications (3) Feed aggregator (2) more... <ul style="list-style-type: none"> Institutions (2) Research data (2) Blog posts (1) Journals (1) more...
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After the initial selection in the page above, a first list of results will be displayed, and in the right column a “Current search” box will display the category that was selected and a “Guided search” box will display further category listings for narrowing down your search.

The Current search box will always display all the search criteria that have been selected and also provide delete icons (crosses) for each of them in order to remove one or more of the criteria (to broaden the search again).

Fig. 1.6c. Guided or “faceted” search: current search box and guided search box

Guided search: OAI provider, AGROVOC Multilingual agricultural thesaurus (AGROVOC)

Results Results 1 - 10 of 12

Repositório da Universidade Técnica de Lisboa
 URL: <http://www.repository.utl.pt>
 Owner: Instituto Superior de Agronomia
 Type of service: OAI provider
 Document Repository

LAO Agriculture Database
 URL: <http://lad.nafri.org.la>
 Owner: National Agriculture and Forestry Research Institute
 Type of service: OAI provider
 Document Repository


ICRISAT Open Access Repository
 URL: <http://openaccess.icrisat.org>
 Owner: International Crops Research Institute for the Semi-Arid Tropics (ICRISAT)
 Type of service: Document Repository
 OAI provider

IDEALS - Illinois Digital Environment for Access to Learning and Scholarship
 URL: <http://ideals.illinois.edu>
 Owner: University of Illinois
 Type of service: OAI provider
 Document Repository

Epsilon Dissertations and Graduate Theses Archive
 URL: <http://diss-epsilon.slu.se>
 Owner: Swedish University of Agricultural Sciences
 Type of service: OAI provider
 Document Repository

Bioversity International Publications
 URL: <http://www.bioversityinternational.org/publication...>
 Owner: Bioversity International
 Type of service: Document Repository
 OAI provider

BIBSYS ASK
 URL: <http://ask.bibsys.no/ask/action/resources?lang=en>
 Owner: Norwegian University of Life Sciences
 Type of service: Document Repository

Facilitated by  GFAR

Current search
 [*] Service type: OAI provider
 [*] KOS adopted: AGROVOC Multilingual agricultural thesaurus (AGROVOC)

Guided search
 Click a term to refine your current search.

Domain
 Agriculture - General/All (11)
 Farming Practices and Systems (7)
 Natural Resources and Environment (7)
 Plant Production and Protection (7)
 Economics and Policy (6)
 Food Security (6)
 Rural and Social Development (6)
 Animal Production and Health (5)
 Food safety and Human nutrition (5)
 Forestry (5)
 more...

Region (location)
 Europe (7)
 Asia (2)
 South America (2)
 North America (1)

Geographic coverage
 Global (6)
 National (6)

FAO region
 Southwest Pacific (1)

1.2.1.2 Example: search for services that may want your contents

Example: an information manager manages a document repository containing resources on the subject of plant protection; the repository implements the OAI-PMH interface and they are looking for service providers that may be interested in harvesting documents from the repository.

In the Advanced search page, in the first section of the form they can limit the search to the domain/subject “Plant Production and Protection” and to the type of service they are looking for: OAI harvester.

Fig. 1.7. Advanced search: only OAI harvesters in the subject area of Plant protection.

<p>Domain</p> <div style="border: 1px solid #ccc; padding: 2px;"> <p>Natural Resources and Environment ▲</p> <p style="background-color: #e0f0ff;">Plant Production and Protection (≡)</p> <p>Rural and Social Development ▼</p> </div>	<p>Specific subject(s)</p> <div style="border: 1px solid #ccc; padding: 2px;"> <p>agriculture-general ▲</p> <p style="background-color: #e0f0ff;">Agroecology (≡)</p> <p>animal production ▼</p> </div>
<p>Type of service</p> <div style="border: 1px solid #ccc; padding: 2px;"> <p>Local search engine ▲</p> <p style="background-color: #e0f0ff;">OAI harvester (≡)</p> <p>OAI provider ▼</p> </div>	<p>Access / licensing / pricing</p> <div style="border: 1px solid #ccc; padding: 2px;"> <p>Based on copyright ▲</p> <p style="background-color: #e0f0ff;">Based on each institution policy (≡)</p> <p>Creative Commons ▼</p> </div>

1.2.2 Learn how to exploit / create interoperable services

Beside a section providing tutorials and glossaries on technologies and standards for interoperability, the RING provides useful learning material also in the metadata available for each service, where the owners of the service are invited to provide

instructions on how to use their service (query it, export from it, or contribute to it) and clear examples.

1.2.2.1 Instructions and examples provided by service managers

Although these fields are not mandatory, the owners of services registered in the RING are invited to provide instructions on how to use their service (query it, export from it, or contribute to it) and clear examples.

This feature is especially useful when a service offers a technologically complex interface (web services, an OAI-PMH interface, a SPARQL engine).

Beside being available in the service record, instructions and examples are also extracted and made available in a special search interface under “How to” at <http://ring.ciard.net/how>.

Fig.1. 8a. Specific example provided for the AgriFeeds service in order to get a specific feed

Example(s):

<http://www.agrifeds.org/en/node/1977/xml?region=Asia&language=en&max=5> will return an RSS feed of the 5 closest upcoming events in Asia

Fig. 1.8b. Instructions provided for the GFAR document repository on how to search and harvest records

Instructions

This section provides detailed instructions on how the service can be interoperated, e.g. the URLs, the parameters, the output format etc.

Instructions for getting information from this service:

The search can be performed using our search engine interface at <http://www.egfar.org/egfar/website/webring/publications/search> or using a RESTful web service (special URLs accepting parameters and returning filtered RSS feeds: see below).

Besides, the GFAR repository supports XML exports compliant to both Dublin Core - the default metadata set for the FAO Electronic Information Management System (EIMS) - and the AGRIS AP format. Thanks to the AGRIS AP export, GFAR is now an AGRIS Center and contributes its records to the **AGRIS search engine**. Records in the AGRIS AP format are exported on request.

The subject vocabulary adopted is the **GFAR taxonomy**, which has been mapped to Agrovoc for better interoperability.

Feeds from the repository: info for webmasters

Pre-defined feeds

Some pre-defined feeds of specific document sets are available [here](#) as cached RSS feeds (updated every 3 hours) for fast harvesting.

Dynamic feeds

Fig. 1.9. The special search interface for examples under “How to”

Practical examples from the registered information services

Search Term(s)

1. **from AgriFeeds**

<http://www.agrifeds.org/en/node/1977/xml?region=Asia&language=en&max=5> will return an RSS feed of the 5 closest upcoming events in Asia

2. **from AGRIS search engine**

<http://www.fao.org/agris/search/search.do?query=%2Bsubject%3Afarmers> will display a list of bibliographical records indexed with the Agrovoc keyword “farmers” as the subject

3. **from GFAR document repository**

A good example of a useful feed for “recent publications from GFAR” would be:
<http://www.egfar.org/egfar/inc/docRepRSS?recordsperpage=20>

4. **from GFAR document repository**

<http://www.egfar.org/egfar/inc/docRepRSS?QueryString=information%20management&recordsperpage=20> will return an RSS feed of all GFAR documents having “information management” in the title, abstract or subject field.

5. **from International Water Management Institute (IWMI) Publications Repository**

> It is possible to create custom searches in this repository. You can embed the search in your own website (example: using iFrames, etc).
Contact: Chandima Gunadasa (see contact info above)

6. **from International Water Management Institute (IWMI) Publications Repository**

> Custom search output can be interoperable via xml interface across an XSLT to be mapped to any other comparable dataschema
Contact: Chandima Gunadasa (see contact info above)

7. **from International Water Management Institute (IWMI) Publications Repository**

> IWMI Publications OAI BaseURL is
<http://imlstdcc.grainger.uiuc.edu/gateway.net/oai.aspx/iwmi.catalog.cgiar...>

1.2.2.2 Tutorials

Under “How to”, tutorials (<http://ring.ciard.net/tutorials>) and glossaries are becoming available.

Fig. 1.10. Index page of one of the available tutorials

OAI Harvesting

The Open Archives Protocol for Metadata Harvesting (OAI-PMH) has been widely adopted as an approach to allow harvesting of metadata. Many of the CIARD RING services are using institutional or thematic repositories that expose metadata using an OAI provider. This tutorial provides a brief overview of the requests that can be made, a description of the response, and some example code which demonstrates of an OAI Harvester.

- OAI Harvesting: Overview
- OAI Harvesting: Identify
- OAI Harvesting: ListMetadataFormat
- OAI Harvesting: ListSets
- OAI Harvesting: ListIdentifiers
- OAI Harvesting: ListRecords
- OAI Harvesting: GetRecord
- OAI Harvesting: Summary

1.2.3 Register your service(s) on the RING

1.2.3.1 Register an account

Users need to create an account in order to register new services and new organizations. Once a user creates an account, whenever he adds a new service he becomes the author of that record and will be responsible for the information contained in that record.

To create an account, click on Register in the left column under “Members Area”.

RING services

Registered services

Advanced search

Summary table

Geographic search

By type & licensing

By KOS

By metadata set

By technology

By organization

Some numbers

How to

Standards

Member area

Login

Register

User account

Account information

Username: *

Spaces are allowed; punctuation is not allowed except for periods, hyphens, and underscores.

E-mail address: *

A valid e-mail address. All e-mails from the system will be sent to this address. The e-mail address is not made public and will only be used if you wish to receive a new password or wish to receive certain news or notifications by e-mail.

Name and affiliation

Title:

First Name: *

Last name: *

Organization: *

The organization for which you are working. You can use N/A.

Role in the organization:

Role in the organization or job title. Mandatory, but you can use N/A.

Country: *

Website:

You and the CIARD / RING community

Your work in Agricultural Information Management:

A description of your work/role. What you do in information management, how you use standards, which ones you use, how you make your services interoperable...

Domain(s) of expertise:

Put each item on a separate line or separate them by commas. No HTML allowed.

Mandatory fields are indicated by an asterisk.

This information is not mandatory, but we encourage users to tell us more about their involvement with CIARD and their expertise, so that this platform can also work as a resource for finding experts.

CAPTCHA
This is to prevent automated spam submissions.

L i L 3 E

What code is in the image?:

Copy the characters (respecting upper/lower case) from the image.

This control helps us prevent automated registrations by spamming systems

If you have created an account but you do not remember your password, you can ask the system to send you a new temporary password and then reset your password to whatever you like.

RING services

Registered services

- Advanced search
- Summary table
- Geographic search
- By type & licensing
- By KOS
- By metadata set
- By technology
- By organization
- Some numbers

How to

Standards

Member area

- [Login](#)
- [Register](#)

User account

Username: *

Enter your The CIARD R.I.N.G username.

Password: *

Enter the password that accompanys your username.

Log in using OpenID

On the next page, type your username if you remember it, or your email address. You will receive a temporary login link in your mailbox.

User account

Username or e-mail address: *

When you receive the temporary login email, click on the link in the email body: you will be directed to a page where you can login. After clicking on the Login button, you will be directed to your Account page where you can reset your password.

You have just used your one-time login link. It is no longer necessary to use this link to login. Please change your password.

Account information

Username: *

 Spaces are allowed; punctuation is not allowed except for periods, hyphens, and underscores.

E-mail address: *

 A valid e-mail address. All e-mails from the system will be sent to this address. The e-mail address is not made public and will only be used if you wish to receive a new password or wish to receive certain news or notifications by e-mail.

Password:

Confirm password:

To change the current user password, enter the new password in both fields.

Status:

Blocked
 Active

Roles:

Set a new password and confirm it

1.2.3.2 Manage your submissions

If you have already submitted records (services or organizations), you can see a list of them and edit any of them by clicking on the “Your submissions” link in the left column under “Members Area”.

RING services

Registered services

- Advanced search
- Summary table
- Geographic search
- By type & licensing
- By KOS
- By metadata set
- By technology
- By organization
- Some numbers

How to

Standards

Member area

- Add a service
- Your submissions**
- Your account
- Logout

Information services submitted by you

- ▶ **GFAR document repository** [edit]

Type: Information service
 The GFAR document repository is a database of GFAR publications with access to the full-text digital document.
- **Global Forum on Agricultural Research (GFAR)** [edit]

Type: Organization
 The Global Forum on Agricultural Research (GFAR) provides this

Clicking on the title of one of your submissions, you can see the full record. Clicking on [edit], you can edit the record: clicking on it will open the editing form, which is identical to the input form described below in chapter 1.2.3 (Register an information source / service)

1.2.3 Register an information source / service

After logging in, you can click on "Add a new service" under "Member area" in the left column to register a new service

Before registering a new service, please check if the service has already been registered by searching for it in the simple search page: <http://www.ciardring.net/services>

What to register in the RING

We consider a "service" any platform that provides information services from one server instance (website, mail server, web services, XML archive...) to any client (browsers, email clients, news readers...).

Examples are search engines, databases, repositories, Open Archives, RSS feeds, XML files, RDF stores...

Who can register services in the RING

Anybody can register new services in the RING, provided that they know the necessary administrative and technical information about the service and they are responsible for the service or authorized by a responsible person. User registration is required in order to trace the source of information and allow users to edit their submission in the future. (For instructions on registration, see previous chapter)

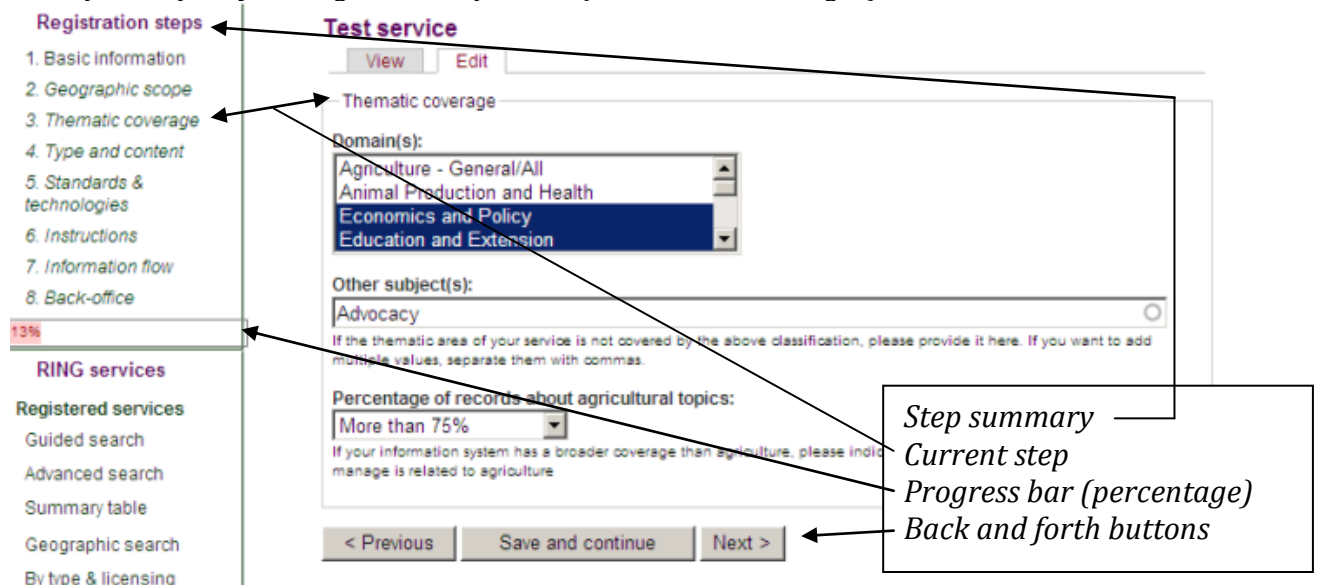
How to register an information service

1. Click on "Add a service" in the "Member area" menu on the left.

2. Start filling in the mandatory information in the form.

The registration consists of 8 steps: you can move back and forth between steps by using the buttons at the bottom of each screen (when editing a service that was already submitted, you can also move freely from one step to another using the links in the left box called "Registration steps").

Example: step 3 of the registration process ("Thematic coverage")



The screenshot displays the registration interface for step 3, "Thematic coverage". On the left, a sidebar lists "Registration steps" from 1 to 8, with step 3 highlighted. Below it, "RING services" are listed. The main content area, titled "Test service", includes a "View" and "Edit" button, a "Thematic coverage" section with a "Domain(s)" dropdown menu (showing options like "Agriculture - General/All", "Animal Production and Health", "Economics and Policy", and "Education and Extension"), an "Other subject(s)" text input field containing "Advocacy", and a "Percentage of records about agricultural topics" dropdown menu set to "More than 75%". A progress bar at the bottom left indicates 13% completion. Navigation buttons at the bottom are "< Previous", "Save and continue", and "Next >". A callout box on the right points to the progress bar and navigation buttons, labeling them as "Step summary", "Current step", "Progress bar (percentage)", and "Back and forth buttons".

Only a few fields are mandatory, however please fill in as many as possible in order to make your service easily searchable in the directory.

Upon registration of the service, please fill in at least the basic mandatory fields under the first two steps: "Basic information" and "Geographic scope", then you can come back later and fill in the remaining fields.

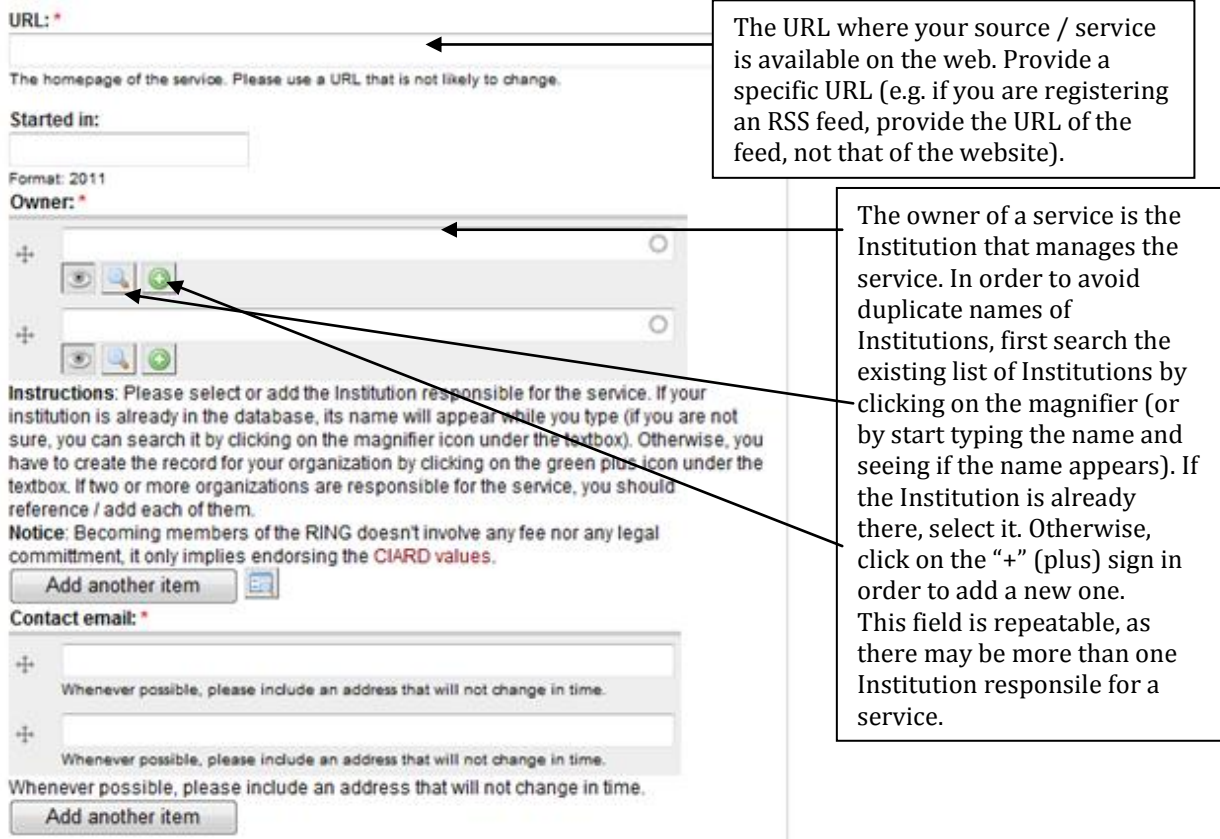
Even if at different stages, please fill in as many fields as possible in order to make your service easily searchable in the directory.

Before filling in the sections on Standards and Instructions, please consider that you may need the assistance of the technical staff responsible for the service.

Detailed instructions for filling in the service registration form

Step 1. Basic information

Name of the service: When filling the "name" field, please avoid using an article at the beginning. The system will warn you if the name of the service already exists in the database and will not allow you to use a duplicate name. If your source / service has a very common name (like "University Library" or "NARS directory"), please include some specification in the title that help identify the service in the search result lists (e.g. the name of the country, or the full name of the Institution).



URL: *
The homepage of the service. Please use a URL that is not likely to change.

Started in:
Format: 2011

Owner: *

Instructions: Please select or add the Institution responsible for the service. If your institution is already in the database, its name will appear while you type (if you are not sure, you can search it by clicking on the magnifier icon under the textbox). Otherwise, you have to create the record for your organization by clicking on the green plus icon under the textbox. If two or more organizations are responsible for the service, you should reference / add each of them.

Notice: Becoming members of the RING doesn't involve any fee nor any legal commitment, it only implies endorsing the **CIARD values**.

Contact email: *
Whenever possible, please include an address that will not change in time.

Callout 1 (URL): The URL where your source / service is available on the web. Provide a specific URL (e.g. if you are registering an RSS feed, provide the URL of the feed, not that of the website).

Callout 2 (Owner): The owner of a service is the Institution that manages the service. In order to avoid duplicate names of Institutions, first search the existing list of Institutions by clicking on the magnifier (or by start typing the name and seeing if the name appears). If the Institution is already there, select it. Otherwise, click on the "+" (plus) sign in order to add a new one. This field is repeatable, as there may be more than one Institution responsible for a service.

Step 2. Geographic scope

Geographic coverage refers to the coverage of your information system, not the location.

Geographic coverage:
National

FAO region:
- None -
Africa
Asia
Europe and the Caucasus

GFAR region:
- None -
Asia Pacific
Central Asia and the Caucasus
Europe

National: country:
- None -
Afghanistan
Albania
Algeria


Select a country only if the geographic scope of your service is National.

Depending on what you select here (national, regional or global), you will be prompted with a list of region and/or countries.

This geographic indexing is different from the Location field at the beginning: this refers to the geographic scope of your service, not the location where it is hosted.

Location (the map) refers to the location of the information service, identified with the location where it is maintained, independent of its physical hosting or their actual geographic scope. Notice: click on the map to find the location: you can zoom in and out and drag the map as in GoogleMaps. **Your service will appear in the map in the homepage only if you mark it on the map below**

Location



Latitude:

Longitude:

If you wish to supply your own latitude and longitude, you may enter them above. If you leave these fields blank, the system will attempt to determine a latitude and longitude for you from the entered address. To have the system recalculate your location from the address, for example if you change the address, delete the values for these fields. You may set the location by clicking on the map, or dragging the location marker. To clear the location and cause it to be recalculated, click on the marker.

Country:

City:

Step 3. Thematic information

Domain(s):
 Agriculture - General/All
 Animal Production and Health
 Economics and Policy
 Education and Extension

Other subject(s):
 If the thematic area of your service is not covered by the above classification, please provide the other subjects you want to add multiple values, separate them with commas.

Percentage of records about agricultural topics:
 - None -
 - None -
 Less than 25%
 Between 25% and 50%
 Between 50% and 75%
 More than 75%
 100%

If the percentage of records about agricultural topics is greater than 75%, please indicate which percentage of records are related to agriculture.

This is a classification of agricultural topics based on the Agris categories.

If the classification above does not have a category that is specific enough to define the content of your service, you can add topics here: this is a free-tagging field.

Also information services that contain only a certain percentage of records on agricultural topics can be registered in the RING.

Step 4. Type and content

Type of service:
 Type of service (e.g. OAI provider, OAI harvester, RSS feed, feed aggregator, document repository, bibliographical database, local search engine, distributed search engine, federated search engine, ontology, web services...). If your service is a combination of any of these, you can provide multiple values. Separate different values with commas. Please use terms that are already present whenever possible: an auto-complete function will help you (just start typing and see).

Type of information managed:
 The type of information object that is managed by your service (documents, events, projects, reports, data...). Separate different values with commas. Please use terms that are already present whenever possible: an auto-complete function will help you.

Language:
 - None -
 Abkhazian
 Achinese
 Acoli
 The language(s) in which information in your system is available

Audience:
 Academic world
 Donors
 Extensionists
 Farmers

Access / licensing / pricing:
 Keywords that describe the type of access / licensing of your service: Open Access policy (green, golden), copyright/licensing policy, pricing (free, per-access, periodic fee, one-time fee). Use at least one (e.g. free or paid). Separate different values with commas. Please use terms that are already present whenever possible: an auto-complete function will help you.

Open Access Mandate:
 N/A
 Yes
 No

Number of records:
 Please tell us roughly how many records are in your system. This can be the current number of bibliographic records for a document repository or bibliographic database, or the rough number of news items in an RSS feed, or the number of listings in a directory...

These fields are free-tagging, but in order to facilitate searches and browsing it is strongly recommended to use terms that are already in the system. If you start typing, a list of already used terms will appear. You can use more than one keyword: separate them with a comma.

Also this is a free-tagging field. Please use existing keywords as much as possible.

Provide the number of records that are available in your system. Even if this number changes in time, even providing a rough number helps to build statistics in the RING.

Step 5. Standards and technologies

This is the most technical section of the registration form. This information is crucial to clarify how your service is interoperable by other systems. For more information on these concepts, see part 2 on Interoperability.

Please indicate which technologies your service uses, with which standards it is compliant, specifying the metadata sets, formats and protocols adopted for **input** in the system and those adopted for **output**.

Software:

Software tool(s) used for creating your information system. Separate different values with commas. Please try to use already existing terms (an auto-complete function will help you just start typing). Add new terms only if you are sure that they are not present in any other form.

Telling other IT specialists which software tool you used to build your service can help them to select appropriate tools to build a similar service.

KOS adopted:

- None -
- AGRIFOREST Thesaurus (AGRIFOREST)
- AGRIS/CARIS Categories (ASC)
- Agroforestry Database (AFT)

Subject vocabulary / knowledge organization system (KOS) used to index content

The Knowledge Organization System (KOS) you use in your system to index records by subject or as authority list for special fields. This list of KOS comes from the Agricultural Information Management Standards (AIMS) website. This information is very important to understand how to interoperate a service. See part 2 on Interoperability for more information on KOS.

Input metadata set(s):

- None -
- Access to Biological Collection Data Schema
- Ag-Events Application Profile
- Ag-LR Application Profile

The metadata set(s) that are accepted as input of the service, e.g. for importing or harvesting content

Information services can adopt different standards and technologies for harvesting/importing records (input) and for exposing/exporting records (output); the RING therefore collects the same information both for the **input** and the **output**.

Input format / notation:

Format / notation accepted for importing / harvesting content into your service. Examples: XML, CSV, Json... Separate values with commas. Please try to use already existing terms (an auto-complete function will help you just start typing). Add new terms only if you are sure that they are not present in any other form.

Input protocols / architectures:

Protocol(s) used to submit / import content into your service. Examples: OAI-PMH, SOAP, RESTful... Separate different values with commas. Please try to use already existing terms (an auto-complete function will help you just start typing). Add new terms only if you are sure that they are not present in any other form.

This list of metadata sets comes from the Agricultural Information Management Standards (AIMS) website. This information is very important to understand how to interoperate a service. See part 2 on Interoperability for more information on KOS.

Output metadata set(s):

- None -
- Access to Biological Collection Data Schema
- Ag-Events Application Profile
- Ag-LR Application Profile

Metadata set(s) used for exporting / outputting information from your system

Output format / notation:

Format / notation used for exporting / outputting information from your service. Examples: XML, CSV, Json... Separate values with commas. Please try to use already existing terms (an auto-complete function will help you just start typing). Add new terms only if you are sure that they are not present in any other form.

Output protocols / architectures:

Protocol(s) used to harvest / export content from your service. Examples: OAI-PMH, SOAP, RESTful... Separate different values with commas. Please try to use already existing terms (an auto-complete function will help you just start typing). Add new terms only if you are sure that they are not present in any other form.

These fields cover more technological aspects of the service. They are free-tagging fields, as there is no agreed standard list of formats (XML, CSV...), protocols (OAI-PMH, SOAP...) and technical frameworks/architectures (OAI, RDF, Linked Data). In order to facilitate searching and browsing and provide a coherent list of technologies, please use existing keywords as much as possible. See part 2 on Interoperability for more information on these technologies.

Step 6. Instructions

Please provide detailed instructions on how your service can be interoperated, e.g. the URLs, the parameters, the output format etc.

Step 7. Information flows

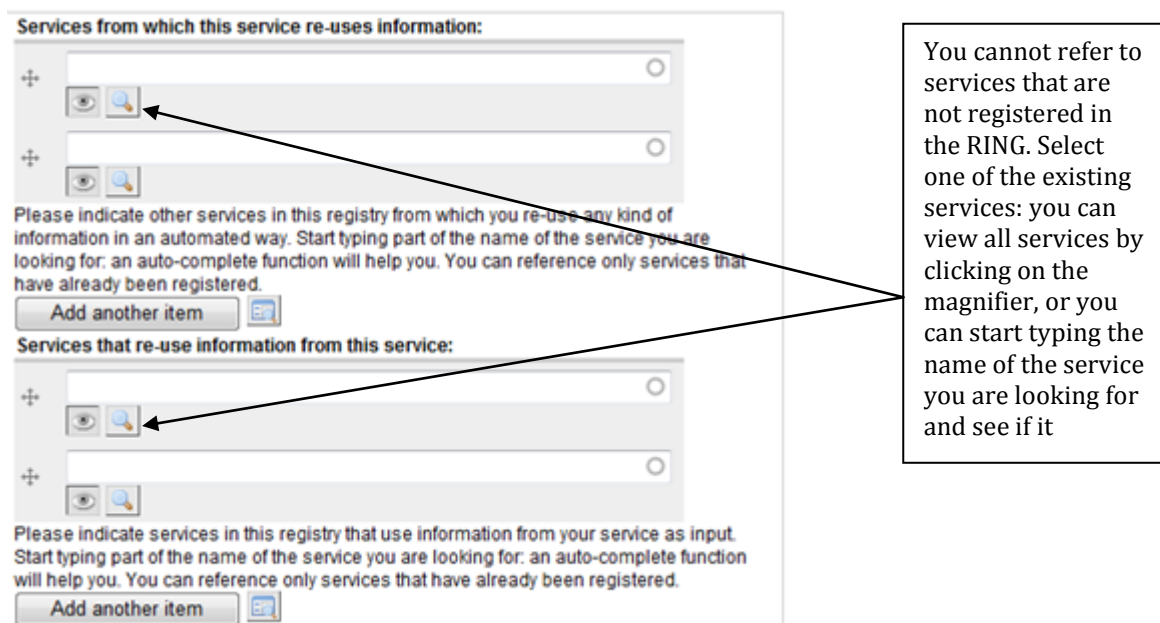
This section aims at highlighting the information flows between services that are registered in the RING. By filling in this information you will make your service appear in the "Information flows" page at <http://ring.ciard.net/information-flows>.

"Re-using" information from a service means harvesting, aggregating, importing, embedding records from a service. Even just embedding an RSS feed from a website means re-using its information.

If you know that other services are re-using records from your service, please also indicate it here.

If your service exchanges information with other systems that are not registered in the RING yet, please encourage the owners of these systems to register them in the RING so that you can link to them.

The field is repeatable: select as many services as necessary.



The screenshot shows two sections of the RING service registration form. The top section is titled "Services from which this service re-uses information:" and contains two input fields, each with a magnifying glass icon. Below this section is a text prompt: "Please indicate other services in this registry from which you re-use any kind of information in an automated way. Start typing part of the name of the service you are looking for: an auto-complete function will help you. You can reference only services that have already been registered." and an "Add another item" button. The bottom section is titled "Services that re-use information from this service:" and also contains two input fields with magnifying glass icons. Below this section is a text prompt: "Please indicate services in this registry that use information from your service as input. Start typing part of the name of the service you are looking for: an auto-complete function will help you. You can reference only services that have already been registered." and another "Add another item" button. A callout box on the right side of the image contains the text: "You cannot refer to services that are not registered in the RING. Select one of the existing services: you can view all services by clicking on the magnifier, or you can start typing the name of the service you are looking for and see if it". Two arrows point from the callout box to the magnifying glass icons in both input fields.

1.2.4 Get your system to request data from the RING

RSS feeds

A general feed with metadata on all registered services is available on all pages with a link in the right column. The URL of the feed is <http://ring.ciard.net/rss/services/all>. This feed is an RSS 1.0 (RDF) feed containing basic RSS metadata and some additional DOAP elements.

RSS feeds per owner organization are also available by browsing "By organization" (in the left menu) and clicking on any organization.

RDF store

The RING database is also available as an RDF store. (See part 2 on interoperability for more information on RDF).

1) On each service page, there is a link to its RDF representation.

The RDF vocabulary that has been chosen to describe services is DOAP ("Description of a Project"), which was conceived to describe software projects. Some DOAP properties are specific to software tools more than to services, but it seems the most suitable vocabulary, among those that are widely known and adopted, for the content of the RING.

The URI for each service is built as follows: RING-domain/node/service-ID/rdf.

For example, the URI of the AgriFeeds service in this RDF store is:

<http://ring.ciard.net/node/2417/rdf>

2) The whole RDF store is accessible through a **SPARQL engine**, which means that any system can run remote queries and get the resulting triples.

The endpoint of the SPARQL engine is:

<http://ring.ciard.net/service/sparql>

The vocabularies used in the RDF store are:

RDF: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>

RDFS: <http://www.w3.org/2000/01/rdf-schema#>

FOAF: <http://xmlns.com/foaf/0.1/>

DOAP: <http://usefulinc.com/ns/doap#>

On the following page on the RING website you can find some examples of SPARQL queries with a basic tabular representation of the resulting triples:

<http://ring.ciard.net/rdf-store>.

Part 2. Interoperability: standards and technologies

2.1 Interoperability

“Interoperability is a feature both of data sets and of information services that give access to data sets. When a data set or a service is interoperable it means that data coming from it can be easily “operated” also by other systems. The easier it is for other systems to retrieve, process, re-use and re-package data from a source, and the less coordination and tweaking of tools is required to achieve this, the more interoperable that source is.

Interoperability⁴ ensures that distributed data can be exchanged and re-used by and between partners without the need to centralize data or standardise software.

Some examples of scenarios where data sets need to be interoperable:

- transfer data from one repository to another;
- harmonize different data and metadata sets;
- aggregate different data and metadata sets;
- virtual research environments;
- creating documents from distributed data sets;
- reasoning on distributed datasets;
- creating new information services using distributed data sets.”⁵

Information sources need to become more easily “discoverable” and to allow other services to semantically query, re-use and re-package their information; in other words they must become truly interoperable and allow for easy automatic retrieval of information, while work on mapping between vocabularies or advanced natural language processing must be done to improve the semantic accessibility of information.

Standards and technologies that improve interoperability are described below.

These standards and technologies are used in the RING as indexing criteria in order to make it easy for information professionals to quickly identify sources and services that adopt them.

Below, standards and technologies are roughly classified under Description and indexing standards (metadata sets, KOS, rules and encoding), Protocols and Architectures, but since there is no agreed way of really defining and classifying these techniques and users may find a granular and exact classification too rigid and artificial, in the RING the organization is slightly different:

- **Metadata sets**

These include metadata sets that have been formalized in any way (schemas, definition files, namespaces) and the reference list comes from the Agricultural Information Management Standards (AIMS) portal.

- **KOS**

“Knowledge Organization Systems”: classifications, subject headings, thesauri, ontologies used to index data. The reference list comes from the Agricultural Information Management Standards (AIMS) portal.

⁴ <http://en.wikipedia.org/wiki/Interoperability>

⁵ From “Building the CIARD architecture for data and information sharing. Background Note for the e-Consultation April 4 - 15” (<http://...>)

- **Technology / architecture**

This classification covers what in the following chapter is described under both Protocols and Architectures. This is an open list (a free-tagging list), which at the moment includes OAI-PMH, RESTful web services, RSS, SOAP, SRW/SRU, XML-RPC.

- **Notation**

This refers to what in the following chapter is described under “Notation / serialization”. Since there is no reference list for such “formats”, this is an open list (a free-tagging list), which at the moment includes CSV, Json, MARC, N3, TXT, XML.

2.2 Description and indexing standards

Matadata sets

Metadata

“Data about data”: the elements that describe an entity of a specific type, e.g. for a person

First name: John Last name: Doe Country: United States of America

Agreeing on a metadata set means agreeing on a common set of elements to exchange information of a certain type.

Metadata vocabularies

Formalization of a metadata set in a series of agreed “property names” for metadata elements, e.g. for a person:

given_name: Valeria family_name: Pesce country: Italy

Vocabularies allow machines to share metadata using the same “labels” for metadata properties.

Namespaces

Metadata elements only have a specific meaning within the vocabulary where they were created; these vocabularies are defined in “namespaces” and elements must associated with a namespace in order to have some meaning

- | |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"> • dc:date indicates the “date” element in the Dublin Core namespace (shortened in the dc: prefix: mappings between namespace URIs and prefixes must be given to machines) • foaf:given_name indicates the “give_name” element in the AgMES namespace (shortened in the ags: prefix) |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

Namespaces are needed in order to avoid duplication of element names and misinterpretation

e.g. “source” element in different namespaces:
dc:source in Dublin Core identifies the source book/document of a document
rss:source in RSS identifies the URL from where the harvested item comes

KOS and Authority data lists

Knowledge Organization Systems are controlled lists (flat, hierarchical, or organized as an ontology) of terms or concepts, used to organize data according to subject areas, domains, geographic coverage etc. Examples are classifications, subject headings, thesauri, ontologies...

Authority lists (which include KOS) are more in general controlled lists of “entities” (e.g. journal titles, author names, geographic names/codes, corporate body names...) used to identify an entity univocally.

Notation, rules, encoding

Notation, “serialization”, format

Metadata elements (or better data sets, record sets, KOS etc, that are exposed through metadata) can be “serialized” in different notations of formats:

Examples:

- CSV comma separated values (->Excel)
- XML
- Microformats
- Json
- ...

```
<firstname>Justin</firstname>
<lastname>Chisenga</lastname>
<country>Ghana</country>
```

```
firstname,lastname,country
Valeria,Pesce,Italy
Justin,Chisenga,Ghana
```

“Rules”: structure, data types and encoding

Vocabularies can be defined in specific “definition files” (DTDs, XML schemas, RDF schemas...) that provide machine-readable **rules for structure, data types and encoding**, e.g. the nesting of the “ags:locationCountry” element inside the “ags:location” element, or ISO encoding for countries and languages, specific date formats etc.

```
<ags:location>
  <ags:locationCountry>GHA</ags:locationCountry>
</ags:location>
```

(With the advent of RDF, the structure has become standardized and “structure” doesn’t indicate the nesting anymore but the class / property model of an RDF schema.)

Notes on metadata sets and interoperability

Recently, the advent of RDF and the common use of technologies for transforming metadata (stylesheets, mapping schemes...) has shifted the focus from format/structure (notation, vocabulary) to data (the actual data exposed through metadata): the use of the same vocabulary, format and structure has become less essential for exchanging information, while the use of agreed encoding standards and authority lists has become more and more important: for integrating a source in a service, it is essential that the necessary data are there and that they are encoded in an agreed machine-readable way.

2.3 Protocols

“A communications protocol is a formal description of digital message formats and the rules for exchanging those messages in or between computing systems and in telecommunications. Protocols may include signaling, authentication and error detection and correction capabilities. A protocol describes the syntax, semantics, and synchronization of communication and may be implemented in hardware or software, or both”⁶

In order not to create too many classifications in the RING and risk confusing users between technologies, protocols and architectures, the RING only has one classification for protocols and what we call “architectures” below.

Creating a reference list for protocols and architectures is difficult also because some protocols leverage in turn other existing protocols and some architectures also define protocols: for instance, in the case of web-based services like those registered in the RING, the basic communication protocol is always HTTP, which is used by all the others (OAI-PMH, RESTful web services, SOAP, SRW/SRU, XML-RPC, SPARQL) and for instance SRW is a sub-specification of SOAP and SRU and RSS are forms of RESTful web services).

2.4 “Architectures”

Architectures in this context can be defined as “technological frameworks” designed to work thanks to a combination of standards and technologies of different types, e.g. combining a protocol with one or more metadata sets and one or more notations.

RSS

RSS stands for Really Simple Syndication. An RSS feed is a file that exposes syndicated contents from a website (or any source) in a way that can be read by RSS readers.

RSS can be considered an “architecture” in that it is built from several standards and technologies:

- it uses a metadata set defined in the RSS namespace (actually, two namespaces, RSS 1.0, which implements RDF, and RSS 2.0): in the RING this metadata set is included in the “Metadata sets” reference list;
- it is serialized as XML;
- in version 1.0, it implements RDF;
- it is a form of RESTful webservice.

Basic RSS 2.0 feed record:

```
<item>
<title>Web 2.0 Principles and Best Practices. An O'Reilly Radar Report</title>
<description>What does Web 2.0 mean to your company and products? What are the risks and
opportunities? What are the proven strategies for successfully capitalizing on these
changes?</description> <pubDate>Sun, 01 November 2006 00:00:00 GMT</pubDate>
<guid>ISBN:0-596-52769-1</guid><author>Tim O'Reilly</author>
<link>http://radar.oreilly.com/research/web2-report.html</link>
<category>technology</category> <category>web development</category>
</item>
```

Si

also allows to extend this with any additional metadata set, knowing that a source is available as RSS feed doesn't tell us everything about its metadata. This is why some sources that are indexed as RSS feeds in the RING are also indexed against different metadata sets.

Example of RSS feed extended with Dublin Core metadata:

```
<rss version="2.0" xmlns:dc="http://purl.org/dc/elements/1.1/">
<channel>
<title>O'Reilly publications</title>
<link>http://www.oreilly.com/</link>
<item>
```

⁶ h

OAI-PMH

In the context of the OA (Open Access) Initiative, the technical protocol called OAI-PMH (Protocol for Metadata Harvesting) is the agreed protocol to harvest metadata from repositories.

The OAI-PMH architecture is based on OAI providers (or data providers) and OAI harvesters (or service providers).

An **OAI provider** maintains one or more repositories (web servers) that support the OAI protocol as a means of exposing metadata. Implementing the OAI-PMH protocol means providing HTTP response pages to the six OAI “verbs” (Identify, ListSets, ListMetadataFormats, ListIdentifiers, ListRecords, and GetRecord). Responses are serialized as XML and can use one or more metadata sets, with the minimum mandatory metadata set being Dublin Core.

An **OAI harvester** is a service that can import metadata from a remote OAI provider sending HTTP requests containing the OAI verbs.

More details on the OAI-PMH architecture are available on the RING portal in the OAI harvesting tutorial: <http://ring.ciard.net/oai-harvesting>.

RDF, the Semantic Web and Linked Data

The “Resource Description Framework” (RDF)⁷ is more than an architecture, it is a conceptual framework supported by some accessory technologies that together help build what is called the “semantic web”.

The conceptual framework is based on a very simple assumption: “triples” constituted by a subject, a predicate and an object can represent and describe everything. In the RDF model, subject and object are entities, or instances of “classes”, while predicates are “properties”.

Adam – is – a person Adam – knows – John John – lives in – New York	<pre> <resource A> - <has title> - “War and Peace” <resource A> - <has author> - <person A> <person A> - <has name> - “Lev Tolstoj” </pre>
---------------------------------------------------------------------------	--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

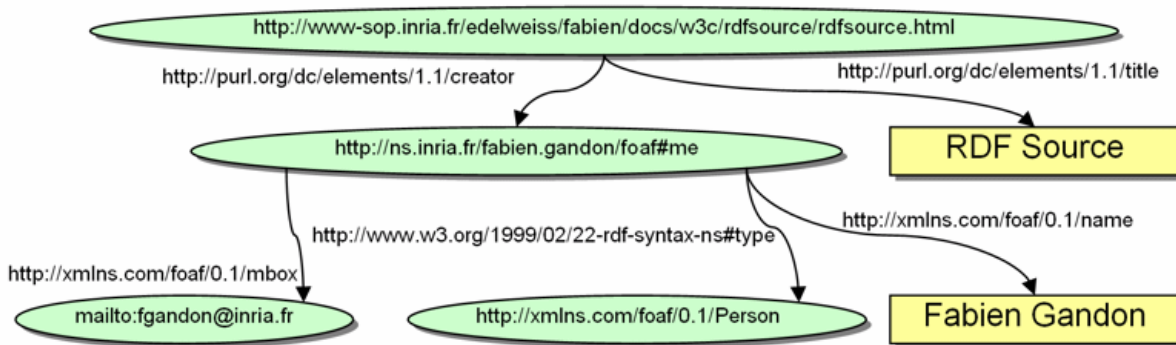
Reducing metadata to this essential structure eliminates a certain degree of incoherence and arbitrariness that is often found in the definition of metadata structures, adding more rigor to the model that has to be followed in describing things. Besides, the basic concept that subject and object should be represented as often as possible by URIs (Uniform Resource Identifiers) gives the possibility to identify entities univocally in different records, thus allowing to interlink records across sources and expand searches navigating through URIs.

⁷ http://en.wikipedia.org/wiki/Resource_Description_Framework

For predicates/properties, any metadata set identifiable through a namespace URI can be used. For subjects and objects, beside literals, URIs identifying entities should be used, preferably from widely used KOS and authority data sources that are exposed as RDF.

RDF can be serialized in different ways: graphs (human-readable), RDF, N3, Jsn...

Fig. 2.1. An RDF “graph” stating that a resource has a title (“RDF Source”) and a creator and that this creator is of type Person and has a name (“Fabien Gandon”) and a mailbox (“mailto:fgandon@inria.fr”) (from <http://www.w3.org/Submission/rdfsource/>):



The corresponding triples are:

Subject	Predicate	Object
<code><http://www-sop.inria.fr/edelweiss/fabien/docs/w3c/rdfsource/rdfsource.html></code>	<code>dc:title</code>	"RDF Source"
<code><http://www-sop.inria.fr/edelweiss/fabien/docs/w3c/rdfsource/rdfsource.html></code>	<code>dc:creator</code>	<code><http://ns.inria.fr/fabien.gandon/foaf#me></code>
<code><http://ns.inria.fr/fabien.gandon/foaf#me></code>	<code>rdf:type</code>	<code>foaf:Person</code>
<code><http://ns.inria.fr/fabien.gandon/foaf#me></code>	<code>foaf:name</code>	"Fabien Gandon"

A possible representation of this graph in RDF/XML:

```
<rdf:RDF xmlns:dc="http://purl.org/dc/elements/1.1/"
xmlns:foaf="http://xmlns.com/foaf/0.1/"
xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#" >
<rdf:Description rdf:about="http://www-sop.inria.fr/edelweiss/fabien/docs/w3c/rdfsource/rdfsource.html">
<dc:title>RDF Source</dc:title>
  <dc:creator>
    <foaf:Person rdf:about="http://ns.inria.fr/fabien.gandon/foaf#me">
      <foaf:name>Fabien Gandon</foaf:name>
      <foaf:mbox rdf:resource="mailto:fgandon@inria.fr"/>
    </foaf:Person>
  </dc:creator>
</rdf:Description>
</rdf:RDF>
```

Linked Data⁸ (or Linked Open Data, LOD) is "a term used to describe a recommended best practice for exposing, sharing, and connecting pieces of data, information, and knowledge on the Semantic Web using URIs and RDF."⁹ It leverages RDF but it goes

⁸ http://en.wikipedia.org/wiki/Linked_Data; <http://www.w3.org/DesignIssues/LinkedData.html>

⁹ <http://linkeddata.org/>

beyond explicitly recommending practices that are only optional in RDF: using URIs for everything and linking to existing URIs as much as possible, resolve URIs to URLs to provide more information about entities, use widely used vocabularies.

2.4 Standards and good practices adopted / recommended in agriculture

Metadata sets

“Application Profiles”

Some application profiles (metadata sets using elements from different existing namespaces) have been defined in the CIARD Content Management Taskforce for describing:

- Documents (Document-like Information Objects, DLIOs): Agris AP
- Learning objects: AgL-AP
- News: RSS
- Events: RSS + Ag-Event AP

See <http://aims.fao.org/website/Application-Profiles/sub>

LODE-BD recommendations

In RDF, any existing metadata set (even if it had not been encoded as RDF) may be used (sometimes subject to a revision of the model). In the area of bibliographical data, where several metadata standards have always existed, the “Linked Open Data (LOD)-Enabled Bibliographical Data” (LODE-BD) recommendations (<http://aims.fao.org/lod>) provide guidelines on how to encode existing bibliographic data for the purpose of exchange across data providers and how to produce LOD-enabled bibliographic data.

Other metadata sets

A registry of metadata sets that can be useful in describing different types of agricultural information is available at <http://aims.fao.org/vest-registry>.

The reference list for metadata sets on the RING portal is harvested directly from the AIMS website.

Subject indexing

Agrovoc

AGROVOC (<http://aims.fao.org/website/AGROVOC/sub>) is the world’s most comprehensive multilingual agricultural vocabulary. Downloaded over a thousand times a year by dozens of countries, it is in daily institutional use to index and search documents, web pages and digital objects. Organized as a concept scheme, AGROVOC contains close to 40,000 concepts in over 20 languages covering subject fields in agriculture, forestry and fisheries together with cross-cutting themes such as land use, rural livelihoods and food security.

Agrovoc is available:

- as a browse / search web interface:
<http://aims.fao.org/website/Search-Terms/sub>
- as a dataset to download (in different formats):
<http://aims.fao.org/website/Download/sub>

- as “web services” that other applications can call to integrate Agrovoc terms:
<http://aims.fao.org/website/Web-Services/sub>
- as “Linked Data”:
<http://aims.fao.org/website/Linked-Open-Data/sub>
Using the Agrovoc URIs that have been published as Linked Open Data (LOD), any source can become a LOD source and have its records automatically linked to related records on the web.

Other KOS

A good reference list of “subject indexing vocabularies” or “Knowledge Organization Systems” (KOS) is available on the AIMS website: <http://aims.fao.org/vest-registry>. The reference list for KOS on the RING portal is harvested directly from the AIMS website.

Authority data

Authority data lists (which may be considered to include KOS) are more in general controlled lists of “entities” (e.g. journal titles, author names, geographic names/codes, corporate body names...) used to identify an entity univocally.

Examples of authority data lists that are useful for managing agricultural information are:

FAO Geopolitical Ontology

The Geopolitical Ontology (<http://aims.fao.org/website/Geopolitical-Ontology/sub2>) is a collection of triples providing URIs for geographic entities mapped to labels in different languages and country codes used in different standard lists, It is available as RDF.

Journal Authority Data (JAD) Collection

The JAD collection (<http://aims.fao.org/authority-search>) provides authority data on journals associated to food, agriculture, development, fisheries, forestry and natural resources. It is available as RDF.

