



Exercise DICOM & FHIR

Track : Imaging

Speaker: Mohannad Hussain

The speaker will be in the hands-on area to answer your questions!

We will explore how data discovery begins with the FHIR resources and correlates all the way down to the DICOM resources (e.g. images).

Before you start...

This tutorial will use Internet-based servers, provided courtesy of the Society of Imaging Informatics in Medicine (SIIM, see <http://siim.org/hackathon> for more information). For your requests to work, please ensure the following http header is included:

HTTP header name	HTTP Header value
apikey	HackathonOrientationSession

The following exercises are progressive, and each step builds on the previous steps, so you should try them out in sequence. Making HTTP requests as described below can be done with your favourite tools. One prime example is Postman (<https://www.getpostman.com/>) but other tools can be used too, including command-line tools like cURL.

Have fun, and remember to ask for help if you get stuck!

Search for a Patient in FHIR

We will search our example FHIR server for patients by the identifier using the following URL:

`http://hackathon.siim.org/fhir/Patient/siimjoe/`

The URL above defaults to returning in JSON format. If you prefer XML, add the following header:

HTTP header name	HTTP Header value
Accept	text/xml



Look at an "ImagingStudy" of this patient in FHIR

You could search FHIR for ImagingStudy resources of that patient from the last exercise, if we picked the identifier of one of them, we can then look at its information like so:

<http://hackathon.siim.org/fhir/ImagingStudy/a257132503242682/>

Typically, FHIR can store a pointer to the DICOMweb resources for a given study in attributes like "endpoint" or "url" but it is not always guaranteed. The SIIM server has it, so have a look at those endpoints, and you can copy/paste them for the next exercise, or form the URL by hand.

We're most interested in the study instance UID (1.3.6.1.4.1.14519.5.2.1.7777.9002.198875685720513246512710453733), which is the most definitive identifier in DICOM (guaranteed to be unique).

Discover the study structure in DICOM

Now we turn our attention to the DICOM server (usually known as the PACS or VNA), to discover what resources are within that study via the following URL:

<http://hackathon.siim.org/dicomweb/studies/1.3.6.1.4.1.14519.5.2.1.7777.9002.198875685720513246512710453733/instances>

Notice how the DICOM server here defaults to XML. If you want to switch to JSON, use:

HTTP header name	HTTP Header value
Accept	application/json

Notice how DICOMweb returns "chunks" of data as an HTTP multipart response when returning XML, but returns in one "part" if using JSON.

Some attributes of interest:

- SOP Instance UID
- Modality
- Retrieve URL
- Series Number
- Instance Number

Let's see some images!

DICOMweb's WADO-RS service allows for retrieval of images using a format like this

<http://hackathon.siim.org/dicomweb/studies/1.3.6.1.4.1.14519.5.2.1.7777.9002.198875685720513246512710453733/series/1.3.6.1.4.1.14519.5.2.1.7777.9002.207203214132667549392101803048/instances/1.3.6.1.4.1.14519.5.2.1.7777.9002.327873213718058651550666129029/frames/1>



Along with this header:

HTTP header name	HTTP Header value
Accept	multipart/related; type=image/dicom+jpeg

The /frames/1 part is mandated by our DICOM server implementation and not by the standard. Also notice how the return is again in multipart HTTP.

An alternative is to use the older standard of WADO-URI, which is a lot more widely supported at this time:

```
http://hackathon.siiim.org/wadouri/?requestType=WADO&contentType=image/jpeg&
studyUID=1.3.6.1.4.1.14519.5.2.1.7777.9002.198875685720513246512710453733&s
eriesUID=1.3.6.1.4.1.14519.5.2.1.7777.9002.207203214132667549392101803048&o
bjectUID=1.3.6.1.4.1.14519.5.2.1.7777.9002.327873213718058651550666129029
```

Should return an image in JPEG format. You could also use PNG by changing the content type URL argument.

BONUS: Data discovery in DICOMweb

DICOMweb allows you to search “ImageStudy” resources for a patient using attributes like Patient Name, Patient ID (AKA MRN). Here’s an example:

```
http://hackathon.siiim.org/dicomweb/studies/?PatientName=SIIM^Joe
```

Notice DICOM’s formatting of the Patient Name. If you wanted to search by last name only, put in SIIM*

BONUS: Bulk retrieval of a study in DICOMweb

Say we want to download the entire DICOM study so we can use a local DICOM viewer (e.g. Micro DICOM or DVTk Viewer). The following URL comes to our rescue:

```
http://hackathon.siiim.org/dicomweb/studies/1.3.6.1.4.1.14519.5.2.1.7777.900
2.198875685720513246512710453733
```

Notice how it returns two chunks in an HTTP multipart response. That means the study contained two DICOM objects (could be two images, but they could be other object types). Each part contains the raw (i.e. binary) DICOM data which can be written as-is to a file then opened in the DICOM viewer.