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DICOM in Dart (DCMiD)

Project 13

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Mentor: Dr. James Philbin

Topic and Goal

Determine the feasibility of using binary DICOM for building browser based medical imaging applications

Method:

- Design and implement a DICOM editor that reads and writes binary DICOM and displays it using HTML5, CSS3 and the Dart programming language.
- Test performance by reading, displaying and writing DICOM studies in binary format.
- Goal: Read and display imaging studies in less than 3 seconds.

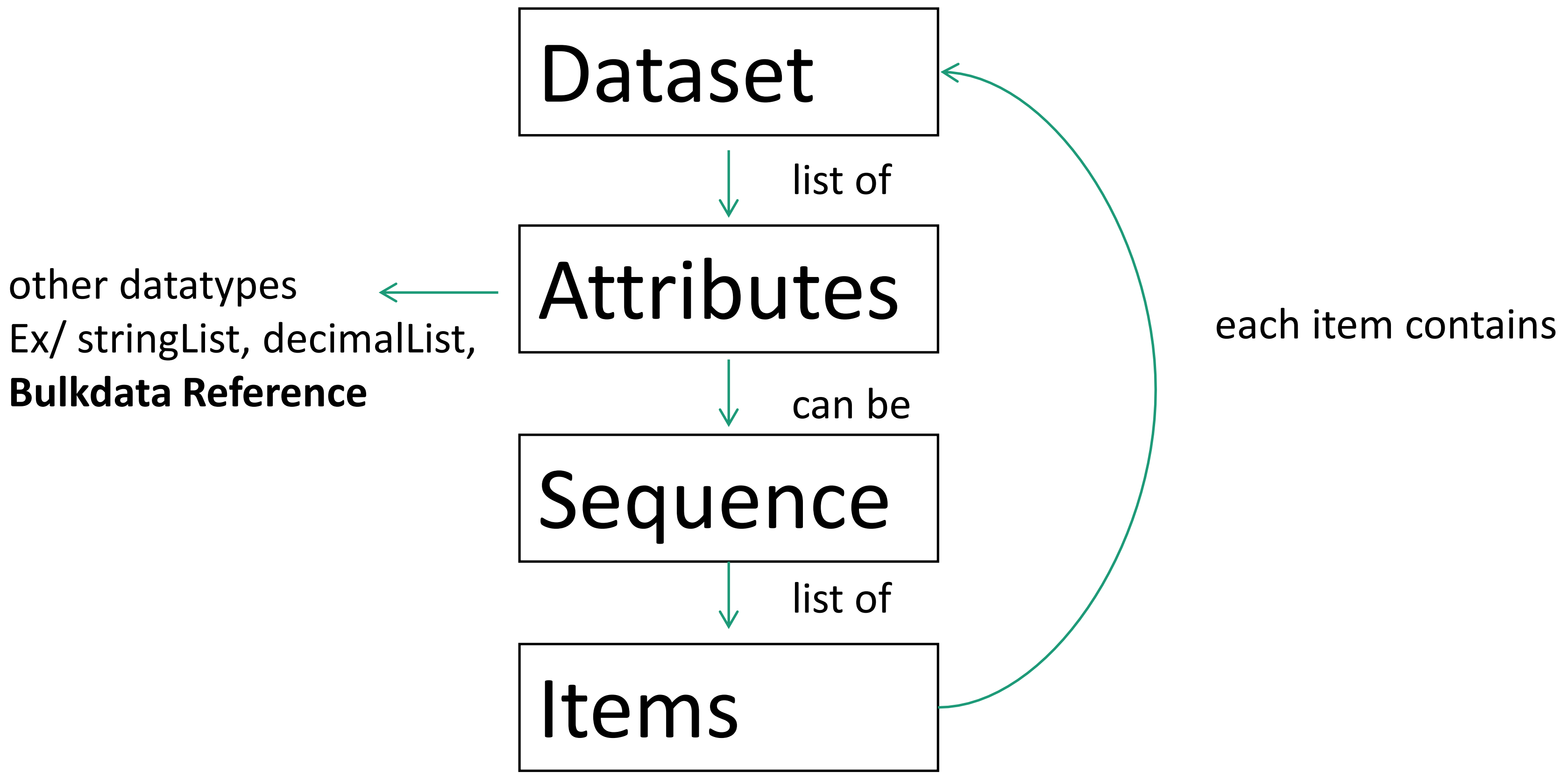
DICOM℠
Digital Imaging and Communications in Medicine

Dart

Dependencies

- ✓ Access to our mentor
- ✓ Computer to write code
- ✓ Bitbucket to share code
- ✓ Dart & DICOM Reference Information
- ✓ Access to DICOM Test Data

DICOM Review



Dart

- **define members whose body returns a single expression**
  - bobLikes() => isDeepFried || (hasPieCrust && !vegan);
- **‘?’ can be used in place of “if-else” statements**
  - a = condition ? b: c
- **Function expressions**
  - var names = people.map((person) => person.name);
- **Underscores for private methods and variables**
  - int _test;
- **Getters and setters**
  - int get test => this._test;

  -
    ```
    void set test (int value) {
        this._test = value;
    }
    ```

* Example code from https://www.dartlang.org/articles/style-guide/

Work To Date

- Our parsing and writing is functional
  - Binary parsers
  - String parsers
  - Data structure
  - Created classes
    - DateTime to override Dart’s DateTime class
      - Needed to write more accurate time
  - Write Output
- Validating parsers with testing
- Developing the basic skeleton of UI for end-point user

Example code

- Binary data is being stored as ByteData in our ByteBuffer class
- Bytedata has a lot of built in functions for binary data types, int in general
    - int getInt8
    - Int getUint32

```
int readUint8() {
    var val = _bd.getUint8(_chkRdIdx(_rdIdx));
    _rdIdx += _int8Size;
    return val;
}
```

* Example code from our bytebuf.dart class

*_bd is the internal ByteData representation of our binary data.

Future

- Give values when it becomes available
- Do not have to parse in time with everything else
- Asynchronous model for functions doing potentially expensive work

```
static readFile(File file) {
   Future handler = file.readAsBytes();
   handler.then((Uint8List bytes) {
     return new ByteBuf.fromBytes(bytes);
   });
}
```

*Example code from our bytebuf.dart class:

Problems

- Updating our code outline as we learn more about Dart
- We have found better ways to structure our code and have been forced to redo pieces of it.
- Parsers have not been affected, but how we handle input and the underlying data structure has had to be rewritten.
- As a result, the tests have to be updated as the methods are reorganized and optimized
    - Complete validation of output can be formally done once the parsers are finalized using unit tests

```
void main() {
  test('Addition test', () {
    expect(2 + 2 == 4, isTrue);
  });
}
```

```
4 PASSED, 1 FAILED, 0 ERRORS
```

What we plan to do

- To continue toward our maximum deliverables, we chose to split the upcoming tasks
  - Optimize parsers (Damish)
  - Validate the most recent version of code (Both)
  - Finish the user interface (Danielle)

- Continue our current frequency of meetings
  - Monday and Thursday at 9:30 with our mentor
  - Sunday, Monday, Wednesday, Friday at 10:00 as a team

Deliverables

- Minimum deliverables (March 20) → (April 5)
  - ✓ Read and display DICOM in a browser and then write it
  - Build a test program that compares input and output to validate correctness (in progress)
  - Create unit tests for each class (in progress)
- Expected deliverables (April 3) → (April 8)
  - Display a work list of studies of n patients (in progress)
  - Display patient as collapse/expand tree for study information model (in progress)
- Maximum deliverables (May 1)
  - Display images
  - ~~Add overlay information~~ (abandoned due to time)
  - Edit metadata
  - Encrypt and decrypt studies using AES (GCM) using an encryption framework created at Hopkins Security Institute → (Summer 2014)

Updated Project Plan

- **February 20:** Have project proposal finished and all of the programming planned and reviewed by Dr. Philbin
- **March 6:** Read input (parse)
- **March 20 → April 5:** Write and validate output
- **April 3 → April 8:** HTML5/CSS3 display metadata
- **May 1:** Display images
- **May 9:** Final Poster Presentation

	Feb		Mar				Apr										May	
	20	27	6	13	20	27	3	4	5	6	7	8	9	10	17	24	1	9
Project Proposal	🟩																	
Read input (parse)	🟩	🟩	🟩	🟩	🟥	🟨	🟨	🟨	🟨									
Validate output			🟩	🟩	🟩	🟩	🟩	🟩	🟥	🟨	🟨	🟨						
Display metadata in browser						🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩			
Display images													🟩	🟩	🟩	🟩	🟥	
Final Presentation																	🟩	🟥

Questions?