

PASTA+ WEB SERVICES (A PRIMER)

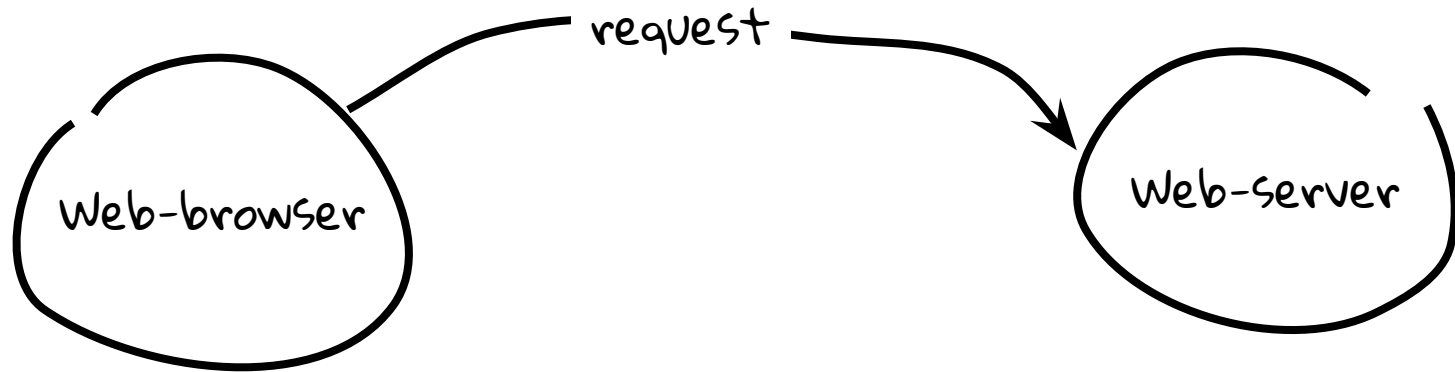
by Mark Servilla
Environmental Data Initiative (EDI)



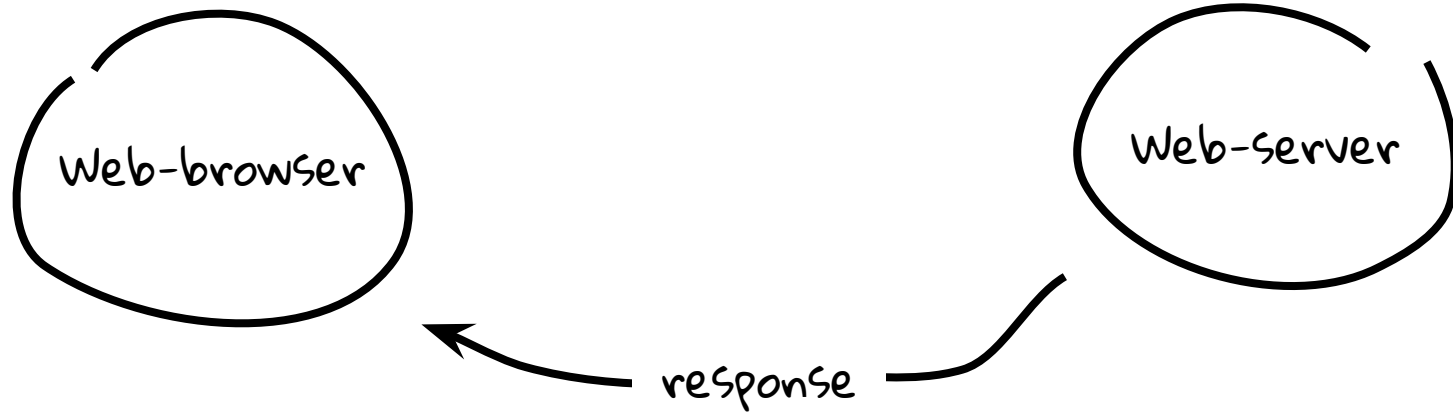
TABLE OF CONTENTS

- Client/server relationship (aka request/response cycle)
- HTTP
- Web services
- PASTA+ architecture
- PASTA+ web services (common methods)
- Discussion/Q&A

CLIENT/SERVER RELATIONSHIP



CLIENT/SERVER RELATIONSHIP



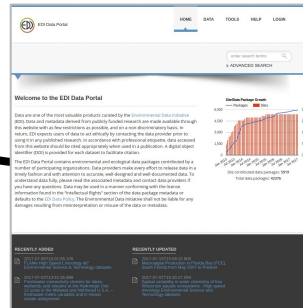
CLIENT/SERVER RELATIONSHIP



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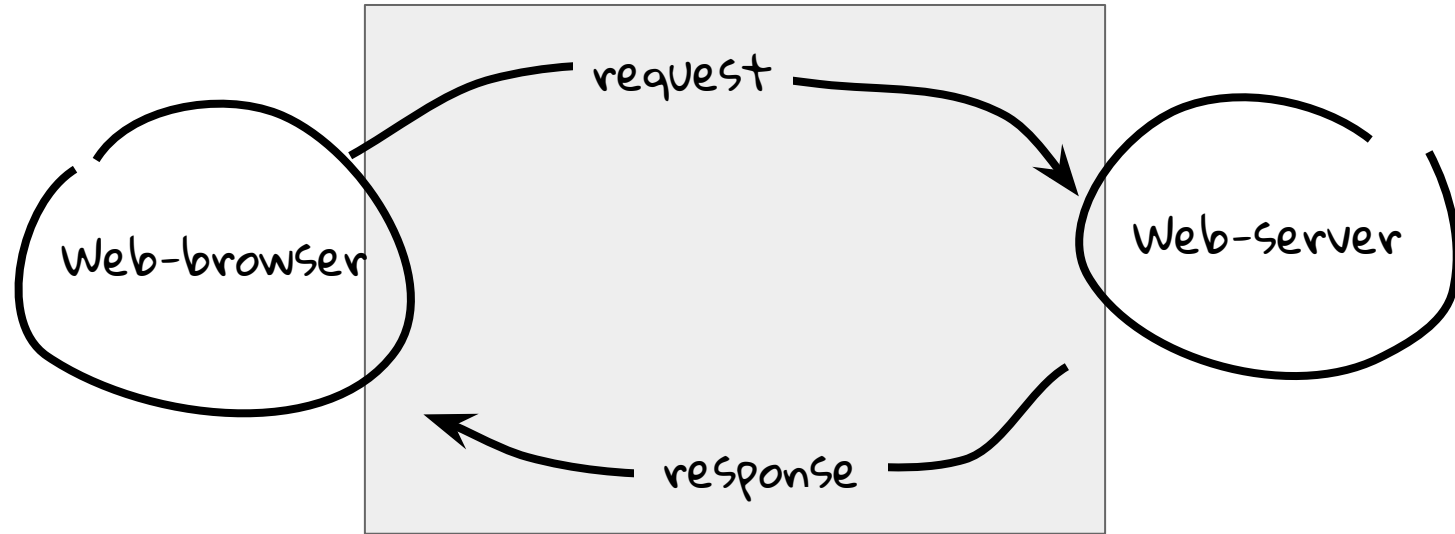
Web-browser

Web-server

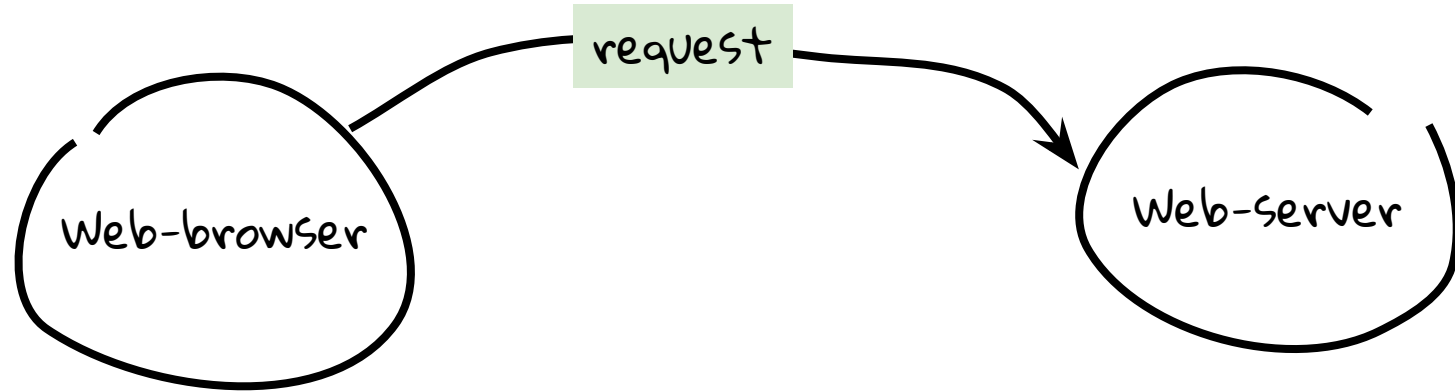


(html)

CLIENT/SERVER RELATIONSHIP



HYPERTEXT TRANSFER PROTOCOL (HTTP)



HYPERTEXT TRANSFER PROTOCOL (HTTP)

request = Action (verb) + URL + optional content

GET
HEAD
POST
PUT
DELETE
CONNECT
OPTIONS
TRACE
PATCH

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Message
Body

HYPERTEXT TRANSFER PROTOCOL (HTTP)

request = Action (verb) + URL + optional content

GET*
HEAD
POST*
PUT
DELETE

Headers

Message
Body

"key-value pairs"



HYPERTEXT TRANSFER PROTOCOL (HTTP) - REQUEST

Action (Verb):

GET

URL:

<https://pasta.ltnet.edu/package/eml/knb-lter-gce/177/22>

Headers:

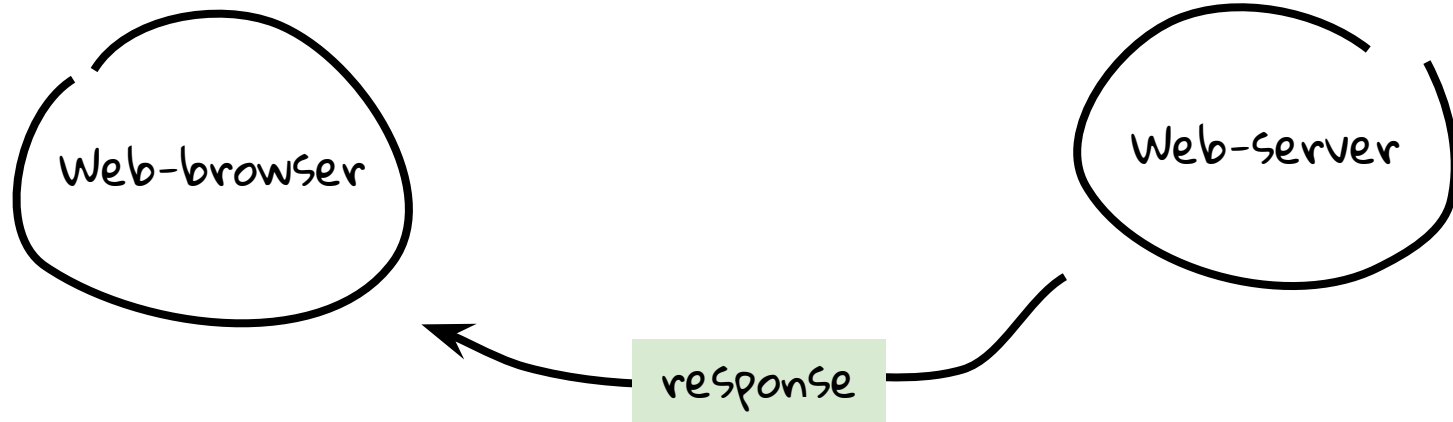
Connection: keep-alive

User-Agent: Apache-HttpClient/4.3.3 (java 1.5)

Host: pasta.ltnet.edu:443

Accept-Encoding: gzip,deflate

HYPERTEXT TRANSFER PROTOCOL (HTTP)



HYPERTEXT TRANSFER PROTOCOL (HTTP)

response = Status + optional content

1xx - Information
2xx - Success
3xx - Redirect
4xx - Client Errors
5xx - Server Errors

Headers

Message
Body

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response = Status + optional content

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"key-value pairs"



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response = Status + optional content

1xx - Information
2xx - Success
3xx - Redirect
4xx - Client Errors
5xx - Server Errors

Headers

Message
Body

200: OK
307: Temporary redirect
401: Not authorized

404: Not found
500: Internal server error
502: Bad gateway

HYPERTEXT TRANSFER PROTOCOL (HTTP) - RESPONSE

Status:

HTTP/1.1 200 OK

Headers:

Server: Apache-Coyote/1.1

Web-Service: DataPackageManager-1.0

Content-Type: text/plain

Date: Fri, 07 Jul 2017 02:48:36 GMT

Content-Length: 382

Message Body:

<https://pasta.lternet.edu/package/data/eml/knb-lter-gce/177/22/dd05325f7f991f7760d6a2ab4c7c6a5a>

<https://pasta.lternet.edu/package/data/eml/knb-lter-gce/177/22/e4d5ade74037037b3ad439de27291e8b>

<https://pasta.lternet.edu/package/metadata/eml/knb-lter-gce/177/22>

<https://pasta.lternet.edu/package/report/eml/knb-lter-gce/177/22>

<https://pasta.lternet.edu/package/eml/knb-lter-gce/177/22>

HYPERTEXT TRANSFER PROTOCOL (HTTP) - CHARACTERISTICS

- Web-accessible objects on servers are "resources"; thus, the name Uniform Resource Locators (URL)
- Resources can be represented in different ways: XML, JSON, plain text, binary streams, ...
- Actions between clients and servers are "stateless"
- "stateful" action may be simulated with sessions

WEB SERVICES

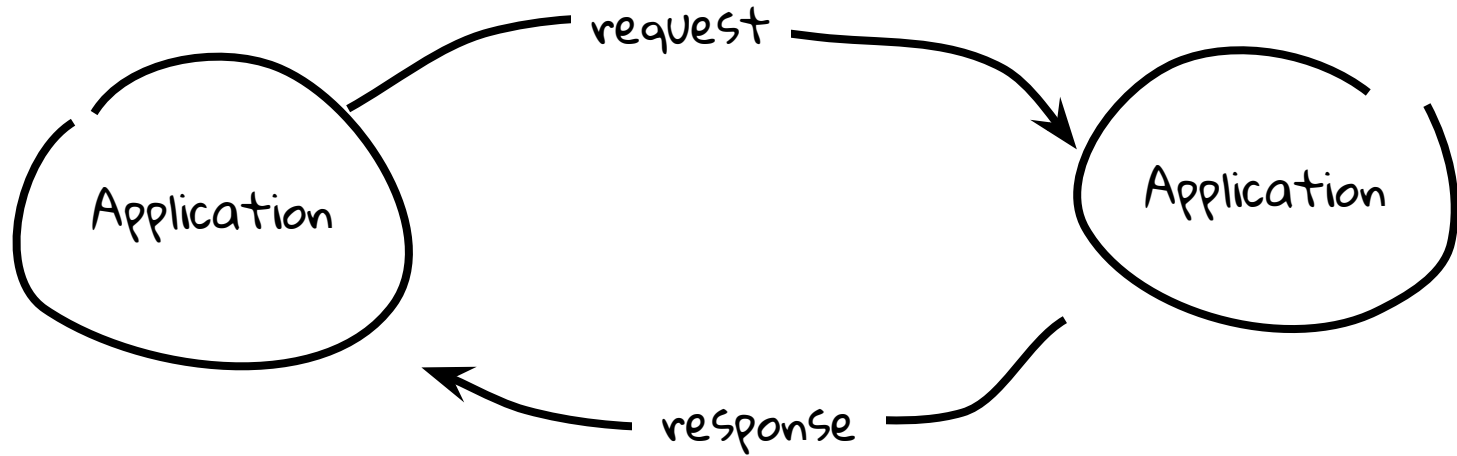
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-- Mark Servilla, 2017

WEB SERVICES



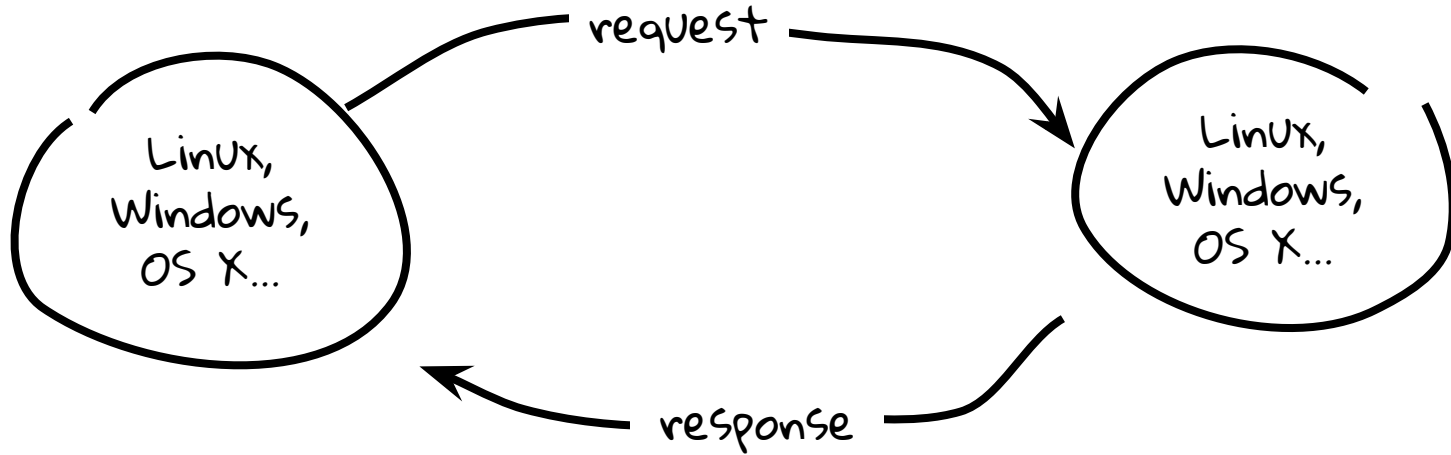
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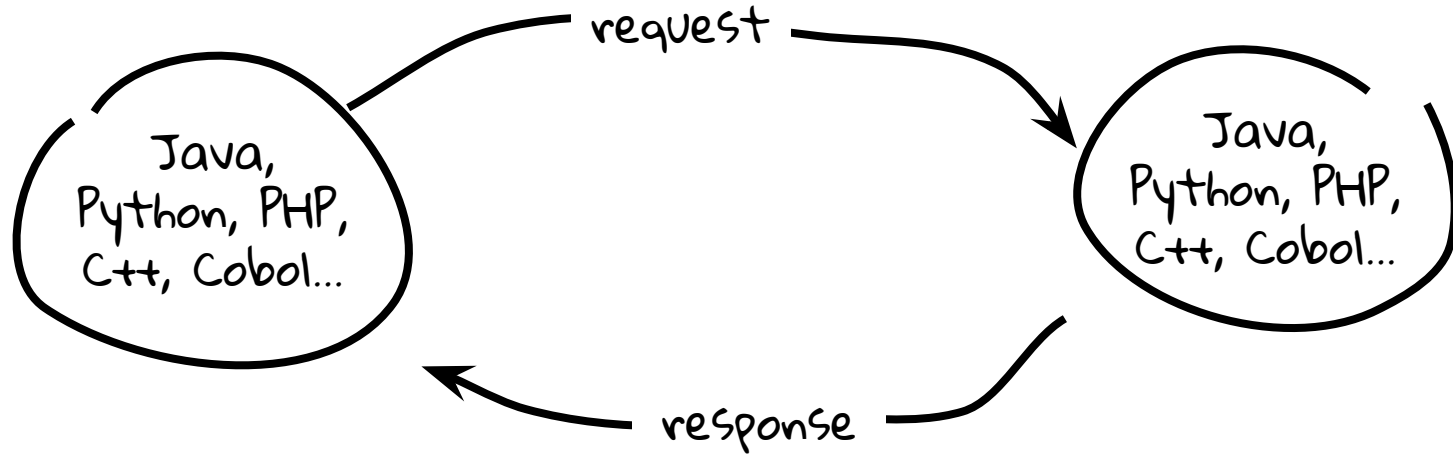
-- Mark Servilla, 2017

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

WEB SERVICES



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- Simple Object Access Protocol (SOAP) - late 1990's, developed originally by Microsoft; platform independent, but fairly complex setup
- Representational State Transfer (REST) - early 2000's, not a protocol, but more of design pattern/style; utilizes existing HTTP protocol

REST

REST = Representational State Transfer

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Roy Fielding



Architectural Styles and the
Design of Network-based
Software Architectures -
2000 Ph.D. Dissertation



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"REST is a design pattern for application-to-application processing of web resources based on the HTTP protocol."

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"...architectural style..."

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REST - APPLICATION-TO-APPLICATION PROCESSING

Processing of
web resources:

- Create
- Read
- Update
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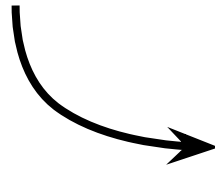
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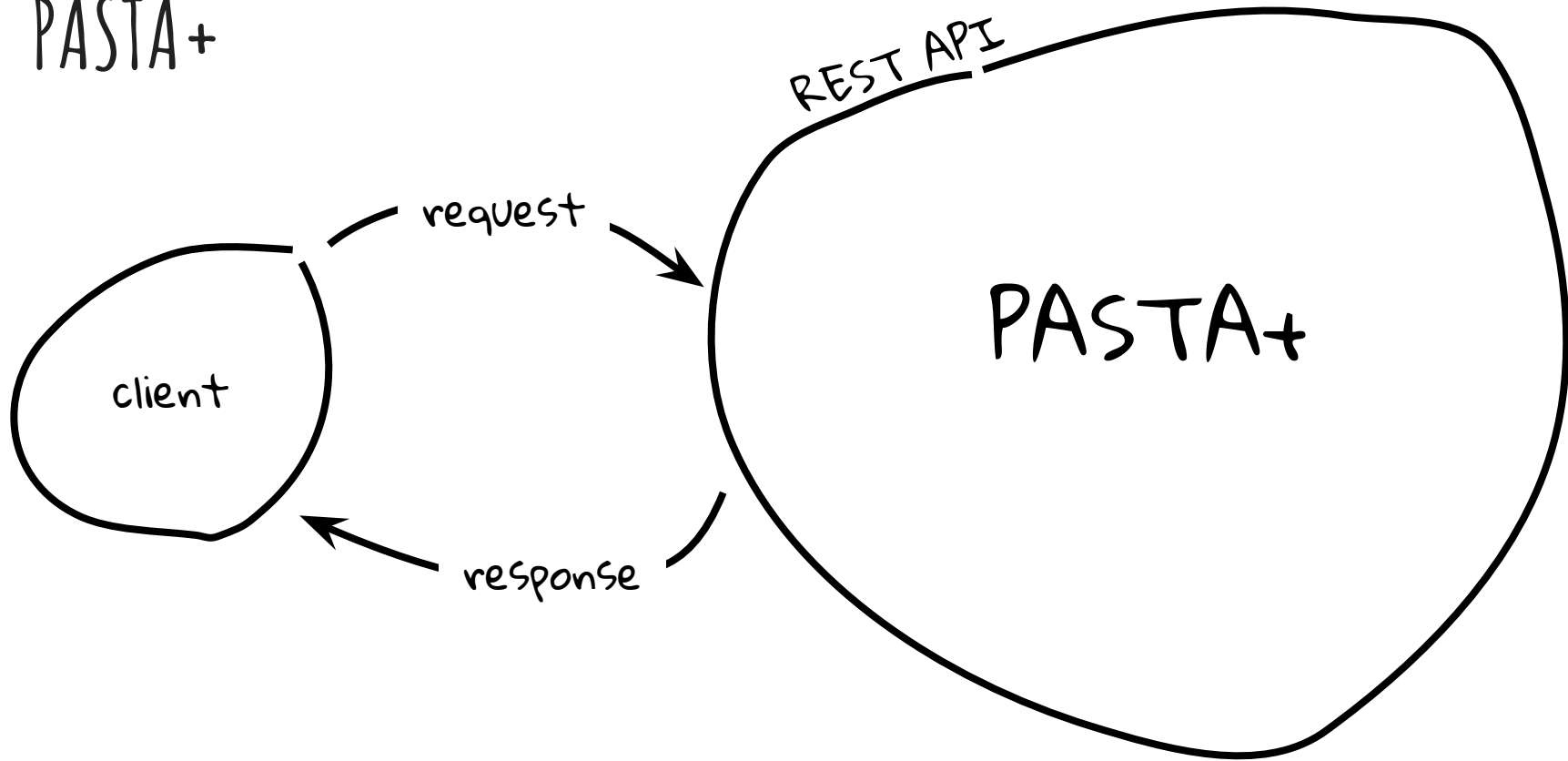


"CRUD" API

REST - HOW TO INTERACT WITH A REST API?

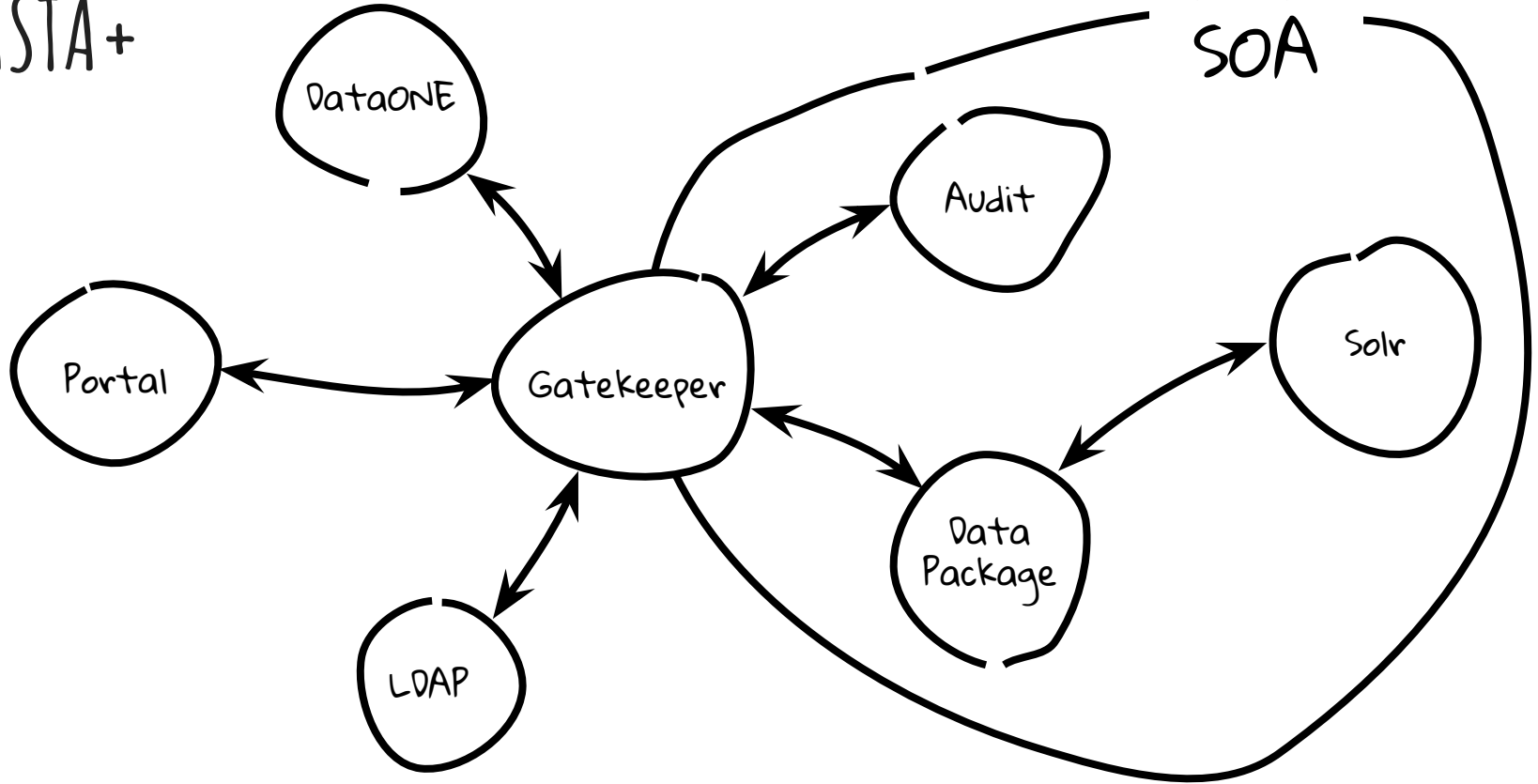
- Web browser (for GET)
- Web browser plugins (for complete enchilada; GET, POST, PUT...)
- Command line applications like CURL
- Programming languages that support Internet connections

PASTA+



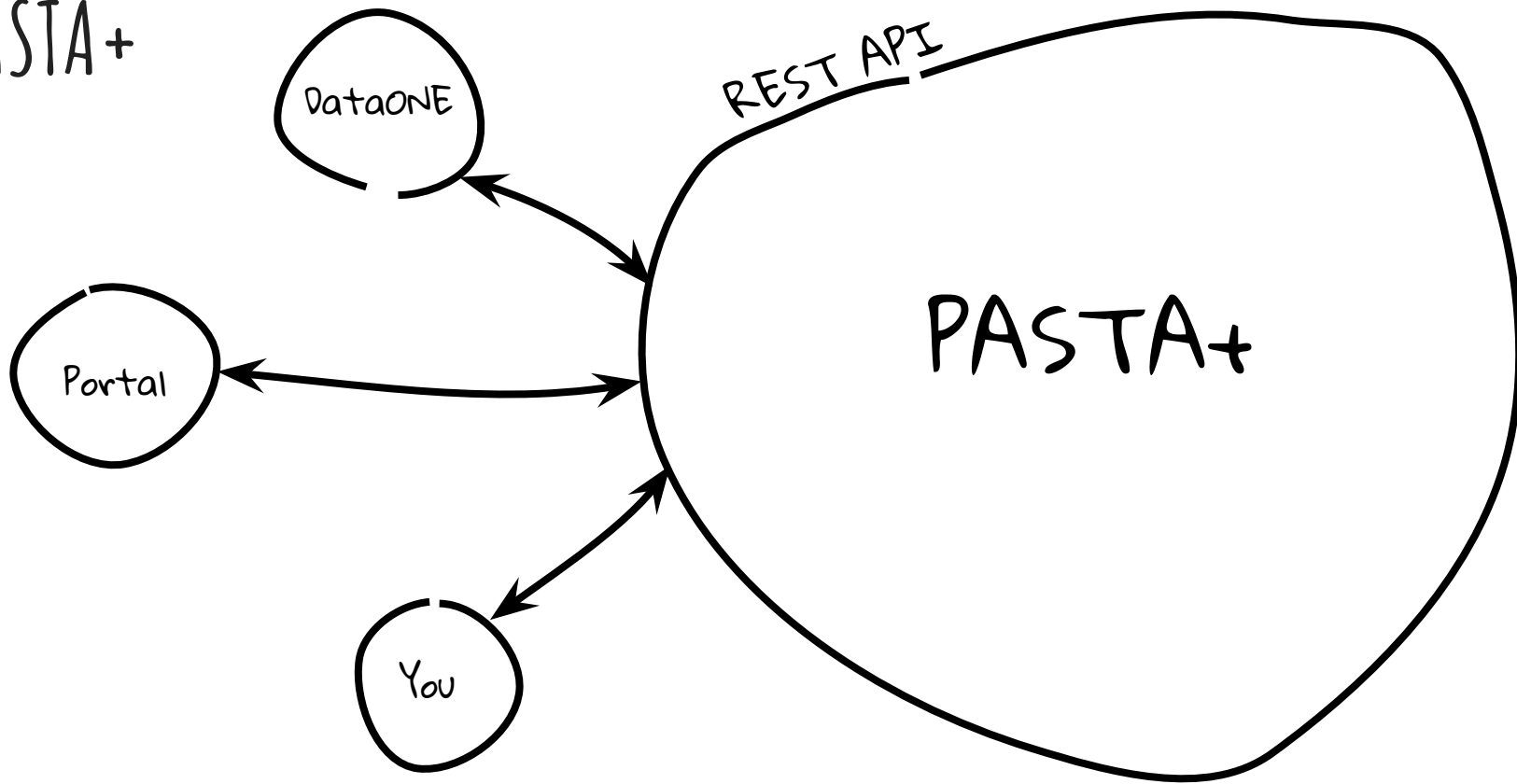
PASTA+

PASTA+
SOA



SOA = Service Oriented Architecture

PASTA+



PASTA+ REST WEB SERVICES

PASTA data package unique identifiers:

edi.10.2

PASTA+ REST WEB SERVICES

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edi.10.2

scope:identifier:revision

PASTA+ REST WEB SERVICES

PASTA data package unique identifiers:

```
edi.10.2
```

```
scope:identifier:revision
```

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

PASTA+ REST WEB SERVICES

PASTA data package unique identifiers:

```
edi.10.2
```

```
scope:identifier:revision
```

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

PASTA+ REST WEB SERVICES

PASTA data package unique identifiers:

```
edi.10.2
```

```
scope:identifier:revision
```

Integer value in increasing order that identifies the version of the data package

PASTA+ REST WEB SERVICES

- List operations - Read operations about the structure of the repository, uses HTTP GET

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- Create/Update/Delete operations - Modifying operations about a specific data package; uses HTTP POST, PUT, or DELETE

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PASTA+ REST WEB SERVICES - LIST

Data package scopes

`https://pasta.lternet.edu/package/eml`

Data package identifiers for a given scope

`https://pasta.lternet.edu/package/eml/<scope>`

Data package revisions for a given scope and identifier

`https://pasta.lternet.edu/package/eml/<scope>/<identifier>`

PASTA+ REST WEB SERVICES - LIST EXAMPLE

```
curl -i -X GET https://pasta.ltnet.net.edu/package/eml/edi
```

```
HTTP/1.1 200 OK
```

```
Server: Apache-Coyote/1.1
```

```
Web-Service: DataPackageManager-1.0
```

```
Content-Type: text/plain
```

```
Date: Sun, 09 Jul 2017 18:35:16 GMT
```

```
Content-Length: 39
```

```
1
```

```
2
```

```
3
```

```
4
```

```
5
```

```
6
```

```
7
```

```
8
```

```
9
```

```
15
```

```
16
```

```
117
```

```
118
```

```
119
```

PASTA+ REST WEB SERVICES - READ

Data package resource map

`https://pasta.lternet.edu/package/eml/<scope>/<identifier>/<revision>`

Data package EML metadata

`https://pasta.lternet.edu/package/metadata/eml/<scope>/<identifier>/<revision>`

Data package data file

`https://pasta.lternet.edu/package/data/eml/<scope>/<identifier>/<revision>/<entityId>`

PASTA+ REST WEB SERVICES - READ EXAMPLE

```
curl -i -X GET https://pasta.lternet.edu/package/metadata/eml/edi/1/1
```

```
HTTP/1.1 200 OK
```

```
Server: Apache-Coyote/1.1
```

```
Web-Service: DataPackageManager-1.0
```

```
Content-Type: application/xml
```

```
Date: Sun, 09 Jul 2017 18:37:56 GMT
```

```
Content-Length: 27795
```

```
<?xml version="1.0" encoding="UTF-8"?>
```

```
<eml:eml packageId="edi.1.1" system="https://pasta.lternet.edu"
```

```
  xmlns:eml="eml://ecoinformatics.org/eml-2.1.1"
```

```
  xmlns:stmml="http://www.xml-cml.org/schema/stmml_1.1"
```

```
  xmlns:xs="http://www.w3.org/2001/XMLSchema"
```

```
  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
```

```
xsi:schemaLocation="eml://ecoinformatics.org/eml-2.1.1
```

```
http://nis.lternet.edu/schemas/EML/eml-2.1.1/eml.xsd">
```

```
  <access authSystem="https://pasta.lternet.edu/authentication"
```

```
...
```

PASTA+ REST WEB SERVICES - DATA PACKAGE LIFE-CYCLE

Step 1: User uploads only data package EML* to PASTA

Step 2: PASTA parses EML and downloads data files from source locations as declared in metadata

Step 3: PASTA performs quality checking against metadata, data, and metadata/data congruency; quality report is generated

Step 4: PASTA registers metadata, data, and report in local registry; a "create" event is recorded in PASTA's audit log; event notifications are sent for all subscriptions

Step 5: PASTA assigns Digital Object Identifier to data package; DOI registered at DataCite

Step 6: PASTA synchronizes data package with DataONE

*EML = Ecological Metadata Language

PASTA+ REST WEB SERVICES - CREATE, UPDATE, & DELETE

Create data package; EML in request message body

(POST) `https://pasta.lternet.edu/package/eml`

Update data package; EML in request message body

(PUT) `https://pasta.lternet.edu/package/eml/<scope>/<identifier>`

Delete data package; all revisions are archived

(DELETE) `https://pasta.lternet.edu/package/eml/<scope>/<identifier>`

PASTA+ REST WEB SERVICES - CREATE EXAMPLE

```
curl -i --user "uid=EDI,o=LTER,dc=ecoinformatics,dc=org:<PASSWORD>" -X POST
https://pasta.lternet.edu/package/eml --header "Content-type: application/xml" --data-binary @edi.1.1.xml

HTTP/1.1 100 Continue

HTTP/1.1 202 Accepted
Set-Cookie:
auth-token=dWlkPUVESSxvPUxURVIsZGM9ZWNvaW5mb3JtYXRpY3MsZGM9b3JnKmh0dHBzOi8vcGFzdGEuZWRpcmVwb3NpdG9yeS5vcmcv
YXV0aGVudGljYXRpb24qMTQ5OTY1NDcwNjcwNCphdXRoZW50aWNhdGVk-KDfCxdYfgoXCiH11JYjhpbiPjdjoOs1EpWpkwXiTzFAgHrbDo
6HorbZuLaTTXC1dy1j1lNO6Q1x2M5XMGXaE4WUorPhiSpMU+no52HODyNnjUIel9TtB8vXZjW3pdk8N+REV2cdLINleDjxB3SusAeYsQIxe
3IJx/IRZWkWL3BtXw4DYknFTfWE2+QxYPb8WqcAOXuaQB7Ht2ujRORvTYJtiHLC+y6B+ABQQswLvAGfycJtQgZSmry+2UsKdTbNVZ2LEAiF
kGsNfPai27MS/szY9pZR3x5TT26CI8K1QYQxqHlaPu0yRH5zfPdmr2AcV++VjEAXN1RnijNUeU31oqvTDdVNoNL/MWo5vuRi5r3RWLtA3UA
X6b3HjAbB7oFmyxkBPi/b60JpxoPTFpjmPaaKmUU4H1YVgfUgFmqyBfPZ1QcJ+wzez4aAKm7cMGwGQ85bM2O2KPvx82j4zy19z0R/miPUjk
gIyyey4Xf415k3caoXV02z8bLNRyGwVx59kr27kT4rAnyogezL8cMkmHUKI8jJgbARwFcqhfvzPXTPMdIRRPegF7KowplM9/D8xmL99u4F
QD/o/nHrxNqr8LnlzlwALRcZ83vyb/amsFKLd/gN7JwXgjXGrIMPMJz4r7LzQvGQG1Q3if5rJ9YjiX608DhzJVv4Y3/qjYkqGY=;Expires
=Thu, 15-Jan-2065 21:30:12 GMT
Expires: Thu, 01 Jan 1970 00:00:00 GMT
Server: Apache-Coyote/1.1
Web-Service: DataPackageManager-1.0
Content-Type: text/plain
Date: Sun, 09 Jul 2017 18:45:07 GMT
Content-Length: 25

create_149962590731841208
```

PASTA+ REST WEB SERVICES - USER AUTHENTICATION

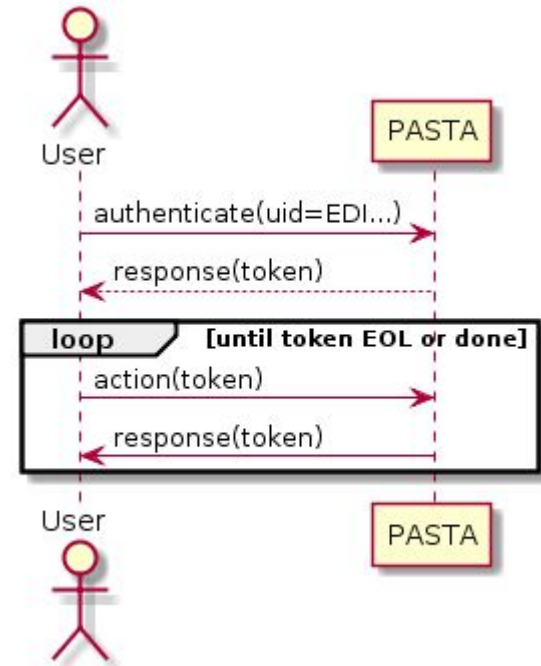
Two forms of request authentication:

1. login credentials using LDAP DN and password bind

`uid=EDI,o=LTER,dc=ecoinformatics,dc=org`

2. PASTA created authentication token

Otherwise, all requests are accepted as anonymously "public"



PASTA+ REST WEB SERVICES - USER AUTHENTICATION

```
curl -i --user "uid=EDI,o=LTER,dc=ecoinformatics,dc=org:<PASSWORD>" -X POST
https://pasta.lternet.edu/package/eml --header "Content-type: application/xml" --data-binary @edi.1.1.xml

HTTP/1.1 100 Continue

HTTP/1.1 202 Accepted
Set-Cookie:
auth-token=dWlkPUVESSxvPUxURVIsZGM9ZWNvaW5mb3JtYXRpY3MsZGM9b3JnKmh0dHBzOi8vcGFzdGEuZWRpcmVwb3NpdG9yeS5vcmcv
YXV0aGVudGljYXRpb24qMTQ5OTY1NDcwNjcwNCphdXRoZW50aWNhdGVk-KDfCxdYfgoXCiH11JYjhpbiPjdjoOs1EpWpkwXiTzFAgHrbDo
6HorbZuLaTTXC1dy1j1lNO6Q1x2M5XMGXaE4WUorPhiSpMU+no52HODyNnjUIel9TtB8vXZjW3pdk8N+REV2cdLINleDjxB3SusAeYsQIxe
3IJx/IRZWkWL3BtXw4DYknFTfWE2+QxYPb8WqcAOXuaQB7Ht2ujRORvTYJtiHLC+y6B+ABQQswLvAGfycJtQgZSmry+2UsKdTbNVZ2LEAiF
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QD/o/nHrxNqr8LnlzlwALRcZ83vyb/amsFKLd/gN7JwXgjXGrIMPMJz4r7LzQvGQG1Q3if5rJ9YjiX608DhzJVv4Y3/qjYkqGY=;Expires
=Thu, 15-Jan-2065 21:30:12 GMT
Expires: Thu, 01 Jan 1970 00:00:00 GMT
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Web-Service: DataPackageManager-1.0
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create_149962590731841208
```

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```
curl -i --user "uid=EDI,o=LTER,dc=ecoinformatics,dc=org:<PASSWORD>" -X POST  
https://pasta.lternet.edu/package/eml --header "Content-type: application/xml" --data-binary @edi.1.1.xml
```

```
HTTP/1.1 100 Continue
```

```
HTTP/1.1 202 Accepted
```

```
Set-Cookie:
```

```
auth-token=dWlkPUVESSxvPUxURVIsZGM9ZWNvaW5mb3JtYXRpY3MsZGM9b3JnKmh0dHBzOi8vcGFzdGEuZWRpcmVwb3NpdG9yeS5vcmcv  
YXV0aGVudGljYXRpb24qMTQ5OTY1NDcwNjcwNCphdXRoZW50aWNhdGVk-KDfCxdYfgoXCiH11JYjhpbiPjdjoOs1EpWpkwXiTzFAgHrbDo  
6HorbZuLaTTXC1dy1jjlNO6Q1x2M5XMGXaE4WUorPhiSpMU+no52HODyNnjUIel9TtB8vXZjW3pdk8N+REV2cdLINleDjxB3SusAeYsQIxe  
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kGsNfPai27MS/szY9pZR3x5TT26CI8K1QYQxqHlaPu0yRH5zfPdmr2AcV++VjEAXn1RnijNUeU31oqvTDdVNoNL/MWo5vuRi5r3RWLtA3UA  
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QD/o/nHrxNqr8LnlzlwALRcZ83vyb/amsFKLd/gN7JwXgjXGrIMPMJz4rr7LzQvGQG1Q3if5rJ9YjiX608DhzJVv4Y3/qjYkqGY=;Expires  
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Expires: Thu, 01 Jan 1970 00:00:00 GMT
```

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Server: Apache-Coyote/1.1
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Web-Service: DataPackageManager-1.0
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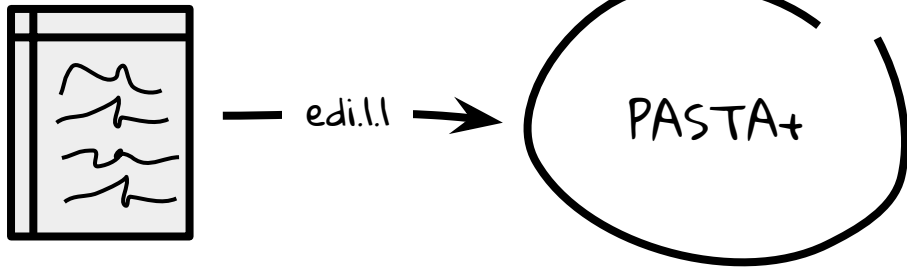
```
Content-Type: text/plain
```

```
Date: Sun, 09 Jul 2017 18:45:07 GMT
```

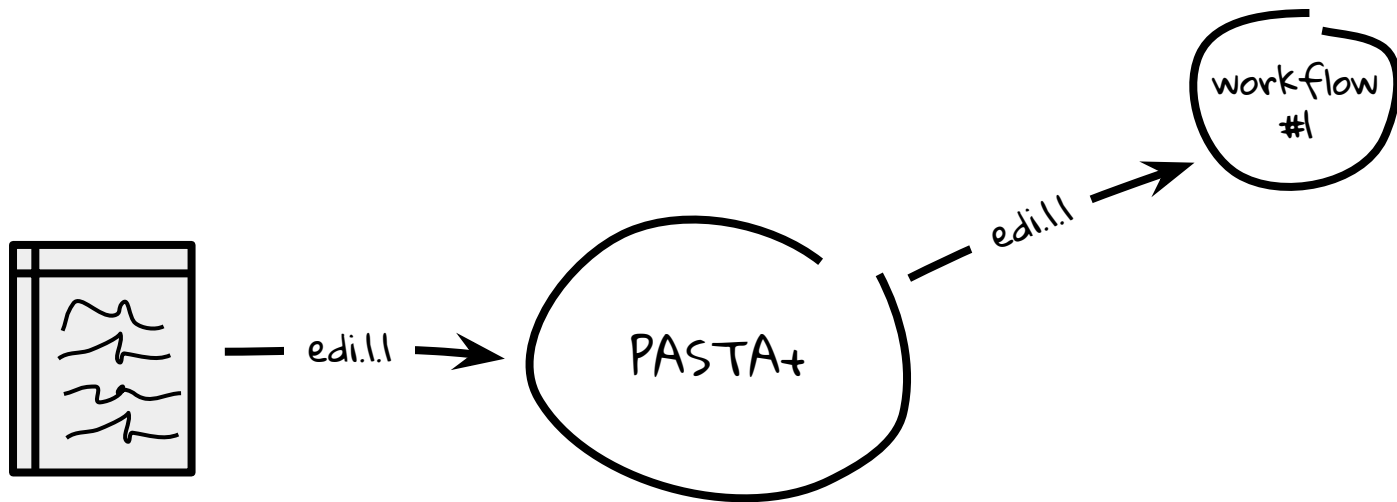
```
Content-Length: 25
```

```
create_149962590731841208
```

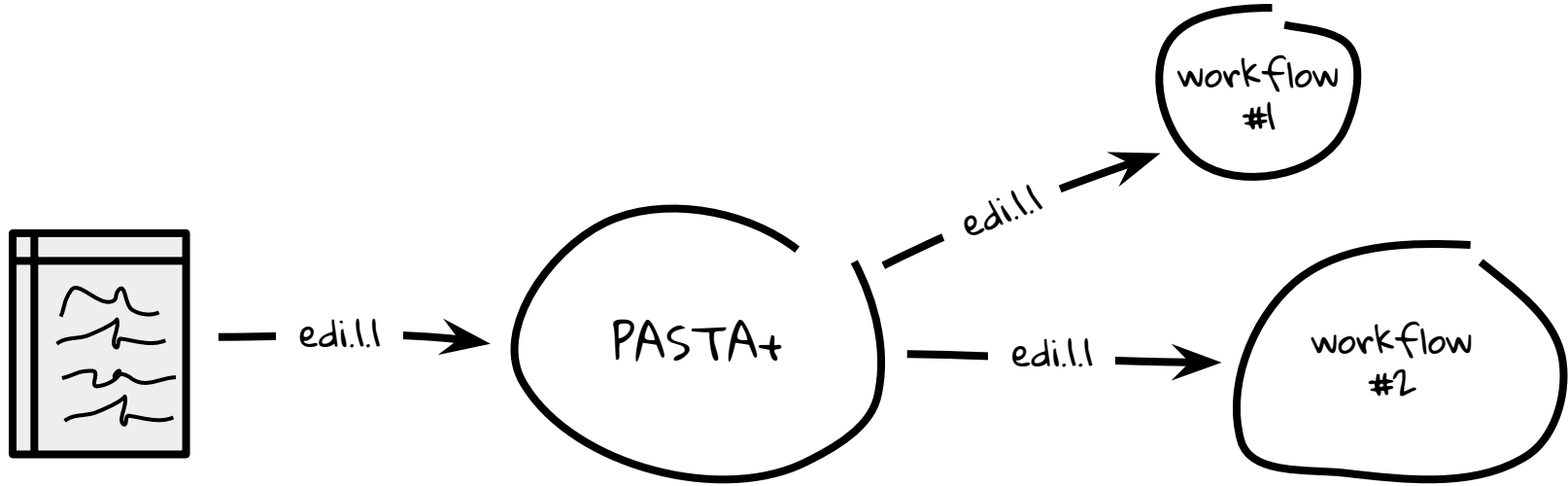
PASTA+ REST WEB SERVICES - EVENT NOTIFICATION



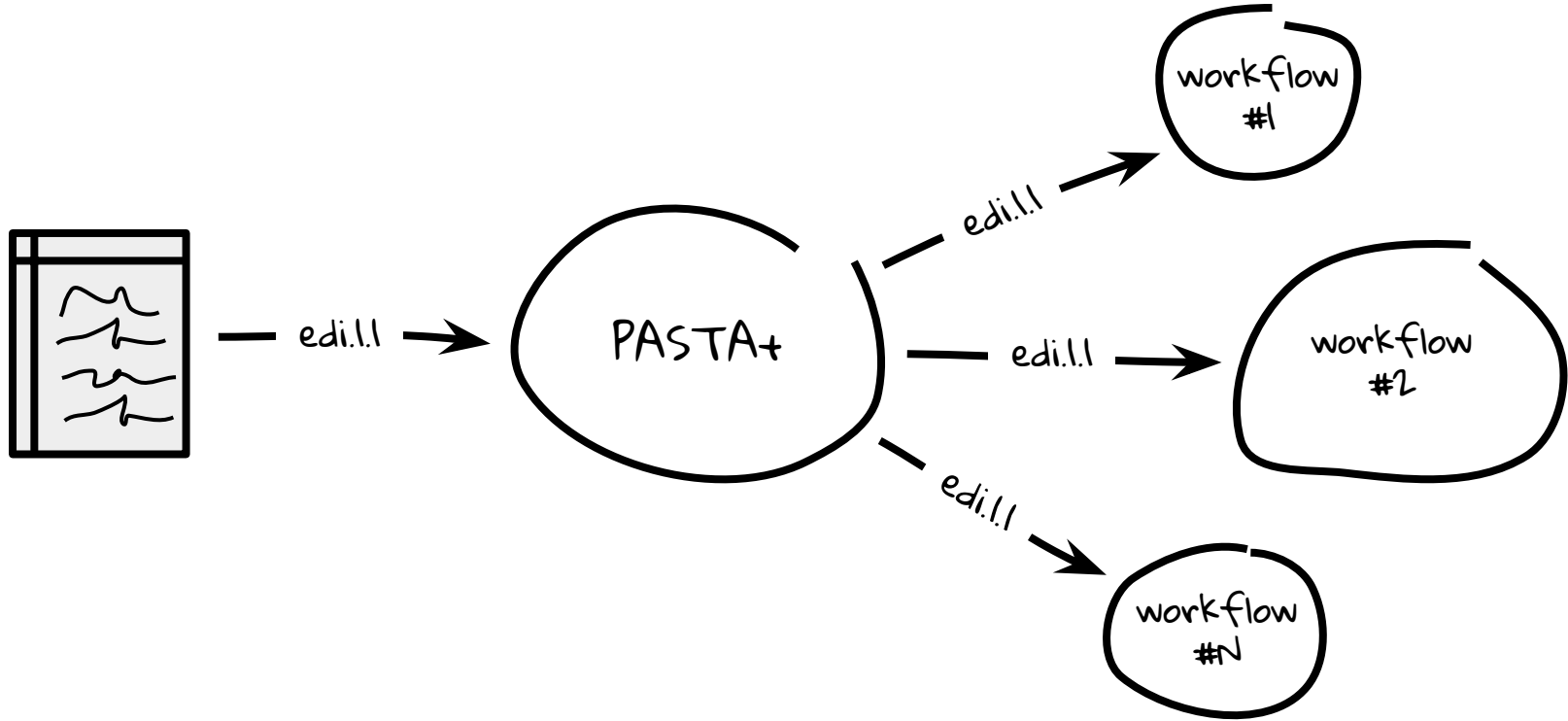
PASTA+ REST WEB SERVICES - EVENT NOTIFICATION



PASTA+ REST WEB SERVICES - EVENT NOTIFICATION



PASTA+ REST WEB SERVICES - EVENT NOTIFICATION



PASTA+ REST WEB SERVICES - AUDIT REPORTING

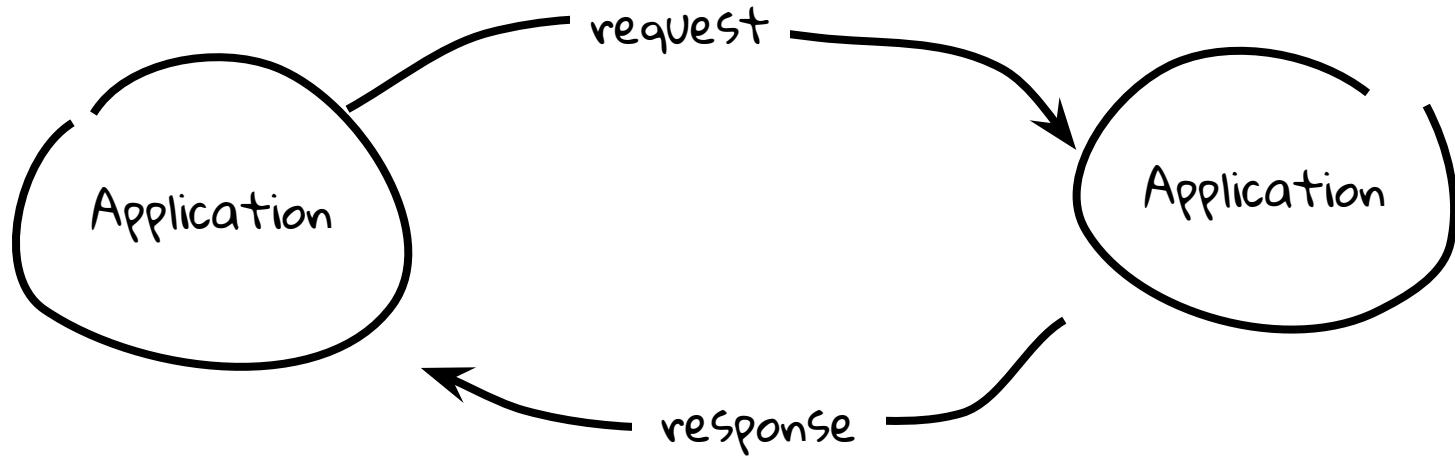
```
curl -i --user "uid=EDI,o=LTER,dc=ecoinformatics,dc=org:<PASSWORD>" -X GET  
"https://pasta.ltnet.net/audit/report?limit=10&resourceId=edi/1/1"
```

```
HTTP/1.1 200 OK  
Set-Cookie: auth-token=dWlkPUVESSxvPUxURVIs...  
Expires: Thu, 01 Jan 1970 00:00:00 GMT  
Server: Apache-Coyote/1.1  
Cache-Control: no-cache  
Web-Service: AuditManager-0.1  
Content-Type: application/xml  
Date: Sun, 09 Jul 2017 20:17:07 GMT  
Content-Length: 5222
```

```
<auditReport>  
<auditRecord>  
  <oid>25302843</oid>  
  <entryTime>2016-12-01T13:05:53</entryTime>  
  <category>info</category>  
  <service>DataPackageManager-1.0</service>  
  <serviceMethod>createDataPackage</serviceMethod>  
  <responseStatus>200</responseStatus>  
  <resourceId>https://pasta.ltnet.net/package/eml/edi/1/1</resourceId>  
  <user>uid=NTL,o=LTER,dc=ecoinformatics,dc=org</user>  
  <groups>authenticated</groups>  
  <authSystem>https://pasta.ltnet.net/authentication</authSystem>  
  <entryText></entryText>  
</auditRecord>  
...
```

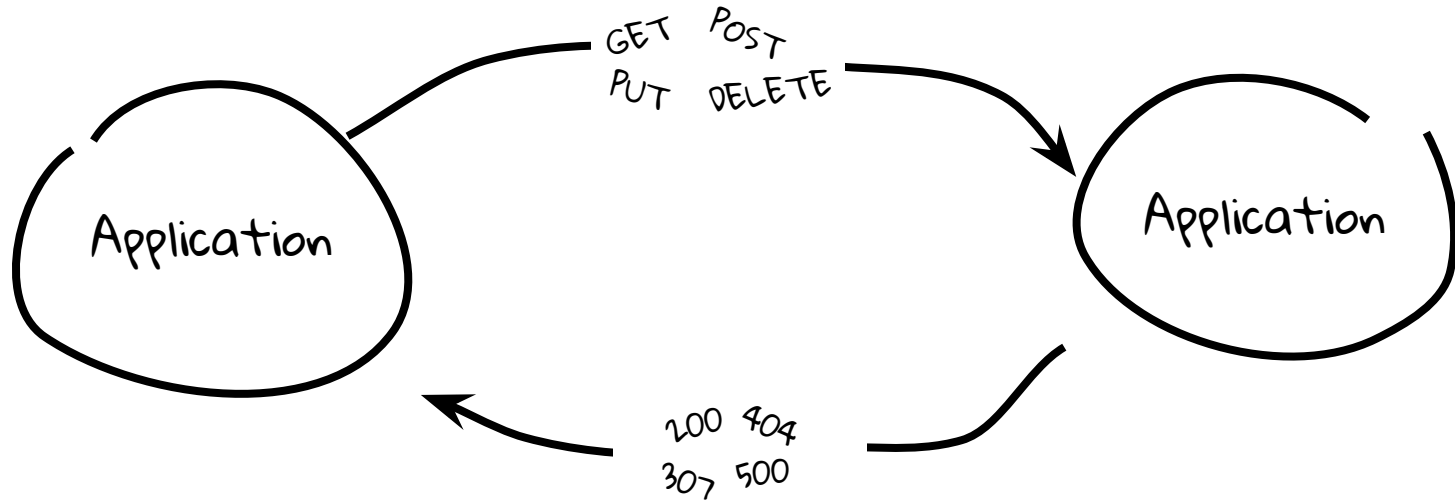
RECAP

Web services are application-to-application processing of resources that take place over the Internet



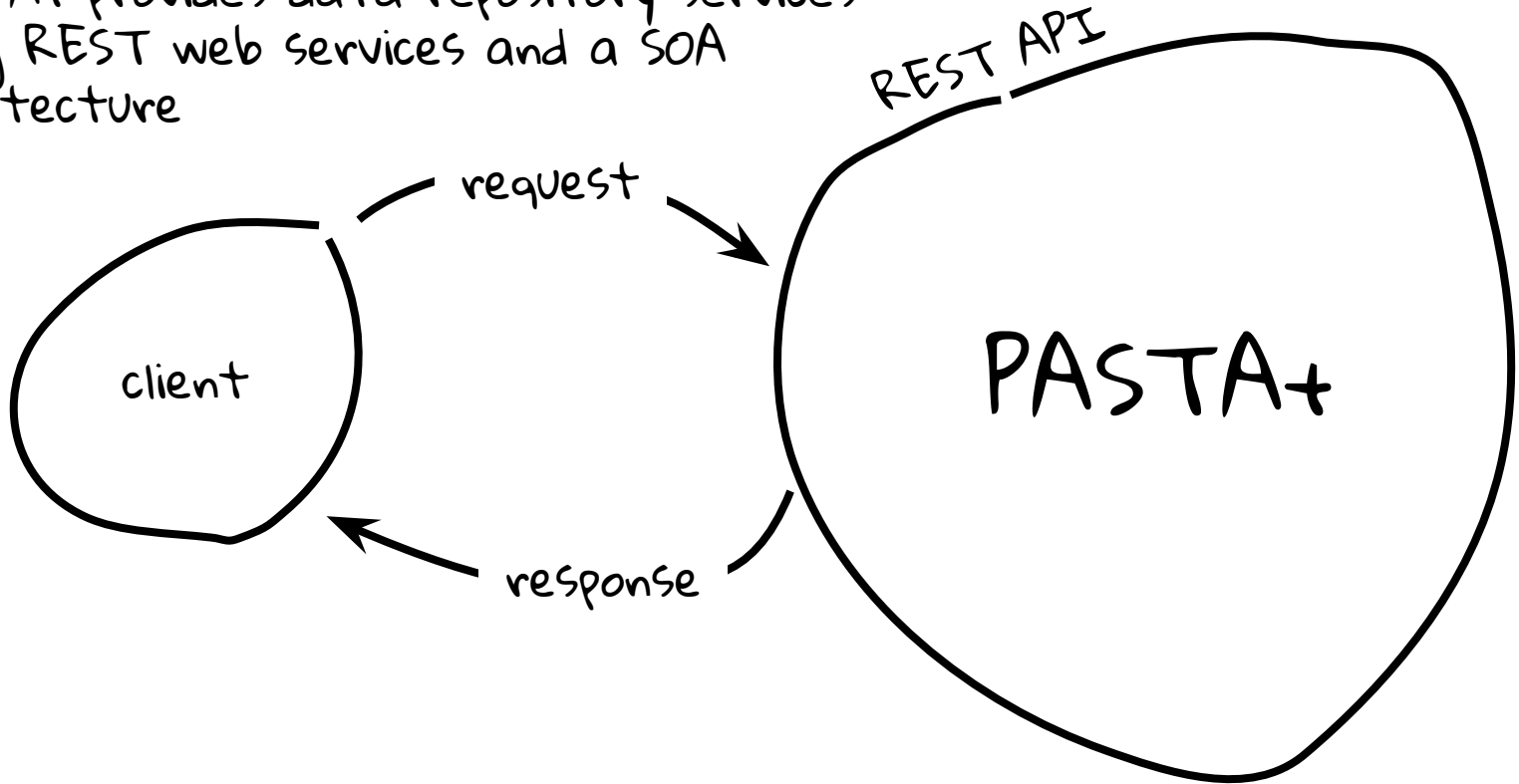
RECAP

REST uses the HTTP protocol to effectively provide web services



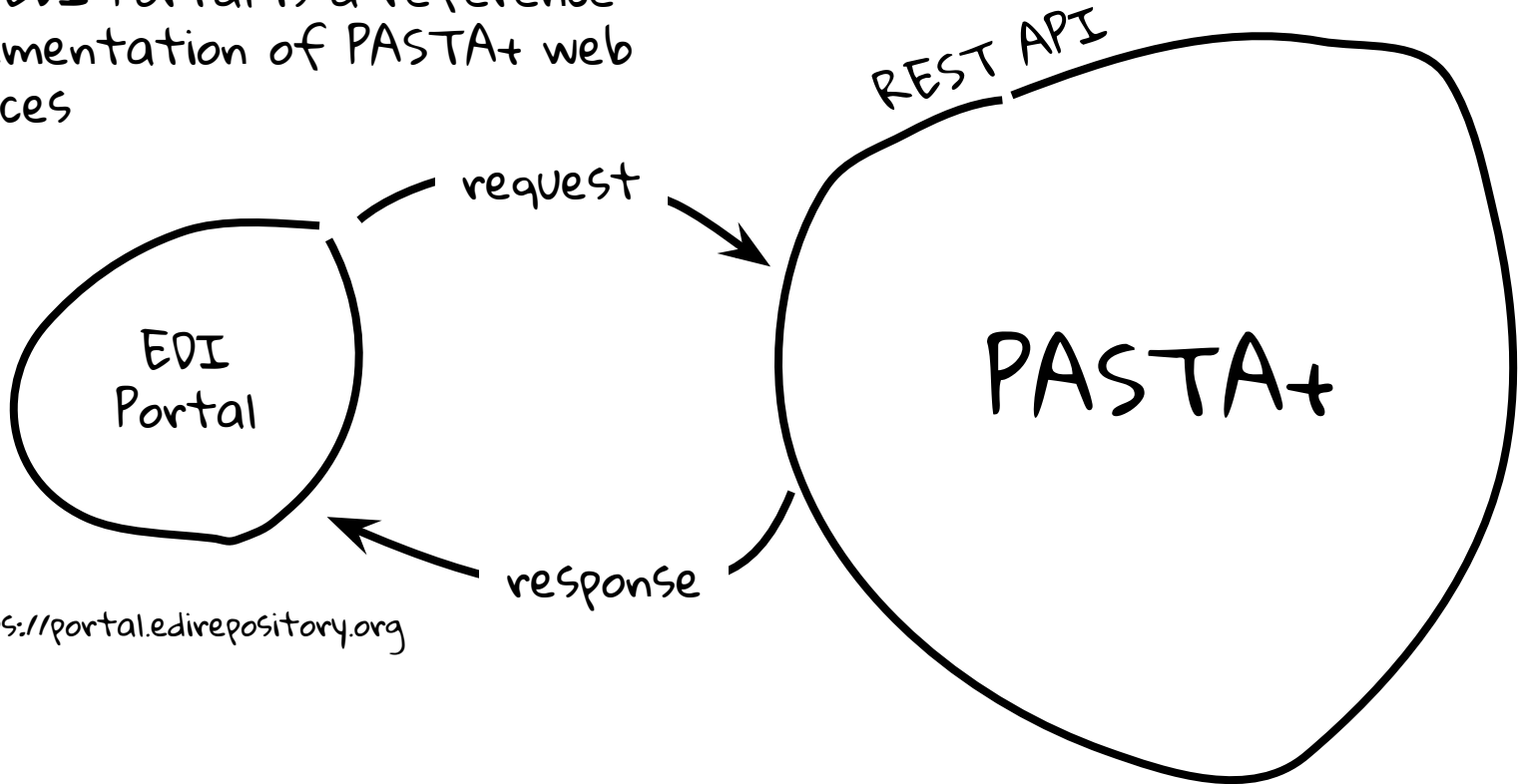
RECAP

PASTA+ provides data repository services using REST web services and a SOA architecture



RECAP

The EDI Portal is a reference implementation of PASTA+ web services



<https://portal.edirepository.org>

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>

Tech Questions - support@environmentaldatainitiative.org

THANK YOU



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