

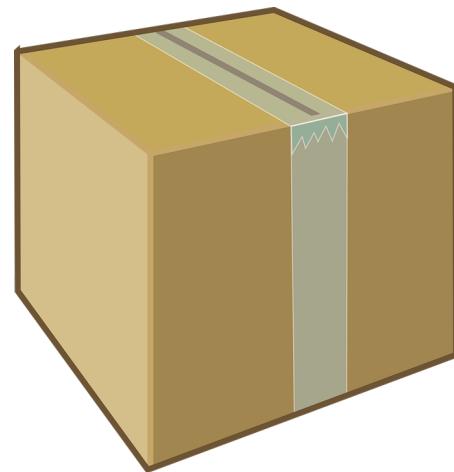


BIBBOX

an open source App Store for life science applications

Dr. Heimo Müller
Medical University of Graz, BBMRI-ERIC CS-IT

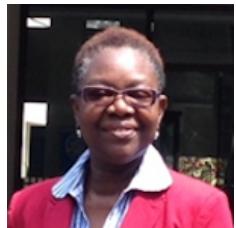
What is in the BOX?



for PI's



BIBBOX is a “out of the box IT solution” for biobanks



Prof. Dr. Majmuna Sandu

PI of the BIBBOX DEMO Biobank

- Phd in Microbiology
- 400+ publications
- Member of H2020 advisory board for rare diseases
- Head of ISBER working group on sample quality

for System Administrators



BIBBOX is a portal to install software tools available as orchestrated docker containers



Alan Punter

System Administrator at the demo biobank

- Hacker since he can think
- His motto: „127.0.0.1 sweet 127.0.0.1“
- Speaks ruby, perl, python, and BASH shell fluently
- Responsible for all software problems at the biobank

for IT managers



BIBBOX is a PaaS running in a VM



Roxana Rilling

CTO @ the University IT department

- Responsible for all servers
- Expert in virtualization technologies in data centers
- Counts Cores / Main Memory / Disk Capacity
- Responsible for all IT resources, especially server and networks

for Data Curators



BIBBOX Apps help me with data integration and harmonization



Santa Morello

Curator of the demo biobank

- Assistant of Prof. Sandu
- Working on her PhD in Biomarker research
- Responsible for 2 data research projects
- Doing the data stewardship for all international cooperation

for Operators



BIBBOX gave me a set of useful software tools for my daily data management tasks in our biobank.

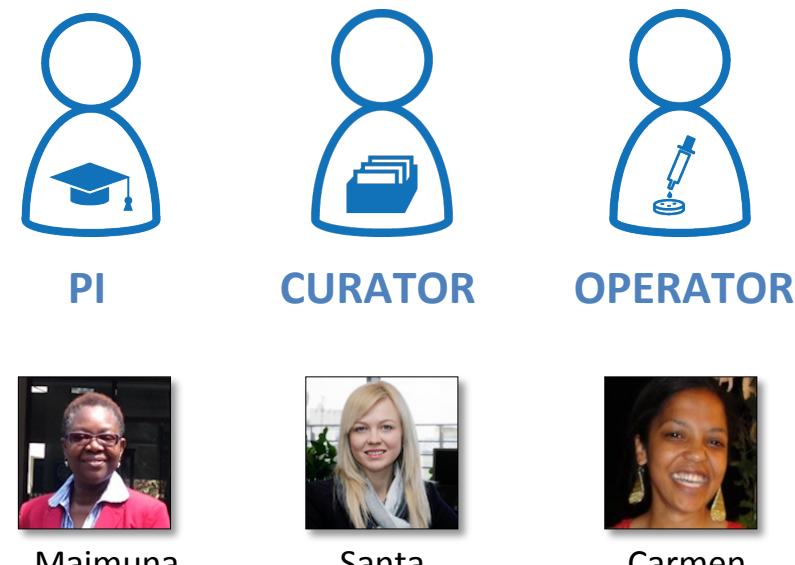
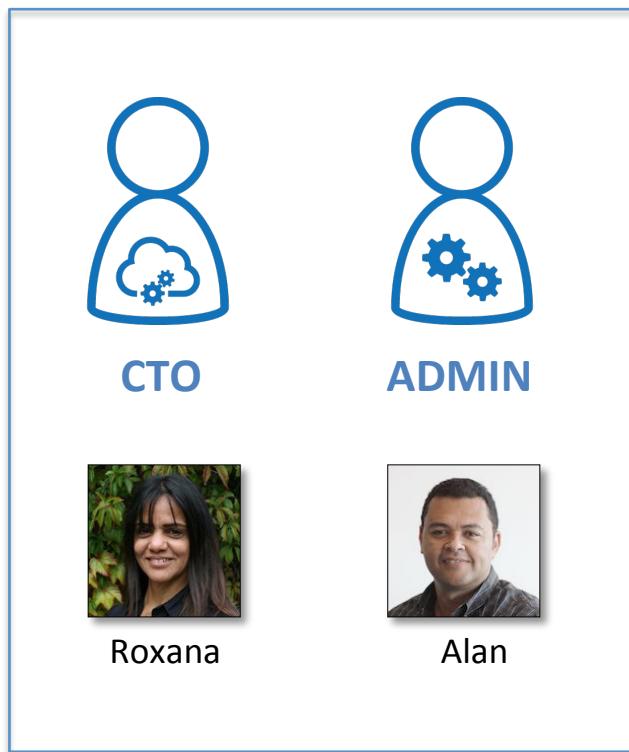


Carmen Rilling

Operator / User of some BIBBOX apps at the demo biobank

- 50/50 between wet lab and data work
- Is the main user of OpenSpecimen
- Uses Phenotips from time to time

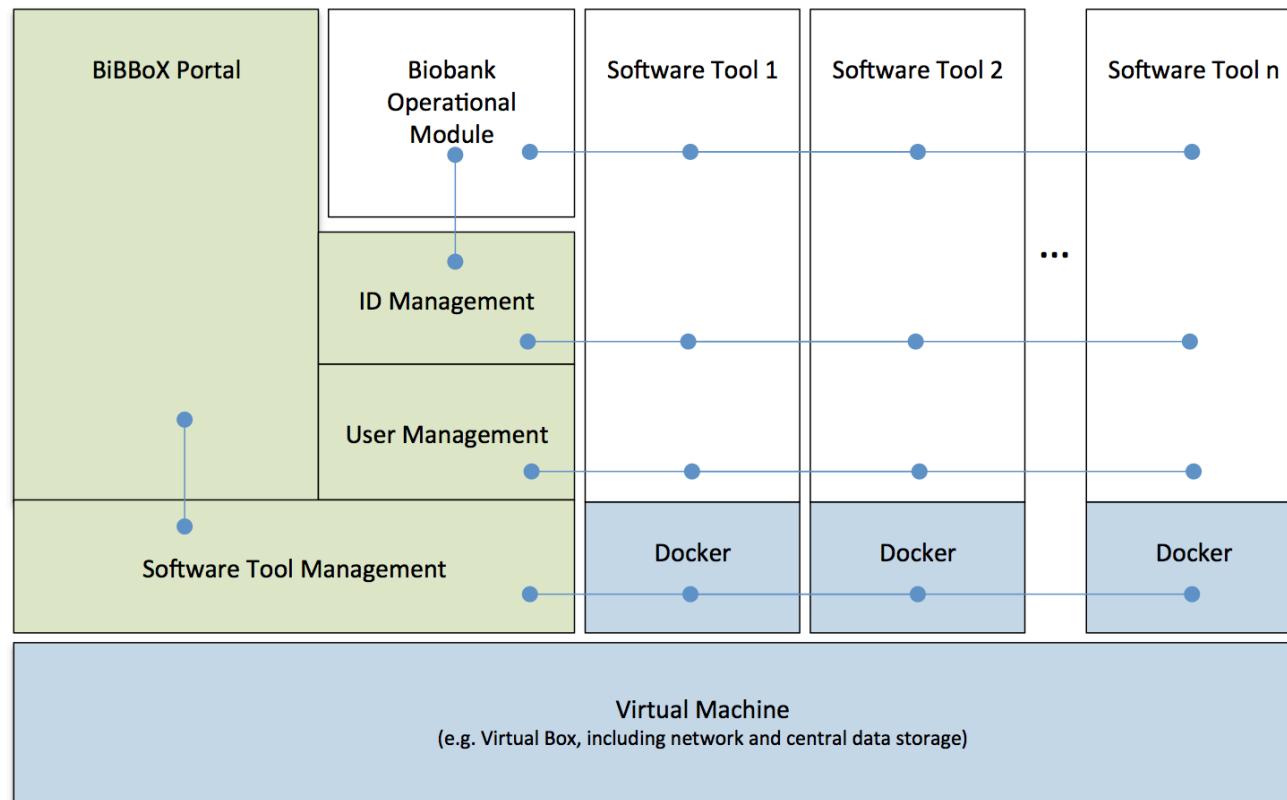
PERSONAS



TECHNICAL ARCHITECTURE



BIBBOX (local) Server



BIBBOX App Architecture

Structure of an App

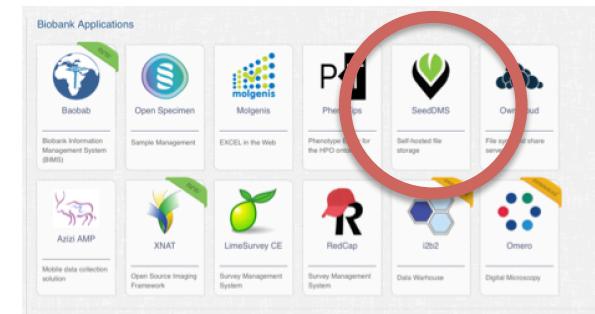
- Based on containers
- Template to generate a docker-compose.yml
- Technical Metadata
- Install Instructions

Documentation

- <http://bibbox.readthedocs.io/en/latest/app-creators-manual/#apps-creators-manual>

Example SeedDMS

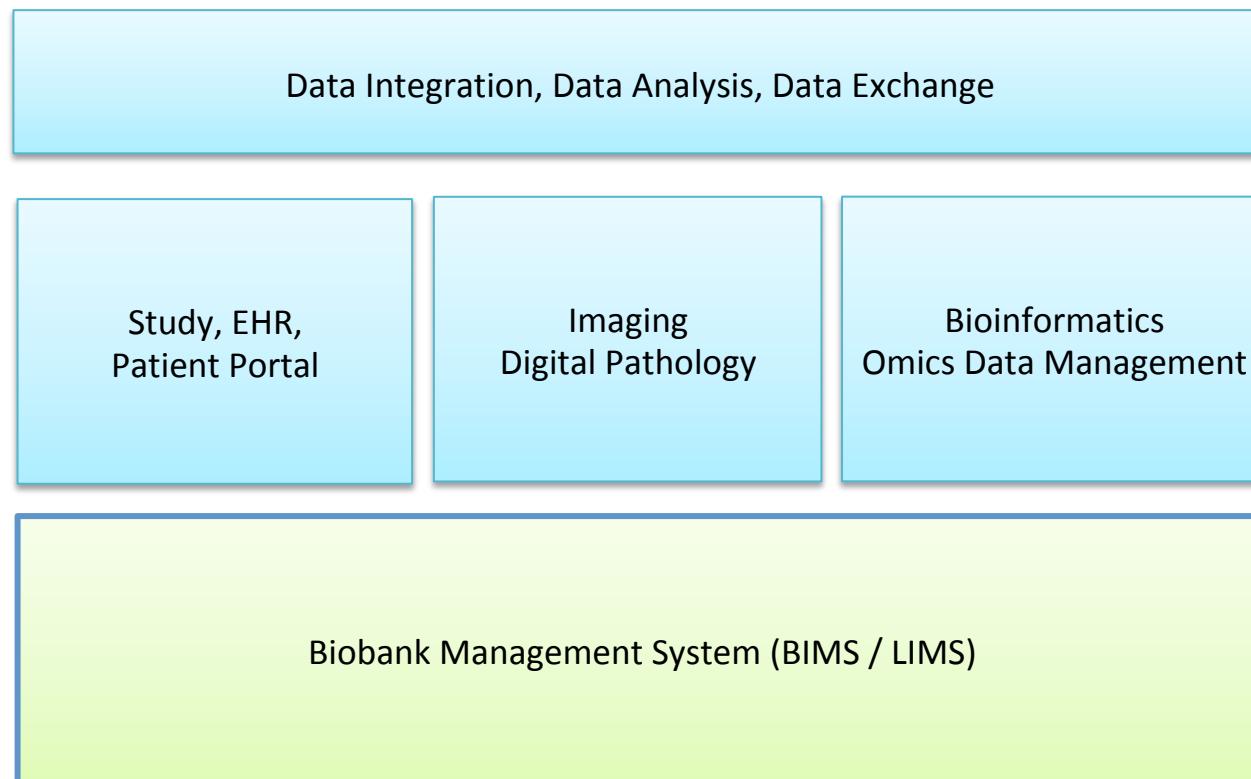
- App description in GitHub
<https://github.com/bibbox/app-seeddms>
- Docker containers in Docker Hub
<https://hub.docker.com/u/bibbox/>



BIBBOX APPS



Biobank IT Components



BIBBOX App Store

The screenshot shows the BIBBOX App Store interface. At the top, there is a navigation bar with links for Home, Applications, Store (which is currently selected), Activities, Settings, and user profile icons.

The main content area is titled "RD Biobank template". On the left, there is a sidebar with a search bar and a "Tags" section containing a list of categories such as Admin, Administration, Backup, Bioinformatics, Blog, CMS, Data Analysis, Data Collection, Data Integration, Data Management, Data Warehouse, Database, Development, Digital Pathology, Document Management, Experiment Management System, Files, Framework, Galaxy, Genetic Disorders, and Graph Database. The "Database" category is highlighted with a blue background.

The central part of the screen displays two sections of applications:

- Biobank Applications**: This section contains six application cards:
 - Baabab (Biobank Information Management System (BIMS))
 - Open Specimen (Sample Management)
 - Molgenis (EXCEL in the Web)
 - PhenoTips (Phenotype Editor for the HPO ontology)
 - SeedDMS (Self-hosted file storage)
 - OwnCloud (File sync and share server)
- Bioinformatics Applications**: This section contains four application cards:
 - STATegraEMS (Experiment Management)
 - Galaksio (Galaxy)
 - Galaxy (Galaxy)
 - Scaleus (Semantic Web Services Integration for Biomedical Applications)

Each application card includes a small icon, the application name, and a brief description. Some cards have a green "new" badge in the top right corner, while others have a yellow "deprecated" badge.



OpenSpecimen

Functionality

- Collection and Sample Management
- Storage / Freezer Management
- Simple Data Capturing
- Cataloguing
- Form Editor
- Retrieval / Shipping

Users

- Biobank Operators
- Data Analysts, PIs

Remarks

- Premium Plugins available, e.g. Redcap Integration



OpenSpecimen

<http://os43-t2.frdb.bibbox.org/#/home>

login: halie

password: Graz2017

A screenshot of the OpenSpecimen web application's home page. The page features a header with the OpenSpecimen logo and a search bar. Below the header is a navigation menu with a 'Home' option. The main content area is a grid of 15 cards, each representing a different functional module. The modules are arranged in four rows: Row 1 contains Collection Protocols, Institutes, Users, Roles, and Sites; Row 2 contains Containers, Queries, Carts, Forms, and Distribution Protocols; Row 3 contains Orders, Shipments, Jobs, Consents, and Training; Row 4 contains Settings, Extras, Specimen Collection, Gels, and Arrays. Each card includes an icon, the module name, and a brief description.



Functionality

- Document Management
- Version Control
- Permission System

Users

- All stakeholders involved

Remarks

- Simple Usage



<http://documents.frbdb.bibox.org/>

login: halie

password: graz2017

A screenshot of a web browser displaying the SeedDMS document management system. The URL in the address bar is "http://documents.frbdb.bibox.org/out/out/ViewFolder.php?folderid=5". The page title is "SeedDMS: Folder 'Cancer Rel...'" and it shows "Signed in as 'Halie Squittino'". The main content area has tabs for "Folder", "Add subfolder", "Add document", "Edit folder", "Move Folder", and "Edit notification list". Below these tabs is a breadcrumb navigation: "DMS / Recommendations / Cancer Related Documents /".

The left sidebar shows a tree view of folder structures:

- DMS
 - Quality Management
 - Recommendations
 - Cancer Related Documents
 - Standards
 - Ethics and Regulations

The central "Folder Information" panel displays the following details:

- Owner: Administrator
- Created: 2017-09-01 11:08:40

A "Fast upload" section with a "Drop files here!" button is present. The "Folder Contents" section lists one item:

Name	Status	Action
TNM-staging-Boecker.pdf	Released	X <input checked="" type="checkbox"/> <input type="button" value=""/>

A note at the bottom states: "This is a classified area. Access is permitted only to authorized personnel. Any violation will be prosecuted according to the national and international laws." and "SeedDMS free document management system - www.seeddms.org".



Functionality

- Human Phenotype Ontology Editor
- Description of Genetic Disorders
- Pedigree support

Users

- RD researchers

Remarks

- Integration to RD Connect platform possible

PhenoTips

<http://phenotips.frdb.bibox.org/>

login: halie

password: graz2017

The screenshot shows the Phenotype database interface. At the top, there are tabs for 'ACTIVE GROUPS' and 'BROWSE GROUPS'. Below this, under 'MY FAMILIES', there is a table with one row: Identifier (Odinson), Reported by (Halie Squittino), and Report date (2017/08/16 15:23). Under 'FAMILIES SHARED WITH ME', it says 'No data has been shared with you.' On the right side, there is a large table titled 'MY PATIENTS' with 13 rows of data. The columns are Report name, Reported by, and Report date. The data is as follows:

Report name	Reported by	Report date
9701	Halie Squittino	2017/08/16 15:19
5003	Halie Squittino	2017/08/16 15:19
2434	Halie Squittino	2017/08/16 15:19
2304	Halie Squittino	2017/08/16 15:19
OIS2000	Halie Squittino	2017/08/16 15:19
9700	Halie Squittino	2017/08/16 15:19
7806	Halie Squittino	2017/08/16 15:19
7800	Halie Squittino	2017/08/16 15:19
KB650F	Halie Squittino	2017/08/16 15:19
7856	Halie Squittino	2017/08/16 15:19
5030	Halie Squittino	2017/08/16 15:19
Fexx3000	Halie Squittino	2017/08/16 15:19
KB650	Halie Squittino	2017/08/16 15:19

At the bottom of the page, there is a footer with the text: 'REPRODUCING OR DISTRIBUTING THIS CLINICAL INFORMATION WITHOUT PERMISSION FROM THE INSTITUTION THAT OWNS IT IS STRICTLY FORBIDDEN. PHENOTIPS VERSION 1.3.2'



Functionality

- “Excel” in the Web
- Data Harmonization
- Data Integration

Users

- Data Analysts

Remarks

- Needs some technical expertise



<http://molgenis.frdb.bibbox.org/>

login: admin

password: admin

A screenshot of the Molgenis Data Explorer interface. The title bar shows the URL "http://molgenis.frdb.bibbox.org/menu/main/dataexplorer?entity=sys_md_EntityType". The main window is titled "Entity" and displays a table of meta-data for entity classes. The table has columns for "Data item filters", "Name", "Package", "Label", and "Description". The "Data item filters" sidebar on the left lists various entity types like "id", "Name", "Package", etc., with checkboxes next to them. The table contains 64 items, with the first few rows shown below:

Data item filters	Name	Package	Label	Description
<input checked="" type="checkbox"/> id	sys_idx_IndexActionGroup	idx	Index action group	This entity is
<input checked="" type="checkbox"/> Name	sys_StaticContent	sys	StaticContent	
<input checked="" type="checkbox"/> Package	sys_scr_ScriptType	scr	Script type	
<input checked="" type="checkbox"/> Label	sys_ont_Ontology	ont	Ontology	
<input checked="" type="checkbox"/> Description	sys_scr_ScriptParameter	scr	Script parameter	
<input checked="" type="checkbox"/> Attributes	sys_ont_TermFrequency	ont	Term frequency	
<input checked="" type="checkbox"/> Abstract	sys_md_Tag	md	Tag	Semantic tag
<input checked="" type="checkbox"/> Extends	sys_ont_OntologyTermNodePath	ont	Ontology term node path	
<input checked="" type="checkbox"/> Tags	sys_set_settings	set	Settings	
<input checked="" type="checkbox"/> Backend	sys_JobExecution	sys	Job execution	
<input checked="" type="checkbox"/> Label (en)	sys_ont_OntologyTermHit	ont	Ontology term hit	
<input checked="" type="checkbox"/> Description (en)	sys_ont_OntologyTermSynonym	ont	Ontology term synonym	
<input checked="" type="checkbox"/> Label (nl)	sys_ont_MatchingTaskContent	ont	Matching task content	
<input checked="" type="checkbox"/> Description (nl)	sys_i18nstrings	sys	Internationalization	Translated la
<input checked="" type="checkbox"/> Label (de)	sys_sec_Owned	sec	Owned	
<input checked="" type="checkbox"/> Description (de)	sys_GeneNetworkScore	sys	Gene Network Score	The gene ne
<input checked="" type="checkbox"/> Label (es)	sys_sec_User	sec	User	Anyone who
<input checked="" type="checkbox"/> Description (es)	sys_FreemarkerTemplate	sys	Freemarker template	
	sys_sec_authority	sec	Authority	
	sys_ont_OntologyTermDynamicAnnotation	ont	Ontology term dynamic annotation	



Functionality

- Electronic Data Capturing
- Surveys
- Data Management

Users

- Scientists

Remarks

- Need specific License from Vanderbilt
- Integration to OpenSpecimen with premium plugin
- Alternative LimeSurvey



<http://redcap-1.demo.bibox.org/>

login: mue

password: Milano2017

A screenshot of a web browser window displaying the REDCap Data Entry interface. The title bar shows the URL "redcap-1.demo.bibox.org/redcap_v7.3.1/DataEntry/index.php?pid=13&page=questionnaire_for_national_elsi_experts&id=1&auto=1". The main content area is titled "Questionnaire For National ELSI Experts" and "CS ELSI Experts' Database". It contains sections for "INFORMATION NOTICE AND REGISTRATION FORM", "Dear Madam / Sir," a note from BBMRI-ERIC about the internal expert database, terms of participation, examples of tasks, participation details, data protection information, and a note about data erasure. The top right of the page has buttons for "Save & Exit Form", "Save & Stay", and "... Cancel ...". The left sidebar includes links for "Record Status Dashboard", "Data Collection Instruments" (with "Questionnaire For National ELSI Experts" selected), "Applications" (including "Calendar", "Data Exports, Reports, and Stats", "Data Import Tool", etc.), and "Help & Information" (including "Help & FAQ", "Video Tutorials", "Suggest a New Feature", and "Contact REDCap administrator").



Functionality

- Medical Image Management
- DICOM support
- Data Management

Users

- Scientists

Remarks

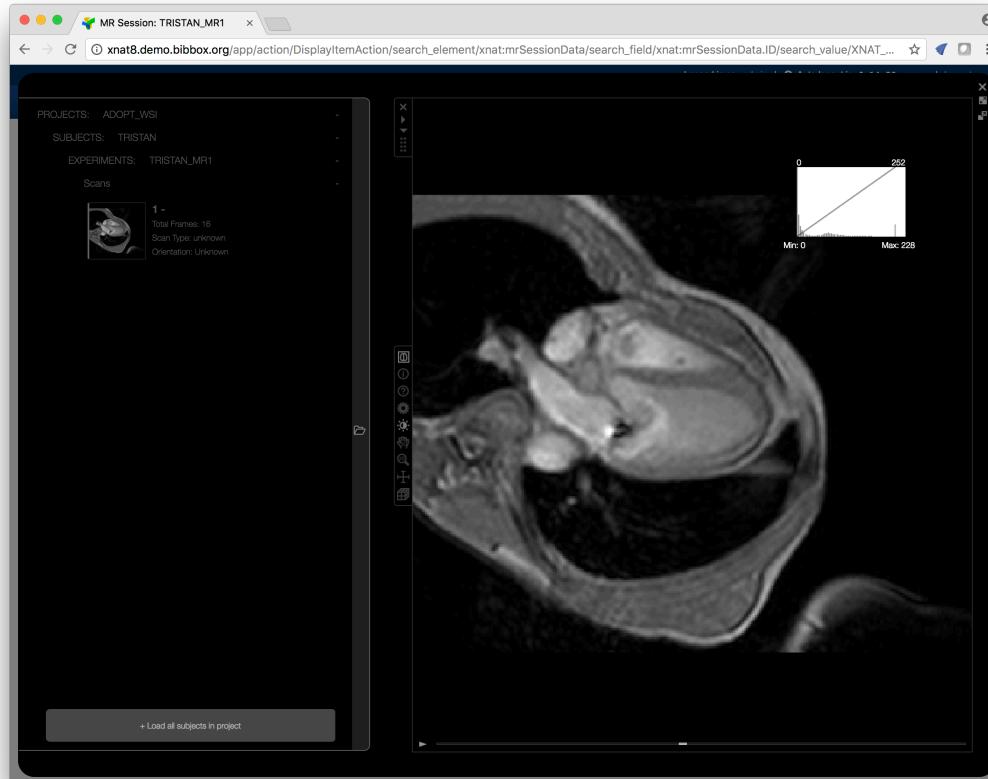
- Alternative OMERO



<http://xnat8.demo.bibbox.org/>

login: admin

password: admin





Jupyter

Functionality

- Phyton and R Scripts in a Web environment
- Script Development
- Data Analysis

Users

- IT experts
- Data analysts
- System Administratores

Remarks

- Programming Skills are needed



<http://scripts.frdb.bibbox.org/notebooks/update-collection-information.ipynb>
token: look in the log windows, admins know how to do

The screenshot shows a Jupyter Notebook interface with the title "update-collection-information". The code cell contains the following Python script:

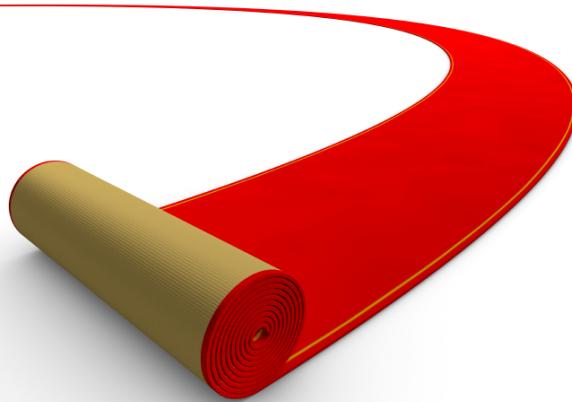
```
donor = {}
collector = {}
anatomicalStructure = ""
primaryContainer = "UNKNOWN"
typeOfCollection = "UNKNOWN"
bioHazards = "UNKNOWN"

material = {
    'label': '',
    'guid': '',
    'materialClass': '',
    'materialType': '',
    'container': '',
    'availableQty': '',
    'storageTemperature': '',
    'fixationStabilization': ''
}
analytics = {
    'affected-genes': [],
    'labvalues': [],
    'primaryContainer': "UNKNOWN",
    'typeOfCollection': "UNKNOWN"
}
fairMetadata = {
    'data-types-available': [],
    'access-restrictions': [],
    'contact-point': {}
}

sampleDescriptionTemplate = {
    'context': {'machine_id': 'frdb.bibbox.org',
               'machine_name': 'French Rare Disease Biobank'},
    'privacy': {'share': 'yes'},
    'preAnalytics': preAnalytics,
    'material': material,
    'analytics': analytics,
    'fairMetadata': fairMetadata
}

def flattenSampleHierarchy(sampleDescription, reclevel):
    sampleList = []
    aliquotDescription = []
    sampleDesc = {
        'specimenClass': sampleDescription['specimenClass'],
        'specimenType': sampleDescription['type'],
        'label': sampleDescription['label'],
        'guid': "SAMPLE--frdb.demo.bibbox.org--" + str(sampleDescription['id']),
        'isStoredAsAliquots': False,
        'availableQty': aliquotDescription
    }
    sampleList.append(sampleDesc)
    return sampleList
```

Rollout & Training



Hosted Service / On-site

Hosted Service

- Central Installation, Updates, Backups
- Fast Internet Connection necessary
- Levels
 - Multitenancy
 - APP Level
 - VM Level (VPN)
- Model Telethon (IT) / Health RI (NL)
- Data Protection Issues

On-Site

- Local IT expertise necessary
- Integration into local user management possible, e.g. LDAP

Installation – Option 1

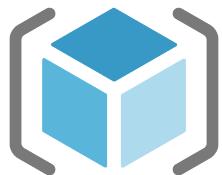


- Provisioning Scripts to build a VM
- Can be deployed to any virtualization system
- Requires high technical expertise

<http://bibbox.readthedocs.io/en/latest/installation-source/>

<https://github.com/bibbox/kit-eb3kit>

Installation – Option 2



- Pre-Build Virtual Machine
- Download as Open Virtual Appliance (OVA) File
- Requires expertise in network configuration

<http://bibbox.readthedocs.io/en/latest/installation-image/>

<http://bibbox.bbmri-eric.eu/resources/machine/>

Installation – Option 3



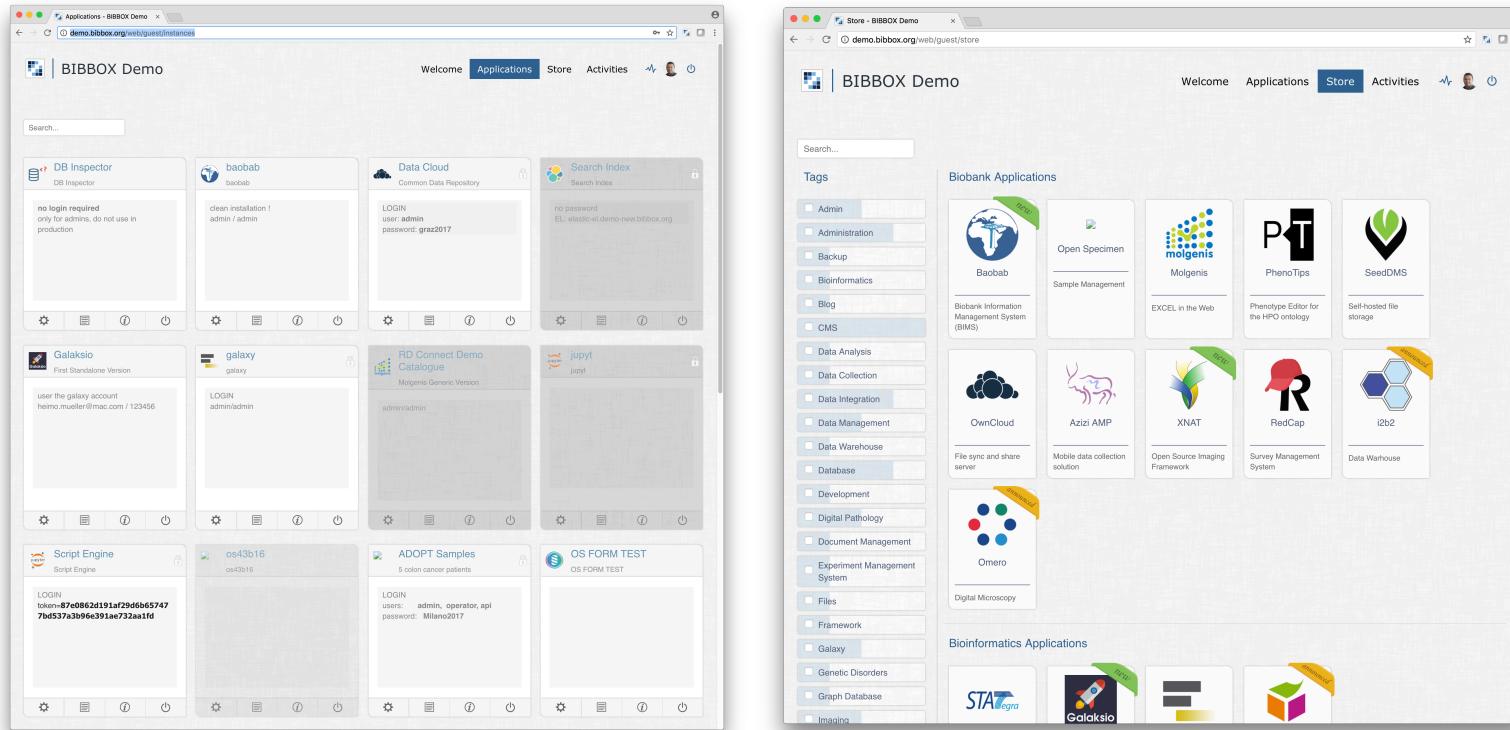
- Physical Box (INTEL NUC Barebone Servers)
- For Testing, Training, Education
- Plug and Play

DEMOS



demo.bibox.org

- <http://demo.bibox.org/web/guest/instances>
playground to install and test APPs
default password: graz2017



demo.bibox.org

- <http://os77.demo.bibox.org/#/cp-view/5/specimens>

5 Colon Cancer Cases

login: admin, operator password: Milano2017

The left screenshot displays the 'Participants' page for a specific case (PPID: 275104131939). The page includes fields for Registration Date, First Name, Middle Name, Medical Identifiers, Social Security Number, Vital Status, CT, MRI, and Lung imaging. Below these, a table shows 'Occurred Visits' with columns for Event Label, Name, Date, and Collection Status. The right screenshot displays the 'Specimens' page, showing a large list of specimen records with columns for Label, Created On, Type, Anatomic Site, Pathology Status, Quantity, and Location. The list contains many entries, mostly labeled with UR-XXXXXX codes.



<http://bibbox.bbmri-eric.eu>

<http://demo.bibox.org>

<http://bibbox.readthedocs.io/en/latest/>

<https://github.com/bibox>

<https://hub.docker.com/u/bibox/>

heimo.mueller@bbmri-eric.eu

[skype: heimo.mueller](#)

[telegram: heimomueller](#)

