



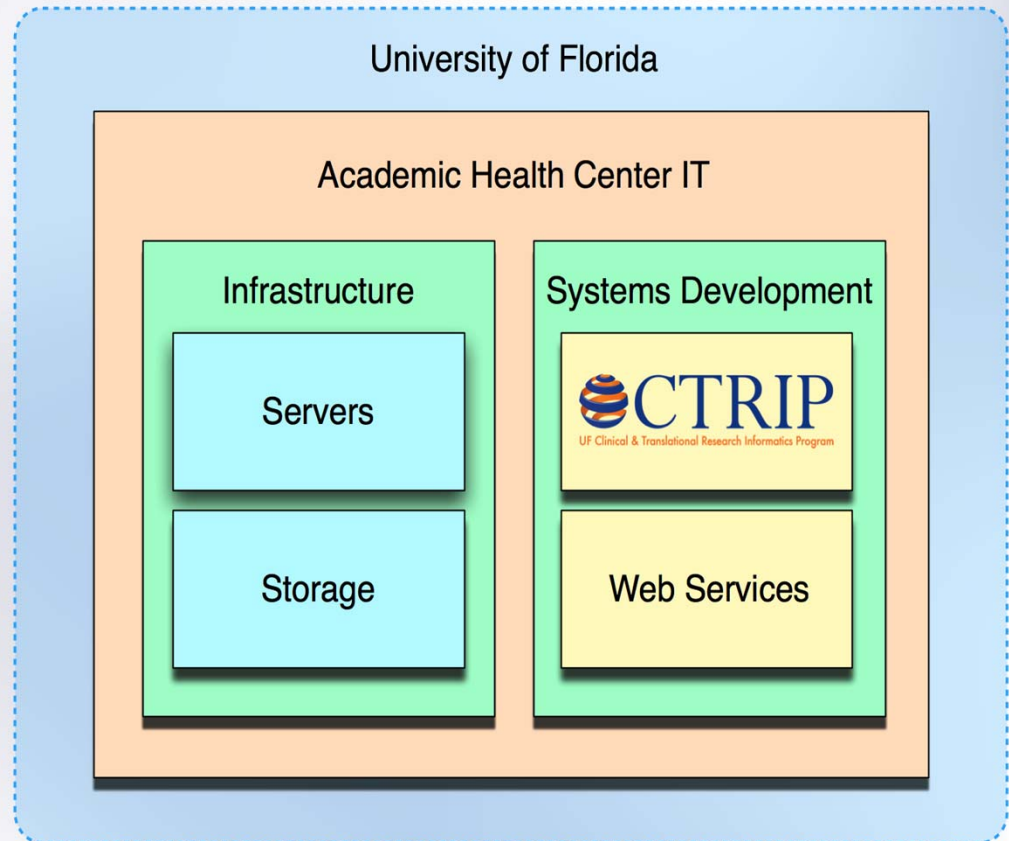
Informatics Systems for ImagingDMD Multicenter Study

Narayan Raum

Clinical & Translational Research Informatics Program www.ctrip.ufl.edu

University of Florida AHC & CTRIP

- 25 Software Engineers in CTRIP
- 100+ active and supported projects
- Informatics support for:
 - Univ. of Florida
 - Grants, contracts
 - State, Federal and Private entities

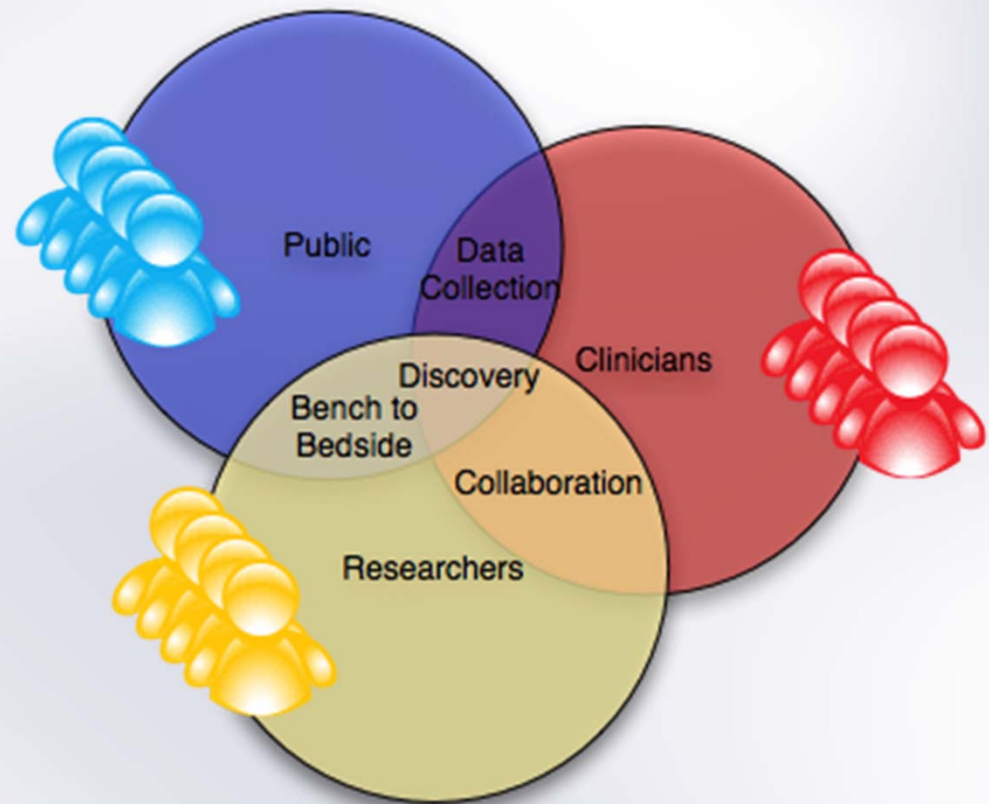


Primary Goals

- Engineer solutions and systems to facilitate the ImagingDMD study
- Leverage open source technologies
- Assist and support research team from technical and operational standpoint

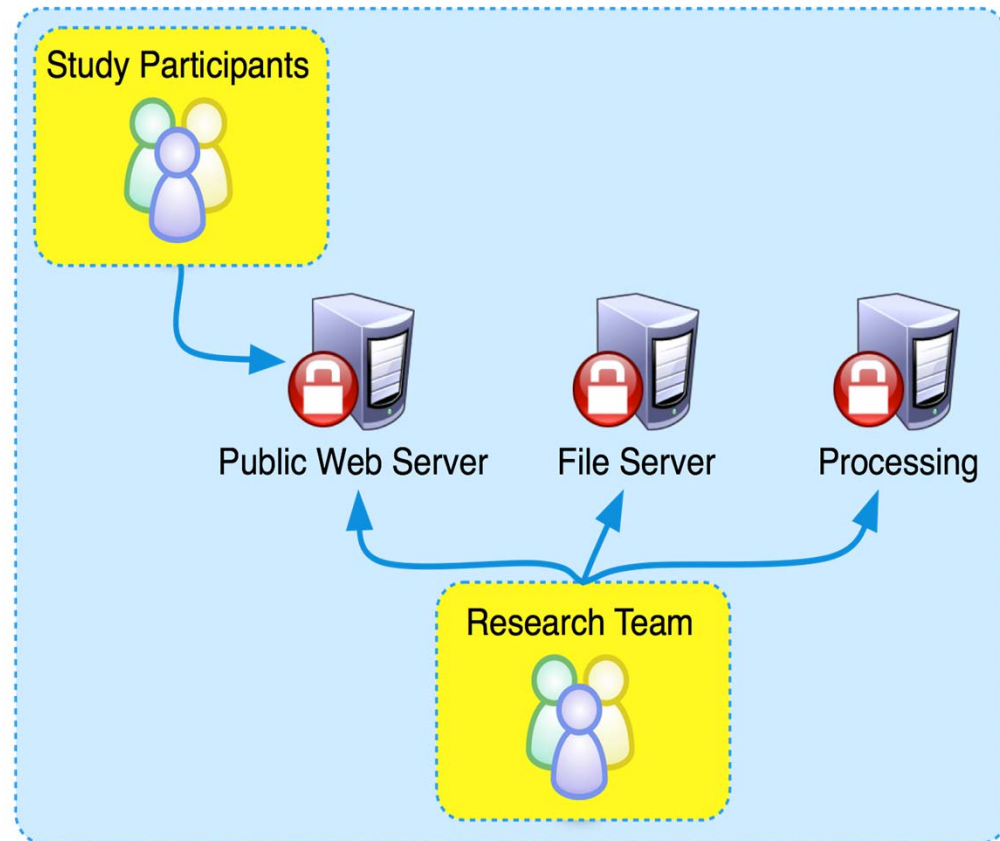
Ultimate goal: Discovery

- Public informed and enrolled in study
- Data collection and management
- Query and analysis of data

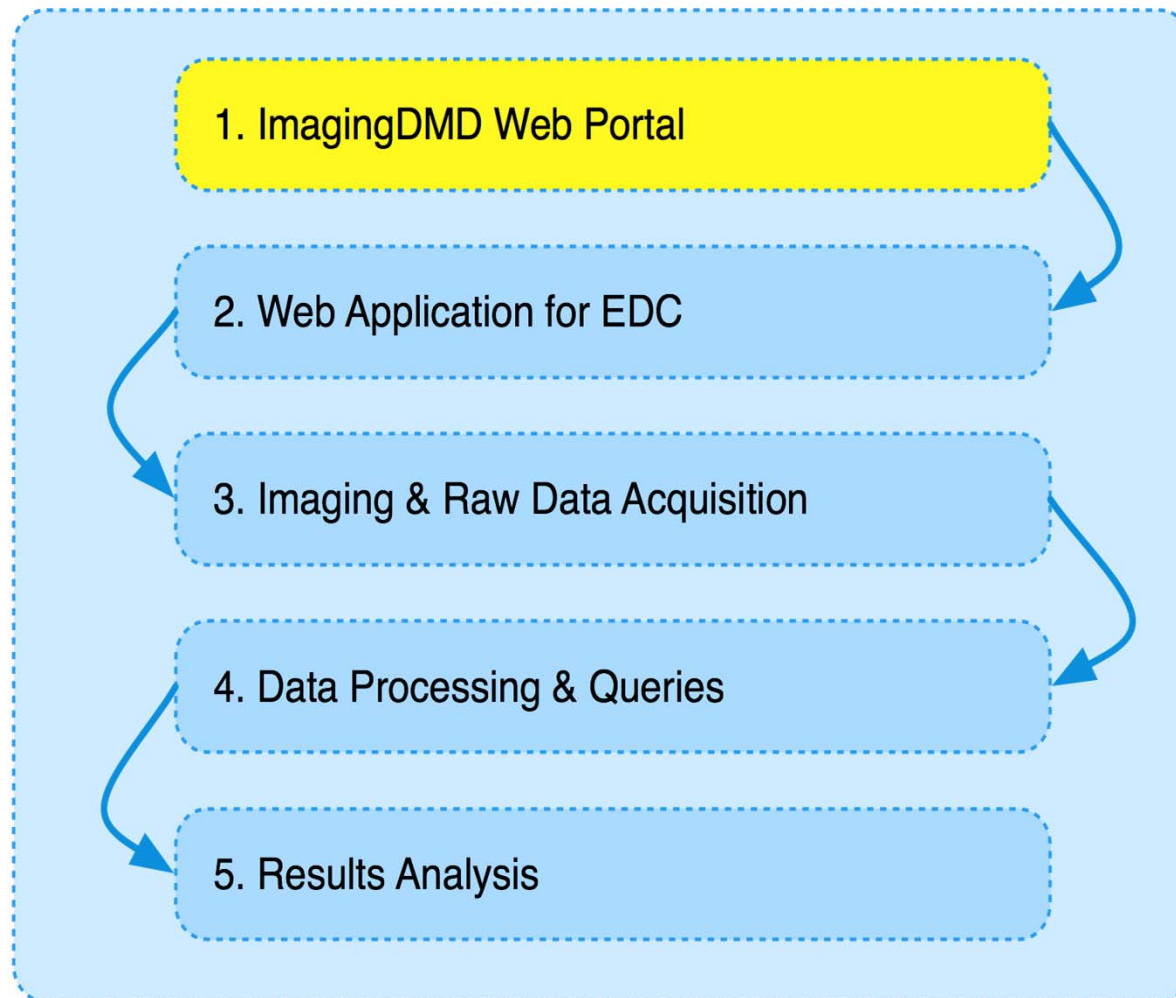


ImagingDMD Systems Overview

- Public web server
 - ImagingDMD portal
 - EDC Application
 - File transfer access
- File server
 - MR Storage
 - All other files related to subject
- Processing Server
 - IDL/Matlab
 - MySQL
- Multi-site systems
 - centrally managed data
 - Sites see own data only
 - Flexible access control lists
 - Low operating costs
- Expandable
 - Add on studies
 - New projects
 - Low startup costs

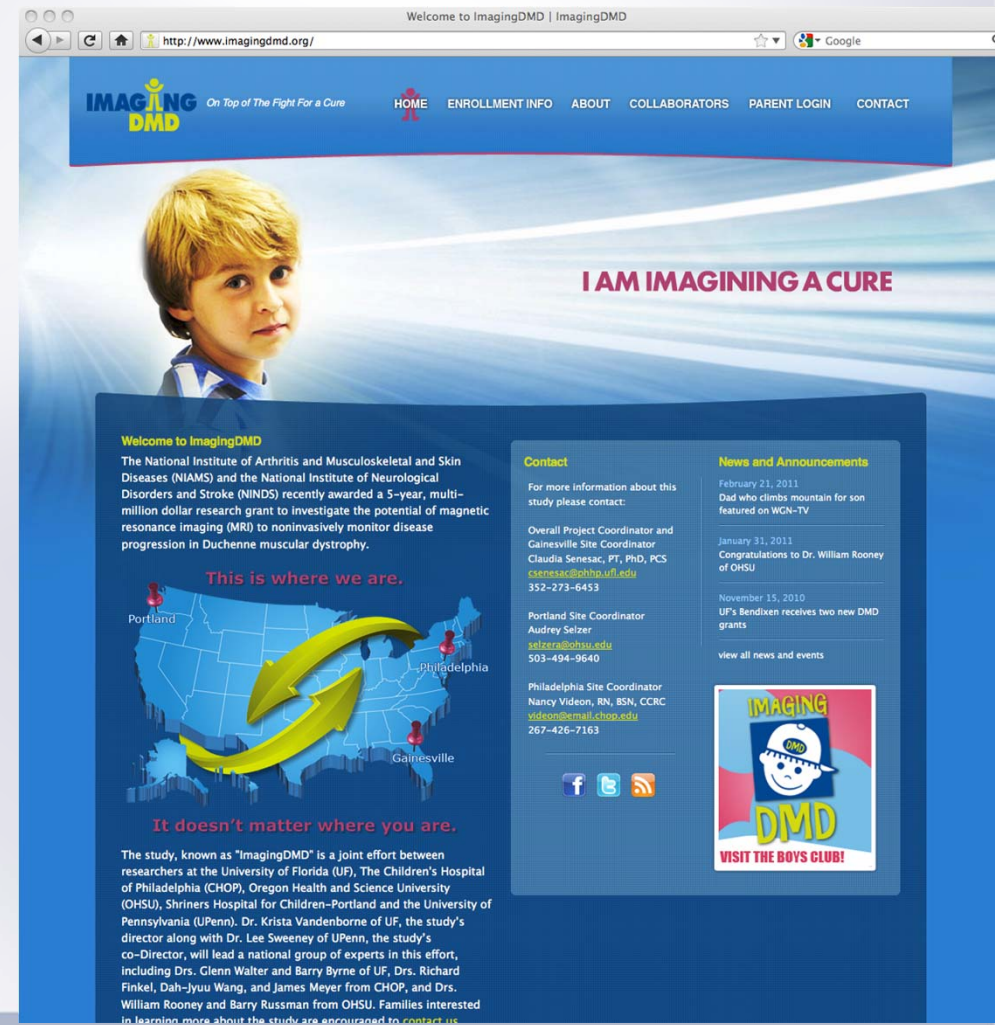


ImagingDMD Web Portal



Public Web Site

- imagingdmd.org
- Study and enrollment info
- Drupal Content Management System
- Customer-updated content



For Boys

Boys Club | ImagingDMD

http://www.imagingdmd.org/?q=boys

IMAGING DMD On Top of The Fight For a Cure

HOME ENROLLMENT INFO ABOUT COLLABORATORS PARENT LOGIN CONTACT

Word Search!



Level 1: Gainesville
Level 1: Philadelphia
Level 1: Portland
Level 2: Gainesville
Level 2: Philadelphia
Level 2: Portland
Level 3: Gainesville
Level 3: Philadelphia
Level 3: Portland

Coloring Pages!



Classic Car
Space Shuttle
Porsche
Skull & Crossbones
Ninja Turtles
Lamborghini

FUN STUFF TO DO!

Hey Boys,

Here are some activities to help pass the time while you're on the road or in the air making your way to visit us in one of our Labs. Ask your Mom or Dad if you can download and print out these sheets to carry with you while you travel.

We'd also like to hear from you (in your own words) any stories you'd like to share about your experience participating in ImagingDMD. Did anything funny happen while you were in one of our Labs? Do you want to share your feelings about the study or anything else with the other boys who are participating? Did you have an opportunity to learn anything about the equipment we use in the Lab or did you meet anyone on our investigation teams that made an especially important impact on you?

We realize that participating in ImagingDMD might not be the most fun thing you've ever done, but we try to keep things light and entertaining. Did you view a good video while in the magnet? Send us your original stories, pictures, poems or jokes that relate to the

Travel Bingo!!



Bingo Card #1
Bingo Card #2

Madlibs!

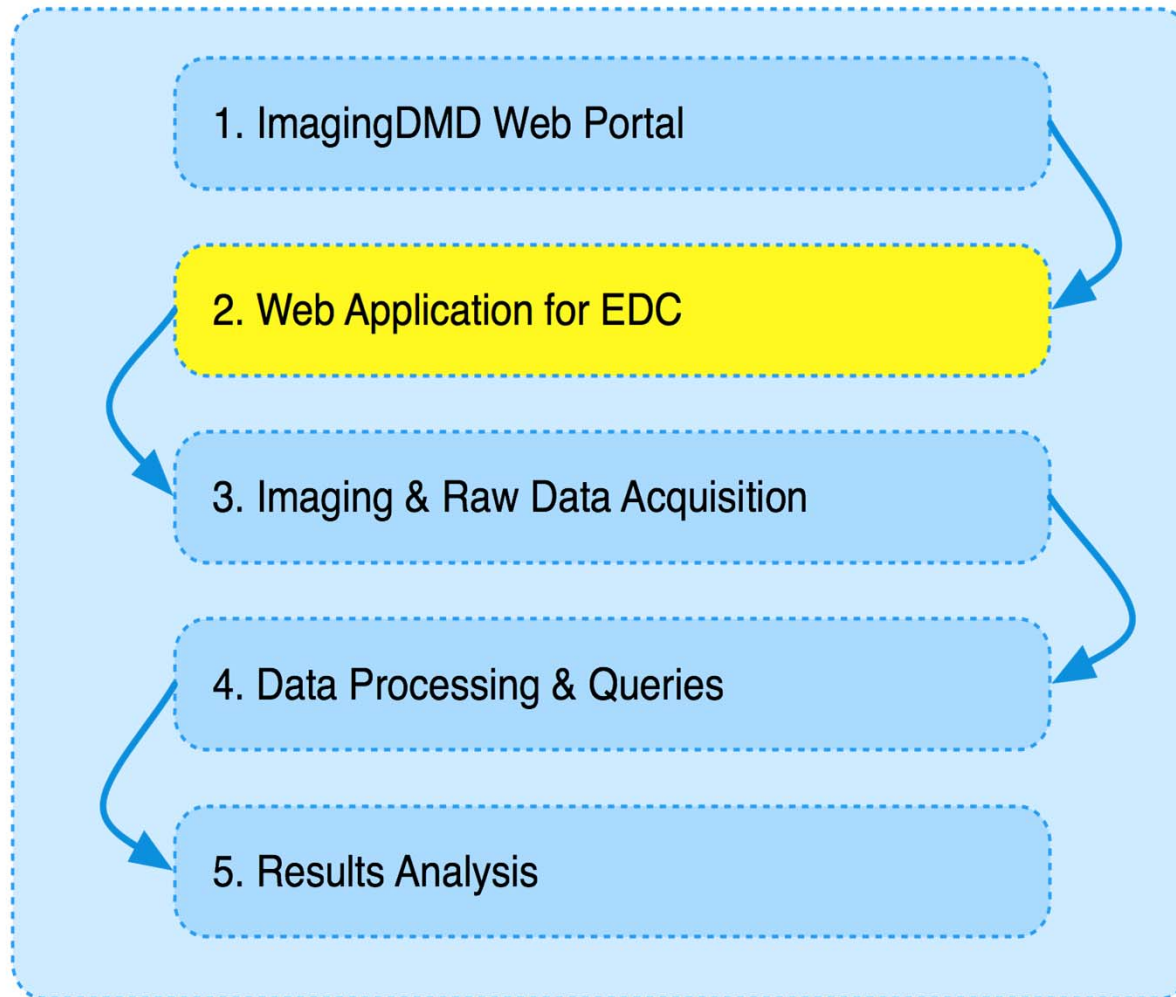


Madlib #1
Madlib #2: Gainesville
Madlib #2: Philadelphia
Madlib #2: Portland
Madlib #3

Mazes!

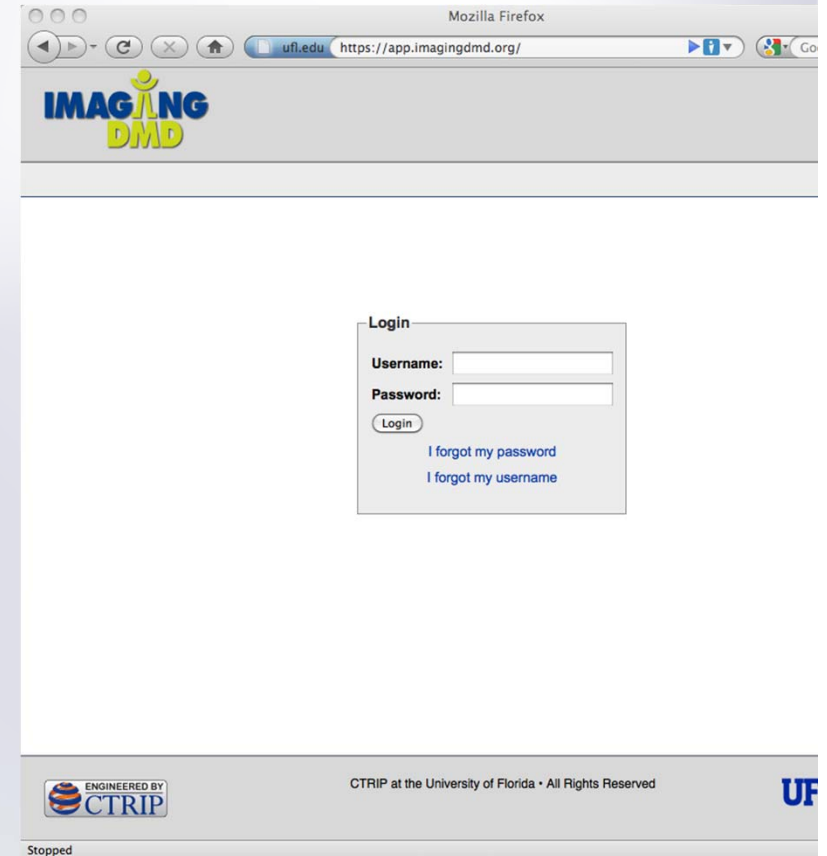


Web Application for EDC



Web Application Technology

- Homegrown application
- Open Source
 - CakePHP Framework
 - MySQL Backend
- Modular
- SSL Encrypted
- Hosted in HSC Infrastructure
- Parents pre-enter data
 - Demographics
 - Medical History
- Coordinators manage data
 - Anytime via web application
 - Report data via web app



Time & Events Matrix

Mozilla Firefox
 https://app.imagingdmd.org/index.php/event_tables

IMAGING DMD

SUBJECTS ADMIN Welcome, ctrip | My Account | Logout

Event Table Demographics

SMITH, JOHN • ID: 2 • RECORD ID: 38094540

DMD Schedule of Data Collection - Corticosteroid Aim 4 (n=20 control DMD)

+ Add a New Form - Incomplete Form
 ✓ Completed Form

	Baseline		Follow up time points									
	Day 1	Day 2	C3 months	C6 months	1	2	3	4	5	6	7	8
Consent Form	+											
MRI Screening For Parents	+		+	+	+	+	+	+	+	+	+	+
MRI Screening For Subjects	+		+	+	+	+	+	+	+	+	+	+
MRI Data Form	+	+	+	+	+	+	+	+	+	+	+	+
Initial Medical History (Health History)	+											
Initial Medication Use (Medical Log)	+											
Medical History Update			+	+	+	+	+	+	+	+	+	+
Medication Use Update			+	+	+	+	+	+	+	+	+	+
Tanner Stages	+		+	+	+	+	+	+	+	+	+	+
Functional Assessment Data		+	+	+	+	+	+	+	+	+	+	+
Blood Sample Data	+											
Skin Sample	+											
Activity Monitor		+	+	+	+	+	+	+	+	+	+	+
Genetic Information	+	+	+	+	+	+	+	+	+	+	+	+

ENGINEERED BY CTRIP

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UF UNIVERSITY of FLORIDA

Done

EDC Interfaces

- Medical History
- Medications
- File Uploads
- Skin Samples
 - Sample ID
 - Email Notifications to Upenn/fedex tracking
- Functional Assessment
 - Procedural Videos
- Biodex Data
- Etc.

The screenshot shows a web browser window titled "Imaging DMD Health History". The address bar displays the URL: https://staging.ctrrip.ufl.edu/dmd/index.php/subject_histories/add/1. The page features a navigation bar with tabs: "SUBJECTS", "DOWNLOADS", "REPORTS", and "ADMIN". Below this, there are sub-tabs: "Event Table", "Demographics", and "Adverse Events". The user is logged in as "Welcome, ctrrip" with links for "My Account" and "Logout". The main content area is titled "Add Health History" and includes a "Health History" section with the following information:

Subject ID: 2	Date of Birth: 02/06/2006
Address: 1234 GAINESVILLE FL - 32608 US	Phone Number: 352-219-2144
Ethnicity: Not Hispanic or Latino(a)	Race: White
Date of Initial Visit: 08/19/2011	

Below the "Health History" section is the "Clinical History" section, which includes a form for "What was the first symptom?" with checkboxes for "Big Calves", "High CK Level", "Delayed Walking", "Abnormal Running or Climbing", and "Other". There is also a text input field for "Other symptoms". The form continues with dropdown menus for "Age of diagnosis for DMD" (set to 2), "Biopsy completed?" (set to Yes), and "Genetic testing completed?" (set to No). The "File Verified By:" field is set to "CTRIP User". There is a section for "Upload Genetic Results:(PDF only)" with a "Browse..." button. The "Report Results:" section is a large text area. At the bottom, there is a question: "What, if any, treatment for muscular dystrophy has your child received and by whom?".

- Medical History
- Medications
- File Uploads
- Skin Samples
 - Sample ID
 - Email Notifications to Upenn/fedex tracking
- Functional Assessment
 - Procedural Videos
- Biodex Data
- Etc.

Imaging DMD Health History

https://staging.ctrip.ufl.edu/dmd/index.php/subject_histories/add/1

IMAGING DMD

SUBJECTS DOWNLOADS REPORTS ADMIN

Welcome, ctrip | My Account | Logout

Event Table Demographics Adverse Events

SMITH, JAMES • SUBJECT ID: 2 • RECORD ID: MR222

Add Health History << Event Table

Health History

Subject ID: 2	Date of Birth: 02/06/2006
Address: 1234 I GAINESVILLE I FL - 32608 I US	Phone Number: 352-219-2144
Ethnicity: Not Hispanic or Latino(a)	Race: White
Date of Initial Visit: 08/19/2011	

Clinical History

What was the first symptom?

☒ Big Calves
☒ High CK Level
☐ Delayed Walking
☐ Abnormal Running or Climbing
☐ Other

Other symptoms

Age of diagnosis for DMD: 2

Biopsy completed?: Yes

Genetic testing completed?: No

File Verified By: CTRIP User

Upload Genetic Results:(PDF only) Browse...

Report Results:

What, if any, treatment for muscular dystrophy has your child received and by whom?

Web-based Canned Reports

- Support daily study mgmt.
- Instant web-based reports:
 - Safety report
 - Adverse events
 - Protocol deviations

Workbook3

100%

Home Layout Tables Charts SmartArt Formulas Data Review

Edit Font Alignment Number Format

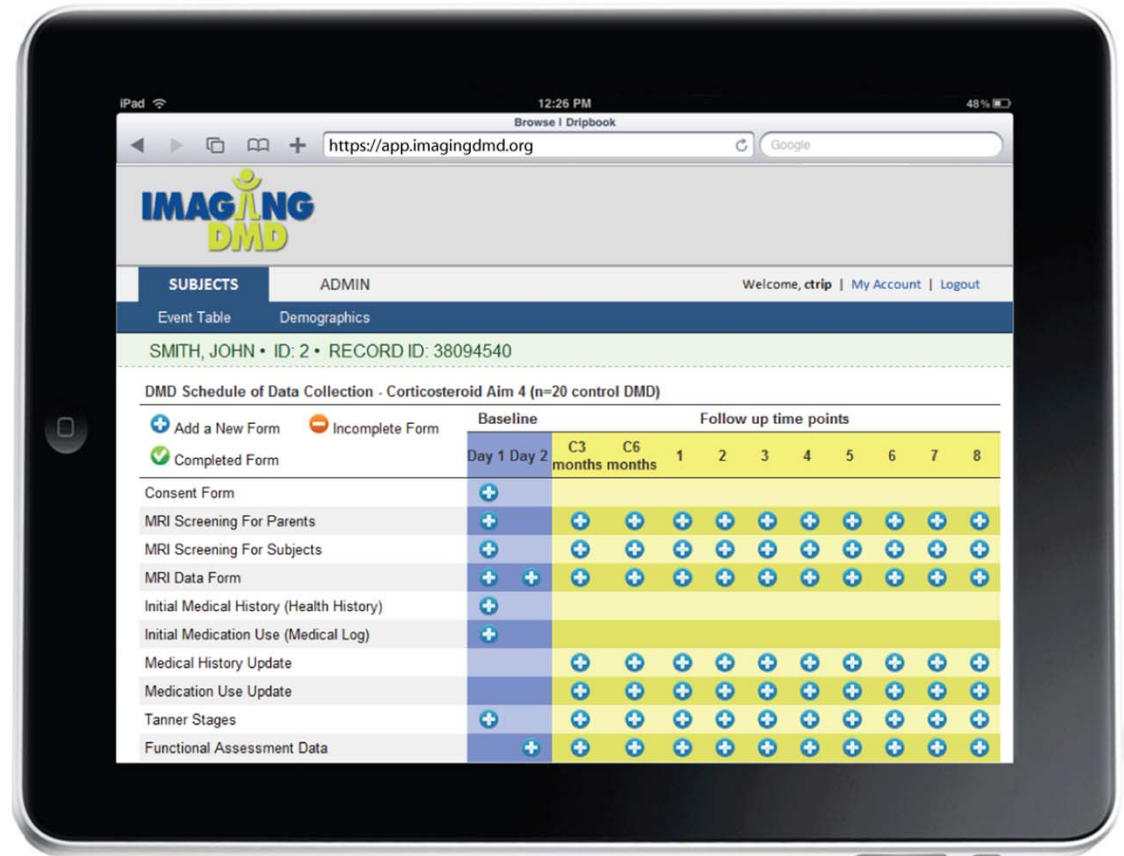
Paste Fill Clear Calibri (Body) 10 A A- A+ Wrap Text General Conditional Formatting Normal Bad

A1 fx

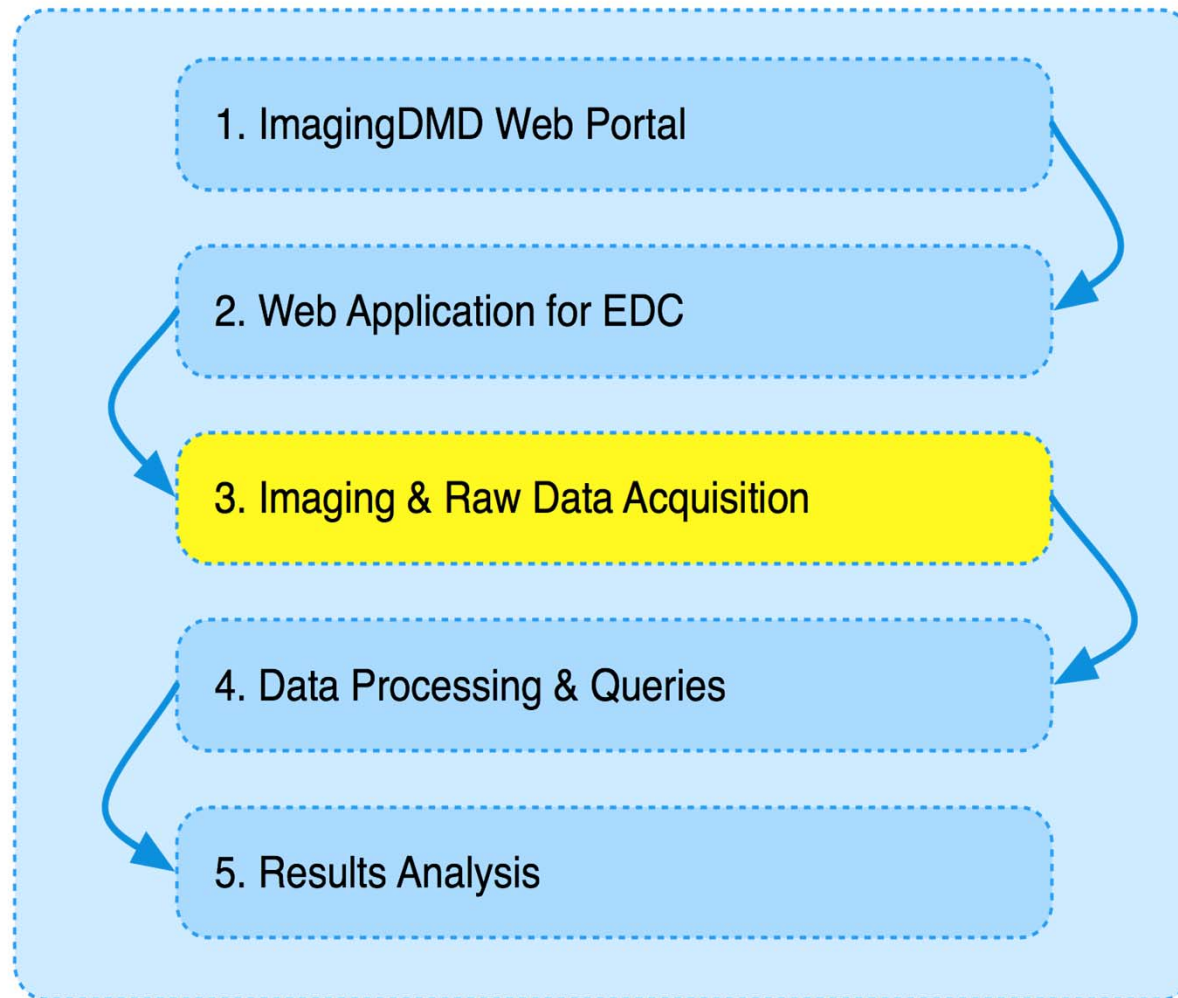
	A	B	C	D	E	F	G	H	I	J
	Subject ID	Site	Study	Form	Day 1	Day 2	C 1M	C 2M	C 3M	C 4M
1										
2	1	UF	Corticosteroid Aim 4 (n=20 control DMD)	Consent Form	C					
3	1	UF	Corticosteroid Aim 4 (n=20 control DMD)	MR Screening For Parent	C	C			C	
4	1	UF	Corticosteroid Aim 4 (n=20 control DMD)	MR Screening For Subject	C	C			C	
5	1	UF	Corticosteroid Aim 4 (n=20 control DMD)	MR Data Acquisition Form	C	C			C	
6	1	UF	Corticosteroid Aim 4 (n=20 control DMD)	Initial Medical History (Health History)	C					
7	1	UF	Corticosteroid Aim 4 (n=20 control DMD)	Initial Medication Use (Medical Log)	C					
8	1	UF	Corticosteroid Aim 4 (n=20 control DMD)	Medical History Update					C	
9	1	UF	Corticosteroid Aim 4 (n=20 control DMD)	Medication Use Update					C	
10	1	UF	Corticosteroid Aim 4 (n=20 control DMD)	Tanner Stages	C	A			C	
11	1	UF	Corticosteroid Aim 4 (n=20 control DMD)	Blood Sample Tracking	C	C				
12	1	UF	Corticosteroid Aim 4 (n=20 control DMD)	Skin Sample Tracking	C	A			A	
13	1	UF	Corticosteroid Aim 4 (n=20 control DMD)	Weight Height ROM Data		C			C	
14	1	UF	Corticosteroid Aim 4 (n=20 control DMD)	Biodex Test Data		C			C	
15	1	UF	Corticosteroid Aim 4 (n=20 control DMD)	Functional Assessment Data		C			C	
16	1	UF	Corticosteroid Aim 4 (n=20 control DMD)	Foot Posture Index MMT Data		C			C	
17	1	UF	Corticosteroid Aim 4 (n=20 control DMD)	Activity Monitor		C			C	
18	1	UF	Corticosteroid Aim 4 (n=20 control DMD)	Upload Additional Information	A	A			A	
19	2	UF	Control Healthy	Consent Form	C					
20	2	UF	Control Healthy	MR Screening For Parent	C	C				
21	2	UF	Control Healthy	MR Screening For Subject	C	C				
22	2	UF	Control Healthy	MR Data Acquisition Form	C	C				
23	2	UF	Control Healthy	Initial Medical History (Health History)	C					
24	2	UF	Control Healthy	Initial Medication Use (Medical Log)	C					
25	2	UF	Control Healthy	Tanner Stages	C	A				
26	2	UF	Control Healthy	Weight Height ROM Data		C				
27	2	UF	Control Healthy	Biodex Test Data		C				
28	2	UF	Control Healthy	Functional Assessment Data		C				
29	2	UF	Control Healthy	Foot Posture Index MMT Data		C				
30	2	UF	Control Healthy	Activity Monitor		C				
31	2	UF	Control Healthy	Upload Additional Information	A	A				
32	3	UF	Natural History	Consent Form	C					
33	3	UF	Natural History	MR Screening For Parent	C	C				
34	3	UF	Natural History	MR Screening For Subject	C	C				
35	3	UF	Natural History	MR Data Acquisition Form	C	C				
36	3	UF	Natural History	Initial Medical History (Health History)	C					
37	3	UF	Natural History	Initial Medication Use (Medical Log)	C					
38	3	UF	Natural History	Medical History Update						
39	3	UF	Natural History	Medication Use Update						
40	3	UF	Natural History	Tanner Stages	A	C				
41	3	UF	Natural History	Blood Sample Tracking	A	A				
42	3	UF	Natural History	Skin Sample Tracking	C	A				
43	3	UF	Natural History	Weight Height ROM Data		C				
44	3	UF	Natural History	Biodex Test Data		C				

Touchscreen Device Friendly

- Carried w/ patient throughout visit
- Interfaces touch-friendly
 - Calendars
 - Select menus
- Video playback for real-time training
 - Position of leg in scanner
 - Functional assessment

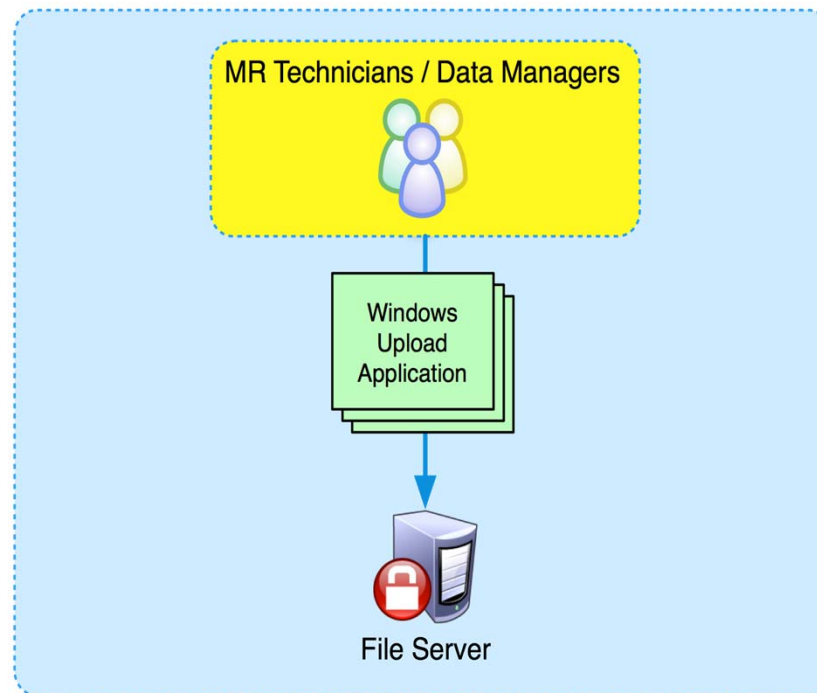


Imaging & Raw Data Acquisition



File Server

- SFTP – Secure File Transfer Protocol
 - Direct shell access
 - Shared drive mountable
- Windows Upload Application
 - MD5 Checksum
 - Directory structure and file management
 - Email log upon completed transfer



Upload Application

The image displays three overlapping screenshots of the 'DMD File Upload' application interface.

Top Screenshot: DMD File Upload - login

This window contains a login form with the following fields and controls:

- User Name:
- Password:
- Login:

Bottom Left Screenshot: DMD File Upload - select files

This window is used for selecting files to upload. It includes:

- Select a subject:
- Select file type: ☒ DICOM ☐ Raw ☐ Text ☐ Other
- Scan date:
- Select files: (Hold Ctrl key to select multiple files.)
- Files to be uploaded:
- Remove the checked files:
- Navigation:

Bottom Right Screenshot: DMD File Upload - report

This window displays the upload report for Subject ID: 10, Subject name: Narayan Narayan, and Scan date: 3/2/2011.

File Size Range

- DICOM: 10 - 30000 KB
- Raw: 10 - 150000 KB
- Text: 1 - 50 KB

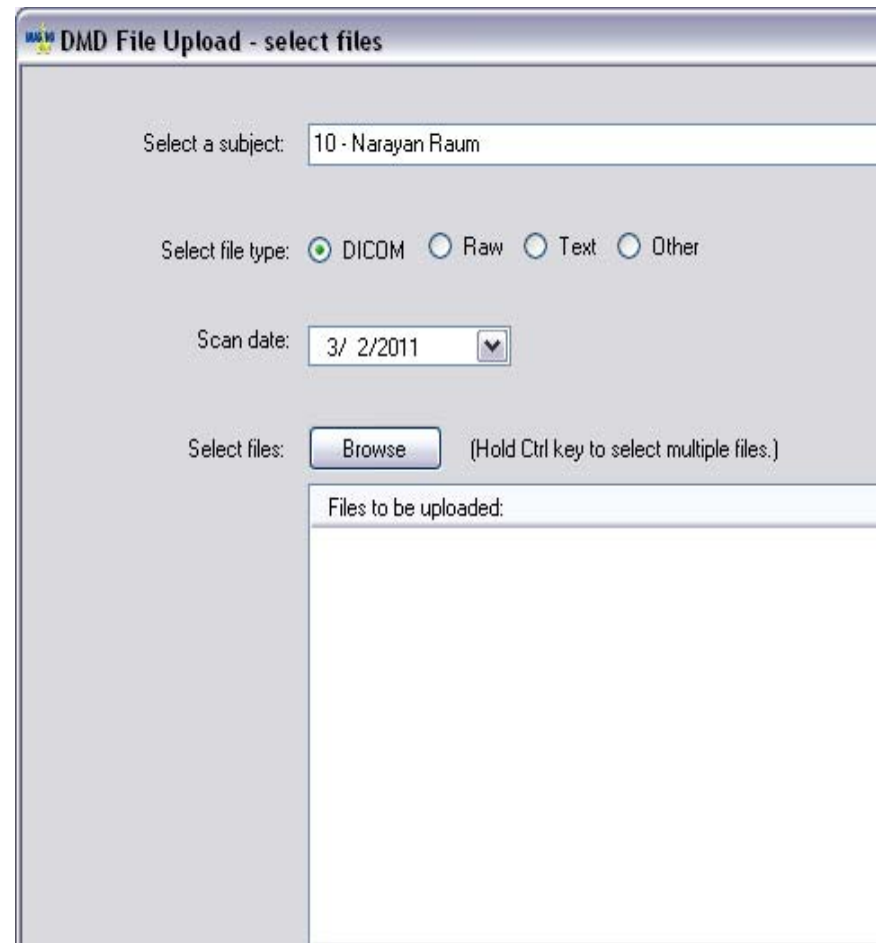
Upload Report

In range?	Checksum	Upload to	Rename to	Status	Pending upload completion
✓	3ea71426c4799a62c5a...	UF/ImagingDMD...	010_2011-03-02_U...	Success!	3ea71426c4799a62c5a55e...
⚠	03a6524ff611ae4fa363...	UF/ImagingDMD...	010_2011-03-02_U...	325,171 kb left	wait until uploading done
✓	c409d74fe84040231a3e...	UF/ImagingDMD...	010_2011-03-02_U...	Success!	c409d74fe84040231a3ee9e...
✓	15661960b22cds4903e...	UF/ImagingDMD...	010_2011-03-02_U...	34,878 kb left	wait until uploading done
✓	2a49519d1c56a392fad...	UF/ImagingDMD...	010_2011-03-02_U...	3,096 kb left	wait until uploading done
✓	b859f6a43228c5a8ed53...	UF/ImagingDMD...	010_2011-03-02_U...	Success!	b859f6a43228c5a8ed538a...
✓	78573bf73f88e8221b...	UF/ImagingDMD...	010_2011-03-02_U...	Success!	78573bf73f88e8221b62c...

Navigation buttons:

Directory Structure Management

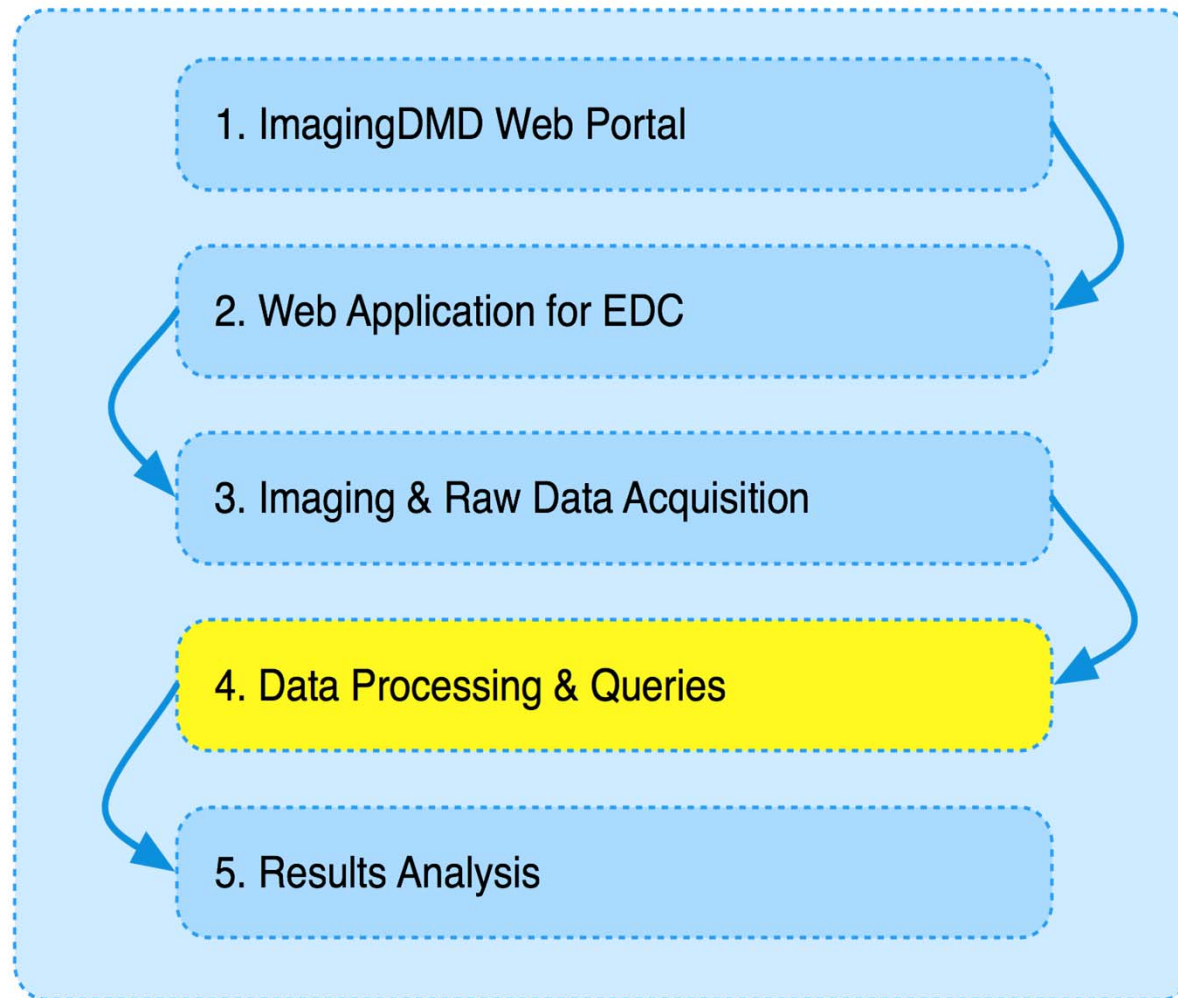
- Original file to upload named “abc123.txt”
- UF
 - 001
 - 001_2011-09-01
 - DICOM
 - Text
 - Raw
 - » UL
 - 001_abc123.txt



The screenshot shows a web-based dialog box titled "DMD File Upload - select files". It contains the following fields and controls:

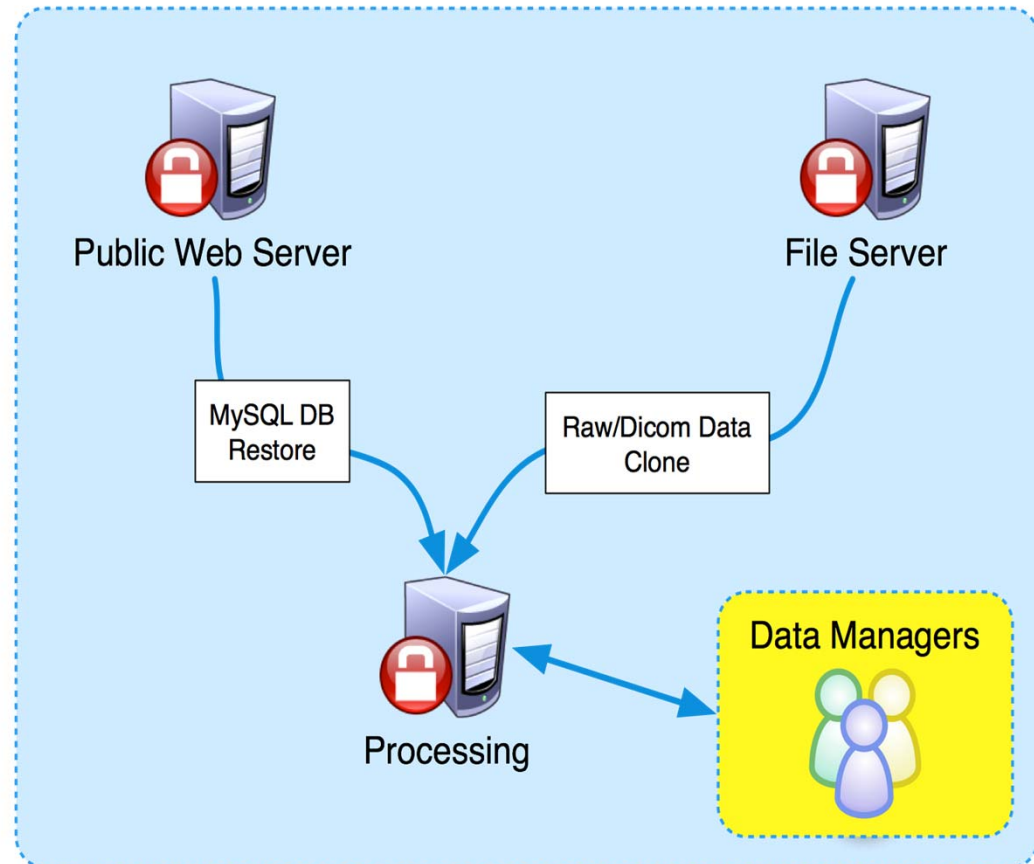
- Select a subject:** A text input field containing "10 - Narayan Raum".
- Select file type:** Four radio buttons labeled "DICOM", "Raw", "Text", and "Other". The "DICOM" button is selected.
- Scan date:** A date picker field showing "3/ 2/2011".
- Select files:** A "Browse" button and a note "(Hold Ctrl key to select multiple files.)".
- Files to be uploaded:** An empty list box at the bottom of the dialog.

Data Processing & Queries

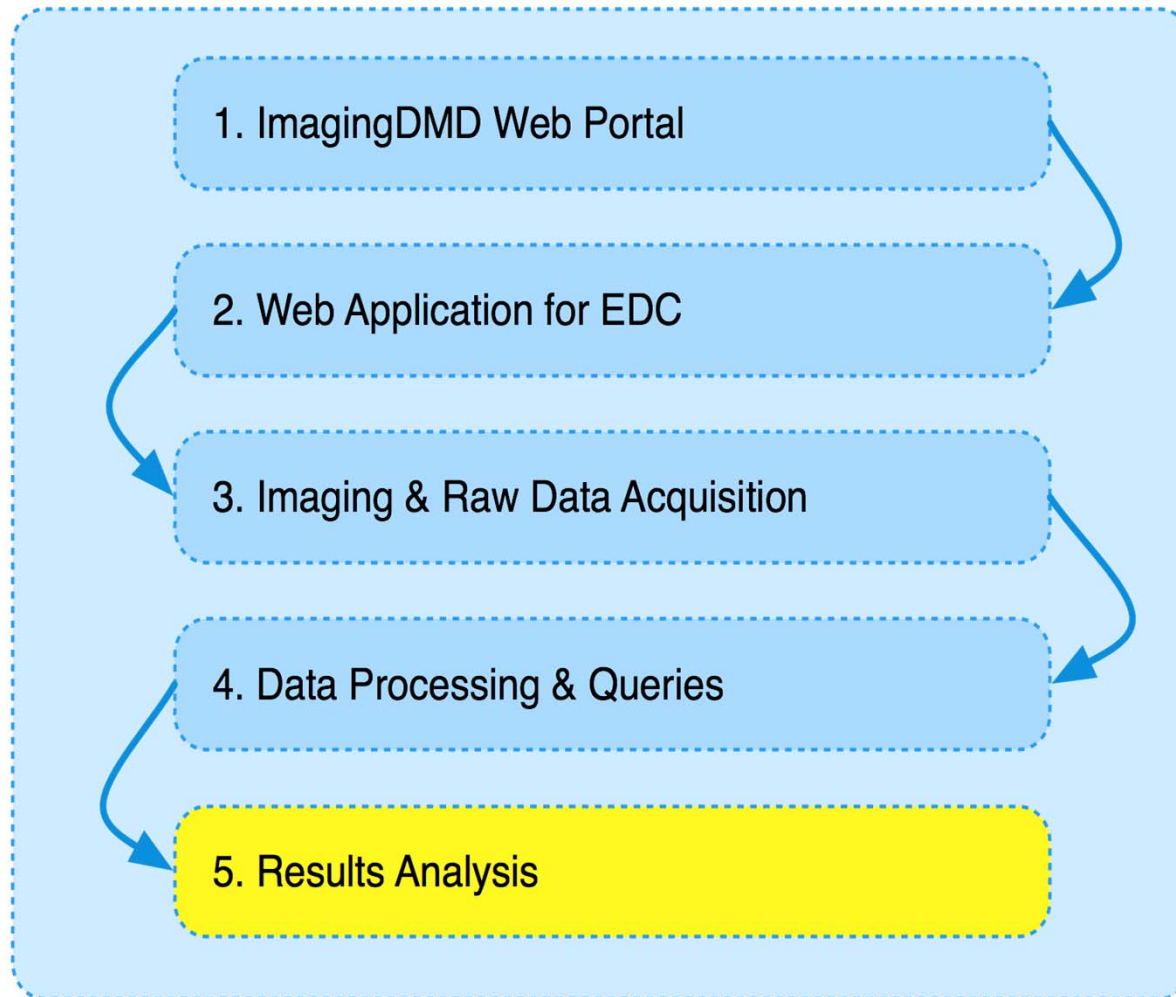


Processing Environment

- Data immediately available
 - Raw
 - Dicom
 - Biodex
- EDC data queries
 - MySQL Instance
 - Database restored daily
 - Custom queries of data
- Software installed for analysis
 - IDL
 - Matlab



Results Analysis



Accepted Poster AMIA 2011

Informatics System with Imaging and Touchscreen Device

Narayan D. Raum, Christopher P. Barnes, Yang Li, Stephen Williams, Uni

Abstract

Duchenne muscular dystrophy, a genetic muscle condition seen in boys, typically requires frequent muscle biopsies to monitor disease progression. CTRIP at the University of Florida assisted in a study aimed at monitoring disease progression through the use of magnetic resonance by implementing a complex informatics system, which is comprised of custom-developed and open source applications including touchscreen friendly EDC applications and MRI management solutions. This poster aims to outline the systems and infrastructure implemented to support the research aims.

The Clinical and Translational Research Informatics Program (CTRIP) at the University of Florida engineered an informatics system to support a national, multi-center NIAMS and NINDS funded research protocol, which is studying the potential of magnetic resonance imaging to, in a noninvasive manner, monitor disease progression in Duchenne muscular dystrophy. Many considerations, use-cases and decisions took place during planning and implementation of the Imaging DMD systems and infrastructure. Additional interfacing strategies and techniques were implemented to ensure user-friendliness and facilitate research. Emphasis was placed on the use of open source applications and solutions, which were instrumental in providing affordable solutions to facilitate the study needs.

System Overview

Public Portal

The public-facing web site was implemented using Drupal, a popular open-source content management system. The portal serves as a gateway for all interests into the study, including activities and information for the young boys with DMD. Parents can obtain a login from study coordinators for patient self-reporting of data. Their access point to the database is through the public-facing web site. The site currently ranks first in a Google search for "imaging dmd". The site also contains links to a very active Facebook profile.

Electronic Data Captu

A touchscreen friendly web app framework. It provides flexib self-reporting, and interfaces to

Screenshots

Homepage



Enrollment Information

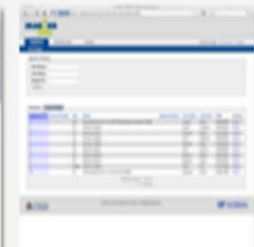


About the Study



Screenshots

Subject Management





Questions & Discussion

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