Archive-in-a-box

(Internal Demonstrator)

Service-Concept
M 1.4.1.1

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Work Package 1.4
Responsible Partner Technische Universität Darmstadt

DARIAH-DE
Aufbau von Forschungsinfrastrukturen für die e-Humanities

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03.03.2012	RB, REC	complete Restructuring (requirements, new candidates)
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1. 'Archive-in-a-box': Introduction

Society nowadays not only depends on paper anymore, it more and more gets computational. This has implications. Like natural scientists, scientists in the humanities have to deal more and more with large amounts of research-data. This trend accelerates as not only the social sciences, but research in general is embracing computational resources and instruments.

This document aims to provide a concept for researchers in the humanities on how to employ digital archives, with a particular focus on philological data. The document gives an overview of software for digital archives already available at the time of writing as well as an evaluation scheme and first result for these products according to DARIAH-DE requirements. From that scheme a recommendation is derived which products could be further integrated into the DARIAH infrastructure to gain a stable and trustworthy in-a-box-experience (preferably in a form of a preconfigured and updateable virtual machine) for all kinds of archival use scenarios in the future research.

1.1. Aim of the document

This document should be understood as the first of two documents. This first document aims to

(1) provide an overview of the already available repository-packages at the time of writing (for a quick overview see table 1 in section 3.1),

(2) take into account interoperability with the DARIAH-DE infrastructure services (AAI, generic search etc.) and the standards they use as key criteria for a recommendation for further integration (see section 2.4),

(3) provide an orientation through recommendations for further testing (according to (1)+(2), see section 5).

1.2. Impact / Background of this document

The document at hand should as well be mainly understood as a set of *recommendations*. These recommendations could apply if you

- plan to introduce a new archival system at your institute / centre or for your own project or network

-- or --

- plan to migrate existing archival systems and their data to a new platform

-- under the condition that --

- you want to do either of this in a way that is sustainable as well as interoperable with main parts of the coming DARIAH-DE-infrastructure (specifications that currently could be taken into account).

1.3. Future of this document, next steps (until 2014)

The document at hand will be followed by a second document. This second document will build on the recommendations provided here and will deliver more in-depth information on the recommended products through tests performed as well as experiences gained on their integration into the DARIAH-DE infrastructure. This information can be such as:

- Installation instructions and pitfalls of each procedure, as well as solutions and workarounds. These instructions may serve for the preparation of a virtual machine (VM) image which can be used to test-drive a particular product and it may serve as input for data centers that wish to offer the product as an application service (AaaS).

- Identification of forks of each packages software-development to follow for sustaining open and secure DARIAH-DE-compatibility (including support-addresses etc.).

- Introduction and discussion of DARIAH-DE-specific patches, extensions and/or plug-ins which should be included into VM images to ensure out-of-the-box interoperability with the DARIAH-DE infrastructure.

The second document is scheduled for February 2014.

2. DARIAH-specific requirements for an 'Archive-in-a-Box'

This section deals primarily with requirements originating from DARIAH itself towards archive-software. To start with a look at the software-candidates for further consideration, you can skip this section and continue to section 3. You may still want to take a look at section 2.4, interoperability, for an introduction of standards and formats used in the DARIAH infrastructure, which are key criteria for the evaluation (section 3/4) and its results according to each software package (section 5) as well as our early recommendations (section 6).

2.1. Textual sources for extraction of requirements

In order to get an overview of the central objectives of DARIAH-DE with respect to the 'Archive-in-a-Box' intentions and to legitimate the present form of this document, we collected relevant passages from the initial DARIAH-DE proposal (as well as two other documents) and slightly refined on them. We marked central *source-passages*, subsumed them under an identifier (**AIB-SRC-number**, followed by reference to the

page) and subsequently extracted some central and/or some relational key requirements for further use within this document.

To cite and subsume the eight main source-passages we found:

(AIB-SRC-1) p.19 – *"Im Aufbau befindliche geistes- und kulturwissenschaftliche Datenzentren und Forschernetzwerke müssen oft ihre lokalen technischen Systeme von Grund auf neu aufbauen. Zur Vereinfachung dieser Startphase bietet DARIAH Orientierungshilfen für bestehende Softwaresysteme und nimmt bei einigen ausgewählten Systemen die nötigen Anpassungen für eine Integration in die DARIAH-Infrastruktur vor (z.B. zur Interaktion mit den Infrastrukturdiensten aus dem DARIAH-DE Unterarbeitspaket 1.2 Interoperabilität Meta-/Daten). Diese Softwarepakete werden in zwei komplementären Diensten angeboten: dem Archive-in-the-box für den Aufbau von Forschungsdaten-Repositorien sowie dem VRE-in-a-Box als Basis für kollaborative Forschungsumgebungen."*

(AIB-SRC-2) p.20 – *"Obwohl DARIAH nicht zentral Langzeitarchivierung (LZA) durchführt, wird DARIAH in diesem Task lokale LZA-Aktivitäten unterstützen. Hierzu zählt vor allem die Integration von Technologien und Konzepten aus der LZA-Forschungslandschaft (z.B. aus PLANETS, CASPAR, nestor, kopal) in DARIAH, z.B. in das Softwarepaket Archive-in-the-box. Ebenso werden die in VCC 3 entwickelten Standards und Konzepte in die technische Infrastruktur integriert, was durch das VCC 1 vorbereitet werden kann."*

(AIB-SRC-3) p.24 – *"In Zusammenarbeit mit VCC 1 e-Infrastructure soll ein »Archive-in-the-box«-Konzept entworfen und umgesetzt werden, mit dem eine einfach aufzusetzende Repositorienumgebung geschaffen werden kann. Damit kann der Datenbestand von neuen DARIAH-Partnern schnell und unkompliziert in die DARIAH-EU-Infrastruktur eingebracht werden."*

(AIB-SRC-4) p.63 – *"Zu den vorgefertigten, generischen Software-Paketen (a) zählt unter anderem Repository Software, die geistes- und kulturwissenschaftliche Zentren bei sich zum Datenmanagement installieren können und die mit der DARIAH-Infrastruktur kompatibel ist. Hierbei können u.a. die Erfahrungen aus dem eSciDoc-Projekt in der Entwicklung des Archive-in-the-box Dienstkonzepts für DARIAH-EU genutzt werden."*

(AIB-SRC-5) p.64 and p.102 – *"Beitrag zur Entwicklung der generischen Archivsoftware »Archive-in-the-box« Dienstkonzept in Abstimmung mit DARIAH-EU (aufbauend auf u.a. Erfahrungen in eSciDoc, TextGrid, Phaidra u.a.)"*

(AIB-SRC-6) p.74 – *"Wo sich AP 3.2 auf Wissenschaftler als Zielgruppe konzentriert, adressiert AP 3.4 speziell Forschungsdatenarchive und große Datensammlungen. Neben der Etablierung von interoperablen Datenstandards (siehe AP 3.3) berät dieses AP dabei auch in der Einbettung von Datenverwaltungsmechanismen in Forschungsdatensysteme. Darunter können Werkzeuge z.B. zur Datenvalidierung sein (z.B. JHOVE) oder auch Prozeduren z.B. zur Beschreibung und Qualitätssicherung von Forschungsdaten. Technische Vorschläge werden hierbei eng mit AP 1.4 abge-*

stimmt und wo möglich auch direkt z.B. im Archive-in-the-box Dienstkonzept umgesetzt."

(AIB-SRC-7) (Source: **VCC1 Document of Work**) *"This service consists of an annotated reference list to existing software solutions for establishing a research archive. All solutions are evaluated for their pros and cons with respect to specific institutional/technical contexts. A how-to for ensuring interoperability with other DARIAH components will be included. This service does not, in itself, include support, training or advice on installation, data ingest, preservation, or maintenance. Furthermore this service does not include Persistent Identifier (PID) minting or institutional AAI facilities for the organization. If required PID services can be provided by DARIAH's Persistent Identifier Service.*

Contributions for DARIAH construction

- *DARIAH-DE - ESciDoc (in which MPG has an important role)*
- *DARIAH-NL - EASY II (created by DANS)*
- *DARIAH-AT - Phaidra"*

(AIB-SRC-8) (Source: **DARIAH-Report D8.1.2** (preparation phase), pp.46/47, not cited because of great text quantity**):** this passage was not put into further consideration, because in contrast to DARIAH-project-proposal and VCC DOW it was outdated and in part too specific for affiliation)

2.2. Requirements

The following high-level requirements (in **bold**) were extracted from these sources. Mentioned under each requirement is list of the sources (see section 2.1) as well as a set of comments that specify the extracted requirements onward.

AIB-REQ-1: AIB candidate is a software package

- AIB-SRC-4 - software to be installed locally (*"bei sich ... installieren können"*)

AIB-REQ-2: AIB candidate must be locally installable

- AIB-SRC-1 - local technical systems (*"lokale technische Systeme"*)
- AIB-SRC-4 - software to be installed locally (*"bei sich ... installieren können"*)
- *Comment 1: a AIB candidate must not be a cloud service*
- *Comment 2: it may be offered by DARIAH partners as a hosted service*
- *Comment 3: it should be popular amongst archive hosters*

AIB-REQ-3: AIB candidates are recruited from existing archive software

- AIB-SRC-1 - assistance for employing existing software *("Orientierungshilfen für bestehende Software"*)
- AIB-SRC-3 - designed and implemented *("entworfen und umgesetzt"*)
- *Comment 1: a AIB candidate does not have be developed from scratch*

AIB-REQ-4: AIB candidates must interoperate with DARIAH infrastructure

- AIB-SRC-1 - extensions for integration with DARIAH infrastructure
- AIB-SRC-4 - compatible with the DARIAH infrastructure (*"mit der DARIAH-Infrastruktur kompatibel"*)
- *Comment 1: a AIB candidate should support common standards (e.g. OAI-PMH, Dublin Core,...)*
- *Comment 2: DARIAH infrastructure services should support common standards*

AIB-REQ-5: AIB candidates may be selectively extended to interoperate with the DARIAH infrastructure

- AIB-SRC-1 - extension for an integration (*"bei einigen ausgewählten ... Anpassungen für eine Integration"*)
- AIB-SRC-2 - integration of technologies and concepts from LTA research *("Integration von Technologien und Konzepten aus der LZA-Forschungslandschaft; DARIAH&LZA"*)
- AIB-SRC-3 - designed and implemented (*"entworfen und umgesetzt"*)
- *Comment 1: not all AIB candidates are supposed to be extended*
- *Comment 2: a AIB candidate should support a plug-in system*

AIB-REQ-6: AIB candidate should be easy to install and use

- AIB-SRC-3 - easily deployable repository environment (*"einfach aufzusetzende Repositorienumgebung"*)
- AIB-SRC-3 - quick and simple (*"schnell und unkompliziert"*)
- *Comment 1: a AIB candidate should offer a VM, and installer or a installable package (e.g. RPM, Deb,...)*
- *Comment 2: as most AIB candidates do not offer that, part of the AIB implementation should be to document and facilitate the installation process*
- *Comment 3: to determine ease of use, online demonstration installations may be helpful*
- *Comment 4: to determine if installation is easy, online demo installations are not sufficient*

AIB-REQ-7: AIB demonstrator is primarily conceptual work

- AIB-SRC-3 - AIB concept (Archive-in-the-Box-Konzept)
- AIB-SRC-4, AIB-SRC-6 - AIB service concept (Archive-in-the-Box Dienstkonzept)
- *Comment 1: this does not contradict AIB-REQ-5/AIB-SRC-3 because the implementation is limited to extending selected candidates to interoperate with the DARIAH infrastructure*
- *Comment 2: for a proper evaluation of AIB candidates, test installations and experiments regarding the integration of DARIAH infrastructure may be necessary*

2.3. First result

Summarizing the requirements extracted from the DARIAH-DE proposal, successful AIB-candidates would be

(a) already existing software packages (Req 1, 3),
(b) easily install-/useable on a local scale (Req 6, 2),
(c) already interoperating with according parts of DARIAH-DE basically (Req 4),
(d) extensible to improve interoperability with the DARIAH-DE infrastructure (Req 5).

This implies that inside DARIAH-DE the work on 'archive in a box' could only be

(e) conceptual work mainly (Req 7).

2.4. DARIAH-DE Dependencies (Interoperability)

While criteria (a) and (b) are self-explanatory, criteria (c) and (d) need to be further elaborated to make the relevant information explicit (regarding DARIAH-DE interoperability) in order to recommend a particular software-package.

The following services currently planned by DARIAH-DE (August 2012) are of interest for our recommendation of archive products. Any evaluated archive product should be compatible with as many as possible of the respective standards used by these services. Central DARIAH-DE-Services (**bold**) and their standards (*italics*) read as follows.

DARIAH Hosting – The hosting service can be used to run archive software directly on DARIAH hardware resources. This can be done either for production purposes or for some short-time testing. Offered service range from the provision of a clean VM with preferred operating system up to assisted installation of the requested archive software solution and help by integration with DARIAH infrastructure.

DARIAH-AAI – The authentication and authorization infrastructure (AAI) service is currently based on *Shibboleth* and *OpenLDAP*. Its preferred solution is *Shibboleth* and the underlying SAML 2.0 standard, especially the two profiles WebSSO and ECP.

DARIAH-BP –The bitstream preservation (BP) offers a file-based service, which provides longterm and redundant binary data storage using a storage virtualization system or a storage resource of choice. It can be accessed by a self-defined, HTTP-based *RESTful* API and is protected by the DARIAH-AAI. An archive-in-a-box system can use this service to store data objects as well as backups of archive's meta data. A solution may already define a storage abstraction layer for which a plug-in for the DARIAH-BP could be implemented. While metadata of each tested archive-application is usually stored in a database, it may be possible to store a backup of this metadata in the BP service as well.

DARIAH-PID – The persistent identifier (PID) service provides location-independent access to digital objects. Under the hood, the *CNRI handle system* is used.

DARIAH-CR – The collection registry (CR) provides a central service for administering and finding different digital archives. Metadata from this registry is harvested using *OAI-PMH* through DARIAH Collection Level Description Application Profile (DCLAP). This service does not directly interact with an archive-in-a-box solution. An archive owner could, however, set up an archive that hosts a collection and then manually register that collection in the DARIAH-CS.

DARIAH-SR – The schema registry (SR) represents crosswalks between metadata schemes that can be used to relate metadata from different collections using different metadata schemes. This function is primarily used by the DARIAH-GS. An archive-in-a-box solution does not directly interact with this service. An archive owner should use any of the metadata schemes registered in this service for the collection to be properly searchable using the DARIAH Generic Search service.

DARIAH-GS – The generic search (GS) service deals with finding of objects and evaluates relevance of collections in DARIAH-CR using crosswalks of the DARIAH-SR. The service is based on *Lucene / Solr*.

3. Selection of Candidates for an 'Archive-in-a-Box'

3.1. Collection of a first list of candidates

After carefully extracting the requirements for an 'Archive in a Box' as well as specifying the main interoperability features with primary DARIAH-DE services successful candidates should offer, we took a look at the already available products that could be employed to implement an ‘Archive in a Box’.[1]

For the evaluation, we leave out each underlying infrastructure project such as Fedora Commons, MyCoRe, eSciDoc, and TextGridRep, because most of them do not provide any end-user oriented user interface directly. Regarding applications, sometimes even additional effort is required to implement a generic or project specific user interface (see VIRR or FACES).

The following table should provide an overview of all initially evaluated candidates, each with a link to a support site. Because some of the packages are quite complex in their structure and involve different levels / layers (while each of this layers has to be tested separately because of possible alternatives on a particular layer) this table includes hints to the respective underlying component of each of the candidates as well.

[1] See also another previous (2004) attempt on this matter: http://www.soros.org/openaccess/pdf/OSI_Guide_to_IR_Software_v3.pdf as well as http://geb.uni-giessen.de/geb/volltexte/2008/6719/pdf/UpmeierArne-2008-09-29.pdf

Table 1: all evaluated Candidates for an 'Archive-in-a-Box'

Candidate	Based on	Created by / supported through	Included
DocPortal	-> MyCoRe	http://www.mycore.de:8291/content/below/index.xml	Yes
dSpace	-> Fedora Commons	https://wiki.duraspace.org/display/DSPACE/Home	Yes
Easy II	-> Fedora Commons	**DANS:** http://www.dans.knaw.nl/en/content/categorieen/projecten/easy-ii-electronic-archiving-system-fedora	No
ePrints	standalone	http://www.eprints.org	yes
eSciDoc	-> Fedora Commons	**MPDL:** https://www.escidoc.org	indirectly
Faces	-> eSciDoc	**MPIB:** http://faces.mpib-berlin.mpg.de	no
Fedora Commons		**DuraSpace:** http://fedora-commons.org/	indirectly
Invenio	standalone	**CERN:** http://cdsware.cern.ch/invenio/documentation.html	yes
MyCoRe		http://www.mycore.de/index.html	indirectly
Mopseus	-> Fedora Commons	**Athena:** http://194.177.192.14/mopseus/quick_guide_en.html	no
OPUS 3	standalone	http://www.opus-repository.org/opus3/index.html	yes
OPUS 4	standalone	http://opus4web.zib.de	yes
Phaidra	standalone	**Universität Wien:** http://phaidraservice.univie.ac.at/das-system-phaidra/	no
PubMan	-> eSciDoc	**MPDL:** http://test-pubman.mpdl.mpg.de:8080/pubman/	yes
TextGridLab		http://www.textgrid.de	no
TextGridLab	-> TextGridRep	http://www.textgridrep.de	yes
TextGridRep-Search	-> TextGridRep	http://www.textgrid.de/	no
VIRR	-> eSciDoc	**MPDL:** http://virr.mpdl.mpg.de	no
VuDL	standalone	http://vudl.org	no
ZOpenArchives	standalone	http://www.pentila.com/solutions/education/zoai-1/zopenarchives-1/zopenarchives	no

3.2. Invalid candidates

Some candidates on this initial list lacked central key-features that a successful candidate for an ‘Archive-in-a-Box’ should have, thus they were removed from the list:

- EASY 2
- Faces (MPIB)
- Mopseus
- Phaidra
- VIRR
- VuDL
- ZOpenArchives

The following section will give a short comment why each of the candidates was removed from the list in the first place. It will be followed by the list of the remaining candidates that came into closer examination.

3.2.1. EASY 2

The main reason for removing EASY 2 is the currently relatively closed nature of the solution. The package lacks open documentation and options for download of the package or its sourcecode. So through accessibility- and time-issues we could not investigate it further for the concept at hand. We may take another look at the package and its advancements by contacting the developers for the following milestone, if this situation changes.

3.2.2. Faces

Faces is an application built on eSciDoc. It was removed from the candidate list because is seems to be custom-built for a particular project: a lifespan database of adult emotional facial stimuli, mainly pictures. It does currently not seem to fit into the mainly philological / textual orientation of DARIAH-DE.

3.2.3. Mopseus

Mopseus – though it is produced and supported by a DARIAH-partner – was removed from the list of candidates because it seems to no longer be developed or maintained and therefore would not be a sustainable solution.

3.2.4. Phaidra

The main reason for the exclusion of Phaidra from the list was the current closed nature of the solution software-side and a relatively major lack of key features of our criteria-list. We may take another look at the package and its advancements by contacting the developers for the next milestone if the situation changes.

3.2.5. VIRR

ViRR is an application built on eSciDoc. The main reason for its exclusion was that this package seems to be custom-built for a particular project only – on various legal artifacts of the period of the Holy Roman Empire.

3.2.6. VuDL

Although VuDL meets many of our requirements and supports some standards (METS, OAI, scanning options, eXist-XML-database, plans incorporation of MODS, ePub and TEI, has user-groups as well as an issue tracker), its focus is strongly on image data and thus does not fit into the mainly philological / textual orientation of DARIAH-DE. According to your intentions and usage you may take a closer look but you will not get DARIAH-DE support currently.

3.2.7. ZOpenArchives

The main reason for the removal of ZOpenArchives from the list was that software-development for this package seemed to be discontinued thus this seems not to be a sustainable solution.

3.3. Candidates for further evaluation

These remaining candidates were evaluated further (see table 1).

Table 2: list of evaluation-candidates for an 'Archive-in-a-Box'

Candidate	Based on	Created by / supported through
DocPortal	-> MyCoRe	http://www.mycore.de:8291/content/below/index.xml
dSpace	-> Fedora Commons	https://wiki.duraspace.org/display/DSPACE/Home
ePrints	standalone	http://www.eprints.org
eSciDoc	-> Fedora Commons	**MPDL:** https://www.escidoc.org
Invenio	standalone	**CERN:** http://cdsware.cern.ch/invenio/documentation.html
OPUS 3	standalone	http://www.opus-repository.org/opus3/index.html
OPUS 4	standalone	http://opus4web.zib.de
PubMan	-> eSciDoc	**MPDL:** http://test-pubman.mpdl.mpg.de:8080/pubman/
TextGridLab	-> Text-GridRep	http://www.textgrid.de
TextGridRep-Search	-> Text-GridRep	http://www.textgrid.de/

4. Criteria

As base of our further evaluation we differentiated initial criteria and added them into a matrix while meanwhile differentiating the latter. V3 of this matrix formed the basis to build the following evaluation and its main criteria on. (see result in appendix 1)

4.1. DARIAH-DE interoperability (max: 5 Points)

A successful candidate for an 'Archive-in-a-box' should support at least three out of the following five central DARIAH-DE Infrastructure criteria (interfaces; one point of one of the criteria is given when all specs apply to the candidate).

1. **DARIAH-AAI**: we consider this service supported if a system supports *Shibboleth* and/or *LDAP* (preferred: *Shibboleth*)
2. **DARIAH-BP:** we consider that a system potentially supports the DARIAH-BP if it provides a storage abstraction layer that supports alternative or (at best) multiple different storage backends.
3. **DARIAH-PID:** we consider a system compatible with the DARIAH-PID service if it provides integration with the *CNRI* handle system.
4. **DARIAH-GS:** we consider a system to be compatible with this service if it offers metadata to be harvested via *OAI-PMH*.
5. **DARIAH Hosting**: Though we do not plan to use the according services itself, we expect a system to be suitable for hosting if cloud-based and/or commercially supported hosting-services exist. Their existence is taken as a hint that stable 'boxed'-scenarios can be build.

4.2. Customization- / Extension-Efforts (max: 5 Points)

If an otherwise successful candidate does not initially support all DARIAH-DE Interoperability-criteria, it at least should have relatively minimal extension efforts in the remaining fields. The according point-value is oriented on each result regarding 4.1. (marginal differences result from fine-granularity and move within a continuum ranging from 0 to 5 points with 0,5 point-steps). The candidate receives

- 5 points if only none or minor extension-efforts are conceivable in remaining fields;
- 3 points if achievable extension-efforts need to be made
- 0 point if the extension-efforts are not achievable within DARIAH-DE; this leads to an exclusion of the candidate out of considerations.

4.3. Sustainability of solution (max: 5 Points)

An adequate candidate should support as much sustainability criteria as possible (*one point for one criterion counts when at least two of each respective properties apply to the candidate*).

1. Tested solution, scalability, stable **use-cases** (quantity, language support), DINI-support.
2. **Bug-freedom, extendibility**, trustworthiness (quality, incl. usability / scientific acceptance).
3. Currently **conceivable**, community-driven **future development**; **User-Feedback: online** as well as **offline (nearness).**
4. Options for **migration** (esp. common standards for importing / exporting).
5. Financial support / stable **institutional support** (e.g. governmental / educational agency).

4.4. Calculation of results

The points for each solution are then summed up to a total score.

For the next milestone we will examine the highest-ranking products.

We recommend that products not reaching at least 9 points should not be considered for common use by DARIAH-DE at the present time (except for special scenarios as mentioned in the corresponding sections).

5. Results

According to a DARIAH-DE-internal, wiki-based evaluation-table we used (a screenshot of the matrix in its latest state is found in appendix 1), we came to the following conclusions regarding the remaining candidates ('1p' means '1 point given in the corresponding context'). For more references, also take a look at appendix 1.

5.1.1. DocPortal

DARIAH-DE interoperability	2,5 / 5
Customization- / Extension-Efforts	2,5 / 5
Sustainability of solution	3 / 5
Total	**8 / 15**

DocPortal is an example application for publication management of MyCoRe, a German semi-commercial framework for digital asset management, both under GPL. Both products work on major modern operating systems.

MyCoRe supports LDAP (and IP-Ranges) for authentication, but does not offer a *stable* support for Shibboleth currently (0.5p). MyCoRe offers a VFS layer[2] with S/FTP and Samba backends, so a DARIAH-BP backend should be realizable (1p). It does not support CNRI (just URN with DNB resolver). There is, through workarounds, support for OAI-PMH (1p) while it delivers metadata through Z39.50/ID3 and data trough SOAP for searching. It does currently support main media types except TEI. Thus, DocPortal has some DARIAH-DE-interoperability in the current state (2,5 of 5 points).

Though the solution is well documented, there are no semi-commercial hosting options currently, some DARIAH-DE-extension-efforts (2,5 of 5 points) could be expected, esp. around CNRI-Handles.

Regarding sustainability (3 of 5 points), the solution has DINI-certified instances (1p), has good and sustained channels for user-/developer-feedback (1p) and supports extensions via modules and plug-ins (even through a 'Geschäftsstelle', 1p). But it only offers Pica3-migration possibilities, hast just a few use-cases currently and no English language support anymore (though I18N is supported).

With an overall result of 8 out of 15 points in our evaluation, the solution could have some promising sides, but must undergo some changes in the next time to be recon-

[2] http://dev.thulb.uni-jena.de/viewvc/archive/branches/MYCORE_DIST/mycore/documentation/ProgGui-de/ProgrammerGuide.odt?revision=367&view=co&pathrev=485

sidered for future evaluation. In its current state DARIAH-DE would have to invest considerable time to extend this solution to meet our requirements (excluded at this point for an official DARIAH-DE 'Archive in a Box').

5.1.2. dSpace

DARIAH-DE interoperability	3,5 / 5
Customization- / Extension-Efforts	3,5 / 5
Sustainability of solution	4 / 5
Total	**11 / 15**

dSpace is an archival system for electronic prints and other kinds of digital academic content that builds up on Fedora Commons though a BSD-like license. In fact, both were developed by the same group of people in the US, dSpace in the first place for MIT, later on it got supported by HP. Both products are implemented in Java and work on major modern operating systems and network platforms.

dSpace supports Shibboleth when running behind a Shibboleth-enabled Apache HTTPD server. Thus, it could be interoperable with the DARIAH-AAI service (1p). dSpace supports multiple storage backends including local files and SRB.[3] There is a bit-preservation service available called 'DuraCloud' which can be (commercially) integrated within dSpace. Thus, integration with the DARIAH-BP could be feasible, but must be tested (0,5p). dSpace seems to directly support the CNRI Handle service so it should be possible to integrate the DARIAH-PID service (1p). While supporting major textual media-types, excluding TEI, OAI-PMH metadata can be harvested from dSpace. Thus, it should interoperate with the DARIAH Generic Search in major parts (1p). Overall, this solution should offer some DARIAH-DE-interoperability (3,5/5 points).

Mild DARIAH-DE-extension-efforts need to be made (3,5/5 points), in particular testing, integrating and possibly extending to use DARIAH-BP and implementing a TEI workaround. Some Language-files for German are available[4].

There seem to be channels for user- / developer-feedback, in Europe via 'ambassadors'. Development is in part community driven, sometimes 'nearness' could be a problem (1p). dSpace offers support and hosting-options mainly in commercial frameworks (1p). It is extensible via a plug-in system while trusted (0,5p) humanities-solutions must be found around the hundreds of working, mostly middle-scale in-

[3] http://www.dspace.org/1_7_0Documentation/Storage%20Layer.html#StorageLayer-BitstreamStore
[4] https://wiki.duraspace.org/display/DSPACE/I18nSupport

stances (none DINI-certified currently, 1p). dSpace offers at least basic migration functionalities (0,5p). It should be a sustainable, although not a mainly european solution (no experiences of DARIAH-partners can be integrated and only external, partly commercial channels could be used) – (3,5 of 5 points).

Overall 11 out of 15 points: dSpace could be a good choice for an Application-as-a-Service with relatively reduced time-investment in existing complex frameworks (recommendation). For the next milestone it will be tested in wider contexts with a look if the at first glance relatively good interoperability-factors meet expectations and also to existing hosting-options, forks of code-evolution and appropriation-needs for text-based European humanists.

5.1.3. ePrints

DARIAH-DE interoperability	3,25 / 5
Customization- / Extension-Efforts	2,5 / 5
Sustainability of solution	5 / 5
Total	**10,75 / 15**

ePrints is an UK-based document-management solution, mainly for educational purposes. Its is written in Perl, licensed under GPL and runs on major modern operating systems via RPM or MSI (MSI is explicitly not recommended).

ePrints does support LDAP and Shibboleth (the latter seemingly with minor difficulties, 0,75p). Since version 3.2, ePrints supports a hybrid storage architecture which allows to distribute data across different storage locations including local storage and cloud storage. Therefore, extending this with a plug-in to use the DARIAH-BP as another cloud storage seems possible (1p).[5] At least two instances does support CNRI[6] through a workaround (must be tested; 0,5p), OAI-PMH is supported (1p). Its search can be extended with plug-ins, e.g for Xapian. Search results can be exported to several formats and services (including OpenSearch, BibTeX, twitter, Google-Earth, and RSS). ePrints has some DARIAH-DE-interoperability in the current state (3,5 of 5 points), in some cases not straight forward.

This does result in some DARIAH-DE-extension-efforts (2,5 of 5 points), esp. regarding the situation around slightly differing formats and testing a CNRI-workaround. Some language-files should need to be translated. It should be considered that

[5] http://www.eprints.org/software/training/3.2/admin/storage_tutorial.php, also see: http://eprints.soton.ac.uk/265818/

[6] http://www.arl.org/sparc/bm~doc/IR_Guide_&_Checklist_v1.pdf; also eMails with Tim Brody, Lead Developer

ePrints is implemented in Perl while most efforts currently underway in DARIAH-DE are realized in Java.

Regarding sustainability (5 of 5 points), the solution not only has DINI-certified installations and a cybermetrics rating of 31 (1p) but as only candidate supports 'Repository Policy options' through OpenDOAR. ePrints supports metadata extraction from major textual input-formats including different TeX-flavors but not TEI (1p). Its migration-options include a very wide variety of major formats (dSpace, OAI-PMH, Dublin Core, JSON ArXiv and others, 1p). Themes / branding in ePrints seems easy (lib/themes) and language-customization is supported. It has some sustained channels for user- / developer-feedback including training, courses, events, hosting and institutionalized consultancy via a trustworthy european university-background (University of Southampton; 1p), has a plug-in / app-concept (67 plug-ins currently, 1p) and seems to have a sustained future development.

With an overall result of 11 out of 15 points in our evaluation, the solution is recommended according to sustainability and open formats but for the next milestone it needs to be tested interface- and format-side to see if the found workarounds regarding interoperability meet expectations.

5.1.4. Invenio

DARIAH-DE interoperability	2 / 5
Customization- / Extension-Efforts	1,5 / 5
Sustainability of solution	4 / 5
Total	**7,5 / 15**

Invenio is a Swiss digital library and document repository. The code is written in Python and released under the GPL. It runs on major modern Linux platforms through a tarball and RPM.

Invenio does support LDAP and Shibboleth (1p). There seems to be no storage abstraction layer by which the DARIAH-BP could be integrated and no information on a dedicated bit-preservation-interface or destined hosting-options. Invenio does not seem to support CNRI handles straight forward. OAI-PMH is supported (1p). Its search-functionality is done through a Google-like multi-level API with citation-metrics, referencing and search-engine-support. Invenio has a reduced DARIAH-DE-interoperability in the current state (2 of 5 points).

This situation does result in considerable DARIAH-DE-extension-efforts (BP, PID; 1,5 of 5 points). As with some other solutions, main parts of the source-code are rather uncommented currently, but support should work. It should be considered that Invenio is implemented in Python while most efforts currently underway in DARIAH-DE are realized in Java.

Regarding sustainability (4,0 of 5 points), the solution has 30 installations worldwide. It seems to be really robust, esp. regarding a huge quantity of documents (over 1 Mio. tested in one instance (1p)). Invenio supports languages though I18N (currently English) but seems to support just a few major textual input-formats (excluding TEI). Its migration-options include major formats (MarcXML, Google Scholar, arXiv, oaidc2 and others; 1p). Invenio, while themes / branding seems easy, has some channels for user- / developer-feedback including meetings via trustworthy university-backgrounds (1p), currently only around high-energy physics (CERN, DESY, EPFL, FNAL, SLAC). It supports extensions via 'modules' (1p) and seems to have a sustained future development (through participating on some at first rather closed CERN-forks of development later on).

With an overall result in our evaluation of 7,5 out of 15 points, the solution seem to be recommendable only for specific projects, e.g. projects with large scale in a rather closed form, possibly DARIAH-DE-searchable, but without any handle-system – with considerations on an own BP-solution as well as a forked code-evolution besides physics-disciplines (excluded at this point for an official DARIAH-DE 'Archive in a Box').

5.1.5. OPUS 3

DARIAH-DE interoperability	1,5 / 5
Customization- / Extension-Efforts	1,5 / 5
Sustainability of solution	4 / 5
Total	**7 / 15**

OPUS 3 is a German document-server (institutional repository), mainly used for publications of Universities ('Hochschulschriften') in most cases. Looking at the access-side of the software itself, it seems to be a rather closed solution currently, although the sourcecode is under the GPLv2. OPUS 3 runs on major modern operating systems and network platforms via a tarball, but without any installer or script.

OPUS 3 does not support LDAP or Shibboleth regarding AAI (just IP-Range). Currently, there seems to be no storage abstraction layer, although, this issue seems to

be on the roadmap for the near future (0.5p). It does not support CNRI (just URN-PIDs for DNB), OAI-PMH is supported (even enriched with XMetaDissPlus2.0 for its – in our evaluation rather singular – DNB-interface, 1p). OPUS 3 does not come with an integrated search engine, instead it relies on external search engines like Google for its full text. To sum it up, OPUS 3 has a weak DARIAH-DE-interoperability in its current state (1,5 of 5 points).

Although the solution is well documented and the rather closed situation regarding sourcecode could have beneficial sides for closed solutions, that does result in some major DARIAH-DE-extension-efforts (1,5 of 5 points), which includes needs to customize some language-support-files.

Regarding sustainability (4 of 5 points), the solution has a lot of DINI-certified installations and a middle global cybermetrics[7] ranking (1p). While its textual input-formats only support PostScript and PDF, its migration-options include major formats (Pica, BibTex, Dublin Core, XMetaDissPlus, epubli.de; 1p), some (esp. the DNB-interface) surely may come in handy in use-cases we did not think of at start. OPUS 3 has channels for user- / developer-feedback via trustworthy former DFG- and BMBF-financed university-backgrounds (1p), seems to support extensions (1p) and seems to have a sustained future development.

With an overall result of 7 out of 15 points in our evaluation, the solution could have some promising solutions user-side but while its use is rather limited, it must undergo heavy changes to be reconsidered for future evaluations. In its current state DARIAH-DE would have to invest considerable effort to extend this solution to meet requirements (only recommended in limited form within intended and *closed* use-cases – then also see OPUS 4; excluded at this point of recommendation as an official DARIAH-DE 'Archive in a Box').

[7] http://repositories.webometrics.info/index.html

5.1.6. OPUS 4

DARIAH-DE interoperability	2,25 / 5
Customization- / Extension-Efforts	2 / 5
Sustainability of solution	4,5 / 5
Total	**8,75 / 15**

OPUS 4 is a German document-server (institutional repository), its intended use is for publications of Universities ('Hochschulschriften'). Other than OPUS 3, it has open access to the software itself and its sourcecode. It is written in PHP and Java and is licensed under the GPL 3. It runs on major Linux platforms via a tarball with unix-installation-scripts.

OPUS v4.22 (German) does only support LDAP (and IP-Range) regarding AAI (0,25p). There is currently no storage abstraction layer that could be used to plug in the DARIAH-BP service (currently only in planning state), but KOBV offers hosting[8] (1p). OPUS 4 does not support CNRI, but at least URN-UUID-PIDs with xepicur-resolver for DNB, OAI-PMH is supported (enriched with XMetaDissPlus2.0 for its DNB-interface; 1p). Its search-functionality is based on Solr. To sum it up, OPUS 4 has a relatively mixed DARIAH-DE-interoperability in the current state (2 of 5 points).

This does result in some DARIAH-DE-extension-efforts (2 of 5 points), esp. regarding more info on the situation around BP. As with other solutions, some parts of the source-code seem to be rather undocumented / uncommented currently, but support seems to work.

Regarding Sustainability (4,5 of 5 points), the solution has DINI-certified (2010) installations besides a lot others (1p). It seems it be robust regarding a medium quantity of documents (10000 tested elsewhere) and secure, as it supports, while being undocumented, GPG (0.5p). It also supports major languages other than German (currently only in v4.02 of Opus) and major textual input-formats (excluding TEI). Its migration-options include major formats (incl. OPUS 3, citations and bibliographies), some (esp. the enhanced DNB-interface) may come in handy in special cases (1p). Themes / branding seems easy. OPUS 4 has some channels for user- / developer-feedback including workshops via trustworthy former DFG- and BMBF-financed university-backgrounds (1p), seems to support extensions (1p) and seems to have a sustained future development.

[8] http://www.kobv.de/bib_opus_archvierung.html

With an overall result of 8,5 out of 15 points in our evaluation, the solution is not recommended beyond intended use-cases (with middle document quantity) though it has extension-potentials beyond this in a variety of ways.

5.1.7. PubMan

DARIAH-DE interoperability	3,5 / 5
Customization- / Extension-Efforts	3,5 / 5
Sustainability of solution	5 / 5
Total	**12 / 15**

PubMan is a document management application built on eSciDoc, which is a German system for eScience-aware knowledge and information management, build on Fedora by the DARIAH-DE partner MPDL. The code of the infrastructure-solution as well at its tested application PubMan ('Publication Managment') run under a CDDL 1.0 (OSI)-licence. Both work on major modern operating systems via Java and an lzPack installer.

eSciDoc does support Shibboleth and LDAP (1p) regarding AAI. As storage backed, eSciDocs repository service currently builds on Fedora Commons, REST is supported. There seems to be no direct plug-in mechanism at the moment to support alternative storage backends, iRODS- and SRB-support seems to be only planned.[9] An alternative integration scenario where metadata is stored in eSciDoc and actual documents are stored in an alternative storage has been considered within the TextGrid project (0,5p).[10] For metadata MODS and METS are supported. The PID Manager supports CNRI through the Handle System of CNRIs Digital Object Architecture (1p), OAI-PMH is supported (in certain versions; 1p). eSciDoc's and PubMan's search-functionality run through REST, SRW/SRU (eSciDoc) and SOAP as well as CoNe and OpenSearch (PubMan). Together both have some DARIAH-DE-interoperability in the current state (3,5 of 5 points).

This should result in some relatively minor DARIAH-DE-extension-efforts (3,5 of 5 points), esp. testing.

Regarding Sustainability (5 of 5 points), the solution has no DINI-certified installations currently but semi-commercial, university-driven services that help getting DINI certification (1p) e.g. through MPI or 'KnowEsis' (consultancy, support, development, im-

[9] http://www.textgrid.de/fileadmin/TextGrid/konferenzen_vortraege/goegrid07/goegrid2-2007-09-13_9-razum-escidoc.pdf

[10] http://www.textgrid.de/fileadmin/TextGrid/reports/TextGrid_R1-3-2_Wege_zur_Verknuepfung_von_eSciDoc_und_TextGrid__erstes_Konzept_.pdf

plementation, even hosting). eSciDoc/PubMan supports major languages, internationalization is done currently (1p); it has a working service / app-concept; major textual input-formats should be supported, TEI-support and other key features for textual work are currently been developed in MPs project 'digitization lifecycle' (1p). PubMan's migration-options include a variety of major formats (ArXiv, eDoc, eSciDoc, BibTeX) and include even Zotero- and Wordpress-interfaces (1p). Themes / branding on the double-solution seems to be relatively easy. Both have channels for user- and developer-feedback, including user meetings, mailing lists and different support teams through trustworthy MPI-backgrounds that as well guarantee eSciDoc's sustainable development through elaborate plans to distribute future tasks (1p).

With an overall result of 12 out of 15 points in our evaluation, the solution is recommended for further testing for the next milestone. If results meet expectations, resulting time could be invested to test other candidates or custom interfaces that seem to be build currently (e.g. to TextGrid).

5.1.8. TextGridRep

DARIAH-DE interoperability	4 / 5
Customization- / Extension-Efforts	3,5 / 5
Sustainability of solution	5 / 5
Total	**12,5 / 15**

TextGrid consists of several components including TextGridLab, an elaborate desktop application for scientists dealing with textual sources through digital state-of-the-art tools, TextGridRep, a repository-solution and TextGridRepositorySearch, a search-solution for such repositories. All parts are 'mainly' under LGPL 3. TextGridLab is a Java-based stand-alone application that runs on major current operating systems, while TextGridRep and its respective search are web-applications / web-services. Currently a rather independend TextGridRep-VM is being worked on in addition (access to beta is given, no documentation available yet). We build our evaluation on information on an early candidate of this latter solution.

TextGridRep thus does support LDAP and Shibboleth (1p), while OAI-PMH and MARC 21 are not supported currently. TG-CRUD is an included service largely similar to the DARIAH-BP, both are being worked on by a DARIAH-DE Partner. The solution offers possibilities of accessing multiple storage points, it is conceivable to implement a TextGrid-based solution on top of the DARAH-BP (1p). Textgrid uses the GWDG Handle System (1p) and offers sophisticated search-functionality through Lu-

cene (supports Corpus Search, a semantic as well as a management and analysis system with linguistic / lexicographical capabilities). Hosting is beening worked on currently through the development of specific, stable VM-images (1p). TextGridRep has good DARIAH-DE-interoperability currently (4 of 5 points). This does result in minor DARIAH-DE-extension-efforts, which would be accomplished mainly though Partners other than Darmstadt (3,5 of 5 points)[11], e.g. OAI-PMH support, DARIAH-BP integration and some new GUI esp. for an extended TextGridRep-VM with major DARIAH-DE-Interoperability and support at least for AiB-use-cases and scenarios being tested in the near future (see section 6, p.27).

Regarding Sustainability (5 points), this leading german repository solution has support on DINI-certified installations (1p). It supports German and English languages as well as major scientifically required texual input-formats – currently it is the only solution with a working TEI solution out-of-the-box (1.5p). Its migration-options include TextGrid itself as well as METS and will support other formats, extensions for some eSciDoc-Interoperability are being worked on,[12] Themes / branding of the TextGridRep-VMs seem to be easy (1p). TextGrid has sustained and near channels for user- / developer-feedback including issue trackers, workshops, user summits through a trustworthy, former BMBF-financed university-background and wide networks including a robust sustainability-strategy for future development (1.5p).

With an overall result of 12,5 / 15 points in our evaluation, this solution of a DARIAH-DE-partner (in form of a special TG-Rep-VM currently under development) is recommended for future tests.

[11] according to a telephone-conference on 21.08.012

[12] http://www.textgrid.de/fileadmin/TextGrid/reports/TextGrid_R1-3-2_Wege_zur_Verknuepfung_von_eSciDoc_und_TextGrid__erstes_Konzept_.pdf

Overview: Table of Results (simplified via point-values)

As a result of our evaluation we constructed a basic overview of all candidates evaluated (see table 3) with respective results as point-values (for in-depth evaluation results see appendix 1).

Table 3: evaluated candidates for an 'Archive-in-a-Box' with respective point-values

Candidate	Based on	Created by / support through	Score (I= Interoperability; E=Extension Efforts; S=Sustainablity)
DocPortal	->MyCoRe	http://www.mycore.de:8291/content/below/index.xml	I 2,5; E 2,5; S 3 = **8** (excl.)
dSpace	standalone	https://wiki.duraspace.org/display/DSPACE/Home	I 3,5; E 3,5; S 4 = **11**
ePrints	standalone	http://www.eprints.org	I3,25; E 2,5; S 5 = **10,75** (nice-to-have)
Invenio	standalone	**CERN:** http://cdsware.cern.ch/invenio/documentation.html	I 2; E 1,5; S 4 = **7,5** (excl.)
OPUS 3	standalone	http://www.opus-repository.org/opus3/index.html	I 1,5; E 1,5; S 4 = **7** (excl.)
OPUS 4	standalone	http://opus4web.zib.de	I 2,25; E 2; S 4,5 = **8,75** (excl.)
PubMan	-> eSciDoc	**MPDL:** http://test-pubman.mpdl.mpg.de:8080/pubman/	I 3,5; E 3,5; S 5 = **12**
TextGridLab	-> TextGridRep	http://www.textgrid.de	I 4; E 3,5; S 5 = **12,5**

6. Expectably interoperable and sustainable candidates / work for the next milestone

According to our findings and the results of the evaluation, for the next milestone M1.4.1.2 we will do test-installations, in-depth-examinations and (if needed) customizations of the following products in this order of priorities:

1. TextGridRep (VM; 12,5 points),
2. Pubman (eSciDoc; 12 points)
3. dSpace (11 points),
4. ePrints (10,75 points)

The first three candidates will be put through full integration tests with DARIAH-DE. Priority (4.) is a merely 'nice-to-have'-candidate we will test if we got enough time left.

The planned future tests of the candidates for M1.4.1.2 will include experimental scenarios to see possibilities, open questions of DARIAH-DE-interoperability as well as usability of each solution in action: to extend the candidates and gain at least one stable candidate.[13]

Some of these planned scenarios for each candidate would be:

- *Scenario 1:* migrate. An institution or individual delivers already existing digital data: migrate it into the DARIAH-DE Infrastructure via 'archive-in-a-box'.
- *Scenario 2:* introduce. In an already existing humanities center no digital data does exist yet: actions are taken to step inside the DARIAH-DE Infrastructure through 'archive-in-a-box'.
- *Scenario 3:* be compatible. Two or more humanities data centers converge technologically: through usage of an 'archive-in-a-box'.
- *Scenario 4:* be useable. Each solution will be tested by at least two textual humanists according to their specific scientific needs.
- *Scenario 5:* show advantages. Each solution will be put through tests to evaluate advantages to regular forms of dealing with concerned matters in the humanities (research-question, workflow, concentration on main research-goals)

According to the results of the document at hand, to ensure and sustain current as well as future DARIAH-DE interoperability, the next milestone M1.4.1.2 will also include and document patches as well as extensions for its recommended solution(s) (at least according to each finding of expectable extension-needs above).

The result will be ready-to-use software-solutions in form of pre-configured virtual machines that work 'out-of-the-box'.

[13] While in some parts of development the document at hand lacked to follow designated internal procedures (according to M2.2.4, p.7) after a internal PM reallocation, M1.4.1.2 will follow them.

7. Appendix 1: Evaluation-Matrix (complex)

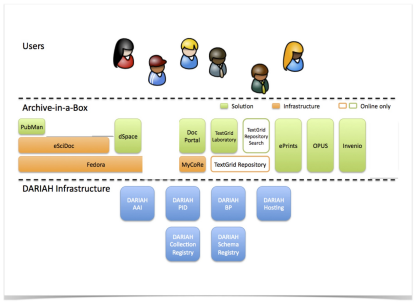
references: https://dev2.dariah.eu/wiki/display/DARIAHDE/AP1.4+Archive-in-a-Box

AiB Candidates

Hinzugefügt von Richard Eckart de Castilho, zuletzt bearbeitet von Rainer Becker am Aug 21, 2012

software packages that can fit into the role of 'archive-in-a-box'.

(-> as well as our list to work with in future you may see the *older list* of initial candidates (including jOAI, EASY II/EOF and Phaidra). jOAI could also be tested for AiB-usage (see TextGridRep))



? = not decided yet / open question (further information); X = does not work / compute

	MyCoRe (-> Docportal) **(excluded)**	DocPortal (<- example-app) **(excluded)**	dSpace (Fedora)	ePrints	eSciDoc (Fedora) (+ -> Pubman)	PubMan <-	Invenio **(excluded)**	OPUS3 **(excluded)**	OPUS4 **(excluded)**	TextGridRep **(according to information on a special, independent VM)**	TextGrid Repository Search **not in evaluation**	TextGrid Laboratory **not in evaluation**
evaluation for M1.4.1.1. interoperability **I (max 5 points)**; extension effort **E (max 5 points)**; sustainability **S (max 5 points)**	I 2,5 E 2,5 S 3 **overall 8** **(excluded)**	<-	I 3,5 E 3,5 S 4 **overall 11**	I 3,25 E 2,5 S 5 **overall 10,75** **(nice-to-have)**	I 3,5 E 3,5 S 5 **overall 12**	<-	I 2 E 1,5 S 4 **overall 7,5** **(excluded)**	I 1,5 E 1,5 S 4 **overall 7** **(excluded)**	I 2,25 E 2 S 4,5 **overall 8,75** **(excluded)**	I 4 E 3,5 S 5 **overall 12,5**	**not in evaluation**	**not in evaluation**
first impression	support could be weak though DINI-certified (older installations) DARIAH-interoperability: work necc. contact academic users for experiences on running systems and their scope; find solution for search, languages (etc. see below)	<-	(seems to be solid, largely DARIAH-interoperable and sustainable solution, large community mainly US-based)	(mostly simple, intuitive, **small/middle scale**, robust, excellent im-/export to a big variety of dataformats; AAI & MARC workarounds for DARIAH; situated in UK, EU-open)	(highly complex, DARIAH-interoperability seems mostly good -> experiences / use-cases (robustness, scale) **TEI-support** through MPI's project 'digitization lifecycle' (or TextGrid)	<- (+ specific additional specs of seperate applications)	(**big scale** (tested record quantity > 1 Mio. records), mainly text), with implications, -> sustain Dariah Interoperability on basic level)	(seems kind of secure (GPG possibility, code kind of closed access), robust, DINI-certified solution for german document-servers (input: PDF, ps only!); reduced DARIAH-interoperability / adaptation-efforts)!	preferred for 'Hochschulschriften' / adaptation-tests to specific use-cases (robust on **middle-scale** (10.000 documents tested) , secure: GPG & DINI-certified, semi-commercial support; input: formats highly reduced!; mainly text; some main parts undocumented, *DARIAH-interoperability:* workaround/extensions could be heavy, formats?)	Dariah-interoperability-issues of the repository could be solved by DARIAH-DE Partners.	**sophisticated search tools** (Corpus Search, semantic/ Management and Analysis System: linguistical/lexicographical) <- output options	**sophisticated scientific tools** (Lemmatizer, lexica-creation, VideoAnnotation, SADE), robust, good support, secure (closed, interfaces, system model) <- output options
Extend for DARIAH	• AAI (LDAP, Shib?); • BP (customize sftp); • PID <-> URN; • Search: Z39.50/SOAP • languages (I18N)	(<- for) • gain productive package: create customized, boxed base-VM, update it? • **also consider** other apps: MILESS 3, MyLIWI, papyri))	• Test BP (SRB / Duracloud) • Debug PID-Interface, • Check Language-Files (translate) • Model / limit Interface for Searching	• test AAI workaround • PID workaround limit search-/ migration options to DARIAH & dSpace; • BP -> Shib/ CRUD	• Tests BP (REST) • include TEI- im-/export developed through MPI	<-	• Test AAI - LDAP • MARC <-> CNRI • BP • Search API/Workflows	• PID <-> URN; • Search; • AAI; • no info on BP	• PID <-> URN; • Search -> Solr • AAI -> LDAP; • BP (DublinCore/OAI, XML/SAX)	• PID (CNRI) <-> tgauth/noid-URI (GWDG); • BP <-> tgcrud (REST?/ see iRods scen.); • search (REST, SOAP, SADE?); • OAI -> jOAI? (evaluate textgrid-escidoc cooperations/plans, esp. this and early plans)	<-	<-
documentation	Documentation (UserGuide PDF) (ProgrammerGuide PDF)	(customizable example for MyCoRe-based apps) Installation	Documentation; Wiki (PDF)	Documentation; Wiki (only)	Documentation (online)	(most not done)	Documentation (no pdf/txt, sources mainly uncommented)	strictly closed (via Mail; PDF (de) Admin (de)	(de, Opus 4.2.2) (e), Opus 4.0.2) Doc-Server	docu	<-	is not a web application
language	(de), *no (e)-support anymore;* though possible through I18N	(de), *no (e)*	(e), customization possible through I18N	(e) (needs to be customized for others)	(de, e, jp) ->	internationalization through *NIMS (Japan)*	(e) many more through GNU gettext / I18N (L10N planned)	(de) / (for e: some code (and codenames) *seem to need minor internati customization here and there, as documented in some source-files*)	(de) / (e)	(de) / (e) +	<-	(de) / (e) +
X Test installation		through code-customisation			link	<-				(other context)	<-	<-
Test AAI integration		<-				<-					<-	<-
Test BP integration		<-	X via Fedora		X via Fedora	<-					<-	<-
Test PID integration		<-				<-					<-	<-
General												
Demo or Live System	Demo	Demo	Demo	Demo	(see options here)	Demo	Demo	Demo / Admin	Demo	->	Live	Demo-Video
Latest stable release	2.1.1 (2011-11-28); 2,2 absehbar	2.1 (2012-01-30)	1.8.2 (2012-02-24)	3.3.10 (2012-05-22)	1.4.1 (2012-03-07)	6.3.0 (2011-03-31)	1.0.0 (2012-02-29)	3.2.1 (2011-08-26) ask for download/password on http://elib.uni-stuttgart.de/opus/sw/; Annette Maile <maile@ub.uni-stuttgart.de>	4.2.2 (2012-07-04) SVN	not official (Subversion)	<-	2.0 (2012-05-11)
Type	Infrastructure	<- Solution for	Solution	Solution	Infrastructure	<- Solution	Solution	Solution	Solution	Infrastructure (online)	Solution (online)	Solution (integral Part of the Infrastructure) (Eclipse-RCP)
Purpose	framework: digital asset management	Publication management	Repository/ Publication management	Document Management (Education, with explicit *Repository Policy options* through OpenDOAR)	scientific/scholarly collabor. research envir (Services/ / Applications; on top fedora/serv. (PubMan, Faces)	<- ('**Application**') support research organizations in management, dissemination, re-use of publications / supplementary material	digital library, document repository	Document-Server (OA)	Document/Publication Managment (OA)	document repository (backend)	<-	digital tools (frontend)
License	GPL (see also)	<-	BSD; Creative Commons	GPL	CDDL 1.0 (OSI) Open APIs through Fedora	CDDL	GNU-GPL	GNU 2; GPL (Publication Licences, Help-Files: CC 2.0)	GPL 3	LGPL3 ("mainly")	<-	LGPL3 ("mainly")
Platform	Java 1.6/2; Apache (ANT1.7.1); SVN-Client; bei Jetty:	<-	**Java**, Tomcat, Fedora (issues)	Perl, Apache 2	Java, JBoss, Fedora	Java, Tomcat, eSciDoc	Python 2,4, Apache2	Apache, PHP 5	Apache 2.2, PHP 5.3 (Multibyte-String); JRE 1.6; Mailserver; Subversion	Apache 6, PHP; JRE 1.6, openldap, fedora, sesame 2.6.4, eXist 1.4.1	<-	Linux, Mac, Win Java, Rich Client Application

	HSQLDB, MySQL, DB2, Oracle, PostgreSQL											
Packaging	ZIP/tar (Windows, Linux, OS X)	<- Part of	• sources • VM	• sources • Deb • RPM • MSI (not recommended)	IzPack installer (sources separate, jar)	ear/jar	tar: sources (RPM etc.)	tar: sources (no installer/script)	tar: sources (script: suse, ubuntu 10.04, 10.10, 11.04)	(single file / Subversion)	<-	ZIP (Win, Lin, Mac)
Plugin system	yes (for different Objecttypes); Modules	<-	• 19 free • 5 commercial • add-ons (incl. semantic search)	• 67 free (doc) • Apps through Bazaar	• 12 free ('services')	some discipline-specific	seems fixed, via modules?	no	Modules	->	->	yes (Eclipse RCP, OSGi)
Media types				(+ geodata)	-> **Mimetypes** (part of core-webapp) should be open to many by model							
Arbitrary bitstreams	(yes)	<-	yes	(yes)	yes	<-	yes	(via SAX, through XML?)	?	(SAX / XML?)	<-	<-
Text	XML, HTML, TXT, PS, PDF, DOC, XLS, PPTP, ODT, SXW, *more via plugins*	<-	plain, HTML, MARC, mathematica, PDF, ps, SGML, doc, wp, TeX, TeX dvi, FMP3, rtf, xml, css	(preview) BibTeX, TeX, PDF, Txt, Word, LateX, UniCode, OpenOffice, REF2014	not specified	<-	Templates: BibTeX, HTML, EndNote, Excel (output, too)	PDF, ps only ((Doumenttype (RIS, BibTex); Classifications (PACS etc.))	plain, PDF, html, xhtml, ps, doc(x), xls(x). documenttype (RIS, BibTeX): workingpaper, article, study/bach./master/doctoral thesis, habilitation, periodical, report, preprint, review, book, bookpart, conference obj., course, lecture, material, other	html, pdf, XML, TEI	<-	html, pdf, XML, TEI
Image	image viewer (IView2)	<-	Gif, JPEG, png, TIFF, BMP, photoshop, PhotoCD	(preview, thumbnail) JPG, PNG	not specified (also see Digilib)	<-	PictureHTML	no	documenttype: picture	jpg	<-	jpg
Audio	Helix Streaming Server	<-	AIFF, MPEG, ra, WAV		not specified	<-	not specified	no	MP3; documenttype: movingimage,	->	->	no
Video	Helix Streaming Server	<-	MPEG,qt	MP4	not specified	<-	not specified	no	AVI, mp4 documenttype: sound	->	->	(via ANNEX)
DARIAH interoperability					**Interfaces**							
DARIAH-AAI (Shibboleth)	(ACL, IP-Range) **LDAP**	<-	yes	yes (through workaround 1, 2)	yes (+XACML)	<-	yes	no (IP-Range)	LDAP (+IP-Range)	yes	<-	<-
DARIAH-BP (Shibboleth/iRods/RESTful HTTP)	**VFS-layer (sftp,** ftp, Samba/CIFS)	<-	Shib	Shib, CRUD, storage controller	Shib only (versioning)	(support for versioning (working, rollback, intellectual))	?	no	no	Shib (+SOAP/REST) (1, iRods Test (-> Grid)) Globus DRS; TG-CRUD	<-	<-
DARIAH-PID (CNRI)	no (URN)	<-	(yes), discussions with CNRI	(yes; workaround)	yes; through PidMan, cache: GWDG-handles	<-	CNRI <-> MARC	no (URN)	no (URN)	maybe? (CNRI <-> GWDG)	<-	<-
DARIAH-CR (OAI-PMH)	yes (Onix)	<-	yes	yes	yes	<-	yes	yes	yes	no (interface-considerations)	<-	<-
DARIAH-SR (OAI, DC, CDWA, WS-/ REST-API)	(yes, tricky)	<-	(yes, tricky)	(yes)	yes	<-	(tricky)	(yes)	(yes)	(yes, tricky)	<-	<-
DARIAH-GS (Lucene, Solr)	Data (through Z39.50; ID3); Metadata (Soap)	<-	should be possible somehow	should be possible	REST / SOAP	<-	should be a little difficult (look at API)	difficult? (see docu on fulltextserver/DNB for hints to circumvent google)	Solr	REST / SOAP	<-	<-
DARIAH Hosting	?	<-	(Storage / S3)	hosting offered	hosting offered	<-	?	(hosting offered)?	hosting offered	inofficial	<-	<-
Metadata		**XMetaDiss, Epicur**	**(no versioning of data)**		**(JHOVE extract, validation, versioning)**					**Model**		
Dublin Core	-->	yes	yes	(yes)	yes	<-	yes	yes	yes	yes (build on)	<-	<-
MARC 21	(yes, not documented)	<-	MARC	no (buggy plugin; no future plans intended)	no (Mods)	(sources: mods3_2/3_3.jar)	yes	no	no	no (planned?)	<-	<-
METS	yes (-> Viewer)	<-	import/export, via plugin (pre-installed)	yes	->	(sources: mets_1.7.jar)	no ?	no	no	yes (import, ##)	<-	<-
Crosswalks	no ?	<-	supported (plugin; import/export): DIDL, METS, OAIDC, RDF, UKETDDC	sort of	Mappings	<-	advanced own system	(XML im/export, SAX?)	(XML im/export)	(thoughts)	<-	<-
Repository interoperability												
OAI-PMH	2.0	<-	yes	yes	yes (Overview) (plugin may be unavailable for some eSciDoc versions)	<-	yes	yes (enriched: XMetaDissPlus2.0 -> DNB)	yes (enriched: XMetaDissPlus2.0 -> DNB)	no (interface-considerations)	<-	<-
SWORD	1.3 (Prog.Guide p113)	<-	v1: client & server; v2: server	2.0 / CRUD	no ->	yes	yes	no	no	no (but see)	<-	<-
AAI					**XACML (policy)**					**SOAP, RBAC**		
CAS	yes	<-	no	no	yes (+ oAuth)	<-	no	no	no	no	<-	<-
LDAP	yes	<-	yes	yes	no	<-	yes (via Webaccess)		yes	yes (OpenLDAP)	<-	<-
Shibboleth	no (solutions?)	<-	yes (1, further documentation missing)	yes (little difficult; 1, 2)	yes	<-	yes	no	no	yes	<-	<-
Bitstream persistence												
File system	open	<-	yes	yes	not directly (content: items, containers, contexts)	<-	yes	?	yes	no	<-	<-
Database	yes	<-	yes (p151ff)	yes	yes (+ datastream)	<-	yes	?	yes	yes (eXist)	<-	<-
iRODS	no	<-	(no, through Fedora?)	no	no	<-	no	no	no	(see)	<-	<-
SRB	no	<-	yes (manual p28ff)	no	no ?	<-	no	no	no	no	<-	<-
DARIAH Bitstream Preservation API	(sftp, ftp, Samba/CIFS)	<-	storage backend / SRB; DuraCloud	hybrid storage architecture	->	REST	no	(planned: LZA-interface)	<- & ?	through TG CRUD / REST (iRods/ Globus DRS ?)	<-	<-
Persistent identifiers	**URN**			**URN (seems possible) ROMEO**	**REST**		**MARC 21 Authority**	**URN**	**URN**	**URI**	**<-**	**<-**
Per site	URN; Resolver <-> DNB	<-	yes	unique ID/URL	no	<-		URN; Resolver <-> DNB (epicur)	URN (UUID); Resolver <-> DNB (xepicur) ?	no	<-	<-
CNRI Handle System	no (system assigned)	<-	yes	"Northumbria migrated from a system using Handles (server bounces legacy handle entries to eprints); Australian customer has integrated ext. tool (intermed. talk to Handle server)." T. Brody (Develope); (ideas on workaround see)	(PidMan) -> Handle System (CNRI); cache: GWDG PID Handle	<-	? (via MARC?)	no	no	TextGridURI (GWDG Handle System)	<-	<-
Miscellaneous features												
Browsing	yes ('taglibs.browsing') (ex.: portable projected through ->	(Miless)	yes	yes, OpenURL	->	yes	yes (via search-engine-API)	yes	yes	yes	<-	<-
Metadata search	(through Z39.50/PQF?) ID3	yes ? (datamodel: person/inst/doc)	yes	yes, sophisticated search options (export to	->	yes, CoNE	yes (and reference, resp. combined)	yes	Solr	yes	<-	<-

				Tex,google-earth, twitter etc.)								
Content search	yes (fulltext: pdf, oO, doc, html, xml); SOAP, integr. fulltextindic., bots	<-	yes (through google, planned), sematic-search plugin, opensearch (servlet) SRW/U	yes (via Xapian or plugin; opensearch)	REST, SRW/SRU	yes (pdf, doc, txt, xml); SOAP	yes (multi-level API with citation-metrics, google-like)	yes (via google)	yes	yes (Corpus Search, semantic/ Management and Analysis System: linguistical/lexicographical)	<-	<-
Customizable UI/Branding	yes, via exempl.prg. (WCMS) (templates)	yes	yes	lib/themes	->	(interface reflections)	yes	distributed along some files (with opus-icon)	css, js ('theme') / 'Layout' (p. 69ff)	no, indirect (needs packed sources)	no	
Workflow support	simple or via module	<-	yes	yes	->	yes (simple/standard/emailcontact workspaces)	yes	?	(yes)	yes	<-	<-
Subscriptions	->	Search -> RSS	RSS 1/2.0 (incl. iTunesU), Atom	Atom, RSS 1/2.0, Global	->	RSS / Atom	personalized RSS (doc-server) +Social bookmarks: connotea / del.icio.us / citeULike)	RSS (possibly reduced (10 latest) +Social bookmarks: connotea / del.icio.us)	RSS	no (Atom is possible through eXist)	no	no
Command line interface	yes	<-	yes	yes	yes	yes (incl. import)	yes	yes	(yes)	yes	yes	yes
Search engine support	yes (Google, Yahoo)	<-	Google Scholar, -Analytics, -Index	yes (google)	->	yes (via sitemaps) / Open Search; (lookup) google Scolar, WorldCat	?	Google Scolar; planned: Interface to DRIVER	Google, GScolar, Base, Opus	indirect (through Google Guava)?	<-	no
Personal collections	not explicit	?	yes	through app	->	yes	yes	yes (supporting DDC, PACS, NASA, JEL)	yes (supporting DDC, CCS, PACS, JEL, MSC, BKL)	yes (indirect via TGLab <->TGRep?)	< - >	<-
User feedback	developermeetings (2/year)	<-	Community Requirements Gathering (last 2008); Jira, UserGroup Meetings (1/year, scale: europe), mailinglist, 'ambassadors' / country, Summer of Code	subscriber-list: (through courses?) developer-Events	Usergroups, Days (1/year)	Support Team (mail), Blog, Mailing-List, UserMeetings, Community	Usergroup-meeting at CERN (1/year?)	Mailinglist	Mailinglist; Workshops (1/year?) (+facebook/twitter)	Support-Team (mail), Usersummits (1/year); Issue-Tracker	<-	<-
Migration of existing data	Pica3-Import (SRU) (Export seems possible); Metadata -> DNB	<-	Batch/ CLI (Module) (reimport, OAI, OAI-Metadata, Mets, Items); DC MetaToolkit (Access, SQL, CSV to DC)	**Import**: ArXiv; Atom, BibTeX, bin, CGI, comp. XML, DOI, DSpace, Endnote, OpenXML, PDF, PubMed, TeX. XSLT, ORE; **Export:** RDF, DublinCore, RSS, Text, XML, XSLT, OAI, MODS, METS, JSON, HTML, Excel, GScholar, iCal, FOAF, IDS, Endnote, COinS, BibTeX, Atom, USERS, ORE (some via plugin / at the first hand specific use (search etc.))	->	**import (MD5, unAPI):** ArXiv, PubMed Central, BioMedCentral, SPIRES, BibTeX (+Endnote soon); eSCidoc, eDoc, Ris, Wos, Mab **export:** (citation) EndNote, RIS, WoS, BibTeX, APA, AJP; eDoc; (formats) rtf, pdf, html, odt, Snippet-XML Interface to **Zotero** and **Wordpress** (export); **REST**-Interface	**import: ?** **export**: MarcXML, GoogleScolar, ArXiv and oaidc2 import batches	**Import:** DublicCore, Pica (WinIBW3, PPN), BibTeX, RIS **Export**: XMetaDiss (+Plus2 -> DNB) (-> database bibcenter bwb); TheO, BibTex, RIS analog: epubli (PoD: Proprint)	**Import:** Opus 3 (via XML-Dump, fulltext, validated, script; also see 98ff, esp. 101: URL rewrite through Apache); XML (p.111f) **Export:** citation, bibliograpy; XMetaDiss <- see also	**Import:** (via tool: script, METS, TG) **Export: TG**	<-	<-
Installations and support												
Commercial suppport	no	<-	USA, sort of (prof. Training Material), though serviceproviders? DuraSpace NonProfitOrganization (governance) : person with 3hrDSpace OfficeHours (irc)	UK, yes (hosting, training, consultancy)	yes, non commercial (MPIs) (hosted solutions are offered)	non commercial through 'early adopters/pilot institutes (mainly MP)	semi-commercial, f.e. through committing (CERN-branch, DESY, EPFL, FNAL, SLAC)	non commercial: Bibliotheksservicezentrum Baden-Württemberg	non commercial: via Zuse-Centre Berlin (part of KOOPERATIVER BIBLIOTHEKSVERBUND BERLIN-BRANDENBURG (kobv; +bsz, uni stuttgart, SULB Saarbrücken SLUB Dresden (DFG-financed) hosting offered))	-->	-->	partners/ cooperations (indirect comm. supp. via DAASI)
DINI certified installations	• 2004: yes • 2007: ? NYD • 2010: ? NYD	<-	hundreds of (not DINI-certified) instances	2007 (München, TUD)	no ?	<-	30 Installations worldwide	yes. 2007: many	yes, first 2010 (see p. 156ff); instances	no	<--	<--
popularity / sustainab. • Cybermetrics Ranking (CR) • **User / Community (UC)**	**UC: 3 academic users**	<-	**1000 Instances (sustain: HP / MIT, some ServiceProviders; DuraSpace NonProfitOrganization)**	**CR: place 31**	**academic community / MPYS / BMBF (former DFG) (initiative for sustainability)**	**<- (interested may also take a look at virr, sengbusch, faces and/or workbench)**	**highly scalebale system, coming from high-energy physics (CERN; DESY; EPFL; FNAL; SLAC)**	**CR: Place 40 (former financed through DFG, BMBF, Bildungsminist. BW)**	**CR 40, KOBV-financed (former DFG support -2010; see commercial support) : <- debugged/fastend code (see changelog); Solr Interface, some new formats (not documented, working at least in Ramberg)**	-->	-->	**>100 Users/Inst. state-of-the-art philological tools (SAWS/textvre: adapted in UK)**

Specifications / Definitions

Authorization and authentication infrastructure

- **CAS** – Central Authentication Service is single-sign-on solution for web applications. Only authentication is supported, no authorization.
- **LDAP** – The Lightweight Directory Access Protocol allows access to user account data stored in an LDAP server, e.g. a Microsoft Active Directory. Many institutions already have and use such servers. LDAP allows for authentication and for authorization using groups/roles. Single-sign on is not supported.
- **Shibboleth** – A federated single-sign-on service for authentication and authorization for use with web-applications.

There are several possibilities how an archive may support these protocols to access external user repositories:

- **none** – no support for external authentication/authorization
- **exclusive** – a single external service may be used for authorization and authentication, if there is a internal user repository, it is disabled
- **authentication** – one or more external services may be used for for authentication, optionally in combination in an internal user repository, but authorization (groups) are managed locally
- **multiple** – one or more external services may be used, optionally in combination with an internal user repository, for authorization and authentication

Since there is a virtually infinite number of ways to configure authentication and authorization, we will concentrate mainly on checking if the two AAI methods offered by DARIAH can be used: Shibboleth and LDAP. Other methods are listed if the product documentation states them explicitly, but this is not further investigated or described here.

Bitstream persistence

This describes how the bitstreams of the digital objects are persisted. Usually, these are persisted separately from their associated indexed (and thus searchable) metadata, which usually resides in a database. Some products, however, chose to persist the metadata as

bitstreams as well, to be able to recover from data loss in the database system.

- **Filesystem**– digital objects are stored as files on the file system
- **Database** – digital objects are stored as BLOBs in a database
- **iRODS** – digital objects are stored in a distributed (and optionally replicated) file storage based on iRODS
  - no support in any of the solutions (except one sample Textgrid-workflow (12ff)
- **SRB** – digital objects are stored in a distributed (and optionally replicated) file storage based on the predecessor of iRODS

DARIAH interoperability

DARIAH offers a number of services that may be used by archive products. These include:

- **DARIAH Hosting** – The hosting service can be used to run archive software directly on DARIAH hardware resources. This can be done either for production purposes or for some short-time testing. Offered service range from the provision of a clean VM with preferred operating system up to assisted installation of the requested archive software solution and help by integration with DARIAH infrastructure.
- **DARIAH-AAI** – The authentication and authorization infrastructure (AAI) service is currently based on *Shibboleth and OpenLDAP*. Its preferred solution is *Shibboleth* and the underlying SAML 2.0 standard, especially the two profiles WebSSO and ECP.
- **DARIAH-BP** – The bitstream preservation (BP) offers a file-based service, which provides longterm and redundant binary data storage using a storage virtualization system or a storage resource of choice. It can be accessed by a self-defined, HTTP-based RESTful API and is protected by the DARIAH-AAI. An archive-in-a-box system can use this service to store data objects as well as backups of archive's meta data. A solution may already define a storage abstraction layer for which a plug-in for the DARIAH-BP could be implemented. While metadata of each tested archive-application is usually stored in a database, it may be possible to store a backup of this metadata in the BP service as well.
- **DARIAH-PID** – The persistent identifier (PID) service provides location-independent access to digital objects. Under the hood, the CNRI handle system is used.
- **DARIAH-CR** – The collection registry (CR) provides a central service for administering and finding different digital archives. Metadata from this registry is harvested using OAI-PMH through DARIAH Collection Level Description Application Profile (DCLAP). This service does not directly interact with an archive-in-a-box solution. An archive owner could, however, set up an archive that hosts a collection and then manually register that collection in the DARIAH Collection Registry.
- **DARIAH SR** – The schema registry (SR) represents crosswalks between metadata schemata that can be used to relate metadata from different collections using different metadata schemes. This function is primarily used by the DARIAH Generic

metadata schemes registered in this service for the collection to be properly searchable using the DARIAH Generic Search service.
- **DARIAH GS** – The generic search (GS) service deals with finding of objects and evaluates relevance of collections in DARIAH-CR using crosswalks of the DARIAH-SR. It is based on Lucene/Solr.

Installations and support
- **Commercial support** – It is possible to get paid support for the product. This is particularly important if a user has money, but no time or interest to learn installing and administering the product.
- **DINI certified installations** – The DINI certification process verifies certain technical, administrative and legal aspects associated with a particular digital archive installation.

Media types

Normally, the archive software will just persist the bitstream. Some archives may not support storing arbitrary bitstreams and be restricted to certain file types. Other archives might support arbitrary bitstreams, but additionally offer special support is required for particular file formats for two reasons:

- the format might be complex or refer to external resources which also need to be preserved (e.g. HTML pages with associated CSS, images, etc.)
- the archive might offer enhanced support to view certain file types directly in the browser (e.g. TEI highlighting, video streaming, map-view for geo data, etc.)

Some examples for formats are given here:

- Text (XML, EAD, TEI p4, TEI p5, PDF, ooXML, HTML)
- Images (JPG, PNG, TIFF)
- Audio (WAVE, AIFF, MP3)
- Video (MPEG1-3)
- 3D Video (MPEG-4, DXF, VRML, X3D, PDF)
- Musical scores (MEI, MusicXML)
- GIS interchange formats (MIF, Shapefile)
- ...

Metadata
- **Dublin Core** – The Dublin Core Metadata Element Set is a vocabulary of fifteen properties for use in resource description. The fifteen-element "Dublin Core" achieved wide dissemination as part of the Open Archives Initiative Protocol for Metadata Harvesting (OAI-PMH) and has been ratified as IETF RFC 5013, ANSI/NISO Standard Z39.85-2007, and ISO Standard 15836:2009.
- **MARC 21** – MARC is the acronym for MAchine-Readable Cataloging. It defines a data format that emerged from a Library of Congress-led initiative that began nearly forty years ago. It provides the mechanism by which computers exchange, use, and interpret bibliographic information, and its data elements make up the foundation of most library catalogs used today. MARC became USMARC in the 1980s and MARC 21 in the late 1990s.
- **METS** – The METS schema is a standard for encoding descriptive, administrative, and structural metadata regarding objects within a digital library, expressed using the XML schema language of the World Wide Web Consortium. The standard is maintained in the Network Development and MARC Standards Office of the Library of Congress, and is being developed as an initiative of the Digital Library Federation. METS metadata is useful for bulk imports and exports of archive data.
- **MODS** – The Library of Congress' Network Development and MARC Standards Office, with interested experts, developed the Metadata Object Description Schema (MODS) in 2002 for a bibliographic element set that may be used for a variety of purposes, and particularly for library applications. As an XML schema it is intended to be able to carry selected data from existing MARC 21 records as well as to enable the creation of original resource description records. It includes a subset of MARC fields and uses language-based tags rather than numeric ones, in some cases regrouping elements from the MARC 21 bibliographic format. As of June 2009 this schema is in its third version (version 3.3). MODS is expressed using the XML schema language of the World Wide Web Consortium. The standard is maintained by the MODS Editorial Committee with support from the Network Development and MARC Standards Office of the Library of Congress.

Persistent identifiers

Persistent identifiers are a means of identifying a digital object independent of its actual location. Such a global identifier does not change when the object is moved between archives. Actually, several archives might be able to serve the same object.

- **Per site** – such an identifier works only for a particular archive site. There is no global resolving mechanism for such identifiers. Still, they can be useful for linking to a particular archive site.
- **CNRI Handle System** – Global persistent identifier service running at http://hdl.handle.net. The global service can delegate to second-level services like the DOI system.

Repository interoperability

Repositories may talk to each other and exchange data. This can be metadata, but it can also be complete collections including all associated digital objects and their metadata. There are several (quasi) standard protocols for this:

- **OAI-PMH** – The Open Archives Initiative Protocol for Metadata Harvesting (OAI-PMH) is a low-barrier mechanism for repository interoperability. Data Providers are repositories that expose structured metadata via OAI-PMH. Service Providers then make OAI-PMH service requests to harvest that metadata. OAI-PMH is a set of six verbs or services that are invoked within HTTP. There are currently three versions of the specification: **1.0**, **1.1** and **2.0**. A product capable of downloading metadata from a remote repository supports a **harvester** role. If metadata is published using OAI-PMH, a **publisher** role is supported.
- **SWORD** – SWORD is a lightweight protocol for depositing content from one location to another. It stands for Simple Web-service Offering Repository Deposit and is a profile of the Atom Publishing Protocol (known as APP or ATOMPUB). There are currently three versions of SWORD: **1.0**, **1.3** and **2.0**. SWORDv1 only supports the depositing of content, while SWORDv2 also supports updating and deleting. SWORD maybe be used for inter-repository communication, but also for bulk up- and downloads by users. If a archive product allows fetching data from a remote repository, it supports a **client** role. If it supports bulk uploads/downloads, it supports a **server** role.

Type

- **Solution –** a usable archive application meant to be used by end users. A solution can be installed locally. Keine
- **Infrastructure** – a framework or component to build archive applications. A generic building block used to build solutions. An end user may not be able to do much or anything at all with such a component because it lacks a suitable user interface.
- **Online** – The solution or infrastructure component is offered as an online service only. There is no downloadable and installable software package.

Miscellaneous features
- **Browsing** – Supports exploration of the archive contents by browsing through the documents without the need to search first. Usually this means navigating through a hierarchy of keywords.
- **Metadata search** – Supports finding objects by their metadata, e.g. using Dublin Core categories.
- **Content search** – Supports finding objects by their content. Usually this means fulltext search, but it could also mean to find images by uploading a reference image.
- **Customizable UI/branding** – Supports changing the user interface to have the colors/logo of the hosting institution, but may go well beyond that, up to completely a customizable user interface. This is properly supported if there is a clean separation between the application and it's look and feel, e.g. by supporting multiple themes, or at least having all the style configurations in a special directory. If it is necessary to manipulate JSP or PHP files, this is usually not considered a good separation.
- **Workflow support** – Supports workflows for particular operations, e.g. upon ingestion of a document into the archive, the document might not be directly visible to the public. Instead a workflow is triggered that requires different publication steps to be performed by different actors. For example a curator might be required to review the document metadata and check licenses before permitting the document to be published.
- **Subscriptions** – Supports notification of users whenever a new digital object is published in the archive that might be of interest. Such interest is usually being expressed by the user saving a query. Whenever a new object is available that matches the query, the user gets a mail.
- **Command line interface** – Central management tasks can be performed using a command line tool that talks to the archive software.
- **Search engine support** – Archive content is advertised to search engines in a special way, e.g. using schema.org.
- **Personal collections** – Users can maintain a personal collection of digital objects which they are interested in. The feature may have a different name, e.g. it is called basket in Invenio.
- **User feedback** – Users can rate archive content and/or leave comments.

Gefällt mir Sei der Erste, dem dies gefällt.

8. Appendix 2: possible logo