

# Adapting LabKey to Pathogen Research

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# Abstract

- The Defense Threat Reduction Agency engages both civilian and DoD laboratories in multiple projects to improve our ability to characterize pathogens involved in an outbreak and to advance the science that would support development of new antibiotics.
- Noblis is customizing an instance of LabKey to support DTRA/CBA's mission in pathogen characterization and biomarker discovery.
- This talk describes the basic system requirements and some of the efforts to customize LabKey to provide those functionalities.
- The research data include many phenotypic and genotypic assays and are sample-centric instead of patient-centric. While LabKey's best known deployments support clinical trials, LabKey's underlying data model can be used to support basic microbiological research.

# System Requirements

- Light Footprint/Web Application
- Single-point sign on (currently username/password)
- Permission management (groups, individual users)
- Collaboration Forum
- Data Submission (minimize effort for submitter, basic validation)
- Search and Data Location (keyword search, faceted search, easy navigation)
- Hardware (expandable, as needed)
- Documentation (User Guide/Tutorials)
- Large file upload and download (for Whole Genome raw reads)
- Sample ID Management
- Lab Activity Management
- Dashboards and Rollups for Specific Use Cases



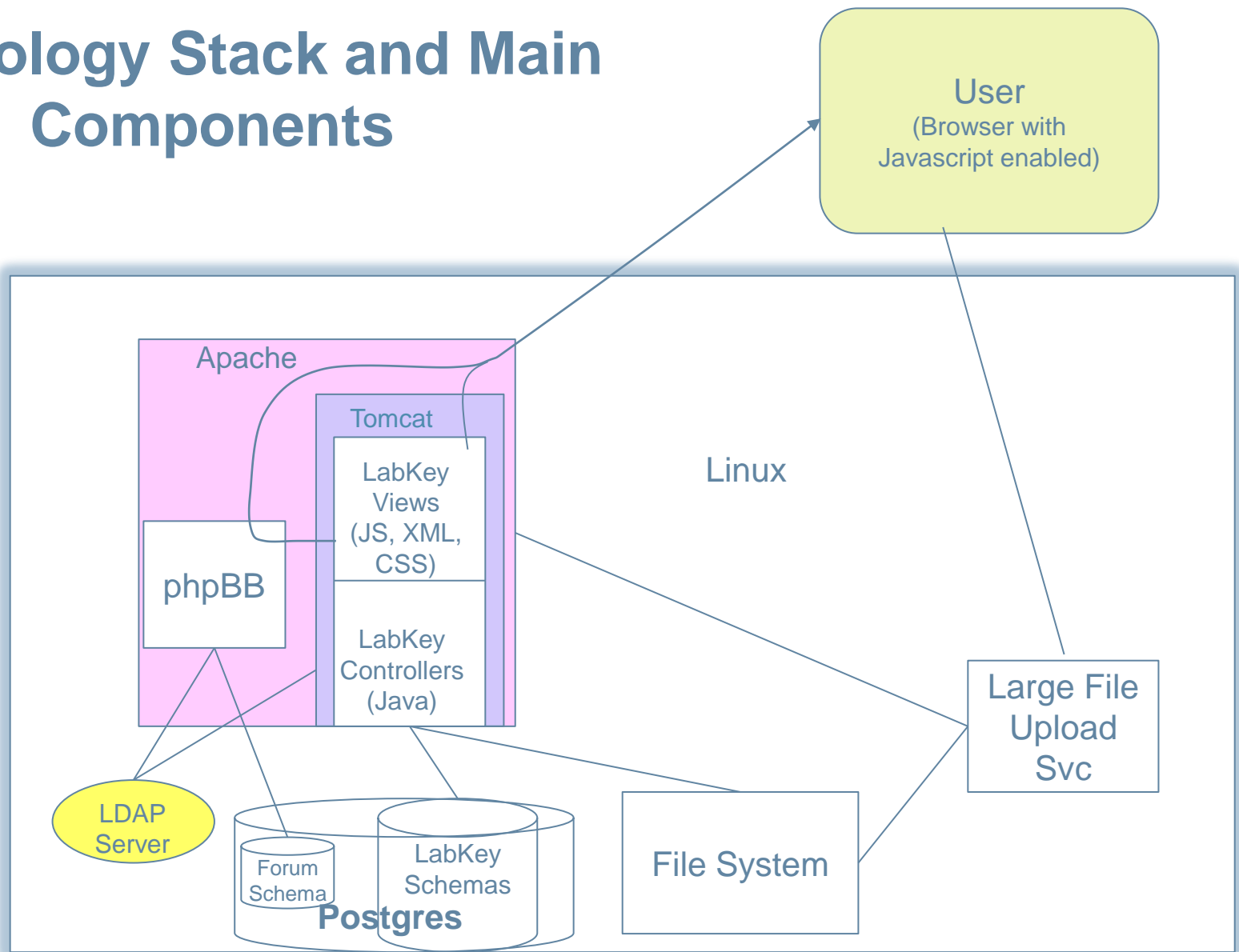
# Assay Definition for CBA Workbench

- Bacterial Assays
  - Purity
  - Colony Morphology (21)
  - Cell Morphology (2)
  - Characterization Assays (7)
  - Phage Lysis (8)
  - Direct Fluorescent Antibody (5)
  - Electrochemiluminescence (3)
  - Enzyme-linked Immunosorbent Assay (?)
  - Biolog (23)
  - Vitek (4)
  - E-Test (44)
  - Fatty Acid Methyl Ester
  - RiboPrinter (4)
  - Optical Mapping (4)
  - Polymerase Chain Reaction (?)
  - Real-Time PCR (?)
  - PLEX-ID (11)
  - Other

- Viral Assays
  - Morphology
  - Growth (5)
  - Plaque Assay (3)
  - Electrochemiluminescence (2)
  - Enzyme-linked Immunosorbent Assay (?)
  - Optical Mapping (4)
  - Polymerase Chain Reaction (?)
  - Real-Time PCR (?)
  - PLEX-ID (5)
  - Other

- Whole Genome Sequencing
- Proteomic Assay

# Technology Stack and Main Components



# Early View of 'BioID' Landing Page

The screenshot shows the BioID Dashboard landing page in a Mozilla Firefox browser window. The browser's address bar displays the URL: <https://bioid.noblis.org/labkey/wiki/home/page.view?name=dashboardlandingpage>. The page features a blue header with the 'BioID' logo and a navigation bar with links to Home, Data Search, Assay Data Entry, Lab Activity Management, Genome Assay Submission, User Forum, Sample Management, and Report Submission. A search bar for 'Search BioID Service' is located on the right. The main content area is titled 'BioID Dashboard' and includes a 'Start Page >' link. It displays four sections: 'Recent Forum Posts' with two entries, 'Recent Assays' with five entries, 'Recent Genomic Assays' with five entries, and 'Lab Activity Management Recent Updates' which shows 'Not yet'. A left sidebar contains 'BioID Projects' (Exercise 4 support), 'PROJECT FOLDERS' (Home, Exercise 4 support), 'PROJECTS', 'MANAGE PROJECT', 'MANAGE SITE', and 'Assay Data Review' (Bacterial Assays, Viral Assays, Whole Genome Sequencing (WGS), Proteomic Assays, Sample Management, Report Submission). The Windows taskbar at the bottom shows the system clock at 12:00 PM on 11/21/2011 and several open applications including BioID Dash..., Inbox - victo..., Computer M..., and LabKeyConfe...

Firefox | Gmail - Inbox - ... | The Full Downl... | "The Painter's P... | W/The Painter's Pa... | Ephel Duath - R... | Data Import: /h... | +

http://localhost:8080/labkey/assay/home/moduleAssayUpload.view?rowid=4 | ephel duath ruins

Disable | Cookies | CSS | Forms | Images | Information | Miscellaneous | Outline | Resize | Tools | View Source | Options

# CBA Workbench

ablanton@noblis.org | Admin | Help | My Account | Sign Out

Search CBA Workbench

Data Search | Assay Data Entry | Organisms | Downloads | Tools | About Us

PROJECT FOLDERS

- Home
- support

PROJECTS

MANAGE PROJECT

MANAGE SITE

Home

Permanent Link

Support

Help

CBA Workbench > Assay List > terrible Batches >

## Data Import

CBA Home > Assay Data Entry > Propagation Assays > Colony Morphology

### Colony Morphology - Data Entry Form

Please fill out information for each category listed below

#### Section One: Sample Identification Information

ORNL/STS Assigned Sample ID:	<input type="text" value="Enter Text"/>
ORNL/STS Assigned Sample Aliquot ID:	<input type="text" value="Enter Text"/>
Internal Assigned Sample ID:	<input type="text" value="Enter Text"/>
Internal Assigned Sample Aliquot ID:	<input type="text" value="Enter Text"/>
Data Inputter/Organization	<input type="text" value="Enter Text"/>

#### Section Two: Assay Specific Information

Media Type: <input type="text" value="choose..."/>	<b>Observations:</b> <div></div>
Growth: <input type="radio"/> + <input type="radio"/> -	
Growth Conditions:	
Temperature: <input type="text" value="text"/> °C	
Incubation Time: <input type="text" value="text"/> hours	
Append image/file: <input type="text" value="File location"/>	

# Data Location and Search

**Search Technology:** LabKey's Lucene-based search engine

**Navigation Technology:** custom interfaces using LabKey core modules and implemented in Javascript

## Tasks:

- Integrate phpBB into search
- Add new facets to faceted search
- Build navigation trees for key entities (e.g. Assay Types)
- Reorganize LabKey's interface to simplify movement around site



# Sample Tracking and Sample ID Management

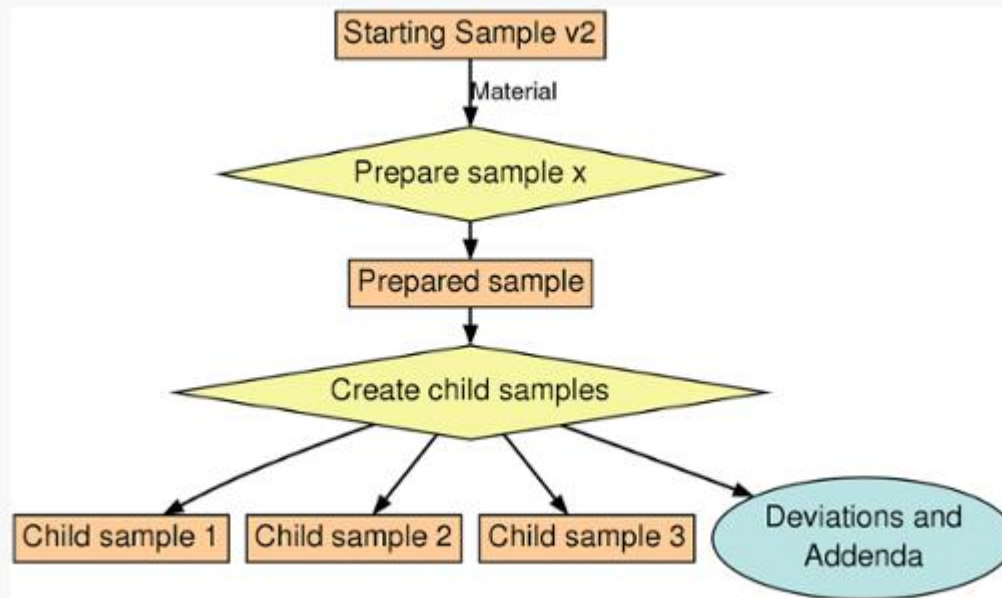
**Sample ID Mgt Technology:** Native LabKey Sample ID Management

**Sample Tracking Technology:** Add functionality for sample tracking

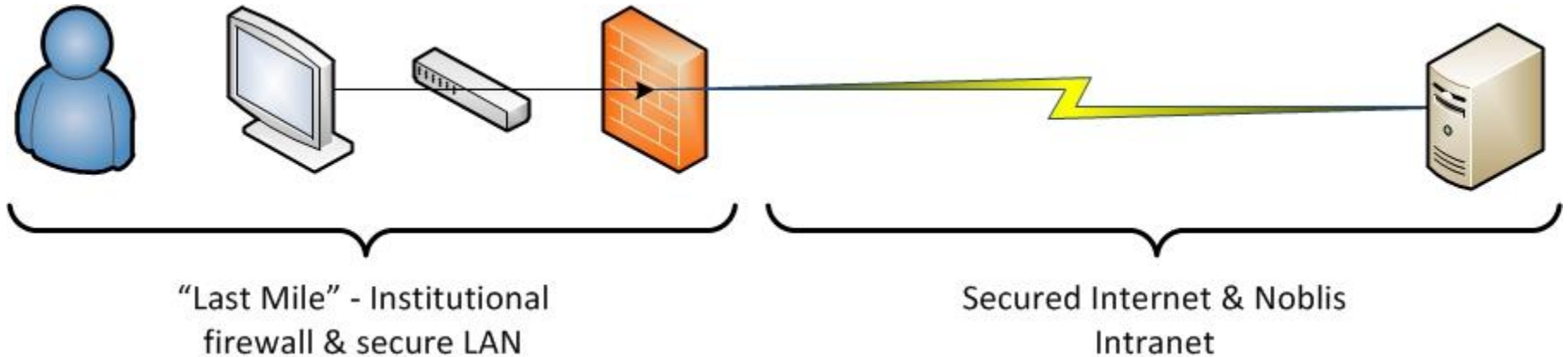
Design and implement a way to attach SOP's to process steps

Use built-in graphics to visualize sample lineage

Click on a node in the graph below for details. Run outputs have a bold outline.



# Large File Upload/Download



- Existing limitations of large file downloads:
  - HTTP download is throttled by the institutional firewall or proxy. (Last Mile)
- Existing limitations of large file uploads:
  - FTPS is blocked by institutional firewall. (Last Mile)
- Technologies being investigated:
  - 1. Integrate FTP download into the HTTP user interface.
  - 2. Integrate bit-torrent download into the HTTP user interface.

# Lab Activity Management

**Lab Activity Management Technology:** Combination of native LabKey module and custom code to provide full functionality

- On-line real time tracking at the task level
- Actually functions as a social tool to support interactions about lab tasking between the individual labs and DTRA management

# Lab Activity Management

Sample List

All Samples

SPL11.010.01 (CDC 2011C-349)

SPL11.010.02 (CDC 2009EL-2050)

SPL11.010.03 (CDC 2009EL-2071)

SPL11.012.01 (GEO-001 GI3305)

SPL11.012.02 (GEO-002 GI3353)

SPL11.013.01 (B'wehr HUSEC041)

Overview

Table View

Refresh Table

Filter Table

Insert Data

Edit Mode

Task	Organization	EHEC Exercise Use	Due Date	Start Date	Complete Date	Data Upload Date	
Sample DNA Extraction	ECBC-GS	High	D+1 (17 June)	2011-06-17	2011-06-17	2011-06-21	
Sample DNA QA/QC	ECBC-GS	High	D+1 (17 June)	2011-06-17	2011-06-17	2011-06-21	
OpGen	ECBC-GS	High	D+1 (17 June)	2011-06-17	2011-06-23	2011-06-24	
Comments: All restriction enzymes evaluated on 3 CDC isolates and available through sharepoint.							
454 Shotgun Library Prep	ECBC-GS	High	D+1 (17 June)	2011-06-17	2011-06-17	2011-06-21	
454 Shotgun	ECBC-GS	High	D+2 (20 June)	2011-06-20	2011-06-21	2011-06-22	
Draft 454 Assembly	ECBC-GS	High	D+3 (21 June)	2011-06-21	2011-06-21	2011-06-24	
ECBC Pipeline Analysis	ECBC-GS	High	D+4 (22 June)	2011-06-22	2011-06-22	2011-06-23	
Comments: assembly stats							
454 Paired End Library Prep	ECBC-GS	High	D+5 (23 June)	2011-06-20	2011-06-21		
454 Paired End	ECBC-GS	High	D+6 (24 June)	2011-06-21	2011-06-24	2011-06-27	
Comments: uploaded on sharepoint							
454 Draft Annotation	ECBC-GS	High	D+5 (23 June)	2011-06-23	2011-06-23	2011-06-23	
Illumina Shotgun Library Prep	ECBC-GS	High	D+1 (17 June)	2011-06-20	2011-06-20		
Illumina Shotgun Sequencing	ECBC-GS	High	D+2 to D+7 (20-28 June)	2011-06-20	2011-06-24	2011-06-27	
Comments: uploaded and available through FTP due to faster connectivity. Coordination with LANL has been completed							
Improved Draft Annotation	ECBC-GS	High	D+11 (5 July)	2011-07-01	2011-07-01	2011-07-06	
Comments: Consensus assembly (454 shotgun, 454 paired end, and Illumina data) and improved annotation uploaded							
Comparative genome analysis	ECBC-GS	High	Throughout, results to be				

Page 3 of 5

Export CSV

Displaying rows 41 - 60 of 95

Page 3 of 5 [Export CSV](#)

Displaying rows 41 - 60 of 95



# Lab Activity Editing

Lab Activity Management (LAM): /home - Mozilla Firefox

e Edit View History Bookmarks Tools Help

Lab Activity Management (LAM... +

noblis.org https://bioid.noblis.org/labkey/lam/home/begin.view

BioID

Home Data Search Assay Data Entry Lab Activity Management Genome Assay Submission User Forum Sample Management Report Submission

joe.user@noblis.org  
My Account | Stop Impersonating

Search BioID Service

BioID Projects

Exercise 4  
support

Assay Data Review

- Bacterial Assays
- Viral Assays
- Whole Genome Sequencing (WGS)
- Proteomic Assays
- Sample Management
- Report Submission

Lab Activity Management (LAM)

Define New Task Assign New Task to Sample View Progress

My Samples

Key	ID
1	SPL11.010.01.2.1
2	SPL11.010.01.2.2

Unassigned Samples  
All Samples

Tasks

Task	Institution	Number of Days	Projected End	Start Date	End Date
Colony Morphology	tbd	2	4 Dec 2011 ...	2 Dec 2011 ...	

User Guide | Contact Us

Find: agar

Next Previous Highlight all Match case

# Acknowledgements

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