A Material Assay Database

for the Low Background Physics Community

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A need

The low background community possesses a vast amount of useful data that is not shared efficiently

We need better sharing mechanisms

- publications
- a repository of assay results

A solution

A community database software package

Well-designed data format

- Simple
- Comprehensive
- Flexible

High quality interface

- Powerful search
- Easy data entry
- Easy administration

Portable

- Local and server installations
- Easy synchronization (replication)

Community owned

- Cross-institutional development
- Open source

A solution

Engine - Apache CouchDB

Open source non-relational database

A flat collection of JSON **documents** of named fields

```
"sample": {
   "name":          "Fused silica",
   "description":   "Corning 7940, lot 56667",
   "source":        "Mark Optics Ltd.",
   "owner":         "LBNL LBF",
}
```

Data aggregated and displayed using **views**

Schema-free so structure can be varied and extended

Distributed (can self-replicate between machines)

A solution

Engine - Apache CouchDB

Speaks HTML

Widely-used (CERN, BBC etc.)

Future-safe data format (JSON text)

Commercial online hosting services available

http://couchdb.apache.org

http://guide.couchdb.org/

http://www.couchbase.com

http://www.cloudant.com

A solution

Search facility - Apache Lucene

Powerful Google-style search engine

Interfaces to CouchDB

http://lucene.apache.org

https://github.com/rnewson/couchdb-lucene

A solution

Application framework - CouchApp

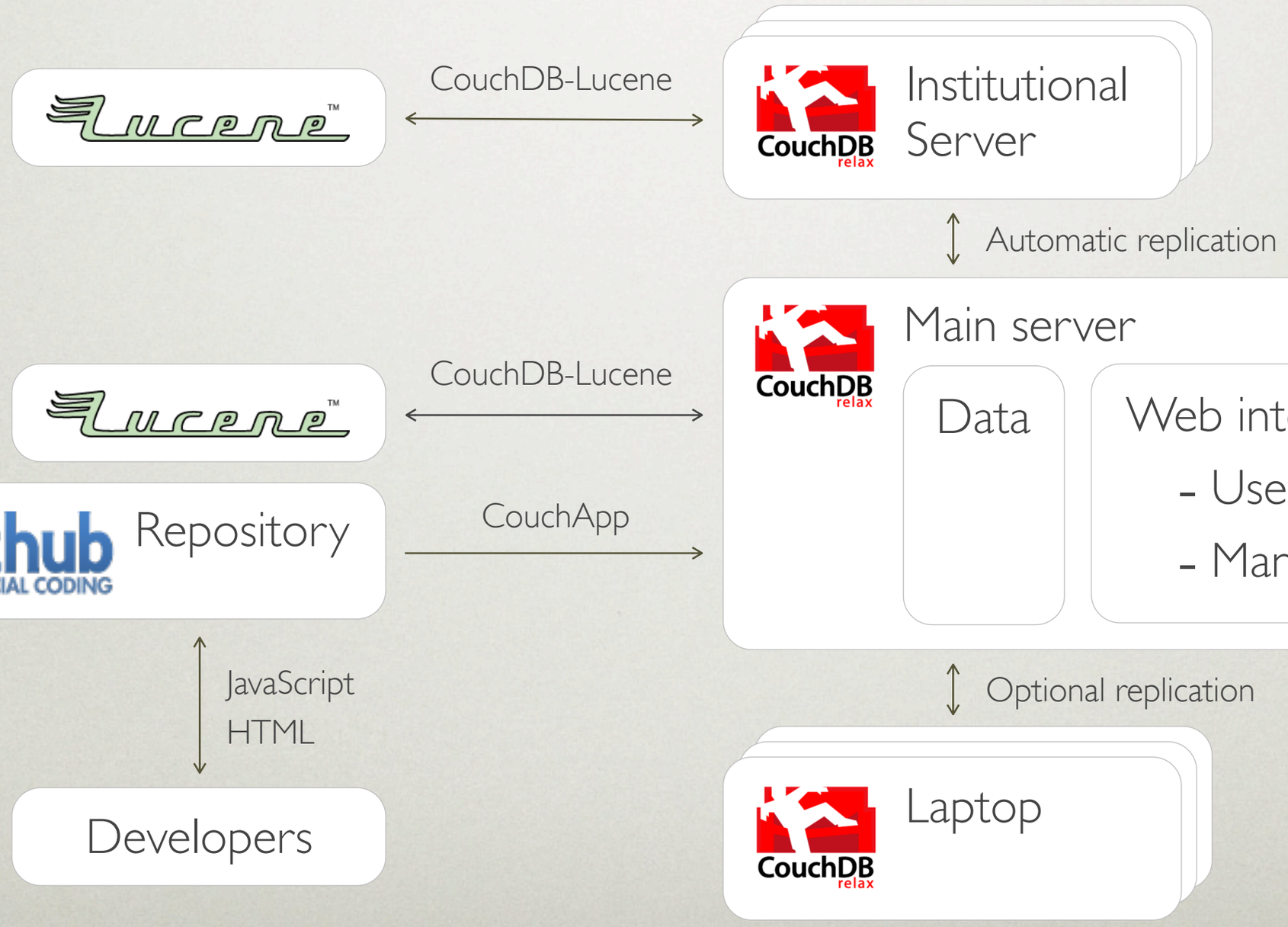
Simple framework for JavaScript and HTML application development in CouchDB

Applications stored as documents within the database

http://couchapp.org

A solution

Schematic



A solution

Data format

Propose the JSON Material Assay Data Format (MADF)

- a set of mandatory core fields
- freely extendable (to meet the needs of individual institutions)

Up for discussion:

- measurement unit control?
- allow rich attachments? (CouchDB supports MIME)

A solution

Data format

Propose the JSON Material Assay Data Format (MADF)

```
{

   "type":           "measurement",

   "sample":         { },
   "measurement":    { },
   "data_source":    { }

}
```

A solution

Data format

Propose the JSON Material Assay Data Format (MADF)

```
"sample": {

   "name":                  "",
   "description":           "",
   "source":                "",
   "owner":                 "",
   "tags":                 ["", “”, “”, ... ]

}
```

A solution

Data format

Propose the JSON Material Assay Data Format (MADF)

```
"measurement": {

   "institution":          "",
   "technique":            "",
   "date":               { "day":"", "month":"", "year":"" },
   "requestor":            "",
   "requestor_contact":    "",
   "practitioner":         "",
   "practitioner_contact": "",
   "description":          "",
   "results": [
      { "isotope":"", "value":"",  "error":"", "unit":"" },
      { "isotope":"", "limit":"",  "c.l.":"",  "unit":"" }
   ]

}
```

A solution

Data format

Propose the JSON Material Assay Data Format (MADF)

```
"data_source": {

   "reference":              "",
   "data_entry_name":        "",
   "data_entry_contact":     ""

}
```

A solution

Interface

Viewer interface

- search box, data submission form
- flexible display of results (list, table, optional detail level)
- download in various formats (CVS, ROOT, PDF)

Management interface

- approve submitted data
- edit / delete existing data

A CouchDB can contain multiple interfaces managing the same data

The LBF database

Prototyping

Software following this model is being written at LBNL

A prototype is being tested:

- The Low Background Facility (LBF)
- The MAJORANA experiment

LBF
OROVILLE LBNL

MAJORANA
Material Assay
Database

e.g. tin

MAJORANA
Material Assay
Database

tin

- Tin, LANL
- Tin, LANL
- Tin, Canberra

MAJORANA
Material Assay
Database

tin

⊟ Tin, LANL

sample	description	Tin, 99.9998% purity			
measurement	technique	Gamma			
	results	U chain	< 1.7		mBq/kg
		Th chain	< 3.1		mBq/kg
		K-40	25	(14)	mBq/kg
		Co-60	< 1.5		mBq/kg

⊞ Tin, LANL

⊞ Tin, Canberra

MAJORANA
Material Assay
Database

tin

⊟ Tin, LANL

sample	description	Tin, 99.9998% purity	
	source	Adam Montoya, LANL	
	owner	LANL	
	set	Majorana	
	mass	710 g	
	geometry	Block of metal	
measurement	technique	Gamma	
	institution	LANL / WIPP	
	date	5 / 2010	
	practitioner	Steve Elliot, LANL (elliotts@lanl.gov)	
	description	The tin was placed inside two nested plastic bags and put inside the WIPP-n cavity. Background spectrum 66.78 days.	
	count length	99.2 d	
	detector	WIPP-n	
	results	U chain < 1.7	mBq/kg
		Th chain < 3.1	mBq/kg
		K-40 25 (14)	mBq/kg
		Co-60 < 1.5	mBq/kg
data	reference	Majorana report M-TECHDOCDET-2010-110	
	entry by	James Loach (jcloach@lbl.gov)	

⊞ Tin, LANL
⊞ Tin, Canberra

MAJORANA
Material Assay
Database

tin

Tin, LANL

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entry by James Loach (jcloach@lbl.gov)

Tin, LANL
Tin, Canberra

Export

Copy and paste into Excel or similar.

```
"Tin, LANL",,"U chain","<","1.7",,"mBq/kg","Th chain","
<","3.1",,"mBq/kg","K-40",,"25","14","mBq/kg","Co-60","
<","1.5",,"mBq/kg"
"Tin, LANL",,"Li","<","0.007",,"ug/g","Be","
<","0.004",,"ug/g","Na","<","9",,"ug/g","Mg","<","1",,"ug/g","Al","
<","1",,"ug/g","K","<","10",,"ug/g","Ca","<","6",,"ug/g","Sc","
<","0.1",,"ug/g","Ti","<","1",,"ug/g","V","<","2",,"ug/g","Cr","
<","5",,"ug/g","Mn",,"0.15",,"ug/g","Fe",,"60.6",,"ug/g","Co","
<","1",,"ug/g","Ni","
<","5",,"ug/g","Cu",,"24.4",,"ug/g","Zn",,"2.5",,"ug/g","Ga","
<","0.3",,"ug/g","As","<","0.2",,"ug/g","Se","<","0.3",,"ug/g","Rb","
<","0.1",,"ug/g","Sr","<","0.09",,"ug/g","Y","
<","0.002",,"ug/g","Zr","<","0.007",,"ug/g","Nb","
<","0.006",,"ug/g","Mo","<","0.3",,"ug/g","Rh","
<","0.006",,"ug/g","Pd","
<","0.03",,"ug/g","Ag",,"231",,"ug/g","Cd","<","0.04",,"ug/g","Sb","
<","37",,"ug/g","Te","<","0.03",,"ug/g","Cs","<","4",,"ug/g","La","
<","0.6",,"ug/g","Ce","<","0.5",,"ug/g","Pr","<","0.6",,"ug/g","Nd","
<","0.01",,"ug/g","Sm","<","0.03",,"ug/g","Eu","
<","0.05",,"ug/g","Gd","<","0.02",,"ug/g","Tb","
```

MAJORANA
Material Assay
Database

tin

Comments & suggestions

Please send feedback to help us improve this database. *Complete all fields*.

Name

Email

Comments

Submit

MAJORANA
Material Assay
Database

tin

Instructions

Enter your search terms in the search box and press enter or click the search button:

Search.

Documents are returned which contain one or more of the search terms.

You can alter this default behavior using operators and wildcards. e.g.

- "stainless steel"
- stainless AND steel
- stainless OR steel
- stee?
- stainless s*

Expand or collapse entries using the ⊞ or ⊟ buttons.

Use this button to alternately expand or collapse all entries:

Expand / collapse all.

Add more detail to search results using this button:

More detail.

Use this button to format the numerical results in CSV:

Export numerical results.

Use these buttons to send feedback or to reach this page:

Send feedback.

Discussion

I believe the LBF model is suitable for community use but wide buy-in is essential to adoption

A committee of interested parties might be formed to study the options and made a recommendation

Development will continue on the LBF software

- software is open source
- collaborators are welcome