Brightening an Archive

Streamlining access to OA datasets

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UC Curation Center

University of California
CDL
California Digital Library

Merritt

CORE TRUST SEAL

Merritt is a CoreTrustSeal certified, open-source digital preservation system maintained by UC3 team at CDL.

- Three independent copies, three different cloud-based storage providers, across two geographic locations with differing disaster threats.

- Microservices for ingest, storage, inventory, audit, and replication.

Our users

Merritt serves librarians and researchers, as well as systems internal and external to the University of California.

- Ten UC campus libraries and affiliated organizations
- eScholarship integration: 85 open access journals
- Dryad OA datasets

Content management in Merritt

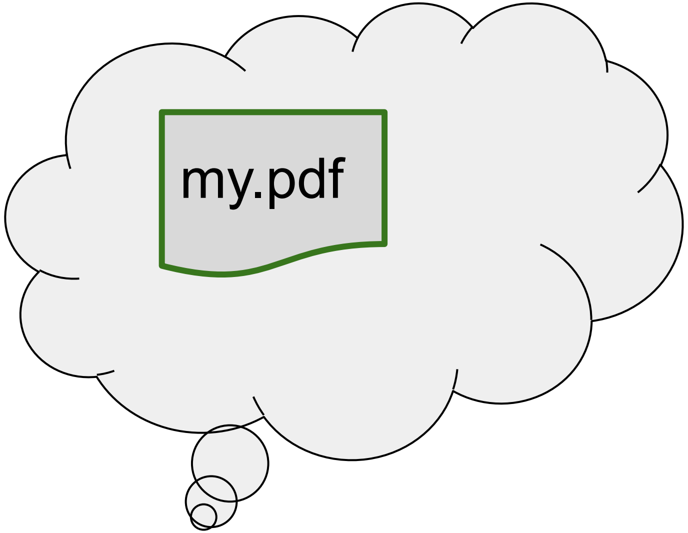
Merritt *individually* manages files and objects.

- A file being a single digital file
- An object can contain one or more digital files + metadata

“Files” in Merritt are stored in cloud storage

Management occurs over multiple cloud storage providers

- Amazon S3 & Glacier
- SDSC Qumulo
- Wasabi



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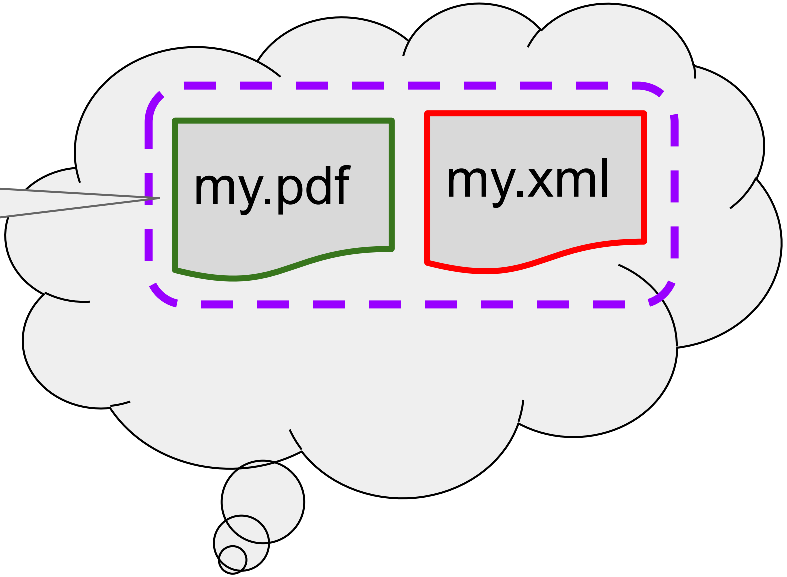
“Objects” in Merritt have digital files and metadata



Objects in Merritt are referenced with an ARK

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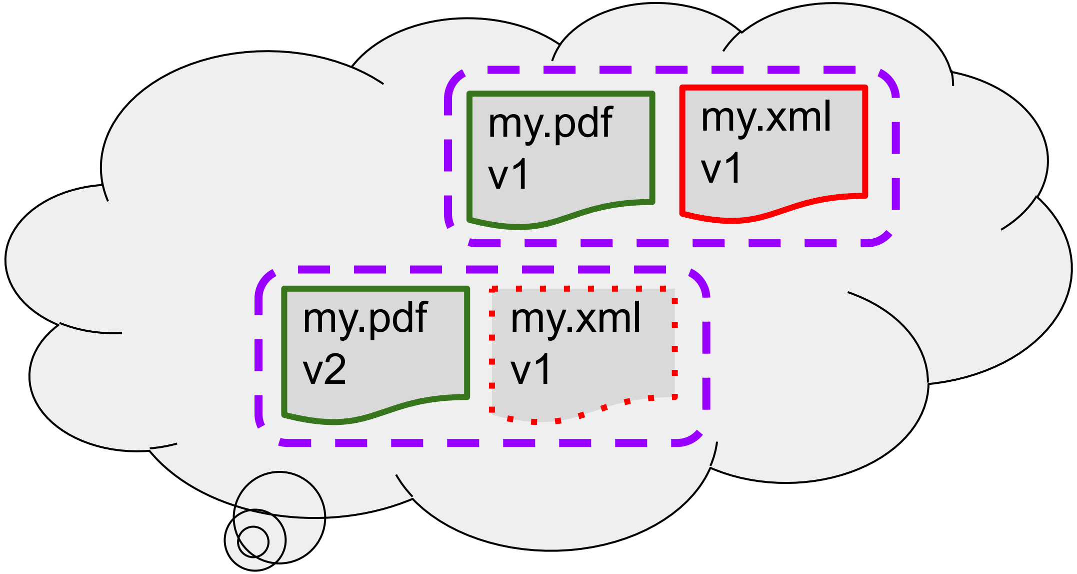
Objects in Merritt can have “Versions”



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Range of file sizes across Merritt

Max file size	Min file size	Average	Producer files
289.8 GB	0	8.5 GB	20,102,755 †

Under 1MB	1MB - 10MB	10MB - 100MB	100MB - 1.0GB	1GB - 10GB	10GB - 100GB	> 100GB
17,830,145	671,802	1,475,116	112,584	11,782	1,231	95

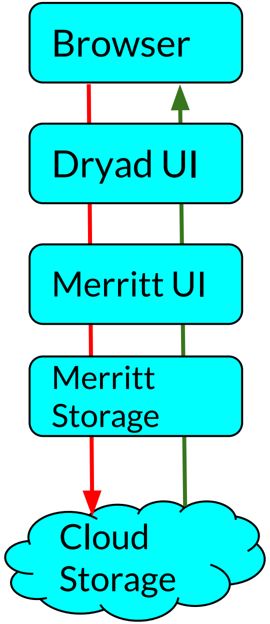
† Many more system files for restructuring the database in the event of a catastrophic failure.

Dryad integration

Dryad contains 34K CC0 datasets from approximately 2000 institutions, and 100K researchers.

- Every new dataset flows from Dryad into Merritt.
- Datasets are replicated to Zenodo
- Dryad generates the majority of access requests (for individual files and entire objects)

http://datadryad.org

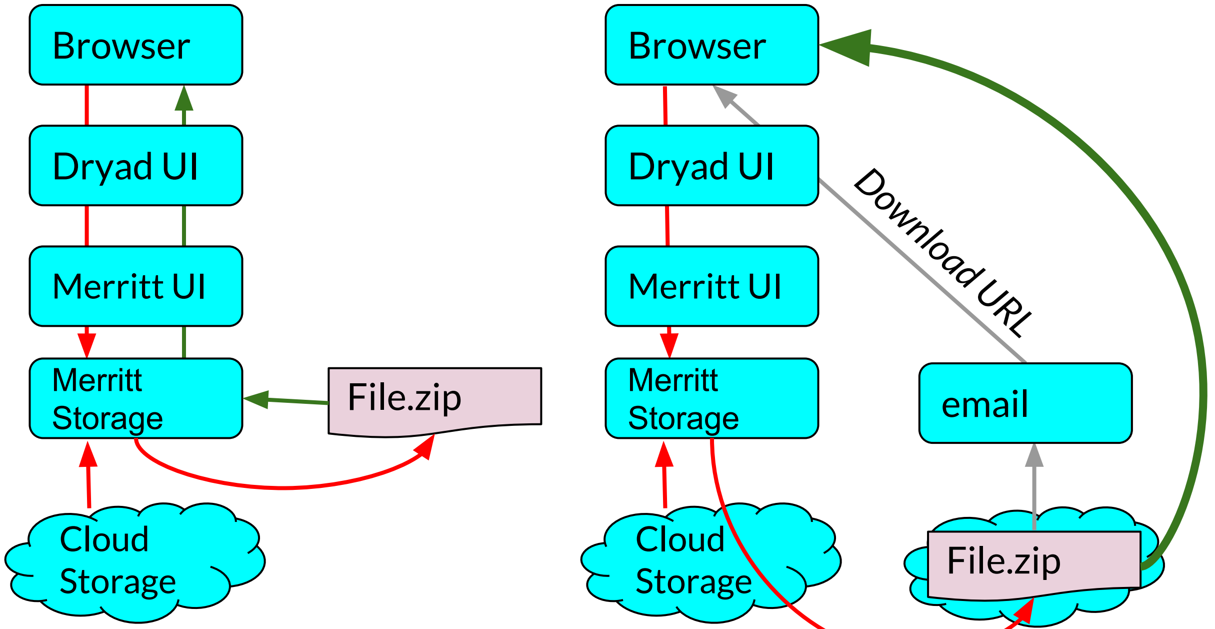


Connecting Merritt & Dryad

Initial integration of the systems

- Downloads of both files and objects were enabled during Merritt/Dryad integration.
- However the initial implementation provided an inefficient means for doing so.

Object Requests (legacy)



Normal Size

Large Object - Asynchronous

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Connecting Merritt & Dryad

Major hurdles to address

- Long-running operations
  - Ingest
  - Download
- Multiple simultaneous downloads occurring through the Dryad frontend.
- Each byte of digital content was streamed through multiple applications.

Long-running operations

- Exceptionally large files: less than .05% to .5% of content
- Could be ingested or retrieved at any time
- Subject to timeout errors on upload and download
- AWS Load balancers timeout at ~1 hour
- We have configured Apache load balancers to permit sessions to last 24 hours
- Waiting for a session to terminate can complicate the timing of a software deployment

Connecting Merritt & Dryad

Additional hurdles to address

- Large dataset objects were delivered asynchronously, with an email notification to the user.
- Depending on the domain, emails could be blocked.

Re-engineering Access

Approach

- Needed a dependable way to stream content directly from the cloud.
  - S3 compatible method that would work across all of our service providers
- Settled on use of **presigned URLs.**

Presigned URL Example: Public

```
$ cat > hello.txt
Hello There

$ aws s3 cp hello.txt s3://terrywbrady-test-ucop-public/ --acl
public-read
upload: ./hello.txt to s3://terrywbrady-test-ucop-public/hello.txt

$ curl
https://terrywbrady-test-ucop-public.s3-us-west-2.amazonaws.
com/hello.txt
Hello There
```

Presigned URL Example – Non-public S3 Object

```
$ aws s3 cp hello.txt
s3://terrywbrady-test-ucop-public/nonpublic.txt
upload: ./hello.txt to
s3://terrywbrady-test-ucop-public/nonpublic.txt

$ curl
https://terrywbrady-test-ucop-public.s3-us-west-2.amazonaws.com/
nonpublic.txt
<Error><Code>AccessDenied</Code><Message>Access
Denied</Message>...
```

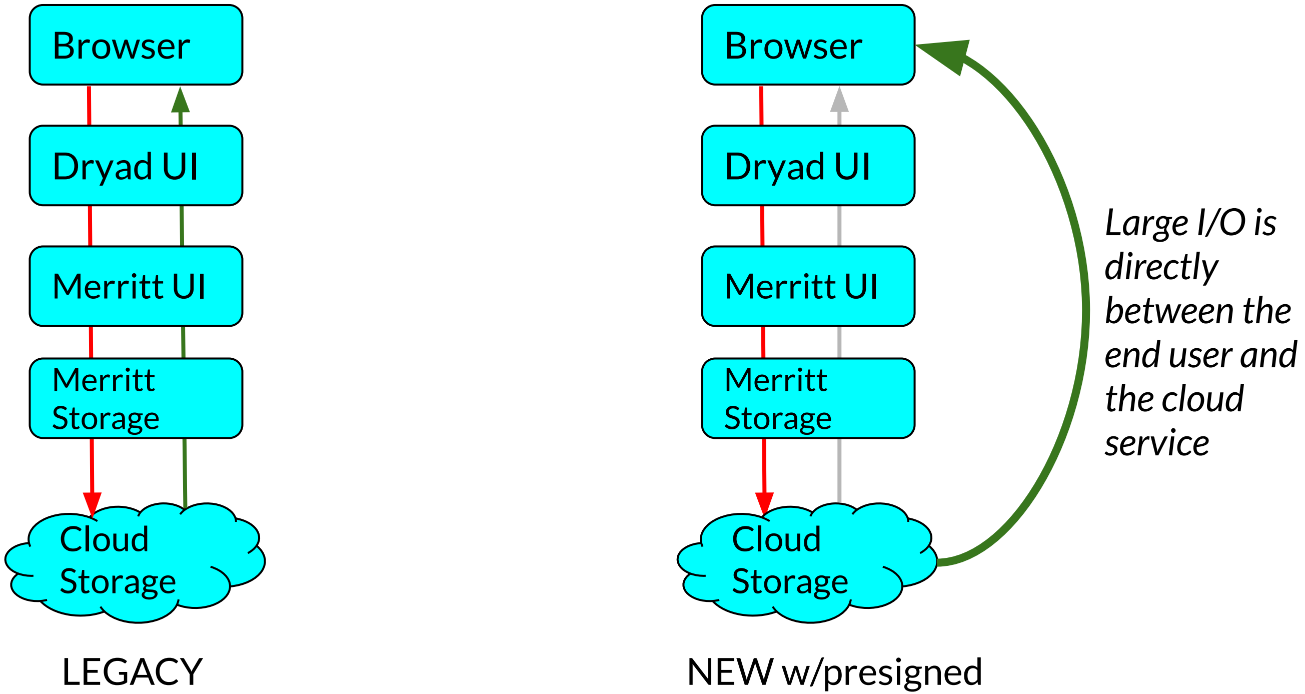
Presigned URL Example – Non-public S3 Object

```
$ aws s3 presign s3://terrywbrady-test-ucop-public/nonpublic.txt

https://terrywbrady-test-ucop-public.s3.amazonaws.com/nonpublic.txt?AWSAccessKeyId=AKIAYOGNF7UOV5VSVMJR&Expires=1591999565&Signature=zppZEk83FBk6UtlNTqmD5ZR3EOA%3D

$ curl "https://terrywbrady-test-ucop-public.s3.amazonaws.com/nonpublic.txt?AWSAccessKeyId=AKIAYOGNF7UOV5VSVMJR&Expires=1591999565&Signature=zppZEk83FBk6UtlNTqmD5ZR3EOA%3D"
    Hello There
```

File Requests



Large I/O is directly between the end user and the cloud service

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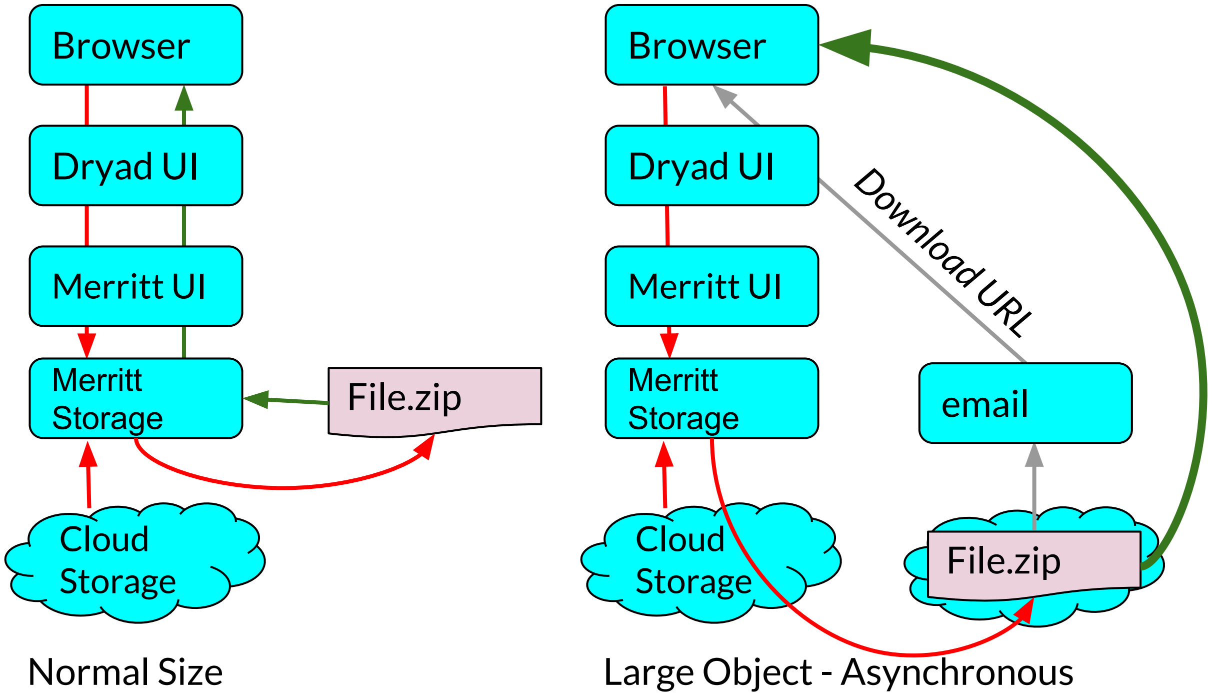
Object Requests (legacy)



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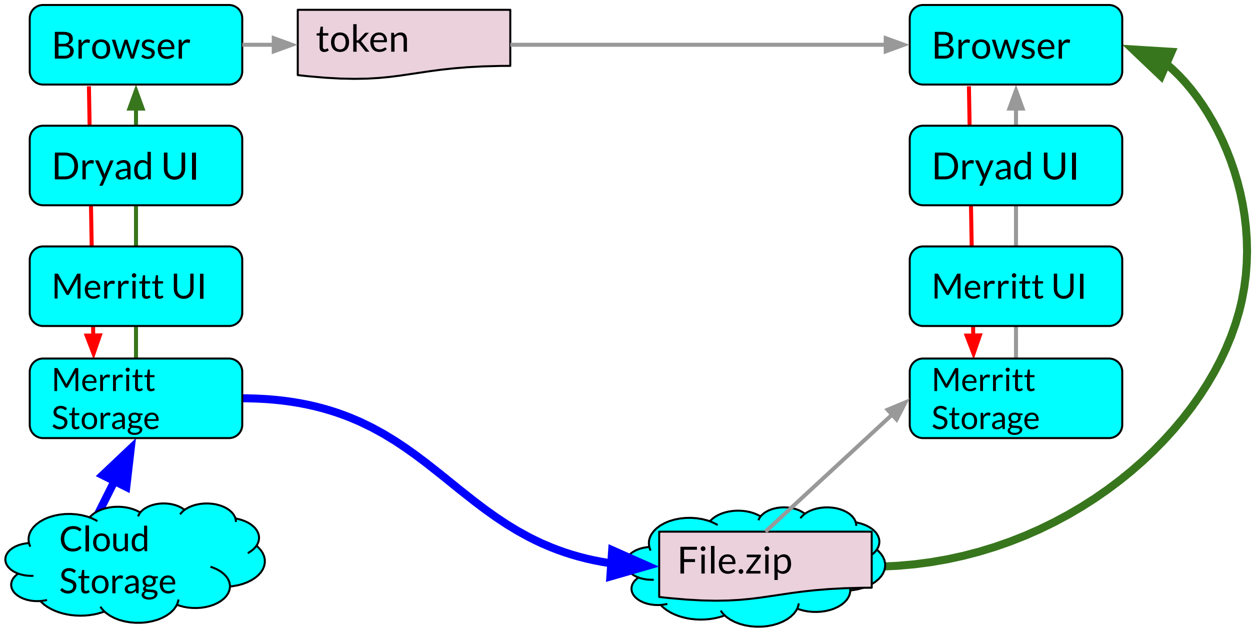
Object Requests (presigned)



All object requests are asynchronous using presigned URLs

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AWS usage change

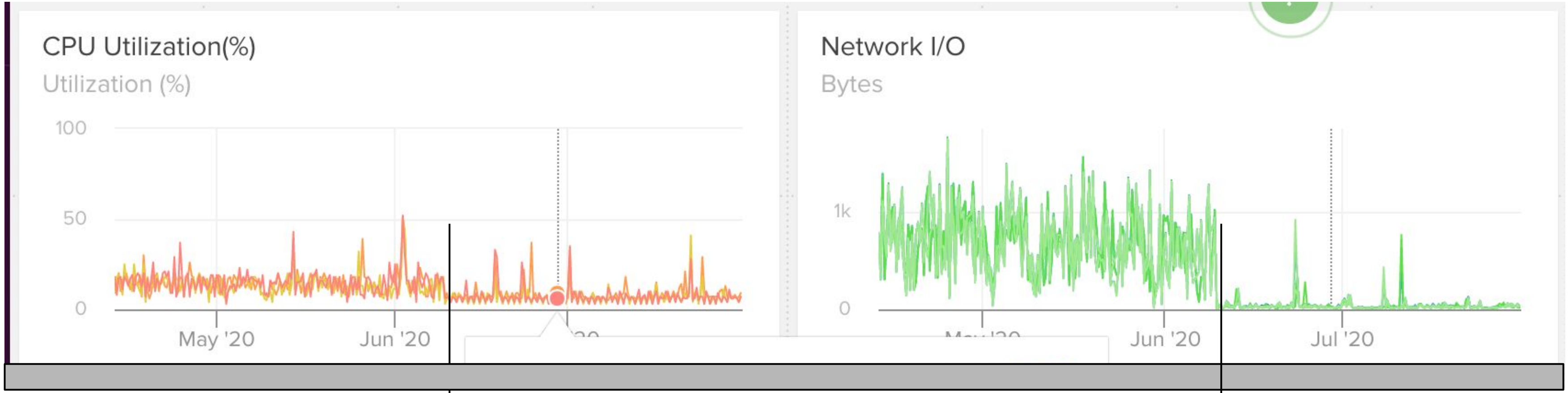
Before

- CPU utilization and Network I/O on Merritt UI hosts was consistently high due to the streaming content back to Dryad.

After

- Network I/O transactions were greatly reduced. CPU utilization also lessened.

Server metrics and the presigned effect



Before | After

Before | After

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Going forward – What about user uploads?

Dryad Presigned Uploads – Went live in March

- AJAX call to authorize an S3 upload and obtain a secure, presigned URL
- Evaporate.js is used to chunk user files into parts
- Upon upload completion, all parts are reassembled via an AWS command
- A manifest is delivered to Merritt for ingest

Dryad deposits in Zenodo

Every dataset is subsequently deposited in Zenodo

- Presigned URLs are used to first download content from S3 – it is then staged for streaming up to Zenodo.
- If a dataset contains software, Dryad now supports sending software files directly to Zenodo.
- All Zenodo deposits are tracked via DOI.

Future plans for Merritt

- Learning from Dryad team’s experience with uploads.
- Presigned upload implementation in Ruby and Java
- Recording Zenodo DOIs with associated Merritt objects

Brightening an Archive

The goal of refined integration with Dryad drove us to make these improvements.

- Resulting API endpoints can be used to obtain *any* file or object in Merritt.
- Serve as building blocks for campuses and institutions, enabling the construction of access layers directly on top of a preservation repository.

Demo

- Let’s retrieve a Dryad dataset object.
- Review an example of a dataset with software.

Questions?

DRYAD

Merritt