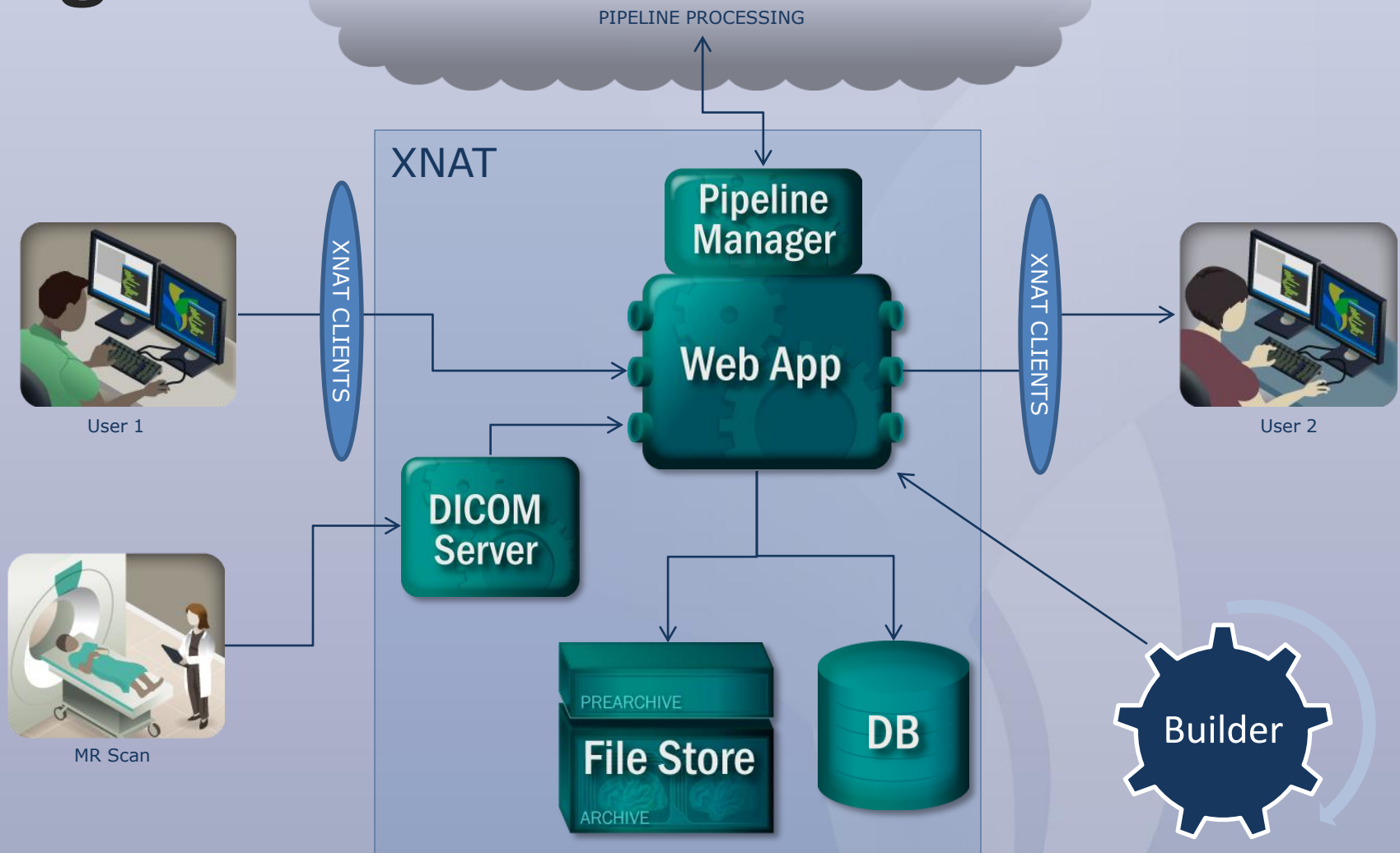# XNAT RESTful Web Services
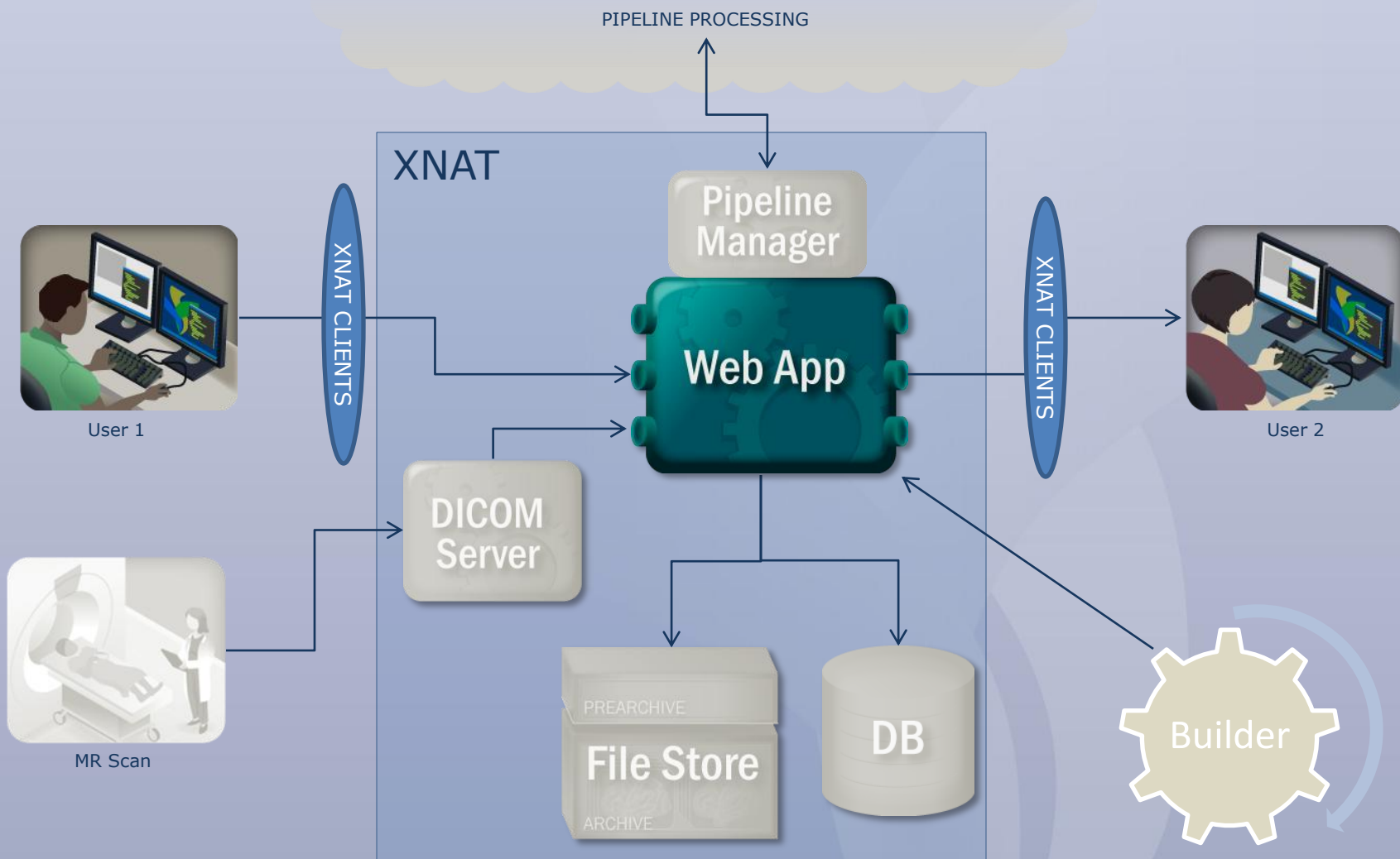
A guide to the ins and outs of XNAT's favorite API

Tim Olsen

XNAT

Big Picture

In this talk

Plan

- Why REST?
- Describe XNAT's RESTful services
- Uploading via REST
- Downloading via REST
- REST in practice (examples)

XNAT

Why REST?

- History
  - SOAP, ArcGet, ArcPut, StoreXAR, StoreXML
  - Cumbersome, Difficult in some languages
- URIs uniquely identify resources (meta & file)
- Uses basic HTTP model
- REST, REST-ful, REST-like
  - HTTP Sessioning

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Navigating XNAT via REST

- Browser (GET only)
- Browser Form
- XNATRestClient
- Rest-client (google-code)
- curl

XNAT REST Output formats

- Individual Items
  - XML
  - HTML
- Listings
  - JSON
  - XML
  - HTML
  - CSV
- Usage: ACCEPT header or ?format=xml

XNAT REST: Authentication

- Basic Authentication (Base 64 encoding)
- JSESSIONID Cookie (HTTP Session)
  - Session expires
  - 15 minute default
  - Configurable in web.xml
- Future OAuth support?

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XNAT and REST

- XNAT data model= Addressable Resources
  – Projects, Subjects, Experiments, Resources,
    Files, Users, Pipelines

DEMO simple walkthrough

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XNAT URIs: Users

[/users](#)

    [**GET** / PUT / POST / DELETE]

[/users/{ID | username | email}](#)

    [**GET** / PUT / POST / DELETE]

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XNAT URIs: Projects

 /projects
        [**GET** / PUT / **POST** / DELETE]
/projects/{ID}
        [**GET** / **PUT** / POST / **DELETE**]
/projects/{ID}/prearchive_code
        [**GET** / PUT / POST / DELETE]
/projects/{ID}/prearchive_code/{0-4}
        [GET / **PUT** / POST / DELETE]
/projects/{ID}/quarantine_code
        [**GET** / PUT / POST / DELETE]
/projects/{ID}/quarantine_code/{0-1}
        [GET / **PUT** / POST / DELETE]
/projects/{ID}/accessibility
        [**GET** / PUT / POST / DELETE]
/projects/{ID}/accessibility/{public | protected | private}
        [GET / **PUT** / POST / DELETE]

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XNAT URIs: Project Users

/projects/{ID}/users

    [**GET** / PUT / POST / DELETE]

/projects/{ID}/users/members/{ID | username | email}

    [**GET** / **PUT** / POST / **DELETE**]

/projects/{ID}/users/collaborators/{ID | username | email}

    [**GET** / **PUT** / POST / **DELETE**]

/projects/{ID}/users/owners/{ID | username | email}

    [**GET** / **PUT** / POST / **DELETE**]

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XNAT URIs: Project Data

/projects/{ID}/subjects
    [**GET** / PUT / **POST** / DELETE]

/projects/{ID}/subjects/{ID | label}
    [**GET** / **PUT** / POST / **DELETE**]

/projects/{ID}/subjects/{ID | label}/experiments
    [**GET** / PUT / **POST** / DELETE]

/projects/{ID}/subjects/{ID | label}/experiments/{ID | label}
    [**GET** / **PUT** / POST / **DELETE**]

/projects/{ID}/subjects/{ID | label}/experiments/{ID | label}/status
    [**GET** / PUT / POST / DELETE]

/projects/{ID}/subjects/{ID | label}/experiments/{ID | label}/assessors
    [**GET** / PUT / **POST** / DELETE]

/projects/{ID}/subjects/{ID | label}/experiments/{ID | label}/assessors/{ID | label}
    [**GET** / **PUT** / POST / **DELETE**]

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XNAT URIs: Project Files

/projects/{ID}/files/{FILENAME}

    [**GET** / **PUT** / POST / **DELETE**]

/projects/{ID}/resources

    [**GET** / PUT / **POST** / DELETE]

/projects/{ID}/resources/{ID}

    [**GET** / **PUT** / POST / **DELETE**]

/projects/{ID}/resources/{ID}/files

    [**GET** / PUT / **POST** / DELETE]

/projects/{ID}/resources/{ID}/files/{FILENAME}

    [**GET** / **PUT** / POST / **DELETE**]

XNAT URIs: Subject Files

/projects/{ID}/subjects/{ID | label}/files/{FILENAME}

> [**GET** / **PUT** / POST / **DELETE**]

/projects/{ID}/subjects/{ID | label}/resources

> [**GET** / PUT / **POST** / DELETE]

/projects/{ID}/subjects/{ID | label}/resources/{ID}

> [**GET** / **PUT** / POST / **DELETE**]

/projects/{ID}/subjects/{ID | label}/resources/{ID}/files

> [**GET** / PUT / **POST** / DELETE]

/projects/{ID}/subjects/{ID | label}/resources/{ID}/files/{FILENAME}

> [**GET** / **PUT** / POST / **DELETE**]

XNAT URIs: Experiment Files

/projects/{ID}/subjects/{ID | label}/experiments/{ID | label}/...
    Or /experiments/{ID}/...

.../files/{FILENAME}
    [**GET** / **PUT** / POST / **DELETE**]
.../resources
    [**GET** / PUT / **POST** / DELETE]
.../resources/{LABEL | ID}
    [**GET** / **PUT** / POST / **DELETE**]
.../resources/{LABEL | ID}/files
    [**GET** / PUT / **POST** / DELETE]
.../resources/{LABEL | ID}/files/{FILENAME}
    [**GET** / **PUT** / POST / **DELETE**]

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XNAT URIs: Scans

/projects/{ID}/subjects/{ID | label}/experiments/{ID | label}/scans
   Or /experiments/{ID}/scans

.../scans
   [**GET** / PUT / **POST**/ DELETE]
.../scans/{ID}
   [**GET** / **PUT** / POST / **DELETE**]
.../scans/{ID}/files/{FILENAME}
   [**GET** / **PUT** / POST / **DELETE**]
.../scans/{ID}/resources
   [**GET** / PUT / **POST**/ DELETE]
.../scans/{ID}/resources/{ID}
   [**GET** / **PUT** / POST / **DELETE**]
.../scans/{ID}/resources/{ID}/files/{FILENAME}
   [**GET** / **PUT** / POST / **DELETE**]

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XNAT URIs: Recontstructions

/projects/{ID}/subjects/{ID | label}/experiments/{ID | label}/reconstructions
  Or /experiments/{ID | label}/reconstructions

…/reconstructions
    [**GET** / PUT / **POST**/ DELETE]
…/reconstructions/{ID}
    [**GET** / **PUT** / POST / **DELETE**]
…/reconstructions/{ID}/{in | out}/files/{FILENAME}
    [**GET** / **PUT** / POST / **DELETE**]
…/reconstructions/{ID}/{in | out}/resources
    [**GET** / PUT / **POST**/ DELETE]
…/reconstructions/{ID}/{in | out}/resources/{ID}
    [**GET** / **PUT** / POST / **DELETE**]
…/reconstructions/{ID}/{in | out}/resources/{ID}/files/{FILENAME}
    [**GET** / **PUT** / POST / **DELETE**]

Note: Resources accessible as input or output files.

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XNAT URIs: Image Assessors

/projects/{ID}/subjects/{ID | label}/experiments/{ID | label}/assessors
   Or /experiments/{ID | label}/assessors

.../assessors
   [**GET** / PUT / **POST**/ DELETE]
.../assessors/{ID}
   [**GET** / **PUT** / POST / **DELETE**]
.../assessors/{ID}/{in | out}/files/{FILENAME}
   [**GET** / **PUT** / POST / **DELETE**]
.../assessors/{ID}/{in | out}/resources
   [**GET** / PUT / **POST**/ DELETE]
.../assessors/{ID}/{in | out}/resources/{ID}
   [**GET** / **PUT** / POST / **DELETE**]
.../assessors/{ID}/{in | out}/resources/{ID}/files/{FILENAME}
   [**GET** / **PUT** / POST / **DELETE**]

XNAT URIs: Sharing

/projects/{ID}/subjects/{ID | label}/projects
    [**GET** / PUT / POST / DELETE]

/projects/{ID}/subjects/{ID | label}/projects/{OTHER_PROJECT_ID}
    [GET / **PUT** / POST /**DELETE**]

/projects/{ID}/subjects/{ID | label}/experiments/{ID | label}/projects
    [**GET** / PUT / POST / DELETE]

/projects/{ID}/subjects/{ID | label}/experiments/{ID | label}/projects/{OTHER_PROJECT_ID}
    [GET / **PUT** / POST /**DELETE**]

/projects/{ID}/subjects/{ID | label}/experiments/{ID | label}/assessors/{ID | label}/projects
    [**GET** / PUT / POST / DELETE]

/projects/{ID}/subjects/{ID | label}/experiments/{ID | label}/assessors/{ID | label}/projects/{OTHER_PROJECT_ID}
    [GET / **PUT** / POST /**DELETE**]

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XNAT URIs: Search

/search
> [GET / PUT / **POST** / DELETE]

/search/ID
> [**GET** / PUT / POST / DELETE]

/search/saved
> [**GET** / PUT / **POST** / DELETE]

/search/saved/{ID}
> [**GET** / **PUT** / POST / **DELETE**]

/search/saved/{ID}/results
> [**GET** / PUT / POST / DELETE]

/search/elements
> [**GET** / PUT / POST / DELETE]

/search/elements/{element_name}
> [**GET** / PUT / POST / DELETE]

XNAT URIs: Pipelines

/pipelines

[**GET** / PUT / POST / DELETE]

/pipelines/{PIPELINE_PATH}

[**GET** / **PUT** / POST / **DELETE**]

/projects/{ID}/pipelines

[**GET** / PUT / POST / DELETE]

/projects/{ID}/pipelines/{PIPELINE_PATH}

[**GET** / **PUT** / POST / **DELETE**]

Uploading data

- Creating XNAT-elements
  - Project, Subject, MR, scans, etc
- Uploading files
- Examples

Creating XNAT-elements

- Post XML
  - In body
  - As parameter of form data
- Post form data parameters
- Use query string parameters
  - Separated from URI by ?
  - Separated from each other by &

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Creating Meta-elements

- Adding via parameters:
  - XML Path
    - xnat:mrSessionData/label=123532
    - xnat:mrSessionData/scanner=1.5T Somewhere
  - XML Path shortcuts
    - label=123532
    - scanner=1.5T Somewhere
    - http://xnat.wikispaces.com/XNAT+REST+XML+Path+Shortcuts
  - req_format=qs VS req_format=xml

Creating Meta-elements

- xsiType

  - Used to specify xsi:type when not obvious

    - /experiments

    - /scans

    - /assessors

  - Example:
    /experiments?xsiType=xnat:mrSessionData

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Uploading Files

- Attach as Multi-part form data

OR

- Write directly in body of message
  - ?inbody=true
  - Default behavior of curl

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Uploading Files: Resources

- Files should always be grouped in resources
  - Use a resource label
    - Brief
    - Unique
    - Descriptive

Example:

.../resources/**DICOM**/files/000120202.dcm

Uploading Files: Compressed

- XNAT can extract zip files on server
  - Use ?extract=true
  - Otherwise, file will remain compressed

FYI, you can download individual files out of zip files on the server like this:

.../files/data1.zip/subfolder/file1.dcm

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Examples

- Bash script for uploading mixed scan data
  - Create projects, subjects, sessions, scans
  - Upload scan files

- Display Script

Downloading Data

- Basic downloading
- Compressed downloads
- Groupings
- Examples

XNAT

Downloading Data

- ## List resources
  - /experiments/ID/scans/ID/resources

- ## List files
  - /experiments/ID/scans/ID/resources/DICOM/files

- ## Retrieve files
  - /experiments/ID/scans/ID/resources/DICOM/files/03220325.dcm

Downloading Data: Compressed

- Add ?format=zip to compress files
- Can be used on any URI that returns a listing of files

Example:

/experiments/ID/scans/ID/resources/DICOM/files?format=zip

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Downloading Data: Groupings

- Combine multiple URIs
- Available on:
  - scans, reconstructions, assessors, resources
- Formats
  - Comma-separated values
  - ALL keyword
  - Grouping by type

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Downloading Data: Groupings

- Comma-separated values
  - /experiments/ID/scans/1,2,3/resources/DICOM/files?format=zip
  - /experiments/ID/scans/1,2,3/resources/DICOM,SNAPSHOT/files?format=zip
- ALL keyword
  - /experiments/ID/scans/1,2,3/resources/ALL/files?format=zip
  - /experiments/ID/scans/ALL/resources/DICOM/files?format=zip

Note: What happens when scan 2 is missing?

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Downloading Data: Groupings

- By type:
  - Scan type
  - Reconstruction type
  - Assessor XSI Type
- Examples
  - /experiments/ID/scans/T1/resources/DICOM/files?format=zip
  - /experiments/ID/scans/T1,T2/resources/DICOM/files?format=zip

Links

- http://xnat.wikispaces.com/Web+Services

- CURL: http://curl.haxx.se/

- Rest-client: http://code.google.com/p/rest-client/

Questions

- ???

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