OpenLabNotes
An Electronic Laboratory Notebook Extension for
OpenLabFramework

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Odense, Denmark
Saarbrücken, Germany
Paper Laboratory Notebooks

- Documentation of experimental work:
  - Setup
  - Results
  - Notes
- Reproducibility
- Legal proof for an invention

Page from a laboratory notebook of Alexander Graham Bell, 1876.

- Notebooks can get destroyed, lost, or stolen.
- Difficult to locate specific information, especially in case of staff changes.
- Difficult to incorporate already digitalized results.
- Difficult to share specific information.
Electronic Laboratory Notebooks (ELNs)

- Documentation of experimental work
- Reproducibility
- Rich text editor
- Full text search
- Document sharing
- Collaborative editing
- Automated backup
- Timestamps

For many years not considered a legal document
- Commercial solutions quite expensive
- Difficult to set up and maintain
- Data migration issues
Types of ELNs

International Agency for Research on Cancer ELN

- General purpose / cross disciplinary
- Specific application
- Free
- Commercial

Logos of various ELN tools:
- MyLabBook
- BiVIA
- FreezerWorks
- LabSoftLIMS
- LabLynx
- STARLIMS
- MediaWiki
- EVERNOTE
- LABVANTAGE
- labguru
CFR21 part 11

U.S. Food and Drug Administration
Applies to all FDA-regulated industries
Provides guidelines for
  Electronic records
  Electronic signatures
Primary intent is to make sure that any recorded information can not be falsified at a later point (e.g. scientific fraud)
How can this be achieved?
How to protect the data

Backend:
  Firewall
  Access limited to system administrators

Frontend:
  Identity:
    User authentication
    Access rules
    Trusted authority, i.e. LDAP etc.

Content:
  Digital signature
  Co-signing for patenting
Digital signature scheme

A

Unsigned document

Signing with timestamp

Co-signing with timestamp

Signed document with detached signatures

B

Signed document

Public key

Private key

Detached signature
OpenLabFramework

Laboratory Information Management System

Web application based on Grails web application framework

Development started in 2010

Published in 2014

Developed for the functional genomics community, but

Generally usable as a sample management and tracking solution due to its modular structure
Documents in OpenLabNotes can interact with existing modules and their DataObjects out of the box.
Create new Note

Title
ELN Note 1

Note
ELN Note 1 content goes here
Copy and Paste

MS Office, Editor, Evernote, Web, ...

Create new Note

Testing word formatting

1. Testing
2. Copy
3. Paste
4. Functionality

OpenLabFramework
Copy and Paste Images

MS Office, Editor, Evernote, Web, ...

OpenLabFramework

Testing word formatting
1. Testing
2. Copy
3. Paste
4. Functionallity
## List Notes

### OpenLabFramework

#### Filter options:
- Results per page: 10
- Creator: [input field]
- Last Modifier: [input field]
- Project: [input field]
- Filter

### NoteItem List

<table>
<thead>
<tr>
<th>Creator</th>
<th>Last Update</th>
<th>Date Created</th>
<th>Finalized Date</th>
<th>Supervisor</th>
<th>Supervisor Signed Date</th>
<th>Title</th>
<th>Note Preview</th>
</tr>
</thead>
<tbody>
<tr>
<td>ELNuserA</td>
<td>4/23/15</td>
<td>4/23/15</td>
<td></td>
<td></td>
<td></td>
<td>ELN Note 1</td>
<td>show</td>
</tr>
</tbody>
</table>

ELN Note 1 content goes here.
Show Note

OpenLabFramework

Show Note ELN Note 1

Title: ELN Note 1
Samples: None added
Upload attachment: 
Previously attached files are shown in a tab below the note.

History
Date: 2015-04-23 10:57:24
created: CEST
Author: ELNuserA
Note status: draft

Shared with: None added
Projects: None added
Notebook: None added
Note:

Unsigned → Signed → Co-signed
Signing a Document

OpenLabFramework

Show Note ELN Note 1

Finalize

Unsigned

Finalize

Signed

Co-signed

Edit

Delete

Download note as docx

Download note as PDF

Title: ELN Note 1

Samples: None added

Upload attachment: Previously attached files are shown in a tab below the note.

Upload a file

Submit

Shared with: None added

Projects: None added

Notebook: None added

Note:
Generate Public/Private Keys

OpenLabFramework

Generate keys

User ELNUserA does not have any keys!

For security reasons we need to generate keys for encryption of notes. Please confirm your password.

Password

Generate keys
Sign Note & Select Supervisor

OpenLabFramework

Sign note

- Public and private keys has been generated for your account

Please confirm your password to sign this note.

Password: [field]

Supervisor: [field]

Sign note

Flowchart:

- Unsigned
- Finalize
- Signed
- Co-signed
Signature Checks
Supervisor Signature

OpenLabFramework

Noteltem List

Filter options:

List notebooks
Create new note
List own notes
List notes shared with me
List notes signed as supervisor

List notes I need to sign

Results per page: 10
Creator:
Last Modifier:
Project:
Filter:

<table>
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<th>Supervisor Signed Date</th>
<th>Title</th>
<th>Note Preview</th>
</tr>
</thead>
</table>

Testing word formatting
Co-signed Document

OpenLabFramework

Show Note ELN Note 1

Note was signed

Download note as docx  Download note as PDF

This note is signed by you and the author.

Title: ELN Note 1

Samples: None added
Add to

Upload attachment: Previously attached files are shown in a tab below the note.

Upload a file

Submit

Shared with: None added
Add to

Projects: None added
Add to

Notebook: None added

History

Date created: 2015-04-23 12:34:21 CEST
Date finalized: 2015-04-23 12:55:01 CEST
Author: ELNuserA
Author signature: ✔
Date signed by supervisor: 2015-04-23 13:26:24 CEST
Supervisor: ELNsupervisorA
Supervisor signature: ✔
Note status: signed

Unsigned  →  Signed  →  Co-signed
Link Documents to Samples

OpenLabFramework

Show Note ELN Note 1

Download note as docx  Download note as PDF

Signed by you and the supervisor, note cannot be edited or deleted.

Title: ELN Note 1

Samples:
- CHO-K1 - RPMI 1640

Upload attachment:

Upload a file

Shared with: None added

Projects:
- ELN Project A

Notebook: None added

History:
- Date created: 2015-04-23 12:34:21 CEST
- Date finalized: 2015-04-23 12:55:01 CEST
- Author: ELNuserA
- Author signature: ✓
- Date signed by supervisor: 2015-04-23 13:26:24 CEST
- Supervisor: ELNsupervisorA
- Supervisor signature: ✓
- Note status: signed

Previously attached files are shown in a tab below the note.
OpenLabFramework

Show Note ELN Note 2

- Title: ELN Note 2
- Samples: None added
  - esyh
    - Add to
- Upload attachment:
  - Previously attached files are shown in a tab below the note.
  - Upload a file
  - Submit
- Shared with:
  - User B (ELNuserB)
  - ELNsupervisorA
    - Add to
- Projects: None added
  - amspro1
    - Add to
- Notebook: None added
  - test
    - Add to
- Note:

History:
- Date: 2015-04-23 14:12:06
  - created: CEST
- Author: ELNuserA
- Note status: draft
Add to Projects

OpenLabFramework

Show Note ELN Note 1

- Title: ELN Note 1
- Samples: None added
- Upload attachment: Previously attached files are shown in a tab below the note.
- Shared with: None added
- Projects: None added
- Notebook: None added
- Note: test

Signed by you and the supervisor, note cannot be edited or deleted.

History:
- Date created: 2015-04-23 12:34:21 CEST
- Date finalized: 2015-04-23 12:55:01 CEST
- Author: ELNuserA
- Author signature: ✓
- Date signed by supervisor: 2015-04-23 13:26:24 CEST
- Supervisor: ELNsupervisorA
- Supervisor signature: ✓
- Note status: signed
Filter Options

OpenLabFramework

Noteltem List

Filter options:

Results per page: 10  Creator (Author):  Supervisor:  Last Modifier:  
Project:  Date:  Created  5  May  2015  -  5  May  2015  Filter
Summary

Electronic Laboratory Notebooks will soon be standard for experimental research

Commercial solutions: Too expensive?

Free solutions: Data protection?

OpenLabNotes:

- Rich text editor
- Full text search and filter options
- Shareability and Export
- Digital signatures (co-signing)
- Documents organized in notebooks and projects

Integrated with OpenLabFramework:

- Direct reference to samples
- Uploading additional documents
- Single solution
Open Challenges

Lack of integration with trusted authorities
ELN data format standard needed

More features:

- Editable copies of finalized documents
- Extend digital signature protection to attached documents

User groups
Deployment challenging
Community adaptation
Requirements & Availability

>= Java 6 with Java Cryptography Extension

Java web application server: Tomcat (6 or 7)

GitHub

https://github.com/NanoCAN/OpenLabFramework
https://github.com/NanoCAN/OpenLabNotes

docker pull nanocan/openlabframework
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