An Overview of the EDI Data Repository and Data Portal (and how to use it for publishing data)

by Mark Servilla
Environmental Data Initiative
Topics

- **Overview of the**
  - EDI Data Repository
  - PASTA software

- **Use of the EDI Data Portal to**
  - evaluate data packages
  - upload and publish data packages
Premises

- You are familiar with the Ecological Metadata Language (EML)
- You know how to describe a data package with EML
History (Annotated)

Early NIS discussions

2007

PASTA development begins

2009

NIS/PASTA user testing and evaluation

2010

LTER Network

2013

LTER NIS Production release

1st LTER MN

DOIs minted

2nd LTER MN

EDI

2016

Transitions to EDI Data Repository

EDI MN

42,700 data packages

DataCite Membership

today

LTER Network

EDI

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DataCite Membership
42,700 data packages

2007  2009  2010  2013  2016  today
History (Highlights)

- 2007: LTER NIS Production release
- 2009: PASTA development begins
- 2010: Transitions to EDI Data Repository
- 2013: 42,700 data packages
- 2016: Today
What is The EDI Data Repository?

- An Internet accessible "open" data repository
- Uses the PASTA data repository software
- Generates Digital Object Identifiers for all public data packages
- Is a DataONE member node operator (two)
- Contains about 42,700 data packages
- Stores about 8.5TB of data
- Recognized by Springer Nature, Scientific Data, ESA, r3data, Plos, ...
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- An Internet accessible “open” data repository
  - Long Term Ecological Research (LTER) Network
  - Long Term Research in Environmental Biology (LTREB)
  - Macro-systems Biology (MSB)
  - Organization of Biological Field Stations (OBFS)

…but open to any environmental/ecological (size friendly) data
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  - 6,300 researcher contributed
  - 21,000 Landsat images
  - 15,400 Ecotrends project
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What is The EDI Data Repository?

EDI user portal

WWW

storage

data are here

data in

data out

data are here
What is The EDI Data Repository?

Your data are in here
What is The EDI Data Repository?

Storage

data are here

EDI user portal

data in

www

data out

data are here

00101000101101011011
01010101010100011101
0010101000101100101
01010100011101100101
010100...
What is PASTA?

- A metadata-driven data repository software system that supports:
**What is PASTA?**

- A metadata-driven data repository software system that supports:
  - A "data package" model
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- Based on a Service Oriented Architecture design pattern
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What’s A Data Package?

Data Package (noun): an assemblage of science metadata (e.g., EML) and one or more science data objects; PASTA data packages include a quality report object and are described by package metadata called a “resource map” (i.e., manifest)
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PASTA Package Identifiers

PASTA data package unique identifiers:

edi.10.1
PASTA Package Identifiers

PASTA data package unique identifiers:

edi.10.1

scope:identifier:revision
PASTA Package Identifiers

PASTA data package unique identifiers:

edi.10.1

scope:identifier:revision

String value that identifies the organization, project, or theme of the data package
PASTA Package Identifiers

PASTA data package unique identifiers:

edi.10.1

scope:identifier:revision

Integer value that uniquely identifies the data package in the namespace of the scope
PASTA Package Identifiers

PASTA data package unique identifiers:

edi.10.1

scope:identifier:revision

Integer value in increasing order that identifies the version of the data package.
Metadata-driven...

- Ecological Metadata Language (EML)
  - XML Schema
  - Current version 2.1.1
    (under active development - 2.2.0 coming soon)
  - Describes the full data package
    (access, who, where, when, how, and what)

https://knb.ecoinformatics.org/#external//emlparser/docs/index.html
METADATA-DRIVEN...

- User provides the EML document, PASTA does the rest
  - EML describes access control of both the full data package or individual data objects
  - EML describes who was involved in the research (individual, organization, role)
  - EML describes where the research occurred
  - EML describes when the research occurred
  - EML describes how the research was conducted
  - EML describes what was researched --- the data (type, physical, and attributes)
    - type: tabular, spatial, database, other
    - physical: size, checksum, source location
    - attributes: detailed information (e.g., column information for tabular)
1. Uploads EML
2. Parses EML
3. Uploads data
4. Performs quality evaluation
5. Mints and registers DOI
6. Publishes data package
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2. Parses EML
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5. Mints and registers DOI
6. Publishes data package

Evaluates only
What is Data Package Quality Evaluation?
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A series of quality checks for...
What is Data Package Quality Evaluation?

A series of quality checks for...

- Metadata validation
  - Well formed and schema valid
  - Content validation (does content match best practices?)
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- Data validation
  - Accessible (can data be downloaded?)
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A series of quality checks for...

- Metadata validation
  - Well formed and schema valid
  - Content validation (does content match best practices?)
- Data validation
  - Accessible (can data be downloaded?)
- Congruence validation
  - Metadata description of data matches physical structure of data (e.g., correct number of columns, rows, datatype, delimiters)
con·gru·ence
/ˈkənɡroʊəns/
noun
agreement or harmony; compatibility.
"the results show quite good congruence with recent studies"
synonyms: compatibility, consistency, conformity, match, balance, consonance, congruity; More
The quality Evaluation life-cycle

1. EML upload
2. EML validation
3. Data validation
4. Congruence validation

EML → Evaluation life-cycle → Publish
Quality Evaluation report

Valid - quality check meets criteria
Warn - quality check does not meet criteria, but does not fail upload
Error - quality check does not meet criteria, results in failed upload
Info - quality check only provides information
<table>
<thead>
<tr>
<th>#</th>
<th>Identifier</th>
<th>Status</th>
<th>Quality Check</th>
<th>Name</th>
<th>Description</th>
<th>Expected</th>
<th>Found</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>packageldPattern</td>
<td>valid</td>
<td>Type: metadata System: Iter</td>
<td>Name</td>
<td>Description</td>
<td>Check against LTER requirements for scope.identifier.revision.</td>
<td>knb-iter-nwk.1424.50</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>On Failure: error</td>
<td></td>
<td></td>
<td>'scope.n.m', where 'n' and 'm' are integers and 'scope' is one of an allowed set of values.</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>xmlVersion</td>
<td>valid</td>
<td>Type: metadata System: Iter</td>
<td>Name</td>
<td>Description</td>
<td>Check the EML version.</td>
<td>emt://ecoinformatics.org/eml/52458a79/2011-sparse.xml</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>On Failure: error</td>
<td></td>
<td></td>
<td>'EML version 2.1.0 or later'</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>keywordPresent</td>
<td>warn</td>
<td>Type: metadata System: Iter</td>
<td>Name</td>
<td>Description</td>
<td>Checks to see if at least one keyword is present.</td>
<td>0 'keyword' element(s) found</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>On Failure: warn</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>methodsElementPresent</td>
<td>valid</td>
<td>Type: metadata System: Iter</td>
<td>Name</td>
<td>Description</td>
<td>All datasets should contain a 'methods' element, at a minimum a link to a separate methods doc.</td>
<td>2 'methods' element(s) found</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>On Failure: warn</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>coveragePresent</td>
<td>warn</td>
<td>Type: metadata System: Iter</td>
<td>Name</td>
<td>Description</td>
<td>At least one coverage element should be present in a dataset.</td>
<td>0 'coverage' element(s) found</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>On Failure: warn</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>geographicCoveragePresent</td>
<td>info</td>
<td>Type: metadata System: Iter</td>
<td>Name</td>
<td>Description</td>
<td>Check that geographicCoverage is present in EML at the geographicCoverage level.</td>
<td>0 'geographicCoverage' element(s) found</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>On Failure: warn</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>onlineURLs</td>
<td>valid</td>
<td>Type: conformance System: knb</td>
<td>Name</td>
<td>Description</td>
<td>URLs return something</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>On Failure: error</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>IntegrityChecksum</td>
<td>error</td>
<td>Type: conformance System: Iter</td>
<td>Name</td>
<td>Description</td>
<td>Two possible responses: valid if checksums match; error if checksums do not match.</td>
<td>815a52bd06ef5730ca5ef33dd359380a59c86ef5f 915a52bd06ef5730ca5ef33dd359380a59c86ef5f</td>
</tr>
</tbody>
</table>
Provenance tracking through metadata

source data

is derived from

derived data

is the source for
Provenance tracking through metadata

EML

- Description method step
- Data Source
  - Title
  - Creator
  - Distribution
    - Online description
    - Online URL
  - Contact information
is the source for

is derived from

This data package is a source for the following data packages:


Generate provenance metadata for use within your derived data package

This data package is derived from the following sources:

4. Biocomplexity at North Temperate Lakes LTER; Coordinated Field Studies: Chemical Limnology 2001 - 2004
5. Biocomplexity at North Temperate Lakes LTER; Coordinated Field Studies: Color 2001 - 2004
6. Biocomplexity at North Temperate Lakes LTER; Coordinated Field Studies: Lakes 2001 - 2004
Strong versioning through identifiers
Strong versioning through identifiers
Strong versioning through identifiers

- knb-lter-nin.2.5
- knb-lter-nin.2.10
- edi.10.1
- edi.10.2
- edi.10.3
- msb-bio.22.21

Time
Strong versioning through identifiers
Strong versioning through identifiers

knb-1ter-nin.2.5 -> knb-1ter-nin.2.10 -> knb-1ter-nin.2.15
edi.10.1 -> edi.10.2 -> edi.10.3
msb-bio.22.21 -> msb-bio.22.26 -> msb-bio.22.346

Time
Strong versioning through identifiers
Strong versioning through identifiers

- knb-lter-nin.2.5
- edi.10.1
- edi.10.2
- edi.10.3
- edi.10.4
- msb-bio.22.21
- msb-bio.22.26
- msb-bio.22.346

Time

Knb-lter-nin.2.5 obsoletes knb-lter-nin.2.10, obsoleted by knb-lter-nin.2.15.

Edi.10.1 obsoletes edi.10.2, obsoleted by edi.10.3, obsoletes edi.10.4.

Msb-bio.22.21 obsoletes msb-bio.22.26, obsoleted by msb-bio.22.346.
Strong versioning through identifiers
Digital Object Identifier (DOI) assignment

Internal: edi.10.1
External: https://pasta.lternet.edu/package/eml/edi/10/1
DOI: doi:10.6073/pasta/8996dd613fd0227e8d041822bbd3071d
Digital Object Identifier (DOI) assignment

Internal: edi.10.1

External: https://pasta.lternet.edu/package/eml/edi/10/1

DOI: doi:10.6073/pasta/8996dd613fd0227e8d041822bbd3071d

Science Metadata + Science Data + Quality Report + Resource Map = Data Package
Digital Object Identifier (DOI) assignment

Internal: edi.10.1

External: https://pasta.lternet.edu/package/eml/edi/10/1

DOI: doi:10.6073/pasta/8996dd613fd0227e8d041822bbd3071d
Digital Object Identifier (DOI) Assignment

EZID California Digital Library, University of California: 2013 - 2016

DataCite DOI allocating agent: 2017...
Data package access control

read, write, or all (change-permission)
EDI Data Policy

The Environmental Data Initiative (EDI) strives to make environmental research data open and accessible to the general public without undue restrictions or barriers. Although EDI strongly recommends making all data publicly available, we recognize that some data may require limited access while it is under review during manuscript preparation. In these cases, the EDI Data Repository supports access control to data when justified by the data provider, thereby limiting exposure of the data resource to only users with appropriate permission. Such access control must be specified in the data package metadata and requires a
EDI makes every effort to ensure that all data are curated with intellectual rights defined by the data provider as found in the data package metadata. Although EDI advocates for open and unfettered access to data packages without use restrictions, we do not forbid data providers from declaring more restrictive licensing agreements for use of their data packages. Data providers should include a statement of Intellectual Rights in the metadata of their submissions. If they do not, EDI reserves the right to add a default declaration of intellectual rights to the data package metadata. The default declaration of intellectual rights used by EDI is based on the Creative Commons CC0 “No Rights Reserved” waiver. See below for the full default statement:

"This data package is released to the “public domain” under Creative Commons CC0 1.0 “No Rights Reserved” (see: https://creativecommons.org/publicdomain/zero/1.0/). It is considered professional etiquette to provide attribution of the original work if this data package is shared in whole or by individual components. A generic citation is provided for this data package on the website https://portal.edirepository.org (herein “website”) in the summary metadata page. Communication (and collaboration) with the creators of this data package is recommended to prevent duplicate research or publication. This data package (and its components) is made available “as is” and with no warranty of accuracy or fitness for use. The creators of this data package and the website shall not be liable for any damages resulting from misinterpretation or misuse of the data package or its components. Periodic updates of this data package may be available from the website. Thank you."
Data package access control

data package level
Data package access control
Data package access control

An error has occurred in the Data Portal:

edu.lternet.pasta.common.security.access.UnauthorizedException: PASTA returned status code 401: User public does not have permission to read this metadata document: https://pasta-d.lternet.edu/package/metadata/eml/edi/121/1 Logging into the LTER Data Portal may let you read this resource.

For further assistance, please contact the Environmental Data Initiative. Please copy the error message shown above into your email message, along with any other information that might help us to assist you more promptly.

[Image with a map and data object list]

- **Data package level**
- **Data object level**
WHAT IS A SERVICE ORIENTED ARCHITECTURE?

"a collection of interoperable, network-accessible services that, when working together, form a large, singular application"
**PASTA Service Oriented Architecture**

- **Gatekeeper**
  - reverse-proxy
  - user identity management
- **Data Package Manager**
  - packaging
  - quality evaluation
  - provenance
  - versioning
  - DOI creation
  - access control
- **Audit**
  - logging service
- **Apache Solr**
  - metadata indexing
  - search
PASTA Service Oriented Architecture

Gatekeeper

LTER MN

EDI Data Portal

LTER Data Portal

EDI MN

User

Storage

Audit

Data Package Manager

PASTA SOA

Apache Solr

Nagios (AWS)

Amazon Glacier

User data are in here
PASTA Service Oriented Architecture

Gatekeeper

Audit

Data Package Manager

Apache Solr

Storage

PASTA SOA

vertically

horizontally

scale
PASTA Service Oriented Architecture

Scaling horizontally to improve performance and availability.
PASTA Service Oriented Architecture

Scaling vertically to add new features or create microservices.
PASTA Service Oriented Architecture

- Vertical scale
- Horizontal scale

- Data Replication (new)
- Quality Evaluation
- Quality Evaluation
- Quality Evaluation
- Data DOI Publish

-or both-
PASTA REST web service API

REST = **Representational State Transfer**

Web services allow “platform-independent” computing between servers that are connected to the Internet (WWW).

REST is a design pattern for application-to-application processing of web resources based on the HTTP protocol.
PASTA REST WEB SERVICE API

Web-browser

request
HTTP GET

Web-server
PASTA REST WEB SERVICE API

Web-browser

response
HTML

Web-server
PASTA REST WEB SERVICE API

Web-browser

request
HTTP GET

Web-server

response
HTML
PASTA REST WEB SERVICE API

Linux, Windows, OS X...

request

f(x)

response

Linux, Windows, OS X...

XML
PASTA REST WEB SERVICE API

Java, Python, PHP, C++, Cobol...

request
f(x)

response
XML

Java, Python, PHP, C++, Cobol...
Portal

DataONE

REST API

EDI Data Repository (PASTA)

Users
PAST REST WEB SERVICE API

"CRUD"

- Create (a resource): HTTP POST
- Read (a resource): HTTP GET
- Update (a resource): HTTP PUT
- Delete (a resource): HTTP DELETE
PAST REST web service API

• **List functions (read)**
  ○ List scopes for data packages in PASTA
  ○ List scope.identifiers for data packages in PASTA
  ○ List scope.identifier.revisions for data packages in PASTA

• **Get resource functions (read)**
  ○ Get metadata
  ○ Get data
  ○ Get quality report

• **Post/Put/Delete resource functions (create, update, delete)**
  ○ Post (aka upload) data packages
  ○ Put (aka revise) data packages
  ○ Post event subscriptions
  ○ Delete (aka archive) data packages
PAST REST web service API

- **List functions (read)**
  - List scopes for data packages in PASTA
  - List scope identifiers for data packages in PASTA
  - List scope identifier revisions for data packages in PASTA

- **Get resource functions (read)**
  - Get metadata
  - Get data
  - Get quality report

- **Post/Put/Delete resource functions (create, update, delete)**
  - Post (aka upload) data packages
  - Put (aka revise) data packages
  - Post event subscriptions
  - Delete (aka archive) data packages

66 total REST web service methods calls available

https://pasta.lternet.edu/audit/docs/api
https://pasta.lternet.edu/package/docs/api
PAST REST WEB SERVICE API

This XML file does not appear to have any style information associated with it. The document tree is shown below.
The Four steps to EDI Data Happiness

1. Login using your user id
2. Reserve your data package identifier (to avoid namespace collision)
3. Evaluate your data package
4. Upload your data package
Login using your user ID

Welcome Back
mservilla
Reserve a data package identifier

1. Reserve a data package identifier

2. Reserve Identifiers
   Reserve the next available identifier values for new data packages that you intend to insert into the EDI Repository (currently restricted to the edi scope):
   How many identifiers in the edi scope would you like to reserve?:
   1
   Reserve Next Available Identifier(s)

3. The following identifier has been reserved for user uid=mservilla.o=EDI,dc=edirepository,dc=org: ed1.99
Evaluate your Data Package

1. access Tools menu
2. choose EML file to evaluate or upload
3. select Allow PASTA to skip upload of data if it has a matching copy
4. select option to manually upload data by selecting files on local system
5. click Choose File to select data file
6. click Evaluate or Clear
## Evaluate your Data Package

### View Evaluate/Upload Results

Select the **Evaluate** or **Upload** results to view (results are stored for 180 days):

![Date Selection]

<table>
<thead>
<tr>
<th>Package Id</th>
<th>Was evaluated</th>
<th>Report</th>
<th>Total Quality Checks</th>
<th>Valid</th>
<th>Info</th>
<th>Warn</th>
<th>Error</th>
</tr>
</thead>
<tbody>
<tr>
<td>edi.98.1</td>
<td>Yes</td>
<td>view</td>
<td>35</td>
<td>25</td>
<td>7</td>
<td>1</td>
<td>2</td>
</tr>
</tbody>
</table>
Upload your Data Package

1. Select an Ecological Metadata Language (EML) file to evaluate or upload.
   - **EML Metadata File:** Choose File | edr-98.1.xml

2. Data Upload Options:
   - Allow PASTA to skip upload of a data entity if it has a matching copy
   - I want to manually upload the data by selecting files on my local system

3. Evaluate | Upload | Clear

   - Object Name: LTER.NIN.DWS.csv
   - Data File: Choose File | LTER.NIN.DWS.csv

5. Upload | Clear

6.
Upload your Data Package
Upload your Data Package
success!
Resources

Read-the-docs - http://pastaplus-core.readthedocs.io

Package API - https://pasta.lternet.edu/package/docs/api

Audit API - https://pasta.lternet.edu/audit/docs/api

PASTA+ on GitHub - https://github.com/PASTAplus/PASTA

Examples - https://github.com/EDIorg/tutorials

Questions - info@environmentaldatainitiative.org
Thank you