DDI Alliance Executive Board Meeting
9 June 2021

Present: Bill Block, Cathy Fitch, Maggie Levenstein, Jared Lyle, Steve McEachern, Barry Radler, Joachim Wackerow, Guests: Darren Bell, Hilde Orten

Funding Proposals

The Executive Board reviewed the funding proposals submitted for the upcoming fiscal year (July 2021 through June 2022). See Appendix A.

Ingo Barkow (Chair of the Scientific Board) had emailed the Scientific Board's feedback to Steve, Bill, and Jared prior to the meeting. Hilde and Darren attended on behalf of the Scientific Board to provide feedback about the funding requests related to scientific or technical activities. According to the funding guidelines on the DDI web site: "If requests are related to scientific or technical activities, the DDI Scientific Board will evaluate the request from the perspective of the Alliance Scientific Plan and provide feedback to the Executive Board. Incoming budget requests related to scientific or technical activities will be prioritized according to their level of importance, and a reasoning with pros and cons for each evaluation will be made available, for the purpose of clarity and transparency."

The Scientific Board's feedback:

The Scientific Board discussed all requests during the meeting on 8th of June 2021. We see all the requests as valid and of similar priorities. Therefore we recommend funding them all even if this necessitates using the savings from previous years.

We see this as a balanced proposal from different working groups and contributors containing multiple important areas to be covered.

Furthermore, the total sum of $93.921 should rather be seen as a reservation for following years as the requests contain a lot of travel costs where like in previous years there is uncertainty if they finally will be used.

Similarly, due to the lack of travel costs in the previous two years there have been budget savings where we recommend investment in this budget period to boost proper working procedures after a long period of obstacles.

Several concerns were discussed among the Executive Board, including:

- Equity -- Some proposals request funding for external consultants while many Alliance members are providing in-kind support and do not receive funding. For what activities is it acceptable to pay outside consultants instead of receiving in-kind contributions? It was recommended that the Executive Board should provide good guidance on this topic. It

was also recommended that requests for external consultants should provide more information about the need for a paid consultant versus using in-kind contributions.

- Reporting -- Funded requests do not always provide follow-up information about deliverables. It was recommended that approved budget requests must provide a report at the end of the fiscal year explaining deliverables.
- Reserves -- The funding requests exceed expected revenue by 50%, requiring use of Alliance reserves. How much should the Alliance retain in reserves? What activities are OK to fund with reserves? It was recommended that the Executive Board establish a policy on reserves, including goals for allocation and minimum acceptable balances. A Board member requested this topic be discussed at the annual meeting of members.
- Travel -- The pandemic has reshaped travel behavior. It was suggested that the Alliance use the next year or two to reassess travel, including to ask travel requests to provide information about why travel is preferred to virtual meetings.

The Executive Board expressed appreciation to the Scientific Board for their review and recommendations. The Executive Board unanimously approved all funding proposals for FY2022 ($152,071 in total).

Annual Meeting of Members Preparation

No further changes to the annual meeting agenda are needed.

Executive Board Election

During the May Executive Board meeting, members discussed reaching out to specific organizations to encourage nominations for Executive Board candidates. Jared will follow-up with Steve about potential candidates.

Appendix A

These are the recurring and requested expenses for FY2022 (July 1, 2021 through June 30, 2022). Recurring expenses are anticipated regular expenses of the Alliance. Funding requests represent all funding requests submitted by Alliance members as of June 8, 2021. Each major Alliance committee or group was asked to submit a funding request. Additionally, a message was sent to the entire DDI community soliciting funding requests. All submitted funding requests are listed below. The DDI Scientific Board evaluated requests related to scientitic or technical activities from the perspective of the Alliance Scientific Plan. They will provide feedback about requests related to scientific or technical activities to the Executive Board. A link to the full funding request description is also provided.

	ITEMNO	Reviewed by Scientific Board?		Activity	Requested	
Recurring Expenses						
			Staff Salaries			
	1	No		Salaries	$45,000	
				Total	$45,000	
			Research Supplies & Services			
	2	No		DDI Registry web hosting	$900	
	3	No		Zoom virtual meetings	$150	
	4	No		Wire fees (estimate)	$100	
				Total	$1,150	
			Alliance Travel & Hosting			
	5	No		Annual meeting hosting	$1,000	
	6	No		Meeting attendance (e.g., UNECE)	$2,000	
				Total	$3,000	
Funding Requests						
Committee/WG Requests						
			Marketing & Partnerships WG			
	7	No		"Conference sponsorships and marketing materials (which we are low on)."	$5,000	
				Total	$5,000	
			Scientific Board			
	8	Yes		Face-to-face meeting of the Scientific Board	$7,000	
				Total	$7,000	
			Technical Committee			
	9	Yes		DDI Registry Resolution Enhancements	$4,637	
	10	Yes		Technical Committee Face-to-Face Meeting focused on the production system	$14,540	
	11	Yes		Content resolution system to support RDF Vocabularies (XKOS) and CVs	$2,000	
				Total	$21,177	
			Training WG			
	12	Yes		Videos (to share on social media)	$1,100	
	13	Yes		Funding for workshops (travel and fees)	$10,000	
	14	Yes		Discount/waiver workshop fees (for DDI members)	$1,500	
				Total	$12,600	
			DDI-CDI WG			

These are the recurring and requested expenses for FY2022 (July 1, 2021 through June 30, 2022). Recurring expenses are anticipated regular expenses of the Alliance. Funding requests represent all funding requests submitted by Alliance members as of June 8, 2021. Each major Alliance committee or group was asked to submit a funding request. Additionally, a message was sent to the entire DDI community soliciting funding requests. All submitted funding requests are listed below. The DDI Scientific Board evaluated requests related to scientitic or technical activities from the perspective of the Alliance Scientific Plan. They will provide feedback about requests related to scientific or technical activities to the Executive Board. A link to the full funding request description is also provided.

	ITEMNO	Reviewed by Scientific Board?		Activity		Requested
	15	Yes		Face-to-face meetings		$12,880
	16	Yes		RDF Syntax Representation Mapping		$4,500
	17	Yes		RDF Syntax Representation Implementation		$8,000
					Total	$25,380
	18	No	DDI URN registration at IANA			
					Total	$4,000
Community Requests						
	19	Yes	DDI Webinar Series Extension Proposal			$7,040
	20	Yes	Statistics Canada			$20,724
					Total	$27,764
					Total Expenses	$152,071
				ESTIMATED REVENUE (per 2021-2022 revenue)		$97,500
				SURPLUS / (LOSS) -- if all recurring expenses and funding requests are approved		-$54,571
				FORECAST FUND BALANCE (30 JUNE 2021)		$295,011
				PLUS SURPLUS/LOSS		-$54,571
				FORECAST FUND BALANCE (30 JUNE 2022)		$240,441
*Currency in USD						
*Last updated June 8, 2021						

Funding requests for 2021/22 from the Technical Committee

Submitted 24 May 2021

Contact: Wendy Thomas (chair) wlt@umn.edu

The funding request for 2021/22 consists of three separate requests including:

- DDI Registry Resolution Enhancements - $4,637
- Technical Committee Face-to-Face Meeting focused on the production system - $14,540
- Content resolution system to support RDF Vocabularies (XKOS) and Controlled Vocabularies - $2,000

These requests focus on the workplan items listed under Technical Processes and are critical to supporting the technical underpinnings of resolution services for DDI URNs, Controlled Vocabularies, and RDF vocabularies as well as address the on-going work of moving standards production away from hand-crafted specifications to automated processes that support iterative development work, testing, and validation. Please note that the DDI Registry Resolution Enhancements has been submitted by Colectica who provide support for the current DDI Agency Registration System and is fully endorsed by the Technical Committee. The funding request for the Content resolution system is an estimate of possible costs during the 2021/22 funding period. Specific costs will depend upon where this system is located (ICPSR, Cloud, or another member agency).

As background material I have included a copy of the 2021/22 Technical Committee Workplan to indicate how these requests fit into the overall goals for the coming year.

Technical Committee Work Plan

2021-05-13 revised

The purpose of the Technical Committee is to model, render, maintain, and update the DDI specifications to meet community needs and align with Alliance strategic goals. The TC receives input from substantive working groups of the Scientific Board, DDI users and developers, and other interested parties. This includes the development of conceptual models, implementation of models in various technical forms, monitoring the metadata landscape and related developments, and initiate and plan possible future directions for the standard.

Work Plan 2021/22

Continue work identified in DDI Roadmap as approved in 2019 within minor 2020 updates

Roadmap document: https://ddi-alliance.atlassian.net/wiki/spaces/DDI4/pages/491555/Technical+Committee?preview=/491555/1998258178/DDI_Roadmap_2021-02-25_update.docx

Product Maintenance and Development:

- DDI-CDI review, vote for publication, and publication if approved. CURRENT STATUS: This has been shifted from the last quarter of the current fiscal year due to adjustments in the DDI-CDI workplan following feedback from presentations/review.
- Codebook 2.6 review, vote for publication, and publication if approved CURRENT STATUS: Group has been working on outstanding issues since June 2020 and has addressed approximately 65% of 2.6 issues
- Long term discussion on the Codebook future structures
- XKOS support – work with group managing XKOS maintenance and development and ensure clear expression of the role of XKOS in DDI Suite
- SDTL support – work with SDTL group to ensure effective use of SDTL with other products as appropriate

Technical Processes:

- Lifecycle 3.4 – Complete the move of Lifecycle to the COGS modeling base, testing of input and output for coverage and consistency. This will include testing multiple outputs (XML schema, RDF, JSON, UMI to begin with). CURRENT STATUS: Evaluated input issues and are currently correcting that script. Output scripts accurately reflect stored content.
  - COGS as a processing tool has advantages for Lifecycle as noted when agreed on in 2019 including; auto generation of output structures based on translation rules from object descriptions stored in structured CSV file; ability to add new output formats as needed; ability to generate output and test new content as created;
  - Review implications of multiple outputs on modeling, incorporating discussions and approaches from the Moving Forward work where appropriate; this may require minor remodeling of some choice or sequence usage

- Complete work with CV and ICPSR in setting up the publication process for CVs to DDI space including resolution support
- Resolution process for DDI URNs – HTTP agency resolution service that allows users to create HTTP service definitions using the registry web application for agencies and sub agencies CURRENT STATUS: Discussed requirements

DDI Product Suite:

- Comparison and mapping work – continue work from 2020/21 creating a content model for overall DDI coverage, product coverage, and mapping. Includes exploring means of expressing mapping for various needs. CURRENT STATUS: Created a content model as a basis for comparison. Working on specific areas of comparison; Classifications, Variable Cascade
- Continue revision work on DDI Alliance web pages under Products and resource pages under Learn (Metadata Examples, Tools, Profiles, and Relationships to Other Standards
- Integrate update of assigned DDI Alliance web pages into standard publication processes

2021 through 2023

- Defining roles of individual products
  - How products work together
  - How advances/changes in one product affect other product development
  - Role of products needs to be clear - use case driven rather than content coverage
  - CDI has a goal of integration to other standards (a hub for integration)– how does this impact current standards and their development - Relatively urgent question in terms of funders - is it a stand alone thing, an integration thing
  - Get feedback from people using CDI to see exactly where and how it's being used and who that community is
- Inclusion of common functionality
  - where to integrate from CDI
  - Review of Moving Forward work to identify areas of improvement (Questionnaire, data description, geographic description, separation of logical and physical clarification and simplify, descriptive content for codebook)
  - Clarify how products work together
- Mapping between products
  - Moving content across products - Identify content that should and can move between products or subsets of products
  - The needs to be a unified approach with expressions of mapping appropriate to needs of target audiences
- Recruitment of new additional members both on TC part and SB part
  - more people, more use cases,
  - integration of technical contacts
- Review Moving Forward content and organize for easy mining of content and discussion

General Goals from TC perspective:

- We need to have a discussion of how products work with each other to meet overall goals

- The TC perspective regarding each product is presented on
  - [Overview of Current Products | Data Documentation Initiative (ddialliance.org)](ddialliance.org)
  - [Developing Products of the Alliance | Data Documentation Initiative (ddialliance.org)](ddialliance.org)
- Mapping is a TC level activity which should involve the groups supporting existing and new products
- Recover the discussion of issues over time and layout points and decisions over time
- Align different product implementations over time - how does that work and what does it look like

Quote for
DDI Registry Resolution Enhancements

Date: 20 May 2021
Expires: 31 Jul 2021

To: Jared Lyle
              DDI Alliance

Item 1: HTTP agency resolution service definitions

- Allow users to create HTTP service definitions using the registry web application for agencies and sub agencies.
- Available token replacements for Agency Id, Identifier, Version, and DDI Urn will be allowed within the service location definitions to enable pattern based per-item http resolution
- Built in service location for defining browser based web page view of items
- Built in service location for defining DDI item download
- Built in service location for defining DDI item set download
- Allow any number of custom service locations for defining user defined services

Item 2: JSON description for agency service locations

- Generate JSON description of agency service locations
- Include additional agency information is JSON description including label, created and modified date

Item 3: Well-Known location for agency service lookup

- Add an api to the registry for downloading agency service discovery documents
- Additionally allow individual institutions to publish DDI service locations using a ./well-known/ddialliance/ location on their own web site.

Item 4: DDI URN Resolver for web users

- Add a page to translate a DDI URN to a web browser service location
- Allow Web Users to be redirected to the defined browser service location for the agency
- Rate limiting to prevent abuse
- Allow links to DDI Registry URN redirect with pre-populated URN

Item 5: Platform Upgrade

- The registry currently uses .NET Core 2.2, which was End Of Life on December 23, 2019.
- We will upgrade the platform to NET Core 5 which includes several benefits, including:
    o Current support and security patches from Microsoft
    o Performance, productivity, and security improvements
- The DNS nameserver zone file generator will also be upgraded to .NET Core 5

Item 6: Deployment and Testing

- Deploy the new registry software, web site and zone file writer service to a virtual machine
- Upgrade PostgreSQL database server to the latest supported version
- Test DNS service record resolution for agencies and sub agencies
- Test HTTP service resolution for agencies and sub agencies

Proposal

All amounts are in US Dollars. For quotes in other currencies, please contact us.

Item	Amount
Item 1: HTTP agency resolution service definitions	$1159.20
Item 2: JSON description for agency service locations	$579.60
Item 3: Well-Known location for agency service lookup	$579.60
Item 4: DDI URN Resolver for web users	$869.40
Item 5: Platform Upgrade	$579.60
Item 6: Deployment and testing	$869.40
Total	**$4,636.80**

Proposal for face-to-face meeting of Technical Committee in 2021/22

Submitted 2021-05-24 by Wendy Thomas, Chair, Technical Committee

The Roadmap focuses on integration of DDI products and moving towards a more effective production model. The first step has been the movement of DDI Lifecycle to COGS and the production of a version 3.4 which takes the content of version 3.3 and expresses it in a more flexible XML schema plus additional expressions including RDF, JSON schema, and UML. This is intricate work and involves technical as well as intellectual issues regarding:

- Vision – automation of production process with a flexible tool that can be adapted to fit a variety of needs
- Bindings – XML, RDF, JSON, UML
- Implications for production, maintenance, tooling, training for Lifecycle
- How can we leverage COGS across other DDI products?
    - SDTL currently uses COGS as a production base
    - Can we use COGS for Codebook?
    - Is there a role for COGS in DDI-CDI, or XKOS

Progress has been made in this area with an initial loading of DDI-L 3.3 into COGS and an evaluation of the ingest process and initial binding outputs. By the time of the meeting the ingest process for Lifecycle will have been corrected and we can concentrate on outputs and differences between the various DDI products. In addition, we will have input on the UML features used by DDI-CDI to inform discussion of the UMI generated by COGS. Note that 5 members of the DDI-CDI working group also serve on the Technical Committee so we will have substantial input from that project.

We are targeting the first half of 2022 in Minneapolis as this seems to work well with our overall workplan and three members live in Minneapolis, reducing the overall cost. This also provides additional time for individual organizations to move to full support of business travel.

Costs are dependent upon location:

Hotel costs while individually higher in US would be lessened by locating the meeting in Minneapolis where 3 members reside and eliminating ground transport and hotel support. Estimated costs if DDI supported all attendees would be $14,000-$15,000. Fewer attendees or institutional support of attendance would lower this cost. Co-occurrence with another event such as NADDI would also lower costs. All these issues would be taken into consideration when scheduling.

Per Person: 10 persons (Minneapolis *3 members live here):

		European	North American	Total (4 European 3 NAmer)
Airfare:		$1000	$400	$5200
Ground Transport:		$100	$100	$700
Hotel:	$120/night for 6 nights	$720	$720	$5040

M&I:	$60/day for 6 days	$360	$360	$3600
Total per person:		**$2180**	**$1580**	**$14540**

DDI Alliance CVs - URI resolution

Darren Bell - 22 April 2021

Background and problem statement

DDI Alliance Controlled Vocabularies (CVs) are hosted on "CESSDA's Vocabulary Service" (CVS) platform at https://vocabularies.cessda.eu/. At time of writing, there are 24 DDI Alliance CVs and 4 CESSDA-specific CVs. This platform is used both for editing CVs and for publishing them.

"Controlled Vocabularies" in this context are hierarchical code lists (up to five levels deep). Each item in a CV has a primary "Code value" (always solely in English) accompanied by a "Code descriptive term" and a "Code definition" both of which can be available in other languages. See below for an example of the Italian representation of the "Analysis Unit" CV:

Code value	Code descriptive term (it)	Code definition(it)
Individual	Individuo	Qualsiasi persona.
OrganizationOrInstitution	Organizzazione/Istituzione	Qualsiasi tipo di str riferiscono alle orga delle imprese, dati
▾Family	Famiglia	Due o più persone sono o meno vivere cui i membri della f
Family.HouseholdFamily	Famiglia: Famiglia convivente	Un termine più spe abitazione in un de
Household	Conviventi	Una persona o un g cludere la condivisi (Eurostat)

CVS Versioning

The versioning model used on CESSDA Vocabulary Service is "verbose" in that each language instantion of a particular CV is represented as a distinct object with a specific version number. Each change to the CV in a particular language will instantiate a new object with an incremented version number. Below is a list of the most current versions of the "Analysis Unit" CV:

Details	Versions	Identity and general	Usage	License and Citation	Export/Download

Language	Version	☑SKOS	☐PDF
English (en)	2.1	☑	☐
Finnish (fi)	2.1.1	☑	☐
German (de)	2.1.1	☑	☐
Italian (it)	2.1.1	☑	☐
Norwegian (no)	2.1.1	☑	☐
Portuguese (pt)	2.1.1	☑	☐
Swedish (sv)	2.1.2 ⌄	☑	☐
Danish (da)	2.0.1		The Danish (da) 2.1.x has not been released yet. You can export the previous version here.
French (fr)	2.0.2		The French (fr) 2.1.x has not been released yet. You can export the previous version here.
Serbian (sr)	2.0.1		The Serbian (sr) 2.1.x has not been released yet. You can export the previous version here.

CVS URN identification and resolution

CESSDA Vocabulary Service provides URNs for each CV e.g.**urn:ddi:int.ddi.cv:AnalysisUnit:2.1** represents the URN for v2.1 of the Analysis Unit CV.
These can be resolved interactively on the site by clicking the accompanying link, which will redirect you to the correct HTML page e.g.
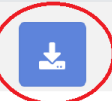https://vocabularies.cessda.eu/urn/urn:ddi:int.ddi.cv:AnalysisUnit:2.1?lang=it

Details	Versions	Identity and general	Usage	License and Citation	Export/Download

Canonical URI   urn:ddi:int.ddi.cv:AnalysisUnit:2.1 🔗
Agency   DDI Alliance 🔗
Translating agency UniData - Bicocca Data Archive 🔗

If machine-actionable URN resolution is required independent of the UI, a REST API is provided - see https://vocabularies.cessda.eu/api-docs

CVS URI Resolution for DDI CVs

Regarding URI resolution (we use URI in the semantic web sense of a string of characters that identifies <u>and locates</u> a resource), the CVS does not currently function satisifactorily. Firstly, URIs for each CV item are currently not persisted in the underlying database. They do appear to be manufactured as an output when a particular CV is interactively downloaded as a SKOS representation (serialized as RDF/XML) :

Details	Versions	Identity and general	Usage	License and Citation	Export/Download
Language		**Version**			☐**SKOS**
English (en)		2.1			☑
Download					⬇

```xml
1   <?xml version="1.0" encoding="UTF-8"?>
2   <rdf:RDF xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
3            xmlns:skos="http://www.w3.org/2004/02/skos/core#"
4            xmlns:owl="http://www.w3.org/2002/07/owl#"
5            xmlns:dcterms="http://purl.org/dc/terms/"
6   >
7     <rdf:Description rdf:about="https://ddialliance.org/Specification/DDI-CV/AnalysisUnit_2.1.html">
8       <rdf:type rdf:resource="http://www.w3.org/2004/02/skos/core#ConceptScheme"/>
9       <dcterms:isVersionOf rdf:resource="https://ddialliance.org/Specification/DDI-CV/AnalysisUnit"/>
10      <skos:notation>AnalysisUnit</skos:notation>
11      <dcterms:title xml:lang="en">Analysis Unit</dcterms:title>
12      <dcterms:description xml:lang="en">Describes the entity being analyzed in the study or variable. This vocabulary can also be used t
        the unit being observed, or from which data are collected. The unit of observation can be the same as, or different from the unit o
13      <owl:versionInfo>2.1</owl:versionInfo>
14      <dcterms:license rdf:resource="Creative Commons Attribution 4.0 International"/>
15      <dcterms:rights>Copyright &#xa9;DDI Alliance 2020</dcterms:rights>
16      <skos:hasTopConcept rdf:resource="https://ddialliance.org/Specification/DDI-CV/AnalysisUnit_2.1.html#Individual"/>
17      <skos:hasTopConcept rdf:resource="https://ddialliance.org/Specification/DDI-CV/AnalysisUnit_2.1.html#OrganizationOrInstitution"/>
18      <skos:hasTopConcept rdf:resource="https://ddialliance.org/Specification/DDI-CV/AnalysisUnit_2.1.html#Family"/>
19      <skos:hasTopConcept rdf:resource="https://ddialliance.org/Specification/DDI-CV/AnalysisUnit_2.1.html#Household"/>
20      <skos:hasTopConcept rdf:resource="https://ddialliance.org/Specification/DDI-CV/AnalysisUnit_2.1.html#HousingUnit"/>
21      <skos:hasTopConcept rdf:resource="https://ddialliance.org/Specification/DDI-CV/AnalysisUnit_2.1.html#EventOrProcessOrActivity"/>
22      <skos:hasTopConcept rdf:resource="https://ddialliance.org/Specification/DDI-CV/AnalysisUnit_2.1.html#GeographicUnit"/>
23      <skos:hasTopConcept rdf:resource="https://ddialliance.org/Specification/DDI-CV/AnalysisUnit_2.1.html#PoliticalAdministrativeArea"/>
24      <skos:hasTopConcept rdf:resource="https://ddialliance.org/Specification/DDI-CV/AnalysisUnit_2.1.html#TimeUnit"/>
25      <skos:hasTopConcept rdf:resource="https://ddialliance.org/Specification/DDI-CV/AnalysisUnit_2.1.html#MediaUnit"/>
26      <skos:hasTopConcept rdf:resource="https://ddialliance.org/Specification/DDI-CV/AnalysisUnit_2.1.html#Group"/>
27      <skos:hasTopConcept rdf:resource="https://ddialliance.org/Specification/DDI-CV/AnalysisUnit_2.1.html#Object"/>
28      <skos:hasTopConcept rdf:resource="https://ddialliance.org/Specification/DDI-CV/AnalysisUnit_2.1.html#Other"/>
29    </rdf:Description>
```

The resulting data (a snippet of which is illustrated above) has some foundational issues however:

1. URIs that are provided in the SKOS do not currently resolve anywhere e.g https://ddialliance.org/Specification/DDI-CV/AnalysisUnit_2.1.html#Individual is a dead link.
2. Perhaps more seriously, these are not RDF resource URIs at all but rather URLs (intended as links to human-readable HTML pages).   In that sense, they have no utility at all in terms of resolving an identifier to an actual piece of data, as would be useful for processing references to CV items in a DDI document.

Requirements going forward

It is assumed that the editing platform for DDI Alliance CVs in the short to medium term will continue to be https://vocabularies.cessda.eu/

In order for a URI for a DDI Alliance CV or CV item to be correctly resolved under the ddialliance.org domain the following will need to occur:

1. Well formed URIs will _either_ need to be persisted explicitly in the CESSDA Vocabulary Services Database and reflect the fact that each specific language instantiation of a specific CV (or CV item) version is represented by a distinct object _or_ there needs to be a clear algorithm to generate the appropriate URI for each language/version object. The Base URL for these URIs will ddialliance.org.

2. The DDI Alliance needs to host a system that can represent and persist CV data as SKOS structures with appropriate additional RDF predicates (e.g. owl, dc and so on) that will represent versioning and change log information. In practice, the most appropriate database for this is a triple store.

3. The DDI Alliance needs to host a machine-readable endpoint that can present these SKOS structures as RDF data (optimally in both JSON-LD and RDF/XML serializations).

4. There needs to be a repeatable, automated mechanism to export CVs and CV items from CESSDA Vocabulary Services to the system alluded to in #2. The frequency of updates to CVs on CESSDA Vocabulary Services will determine the periodicity with which these updates need to take place.

Proposed solution

Broadly based on ELSST (the CESSDA Thesaurus platform), the following is proposed as an infrastructure installed on a single Linux server:
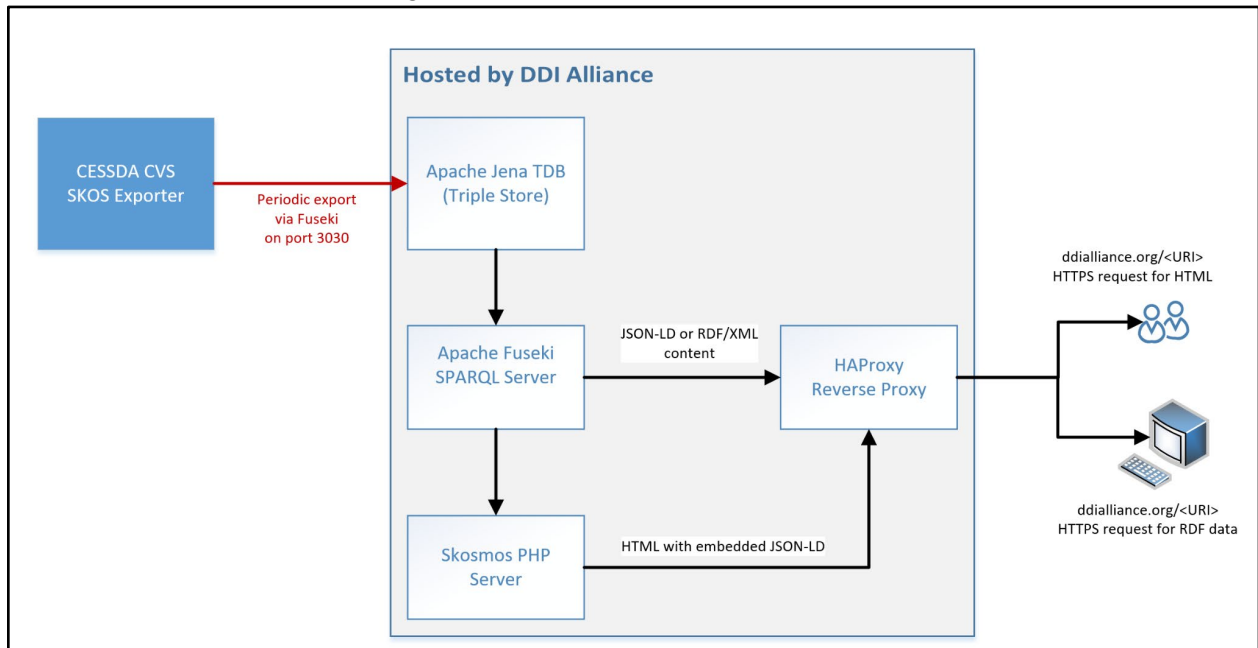
Note that Fuseki/TDB could host and provide resolution for any graph entity including RDF schema like : https://rdf-vocabulary.ddialliance.org/xkos.ttl and allow for traversal and inference of properties (not currently possible with the current static file retrieval of xkos.ttl).

Rough estimate of work involved

1. Define schema required to represent CESSDA CVs in RDF; define x-walk from CESSDA CVS schema; define URI namespace and URI syntax to handle language and version specificity (several days).
2. Install TDB/Fuseki/Skosmos at DDI Alliance host and implement appropriate security/DNS/firewall configuration (1 to 2 days)
3. Write transform to export data from CESSDA (1 to 2 weeks)
4. Pilot and test periodic upload (several days).
5. Load XKOS onto Apache Fuseki and test resolution and inferencing (1 to 2 days)
6. Load testing (1 day)
7. Release to production, promotion, training, maintenance plan, technical documentation, disaster recovery plan (1 to 2 weeks)

<div align="center">

DDI Training Working Group
Annual Report (2020-2021)
Budget Request for FY2022 (July 2021 through June 2022)

</div>

Submitted by: Jane Fry (co-Chair) and Anja Perry (co-Chair)
Submitted on: June 19, 2021

Some Highlights from the past year

The DDI Training Group consists of 13 active members and meets the first Tuesday of each month. We have had three new members join us, four members are currently on leave, and one member left the group due to a change in her job. Having new members join us helps to invigorate the group and bring in new perspectives.

In the past year, two sub-Working groups have achieved their goals and, therefore, have disbanded. They are the Training Webpages Update and the Gap Analysis sub-working groups. The members of these sub-groups chose which of the other 2 sub-groups they wished to join, that is, either the Slide Decks Review or the Training Opportunities sub-groups. These two remaining sub-groups continue to meet on a regular basis and to work towards completing their goals.

The goal of the Training Webpages Update sub-group was to review all of the DDI pages related to Training and this review has led to the composition of four new webpages directed at the potential user who has no previous knowledge of DDI. This sub-group found these types of webpages to be a gap on the website. After many drafts and reviews, the pages are ready to be finalized. Stay tuned!

DDI outreach from different individuals has resulted in presentations for new groups, including CODATA, FAIRsFAIR and the Dublin Core Metadata Group. We are pleased that we have formed an excellent working relationship with CODATA and they are helping us with our webinars by marketing them for us (allowing us to reach greater potential participants), and allowing us to use their webinar software. This latter item is of great help to us as they are also the hosts (and deal with all technical issues), and there is no cost to us, resulting in a savings in our budget.

We have set up two Zenodo Communities: [DDI Training Material](#) (formerly the DDI Training Library) and the [DDI Training Group](#) (to share slides used in workshops and training events). The latter Community had done six presentations as of the end of May 2021. The first set of slides of Training Material is currently under review by the Scientific Board and will be published soon.

Training Plan

Our overarching goal is to offer a continuum of online training resources, from basic to more advanced, to encourage DDI use. These training resources will be offered in a variety of

mediums, from prepared self-selected slide presentations, to webinars, to in-person training.

There are a number of goals we hope to accomplish in the next year.

- **Slide decks:** To complete the rest of the slide decks that were started at the last Dagstuhl Workshops. These slide decks are intended to be used by anyone, either in a presentation of their own, or in learning about DDI themselves. This set of slide decks will also form the core of the DDI Training Material. As other topics are determined, new slide decks will be put together, e.g., one for Metadata.

- **Training opportunities:** To continue to identify different DDI training opportunities, eg.,webinars; conferences. To take advantage of these opportunities by putting together a schedule of upcoming webinars. To continue to monitor the training requests which are sent in and to keep a spreadsheet with the basic information from the requests for tracking purposes.

- To update the *Events webpages* by making the information consistent and by depositing the existing presentations into the appropriate Zenodo DDI community. This latter task will be coordinated with the Marketing Group.

- To update the Terms of Reference and Mission for the Training Group. These were written almost 2 years ago and it is time to update them. This includes solidifying the name of this group, i.e., Group, Working Group, Committee.

Discussion

The co-Chairs have met with the Chair of the DDI Marketing WG, Barry Radler, a number of times to continue co-ordinating activities, e.g., videos. As well, they have met with the Chair of the Technical Committee, Wendy Thomas, to co-ordinate the revision of the Training web pages. These meetings will continue as needed.

The members of the DDI Training WG are quite encouraged to see the fruits of their labours for the past year. And we have more ideas for the future once our initial goals have been completed. We welcome any feedback or comments.

Budget Request

We are including the budget request in our Annual Report to be transparent in our goals for the next year. The Training Working Group requested $12,600 for FY2022. This request was granted.

FY2022 (July 1, 2021 - June 30, 2022)

Training Group Activity	Purpose / Goal	Audience	Cost (USD $)
Videos (to share on social	4 short videos (to increase our	new and advanced users	1,100

media)	number of short videos) to be produced by Kristi Winters. Will co-ordinate with Marketing.		
Funding for workshops (travels and fees)	DDI will be promoted by submitting workshops to about 5 conferences. Travel costs and conference fees are covered for the instructor.	new users	10,000
Discount / waiver workshop fees (for DDI members)	We will offer a workshop fee waiver for DDI members and a conference fee discount for instructors at two conferences (EDDI and IASSIST).	new and advanced users	1,500
Web page update	Members of the Training Group continue to update and make changes to training-related content on the DDI website.	new and advanced users, DDI Trainers	In-kind contributions
Translation	Start with the translation of the basic introductory slide decks.	new and advanced users	In-kind contributions
Training Material update	Members of the Training Group continue to produce Training Material (including exercises) on Zenodo and the DDI website (with the help of the DDI assistant).	new and advanced users, DDI Trainers	In-kind contributions
Teaching in webinars or at conferences	Members of the Training Group engage in teaching activities to increase DDI knowledge in the research community.	new and advanced users	In-kind contributions
TOTAL			12,600

Active Members of the DDI Training Working Group

Alina Danciu
Adrian Dusa (joined March 2021)
Jane Fry   co-Chair
Dan Gillman
Arofan Gregory
Kaia Kulla
Kathryn Lavender (joined March 2021)
Marta Limmert
Jared Lyle
Hayley Mills
Laura Molloy (joined March 2021)
Hilde Orten
Anja Perry   co-Chair

CDI WG Budget Request for 2021-2022

Note that we have renamed ourselves the "Cross-Domain Integration Working Group" and so I use that name instead of "Modelling, Representation, and Testing".

Summary

We are requesting funding for anticipated face-to-face meetings for the further development of the DDI-CDI specification, and efforts to support near-term implementation.

We are also requesting funding to finalize the RDF syntax representation, which work was addressed for the DDI 4 Prototype but now requires some updating to reflect the developments in DDI-CDI.

Face-to-Face Meetings

There are a few significant points regarding DDI-CDI:

- DDI-CDI will be released in production version in June-July.
- Feedback from the community has been rich and it is timely to review next steps.
- In partnership with CODATA, we have produced a significant report which highlight use cases for implementation.
- There is a significant opportunity to explore those in detail and develop some detailed implementations, partly but not exclusively in relation to CESSDA.

We are planning two weeks at Dagstuhl for which the space is reserved and confirmed by the Leibniz Centre for Informatics.

- The first week will review and prioritize the next workplan for DDI-CDI. Several features were highlighted in the public review which were not implemented due to constraints of time and resources. These have been outlined in the plan presented to the Scientific Board and would be the focus of this event.
- The second week will explore use cases for implementation and builds on the series of workshops on cross-domain interoperability and recent work in the EOSC context around DDI-CDI. This workshop will explore use cases which were identified in the EOSC report: including the application of DDI-CDI to the maintenance of the European Social Survey; and cross-domain case studies involving i) social science and environmental data, and ii) demographic, public health, clinical and genomics data.

After 18 months of working online and given the development arc described above, intensive face-to-face work is timely and essential. It also gives us an opportunity to invite and recruit new individuals to contribution to the work.

Therefore we request four transatlantic flights to participate in these workshops. Costing is presented below.

The current circumstances of widespread vaccination and the opening up of travel allow us to think that this plan will be possible.

However, if we find that this proves not to be the case, then we will fall back on a plan B, holding the September workshops in a partly virtual format and arranging a further workshop in the spring of 2022. In that case the funding request would be split between the two activities.

Face-to-face travel expenses (flights, train, accommodation, taxis): 12,880 USD

RDF Syntax Representation

Considerable work was done with the DDI 4 model and identifying a suitable mapping into the RDF syntax in the past. We wish to build on that work, as the RDF syntax representation is, after XML, the most critical one for the user community, given the popularity of Linked Open Data in many domains as well as the SBE sciences.

The work to finalize this mapping will require some consulting effort. We have broken this into two discrete tasks, as the skills needed for each are not necessarily found in the same individual:

1. Updating the mappings from the DDI-CDI model to the needed syntax constructs
2. Implementing the mapping as a transformation (similar to what we use for the XML syntax representation)

The mapping work is estimated to cost 4,500 USD

The implementation of the syntax representation will cost 8,000 USD

We assume that these tasks can be conducted on a fixed-price basis, as this is likely to be more cost-effective given current hourly rates for programmers and RDF experts.

Totals

The total amount requested will be:

25,380 USD

DDI URN Resolution

Description and Discussion

Draft, 2020-10-13, Joachim Wackerow

Updated for CVs, 2021-03-09

Introduction

The DDI specifications use the DDI URN ([Uniform Resource Name](#)) as persistent identifier. It is used for any resource which is defined by DDI specifications and can be identified by a DDI URN.

The DDI URN is an URN defined according to the [RFC 8141](#). "Request for Comments (RFC) is a publication from the Internet Society (ISOC) and its associated bodies, most prominently the Internet Engineering Task Force (IETF), the principal technical development and standards-setting bodies for the Internet." ([Wikipedia](#)). "A Uniform Resource Name (URN) is a Uniform Resource Identifier (URI) that is assigned under the "urn" URI scheme and a particular URN namespace, with the intent that the URN will be a persistent, location-independent resource identifier." (RFC 8141).

The Namespace Specific String (NSS) of all URNs using the "ddi" NID is a globally unique identifier consisting of the DDI agency identifier (registration authority identifier), the identifier of the DDI resource (data identifier), and the version of the resource (version identifier). This structure is according to the International Registration Data Identifier (IRDI) defined in ISO/IEC 11179 Information technology - Metadata registries (MDR) - Part 6: Registration, Annex A.

The DDI URN is defined in a specific RFC (22 pages) with the title "A Uniform Resource Name (URN) Namespace for the Data Documentation Initiative (DDI)" written by Joachim Wackerow. This RFC will be soon submitted for comments and approval to the related IETF email list (urn@ietf.org). The goal is to achieve a formally approved namespace in the [official IANA registry of URN namespaces](#).

In a subsequent step, the registration for "DDI" in the "URN.ARPA" zone is planned ("ARPA" is an Internet top-level domain). This will enable DNS-based ([Domain Name System](#)) resolution of a DDI URN to specific DDI services. A DDI service could enable the resolution of a DDI URN to a physical location like an URL ([Uniform Resource Locator](#)).

It should be noted that there are some dependencies on the IETF authorities regarding the steps described in the two previous paragraphs.

This paper at hand describes the multiple levels and steps of the resolution process and the related body of responsibility. The paper points out some issues in the overall setup and raises some related questions.

There are surely more open issues and questions. The document is open for comments.

Resolution Steps

The different steps of the resolution process are listed here:

1. A program (client) sends a request for a specific DDI URN to the DNS (server) with the DNS zone ddi.urn.arpa. The DDI URN is "urn:ddi:us.mpc:PISA-QS.QI-2:1".
2. DNS delegates the request to the nameserver of the DDI Alliance because this will be the default route for DDI URNs.
3. The nameserver of the DDI Alliance delegates the request to the nameserver of the MPC. The DDI agency "us.mpc" has an entry in the DDI agency registry which defines the MPC nameserver as default route for DDI URNs of the DDI agency us.mpc.
4. The MPC nameserver answers with a list of available DDI services. One of the possible DDI services should be the resolution of a DDI URN to an URL.
5. The program selects one of the DDI services. The program sends a request for the DDI URN "urn:ddi:us.mpc:PISA-QS.QI-2:1" to this specific service.
6. The DDI service sends an answer. This is an URL in the case of the service which can resolve to an URL.
7. The program can use this URL to request the resource which is identified by the DDI URN.

Steps 1 and 5

The program needs capabilities to interact with the DNS, i.e. sending specific requests and receiving list of services.

Responsibility

The application programmer is responsible for this respectively the organization which is interested in DDI software for the use of distributed DDI resources. The programmer can use available program libraries for these purposes.

Open Issue

There are specific program libraries of Colectica available at the DDI Alliance registry site. It needs to be explored whether they are sufficient for the simple use in DDI software.

Step 1 and 2

Prerequisites for the steps one and two are …

- the approved RFC for the DDI URN, i.e. a formal URN namespace for DDI resources,
- the entry "ddi.urn.arpa" in the DNS system, and
- the delegation of DNS requests to the DDI Alliance nameserver.

Responsibility

The DDI Alliance is responsible for this. Joachim Wackerow is working on this.

Step 3

The nameserver of the DDI Alliance needs to be configured in a way that DNS requests are delegated to the specific registered nameservers (in the DDI agency registry).

Responsibility

The DDI Alliance is responsible for this.

Open Issue

It needs to be determined who the actual work is doing. It should be noted that there is some dependency of the University Michigan IT regarding nameservers. One option for doing the work would be Colectica. Colectica is already maintaining the DDI Alliance registry on behalf of the DDI Alliance.

Step 4

The available DDI services of a DDI agency need to be configured in the agency nameserver.

Responsibility

The DDI agency is responsible for this.

Open Issue

DDI services – at minimum the resolution of DDI URNs to physical locations like URLs - are crucial for the distributed use of DDI resources.

Are enough resources and competence available in every DDI agency to maintain DDI services and to configure the agency nameserver accordingly?

Could offers of the DDI Alliance help here? Like support (for example tutorials) for maintaining DDI services at DDI agencies? Or are central DDI services at the DDI Alliance the solution? This would raise other questions like:

- What is the policy of the DDI Alliance on this? This would need to be developed first.
- What are the required resources for this? Can the DDI Alliance afford this?

Step 5

The program needs capabilities to communicate with DDI services.

Responsibility

The application programmer is responsible for this respectively the organization which is interested in DDI software for the use of distributed DDI resources.

Open Issue

DDI services are currently not standardized. Standardized DDI services and related program libraries would enable easier development of software for the use of distributed DDI resources.

A REST-based API for the resolution of DDI URN to URLs and related program libraries seem to be most important.

DDI Vocabularies

DDI Vocabularies are also DDI resources which are identified by DDI URNs. The resolution of these DDI URNs to URL is important for any use of the DDI Vocabularies.

Open Issue

It should be clarified how this can be achieved. There are DDI Vocabularies from the DDI Alliance and from CESSDA. Could a collaborative approach be possible?

The DDI Alliance vocabularies have currently a wrong URN. This needs to be corrected.

Side issues:

- Does the URN change trigger a new version of the CVs?
- The CVs are still available only in Genericode. There was agreement to use SKOS. The CVs should be transformed to SKOS. There is already work available from Benjamin Zapilko, see: https://github.com/linked-statistics/DDI-controlled-vocabularies.

Conclusion

The described scenario needs some efforts to provide a workable basis. This will need some time. The "Open Issue" and dependency sections describe some possible obstacles.

Workaround

Until completion of all steps described above, a limited workaround for the resolution of DDI URNs to URLs would make sense. One option is to provide a DDI HTTP-based service which takes the DDI URN as a HTTP query parameter and answers with the related URL. This approach would not require the steps 1 to 4. The investment in the development of this service would not just be for the workaround. This service could be improved later for the final solution.

One option for maintaining the resolution table from DDI URN to URL is the use of the standardized XML Catalog approach. There is related software available – for example in the Java runtime environment. The prototype DDI4R uses this approach.

A workaround approach would raise again the resource questions mentioned above.

DDI Webinar Series Extension Proposal

Summary

This proposal builds on on-going work which the Training Opportunities Subgroup has been doing in collaboration with CODATA around the DDI Webinar Series to better leverage the current marketing and training opportunities highlighted by those efforts. Recent webinars have been quite popular: introductory DDI presentations In December of 2020 and the initial webinar on metadata both had more than 75 attendees, with a high level of engagement. We feel that both from a training perspective and from a marketing perspective these channels provide a significant new audience for DDI products.

Further, CODATA is involved with separate efforts focused on Research Data Management training, primarily aimed at young researchers and prospective data managers through their Research Data Management School and related activities through the FAIRsFAIR project. We feel that metadata broadly and DDI specifically could be fit into these curricula at appropriate points and have had some exploratory discussions with individuals in these groups.

We see the benefits of actively pursuing these channels through an enhanced webinar series and engagement with CODATA training activities as:

- Accelerated development and testing of DDI Training Materials (as the basis for webinars and other presentations) – these would be coordinated with the DDI Training Slide Review group
- Broader audience for DDI Trainings/Tutorials through the webinar series
- Large marketing impact among RDM communities which are not currently aware of DDI products and DDI-based approaches/solutions
- Creation of recorded webinars for distribution through the YouTube channel
- Creation of "short version" presentation materials for use in marketing activities and videos
- Train-the-trainer opportunities to give members of the DDI community experience in preparing and delivering webinars based on the DDI Training Materials being developed in the Training WG

The Training WG has a more narrowly defined scope, and it is felt that a joint activity, planned by both the Training Opportunities subgroup and the Marketing group, and conducted in concert with the current webinar series, is the best way forward. It has the advantage of being integrated with existing efforts, but also taking into account the concerns of the Marketing group.

Current Training Outline

Currently, there is a planned series of 5 webinars, the first of which was successfully delivered, An additional four webinars are planned, based on materials being developed for the Training Materials and input from other relevant sources. The first five webinars have been resourced, with the development of slides accelerated through "mini-sprints" funded with unused (due to COVID travel restrictions) money in the Training WG budget at the end of FY 2021.

The Training Opportunities group has committed to conducting the remaining webinars outlined in the series, although some questions remain as to how best to resource these. It is felt that the proposed programme should be as ambitious as realistically possible, but that no public commitment should be made until any given webinar can be practically planned and resourced.

The current DDI Webinar Series is described in the attached outline.

Proposed Activities

1. Webinars

This proposal would cover the delivery of all the webinars outlined in the proposal (or their equivalents, as appropriate) and would further allow for additional webinars to be conducted as appropriate (up to three additional activities could be added to the existing program, extending the series from the 9 currently envisioned to a programme of 12.)

Each webinar would produce a full set of slides for addition to the Training Materials, which would be developed according to that template and style and submitted to the Slide Review subgroup for review/acceptance. This would accelerate the development of materials for the library. The "mini-sprint" methodology would be employed for the creation of these decks, working closely with appropriate members of the Training WG and DDI community broadly.

Each webinar would involve new presenters as appropriate, to give interested members of the DDI community experience in the webinar process.

Further, each webinar would produce two versions of the presentation:

(1) A "Tutorial" version suitable for 90-120 minute presentations
(2) A "short" version suitable for use in a 10-15 minute presentation at conferences or similar for a (these might also form the basis of short marketing videos)

2. Engagement with External Training Initiatives

Through our connection with CODATA, we propose to plan and pursue collaborative work with their "Research Data Management School" and related activities going on under the FAIRsFAIR umbrella.

While FAIRsFAIR is largely a European project, the CODATA School is more focused on LMIC countries, although their virtual programme is international – events will include as many as 800 participants from around the globe on general RDM topics.

There are a range of opportunities here which could be pursued:

1. Adding a specialized DDI curricula to their "Data Stewardship" programme, by giving tutorials in support of their current events (they have many virtual presentations and conduct a multi-week "summer" programme in Europe each year).
2. Giving webinars as part of their broader RDM series on data management topics involving metadata and standards such as DDI (FAIR could be a good jumping-off point for this audience, which is largely made up of beginning researchers)
3. Working with FAIRsFAIR to help support their training resource centers by inclusion of DDI- and metadata-related material.

We propose that a reasonable set of activities be identified through discussion and consultation with the CODATA and FAIRsFAIR teams, and that these be carried out over the course of the year. We would anticipate that this would result in a half-dozen specific events, and likely other more concrete deliverables in terms of a DDI contribution to the RDM resource centers for FAIRsFAIR.

The envisioned plan would be developed by members of the Training Opportunities Subgroup, Marketing, and other DDI community members as appropriate, but would be prioritized according to the combined goals of the Training and Marketing groups.

Budget Request

The anticipated effort involved in this work is expected to be on the order of 5 person-weeks of dedicated time, supplemented by the volunteer work already on-going in the Marketing and Training WGs.

The requested budget would only include money for consultation. Any travel needed to engage with the CODATA Research Data Management School programme or other, similar face-to-face events is likely to be local and could be handled institutionally. Note that the webinar series has arranged to use the existing CODATA platform, so there is no need for additional software licensing.

The total requested is 7040 USD.

A vision for DDI in a research infrastructure

The DDI suite of products consists of multiple specifications in the form of a UML model representation, i.e. XMI, and syntax representations, e.g. XML Schema, JSON-LD, RDF/OWL, etc. together with documentation in various forms. The specifications of the DDI products follow different architectures: DDI Lifecycle, for instance, is XML Schema-driven, i.e. all syntax representations are derived from XML Schema constructs, which functions as the de-facto model; DDI-CDI, in contrast, follows a model driven architecture approach[1], in which a conceptual, platform-independent model (PIM) captures the high-level entity-relationship specification and a number of platform-specific models (PSM) describe the intricacies of the different syntax representations. Both specifications can describe a data layer, consisting of various types of data, from very structured to NoSQL and streams, together with the concepts it represents and the various processes involved in data production, integration and sharing.

In order to produce the building blocks of a future global research infrastructure, we need to make the DDI products into an implementation reality. To that end, we envision a rich framework and ecosystem of reusable and shareable libraries, micro-services and tools, all built around a community of vendors and open source developers that can provide a marketplace of evolving components, services and protocols, and easy integration with other specifications and standards, most notably SDMX, DCAT and PROV. This extended FAIR ecosystem will then be leveraged to implement data production solutions and advanced analytics, including Big Data and machine learning.

This vision addresses mainly two DDI Alliance strategic actions: (1) high-level goals and (3) Improvement of interoperable and distributed DDI infrastructure for use and reuse of DDI resources. It will also facilitate the seamless integration of content from existing and future DDI registries and repositories [as per action (4) Registries/repositories] into a global data production infrastructure.

The next diagram shows an overview of the implementation stack.
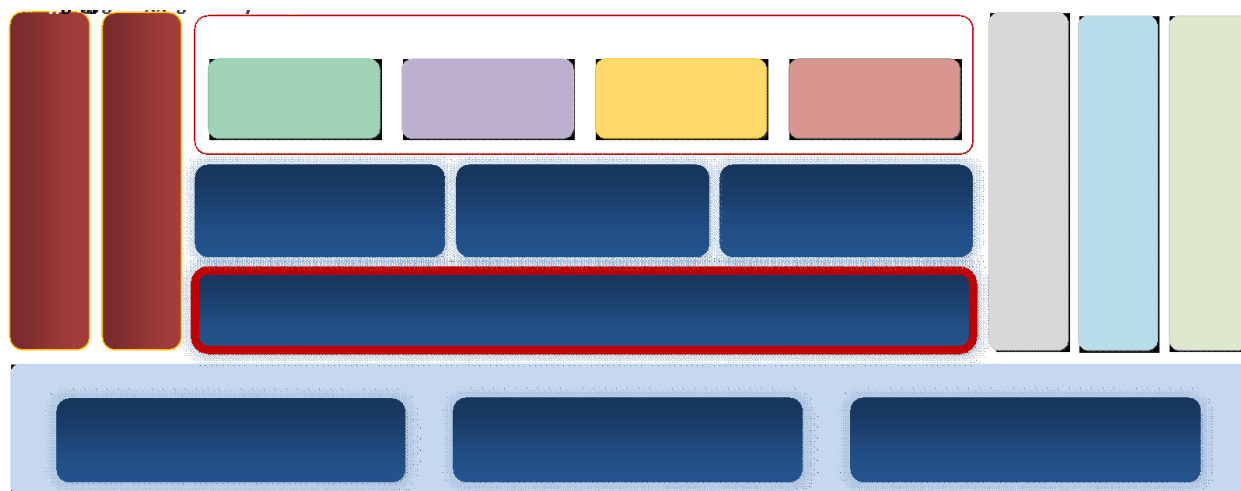
Such an ecosystem can be initially enabled by a rich DDI libraries layer (center). These libraries should span both lifecycle and CDI. This project will tackle the definition of a generic framework for both DDI versions and will focus on the development of libraries for a meaningful fragment of CDI.

---

[1] https://www.omg.org/mda/

DDI libraries development

We need to provide libraries in a variety of languages, e.g. R, Python, Java. These libraries will map the syntax representations of DDI to constructs in the respective languages. These high-level languages share a lower-level development language, which is C. The idea is to create a common, generic C/C++ library that deals with the serialization and deserialization of DDI objects and then creates the specific objects and methods in the respective higher-level languages. This way we can use the same code base to handle the common functionality, e.g. reading and writing syntax representations, on top of which we'll have multiple code packages for the language-specific functionality, e.g. creating and maintaining language constructs.

In order to get there, we first need a clear design of the necessary language constructs. These constructs consist basically of classes and methods. They need to cover not just the DDI model but also the linkage to the data itself – e.g. integrating data and metadata in a data frame. In addition, they need to provide higher-lever methods capable of manipulating composite objects not just individual ones – e.g. some entities, like classifications, are composite objects spanning multiple classes that usually need to be managed together.

To produce such a design, we are proposing to use a kind of domain driven design[2] approach in which the main set of classes and methods are defined using one specific prototyping language, e.g. Python. This requires domain experts, i.e. DDI modelers, working closely together with language experts, e.g. Python programmers. The result of this exercise is a prototype implementation that can then be used by a C/C++ developer to implement the DDI libraries.
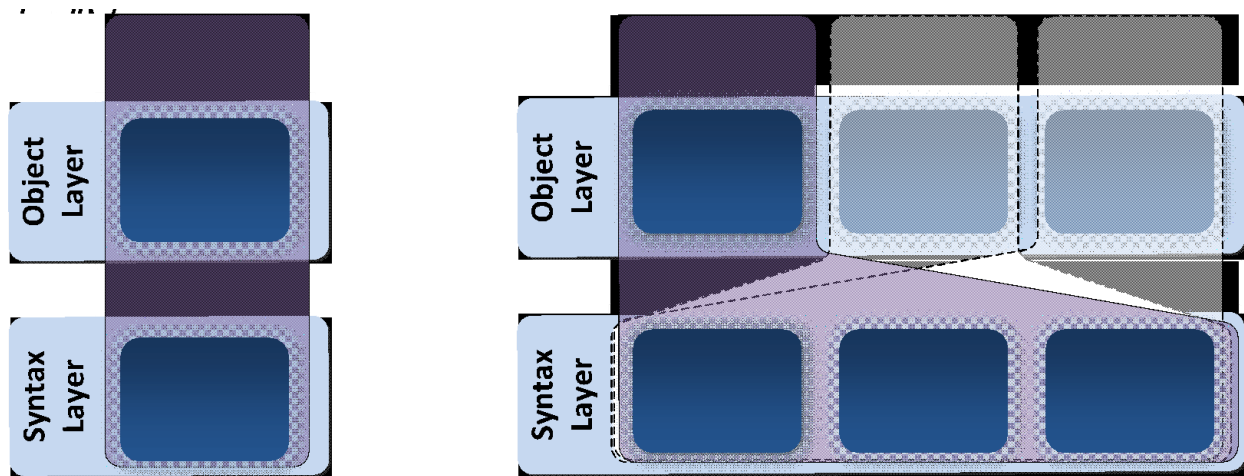
The object layer domain driven prototype provides higher-level functionality suitable for defining library requirements. However, the object model does not address data serialization and deserialization, storage and interoperability across languages. We propose prototyping a data interface layer, in addition to the several model specifications. The model specifications allows for model validation, and the data interface

---

[2] https://martinfowler.com/bliki/DomainDrivenDesign.html

layer provides persistency and conversion to/from the object model. One approach for the data interface layer is to adopt a data format that implements an Interface Definition Language (IDL). IDLs allows the specification of messages in a language-and-platform-neutral way through defined schemas. Out of the schemas, data serialization and deserialization classes for a variety of programming languages can be generated. The generated classes guarantee data interoperability across platforms. In addition to the IDL, an XML data object model (DOM) can serve as a data interface layer for the XML schema access. Therefore, we provide multiple model specifications for syntax access and multiple data interface layers for data access. Persisted data can be validated using the higher-level object model, and independently validation methods can be developed for the model specifications. Examples of IDLs include Google's Protocol Buffer and Flatbuffer, Apache Thrift, Apache Avro.