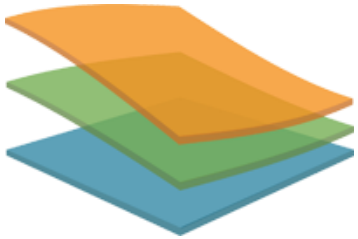


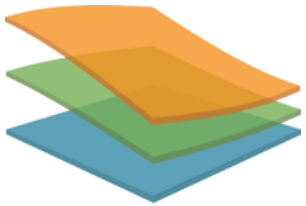
Learning Layers

Scaling up Technologies for Informal Learning in SME Clusters

The Social Semantic Server

A Flexible Framework to Support Informal Learning at the Workplace

Sebastian Dennerlein, Dominik Kowald, Elisabeth Lex, Dieter Theiler, Emanuel Lacic, **Tobias Ley**, Vladimir Tomberg, Adolfo Ruiz-Calleja

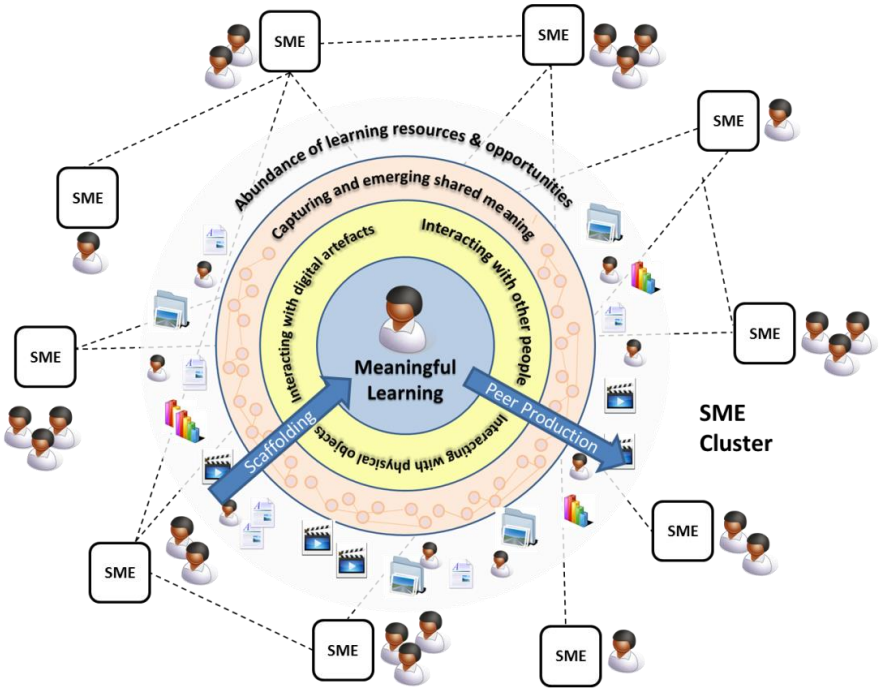


Agenda

- **Introduction:** ***Scaling Informal Workplace Learning***
- **System Design:** ***Designing a flexible framework for informal workplace learning***
  - Theoretical Underpinning
  - Design Principles
- **System Implementation:** ***SOA for a Hybrid Knowledge Representation***
  - Software Architecture
  - Services
- **Applications:** ***B&P, KnowBrain & Bookmarker/ Attacher***
- **Conclusion** ***on the Support of Informal Learning***
- **Future Work:** ***Next Steps & What else can be achieve by the SSS?***

Learning Layers Project: Scaling Informal Learning

- Looking at Learning in Work Practices
  - [Eraut and Hirsch 2007, Maier 2009, Attwell 2003, Kooken et al. 2009, Collin 2006]
- Unlock Peer Production
  - [Schmidt et al. 2009, Maier & Schmidt 2007]
- Scaffolding for Meaningful Learning
  - [Ley et al. 2010, Lindstaedt et al. 2010, Siadaty et al. 2010, Pata, 2006]
- Scale through Regional Clusters
  - [Deitmer and Attwell 2000]

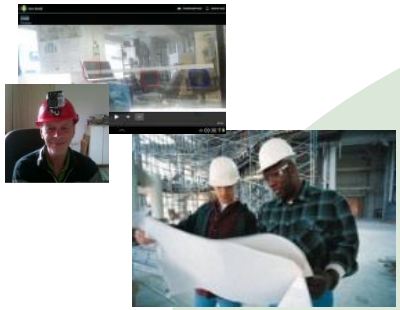


Example: Building & Construction

Seattle Municipal Archives
http://www.flickr.com/photos/seattlemunicipalarchives/7165372144/

A possible scenario

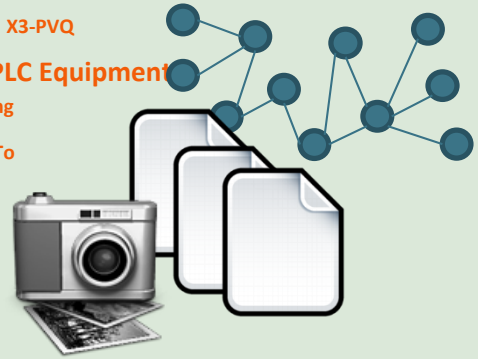
Use of video recording and annotation



Explaining the use of a new construction technique and materials on site

Making video material available on site through QR tags

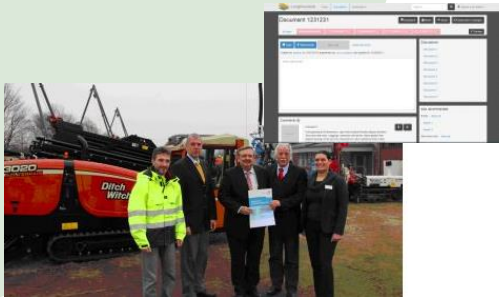
X3-PJC X3-PVQ
X3-POZ PLC Equipment
Straw Building
How To



Collection transformed into instructional material to enhance traditional training

Further questions on the use of the technique connected to site

Material, questions and best practices collected and discussed



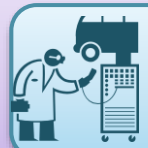
Scaling Informal Learning: Project Architecture

Workplace Learning Layer
Integration through Workplace Learning Practices

Interaction Layers: An Ecosystem of Tools

Interacting with People

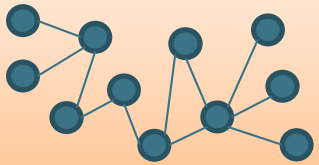
Interacting with Digital Materials



Interacting with Physical Objects

X3-PJC X3-PVQ
X3-POZ PLC Equipment
Straw Building How To

Social Semantic Layer
Integration through Shared Meaning



Architecture & Integration Layer
Integration through Common Infrastructure

Deployment & Sustainability
Scaling in Regional Clusters

Scaling Informal Learning: Project Architecture

Workplace Learning Layer
Integration through Workplace Learning Practices

Interaction Layers: An Ecosystem of Tools

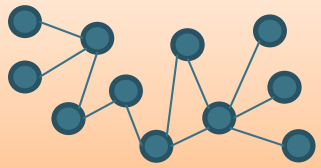
Interacting with People

Interacting with Digital Materials

Interacting with Physical Objects

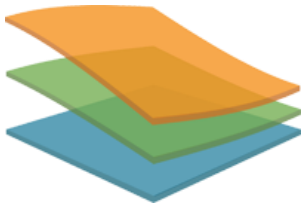
X3-PJC X3-PVQ
X3-POZ **PLC Equipment**
Straw Building How To

Social Semantic Layer
Integration through Shared Meaning



Architecture & Integration Layer
Integration through Common Infrastructure, Software Development and Tools

Deployment & Sustainability
Scaling in Regional Clusters



Theoretical Underpinnings

- Individual knowledge is constructed through collaborative knowledge building via **artefact mediated communication** (Cress et al., 2013; Stahl, 2000; Suthers, 2005)
- Community of learners is considered as a distributed cognitive system (Hollan et al., 2000; Hutchins, 2000)
- Social construction of meaning in a distributed cognitive system, meaning making (Suthers, 2005)

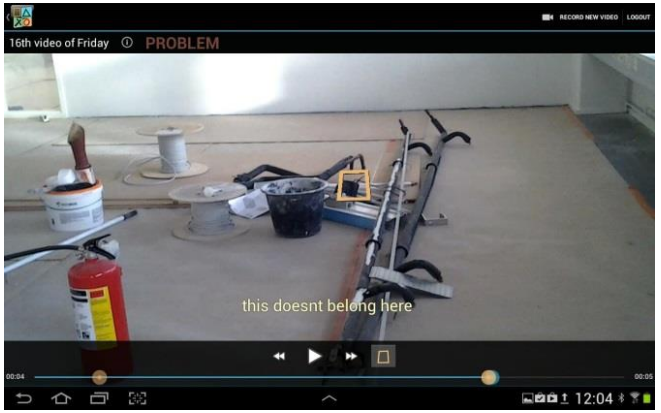
How shared meaning emerges in Artefact-Mediated collaboration

- Artefact-mediated communication needs minimal shared understanding, i.e., a common ground
  (Clark & Brennan, 2003; Cress & Kimmerle, 2013)
- Shared Meaning is a result of social practices and negotiation
  (Wenger, 1998)

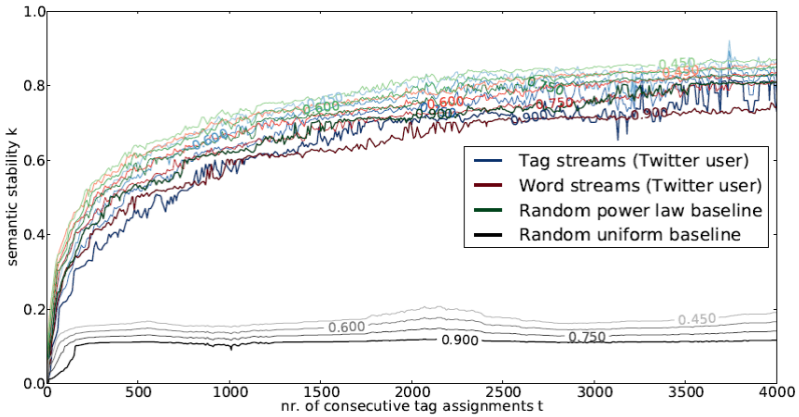
- *Actors, artefacts, interpretations and their reifications co-evolve in a constant dynamic process of meaning making*

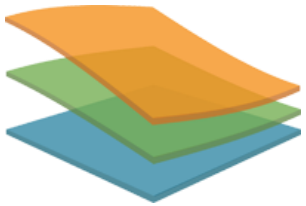
PLC Equipment X3-PJC Lightning Solution

X3-POZ



How To Toilet





Goals of the Research

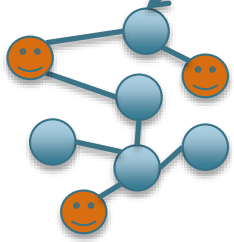
- Develop a framework and services that make available a network composed of learners and their shared artefacts
- Network is built by capturing how these artefacts are used in workplace activity
- Services expose particular structural aspects of that network in the learning context

1 Knowledge is built by people interacting with other people and artefacts

5 New Information displayed to Support User Interactions

2 Each interaction increases the network ...

An Artefact Actor Network



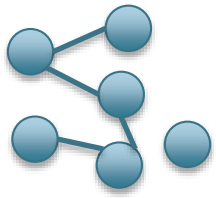
3 ... and is tracked in the history

Traces of the Network History

Who	When	Where	What	...	...	...	...	...	...
Who	When	Where	What	...	...	...	...	...	...
Who	When	Where	What	...	...	...	...	...	...
Who	When	Where	What	...	...	...	...	...	...

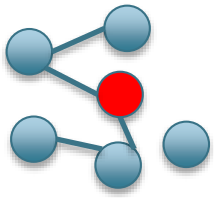
4 Intelligent Services derive new information

Trust and Social Network



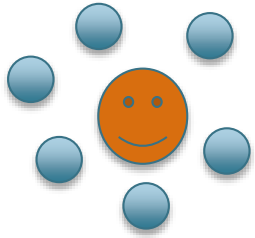
Whom to ask?

Recommended Resource



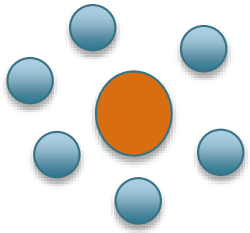
What to read and watch?

User Profile



Who are the experts?

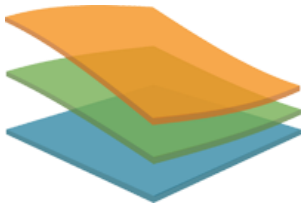
Resource Profile



What's the quality?

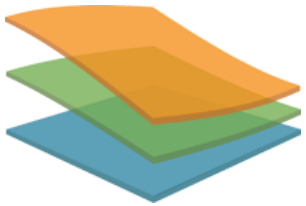
Topic Modeling

What do people talk about?



Design Principles

Claims	Design Principles
Persons **interact** in a small group or the whole community of learners **via shared artefacts.**	• **DP1:** The SSS establishes a hybrid network of persons and artefacts built up by the interactions of persons and artefacts. • **DP2:** The SSS creates and infers groups of users to let learners interact in trusted learning settings. • **DP3:** The SSS removes possible inherent boundaries from existing tools.
The **situational context** in which knowledge construction and application takes place **is important** both **for individual learning** as well as for establishing **shared understanding**.	• **DP4:** The SSS can track the physical, time, social and semantic context in which interactions have taken place. • **DP5:** The SSS can provide cues/recommendations (e.g., tags, artefacts, etc.) to remind users of the context in which an interaction has taken place.
People (i.e. their interpretation) and **artefacts influence each other in a dynamic process** of coordination of representational states.	• **DP6:** The SSS makes persons aware of collaborators' interpretations via services. • **DP7:** The SSS allows persons to express their interpretations that lead to manifestations in artefacts via services (e.g., discussion, tagging).
Cognition represents a **"cultural process"** that allows **access to the history of the translations** between artefactual, internal and physical structure.	• **DP8:** The SSN tracks the history of network interactions and can store different states of that network.
Internal, digital and physical **environment is connected** so that there is a **constant exchange** between internal and external structures.	• **DP9:** The SSS can represent different knowledge structures in different levels of maturity. • **DP10:** The SSS provides a mapping to physical objects. • **DP11:** The SSS supports different formality levels of metadata.

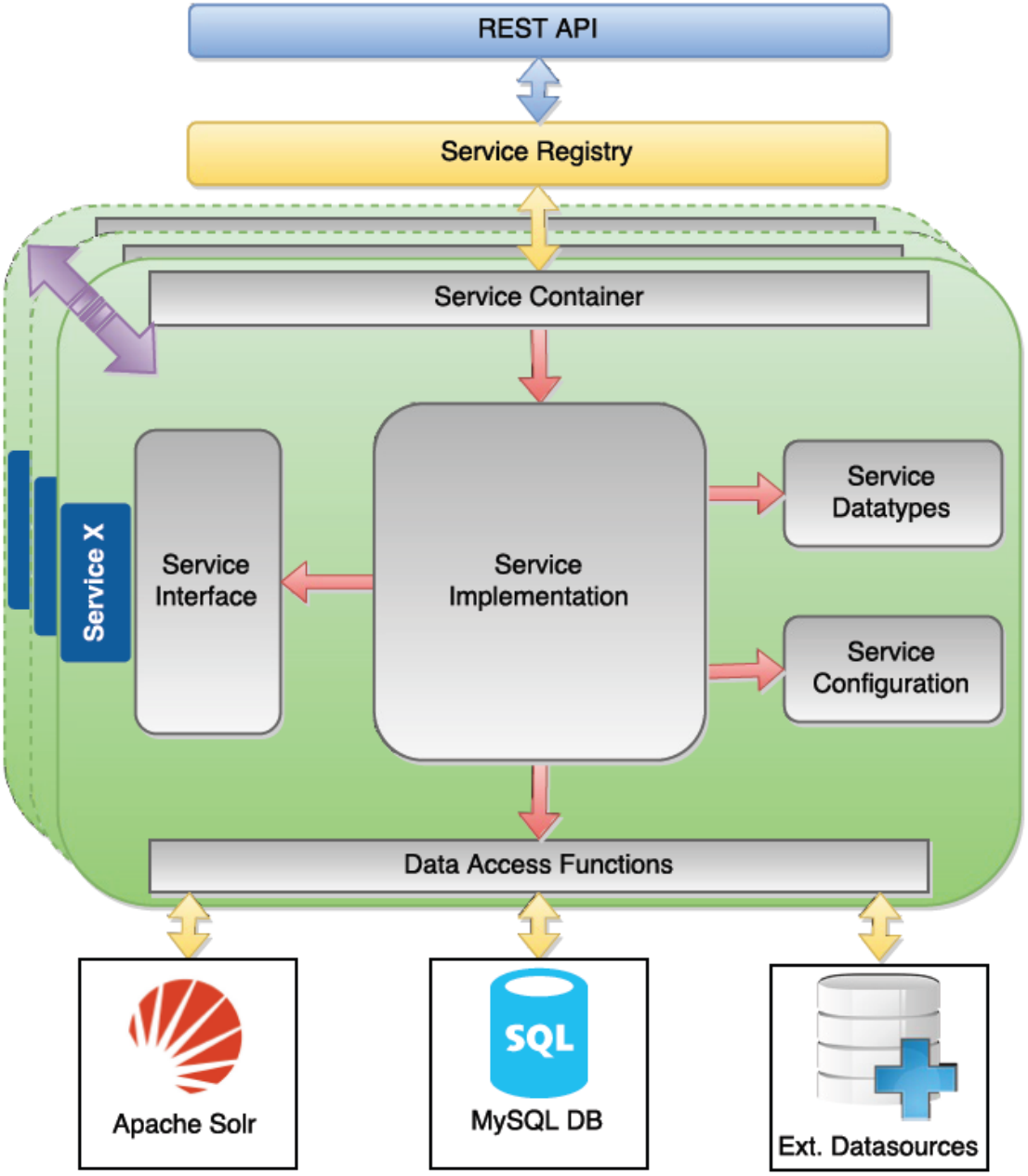


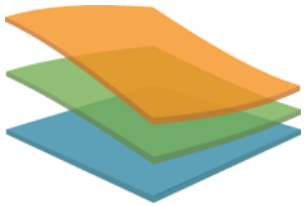
Software Architecture

- SSS follows ideas of **Service-Oriented Architecture (SOA) and Microservices**
- Functionality is divided in services that can be easily maintained, tested and combined to new services or more powerful ones
- **Key benefits:**
  - Loose coupling
  - Abstraction
  - Reusability
  - Autonomy
  - Statelessness
  - Composability

- This architecture design aims at **supporting various tools with common functionality**
- SSS is open-source software and available from the Learning Layers GitHub
  - https://github.com/learning-layers/SocialSemanticServer

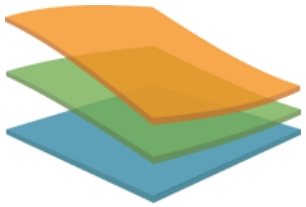
- **Service Registry**
  - Forwards requests from REST API
- **Service**
  - Implements interface
  - Provides its datatypes, configuration and data access functions
  - Has Service Container: Access point to concrete implementations
- **Hybrid data persistence**
  - MySQL
  - Apache Solr
  - External datasources (e.g., Evernote)





SSS Services

- **Metadata**
  - (1) formal (e..g, time, location), (2) domain specific (e.g., from ontology), (3) user provided metadata (e.g., tags)
- **Activity**
  - Trace users‘ interactions with resources (e.g., log files)
- **Search**
  - Full-text searches based on metadata (e.g., tags) or content (via SOLR)
- **Recommendations**
  - Tag-, resource-, user recommendations based on semantic, social and location-based context (e.g., Seitlinger et al., 2013; Kowald et al., 2014)
- **Gardening Knowledge Structures**
  - Topic Modelling (via LDA) and tag recommendations
- **Discussion**
  - Discuss around entities and multimedia Q&A
- **Access Restrictions**
  - Build groups of learners and share learning material with others
- **Collection**
  - Organize data in collections or learning episodes



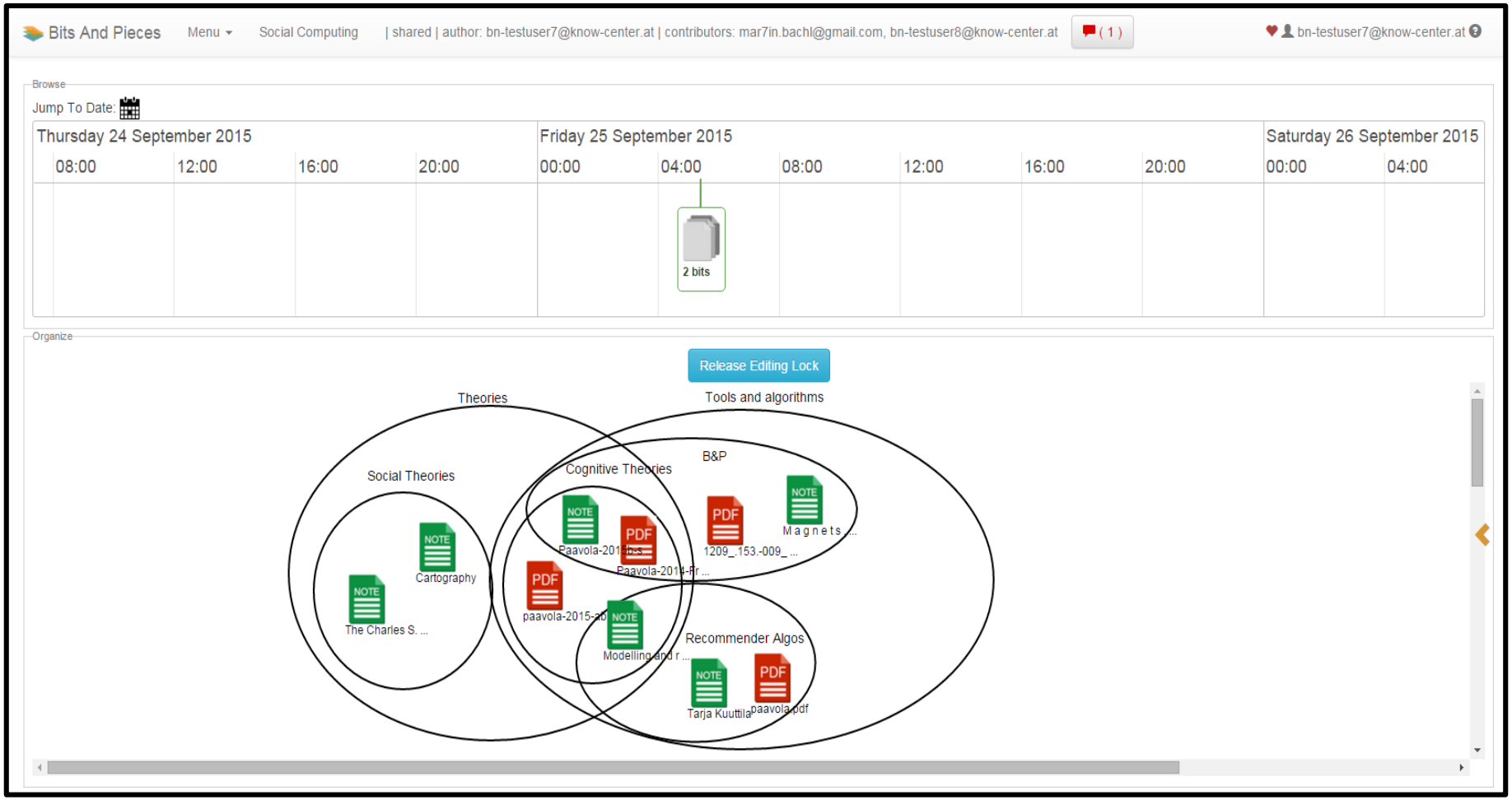
Applications of SSS and Its Services

- Backend technology for various Learning Layers tools in **Healthcare and Construction domain**

- Examples:
  - **Bits & Pieces**
    - sensemaking of learning experiences
  - **KnowBrain**
    - Collaborative organizing and discussion of learning material
  - **Bookmarker / Attacher**
    - Exploration of topics on the Web and formalization into blogs

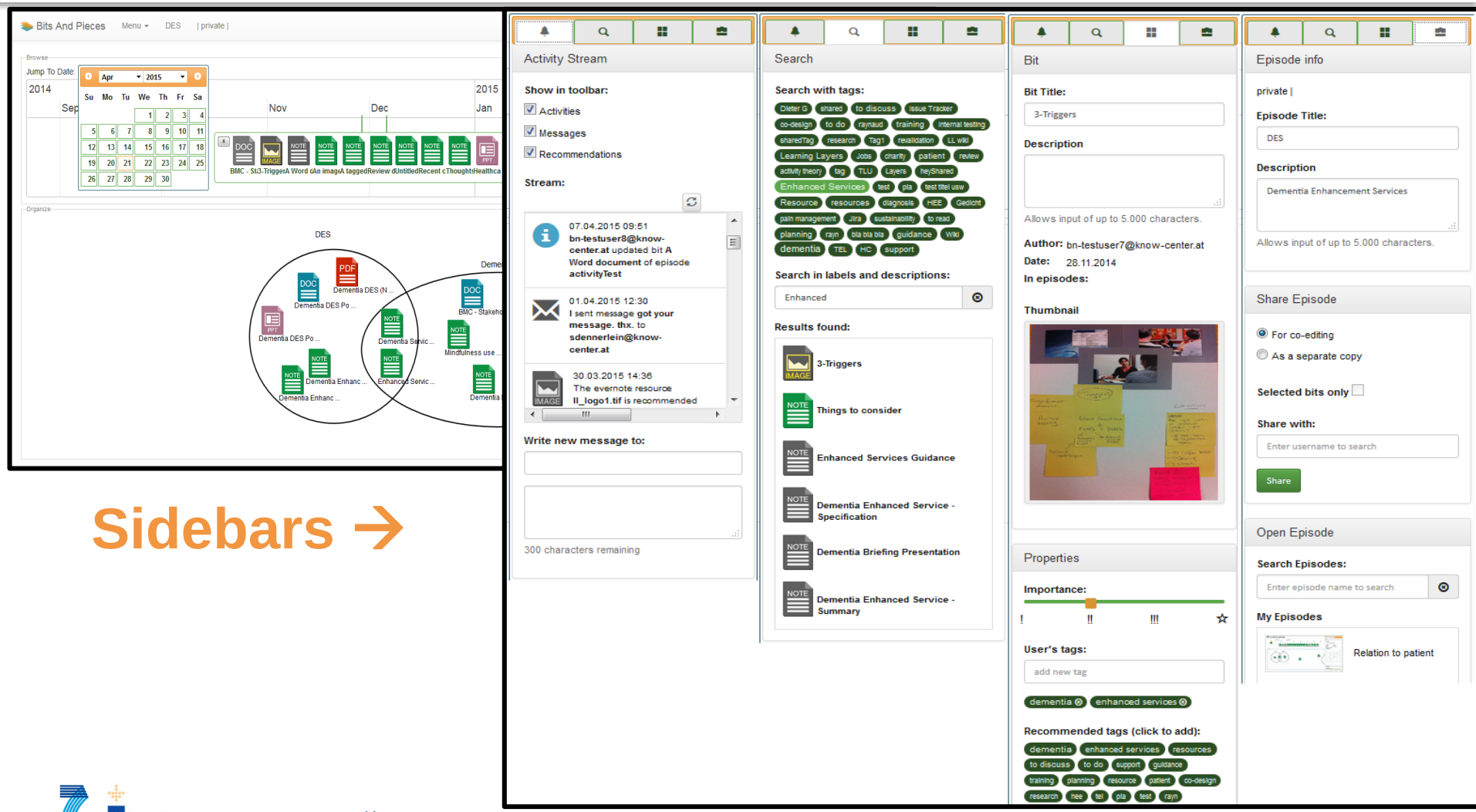
- Others:
  - e.g., Living Documents, AchSo!, DiscussionTool, Learning Toolbox
  - see: https://github.com/learning-layers/

Bits and Pieces



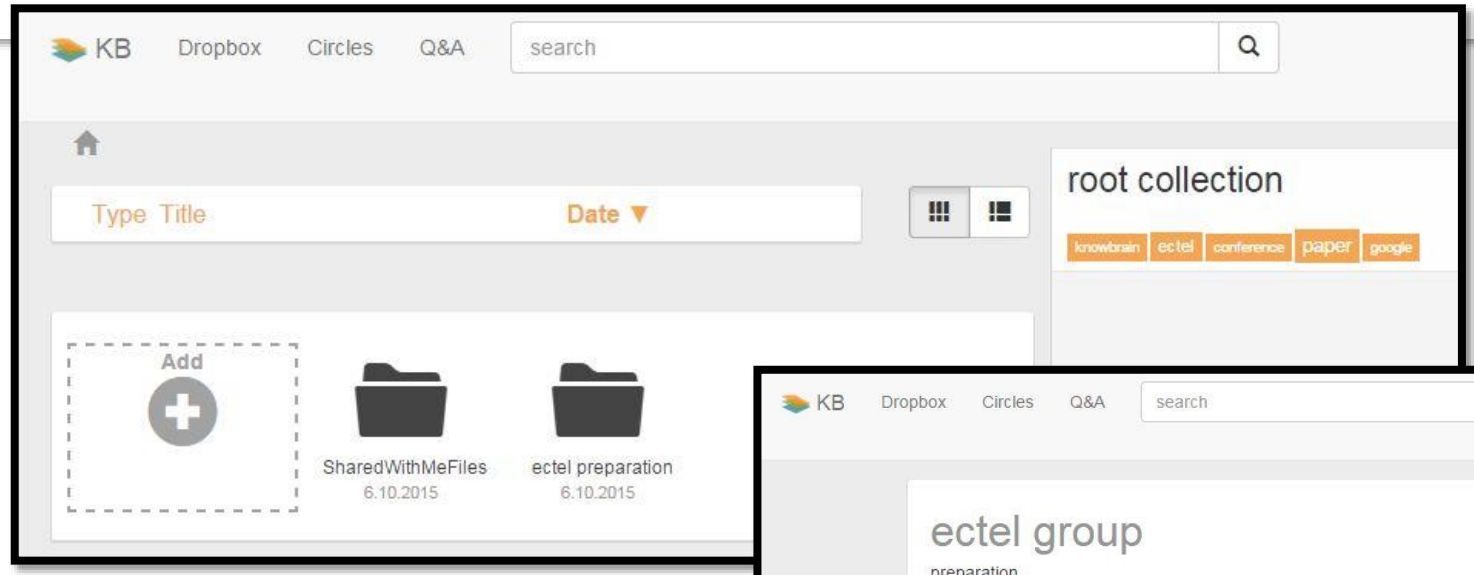
Bits and Pieces

Notifications **Search** **Context** **Sharing**



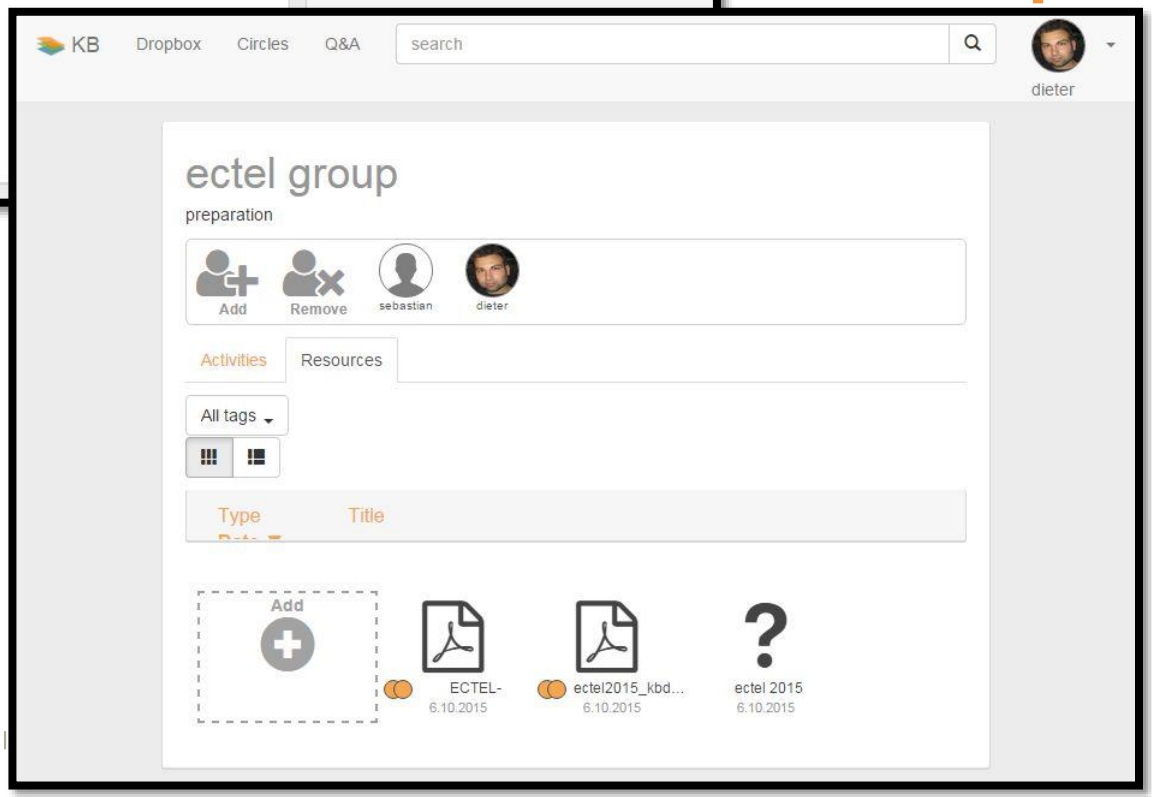
Sidebars →

KnowBrain



Dropbox

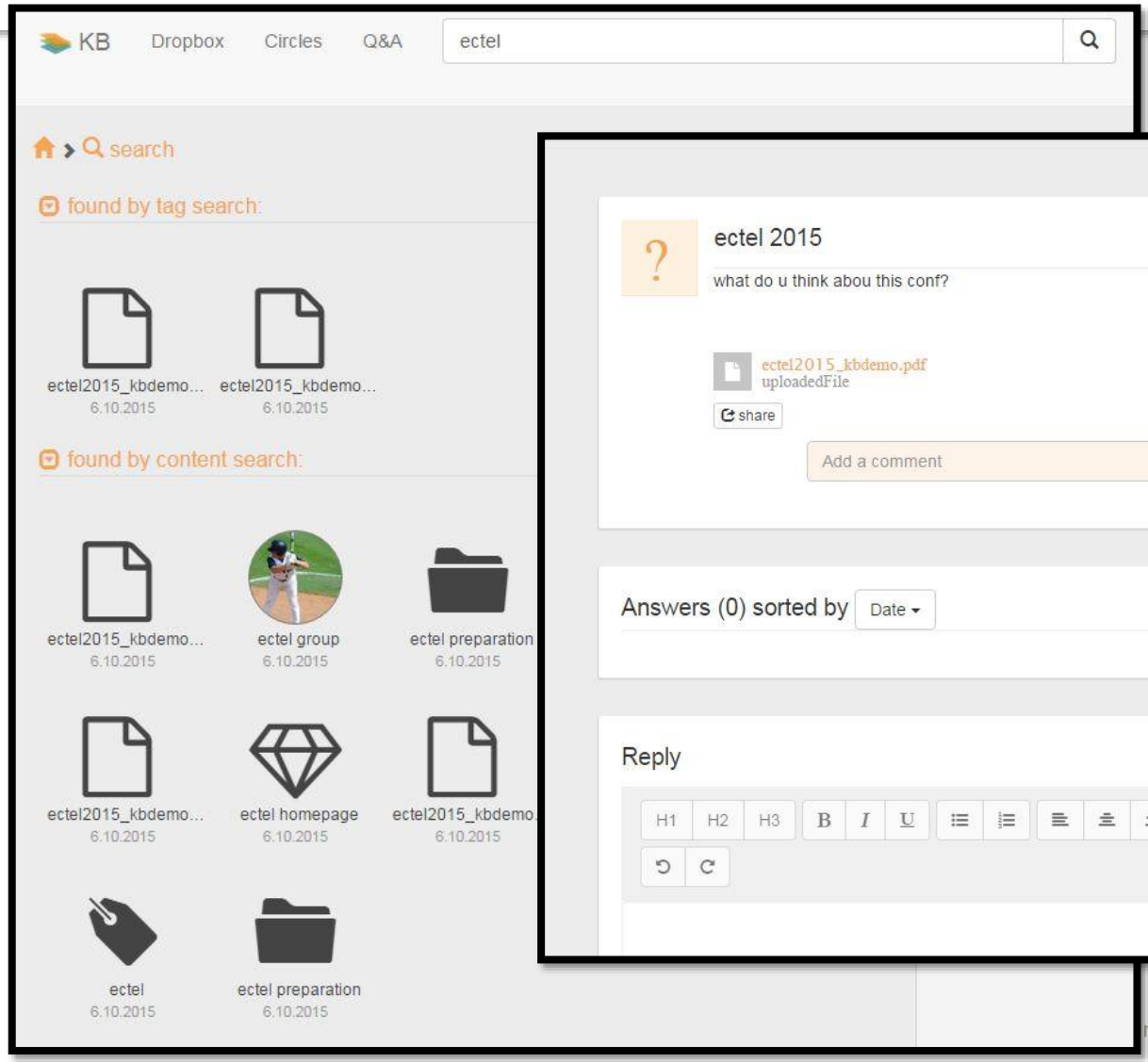
Groups

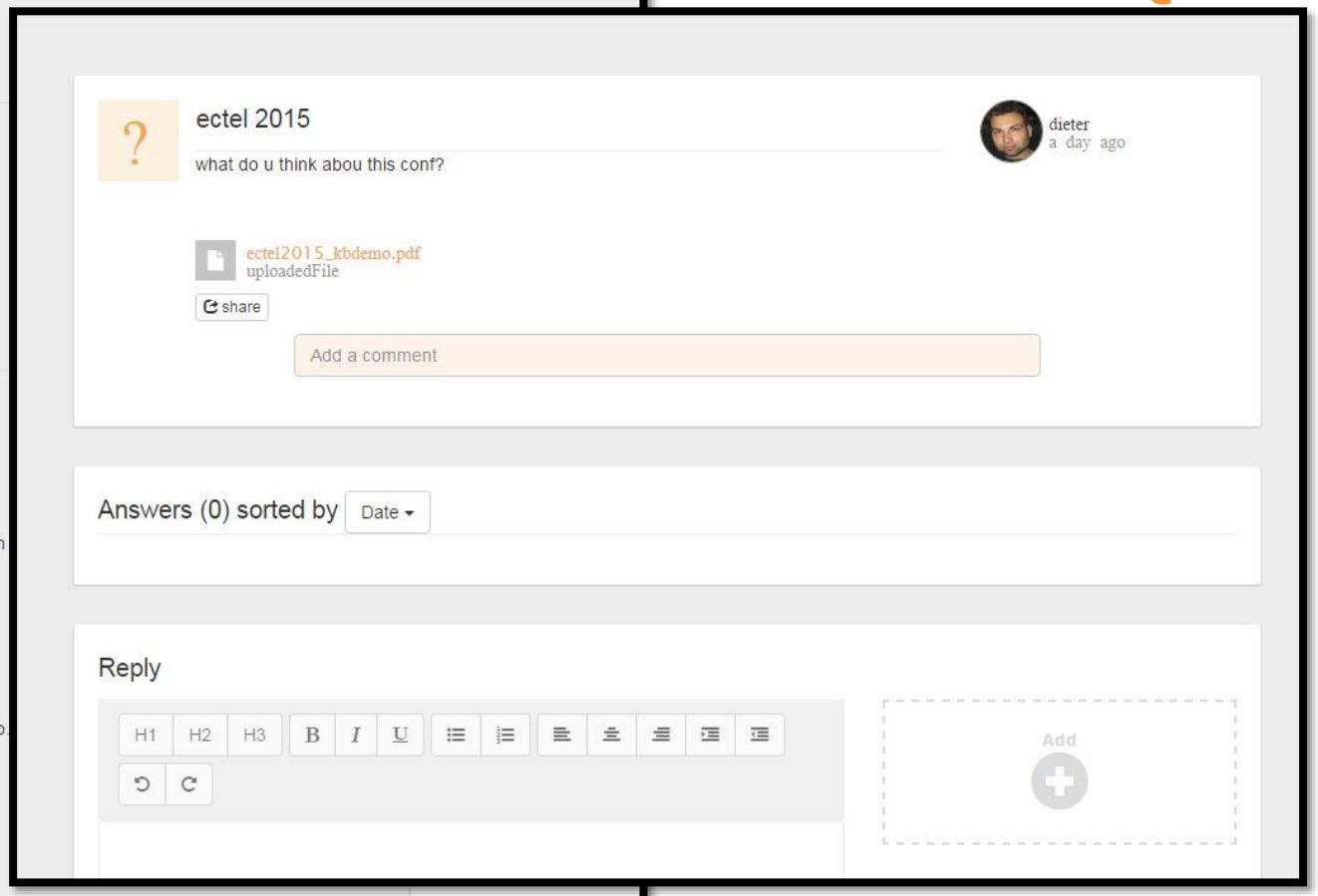


KnowBrain

Search

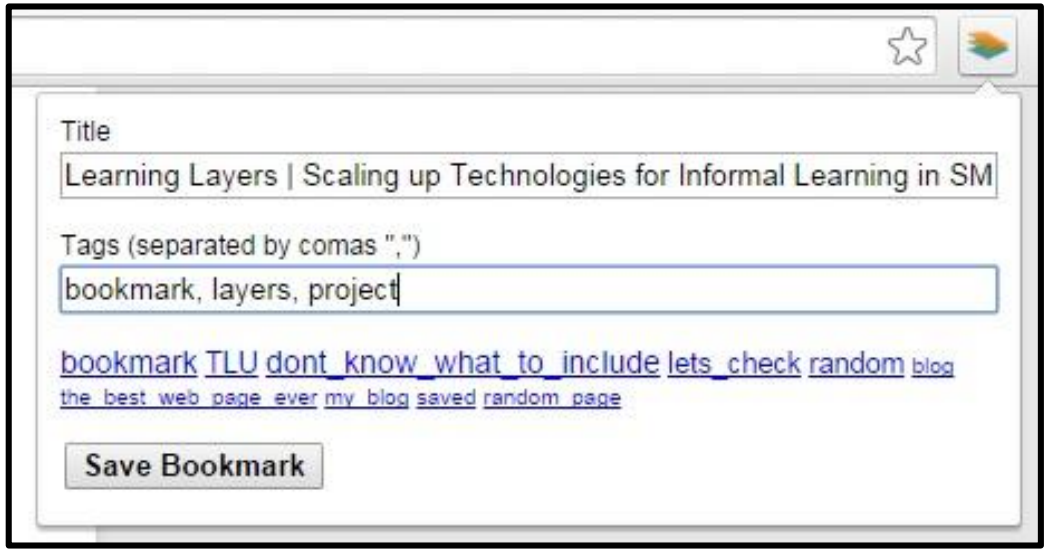
Multimedia Q/A



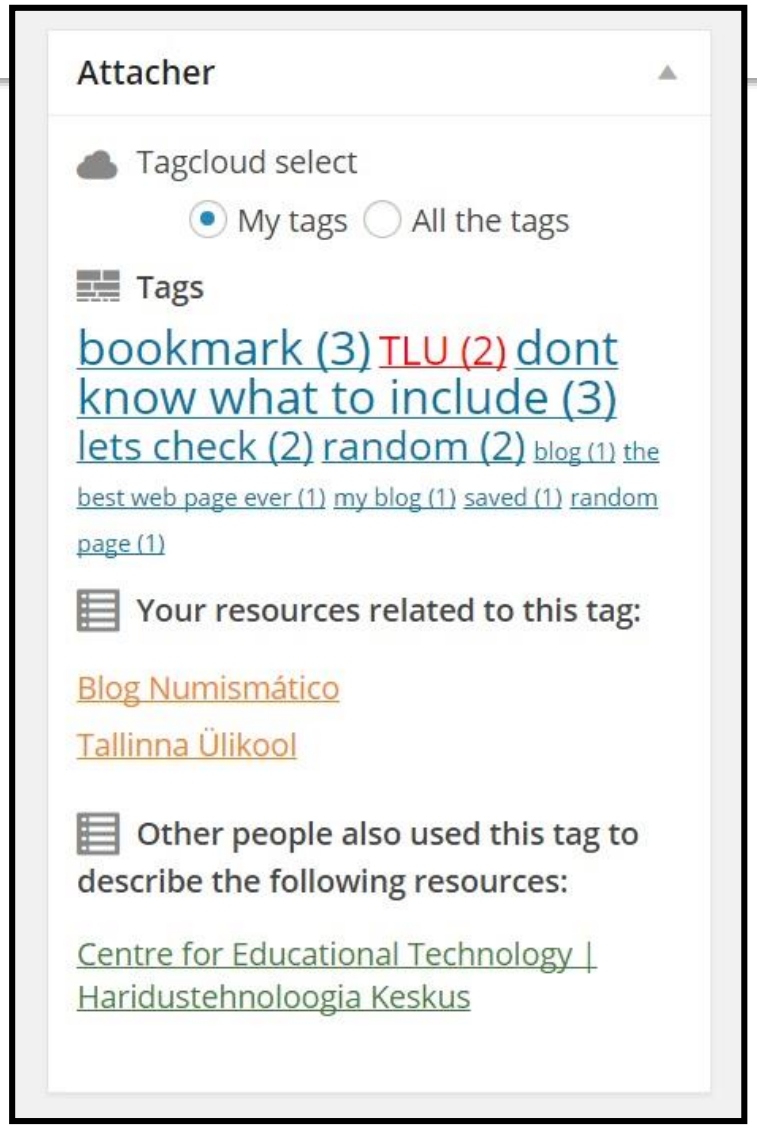


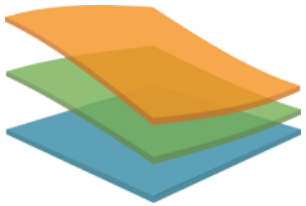
Bookmarker / Attacher

Bookmarker



Attacher





The SSS …

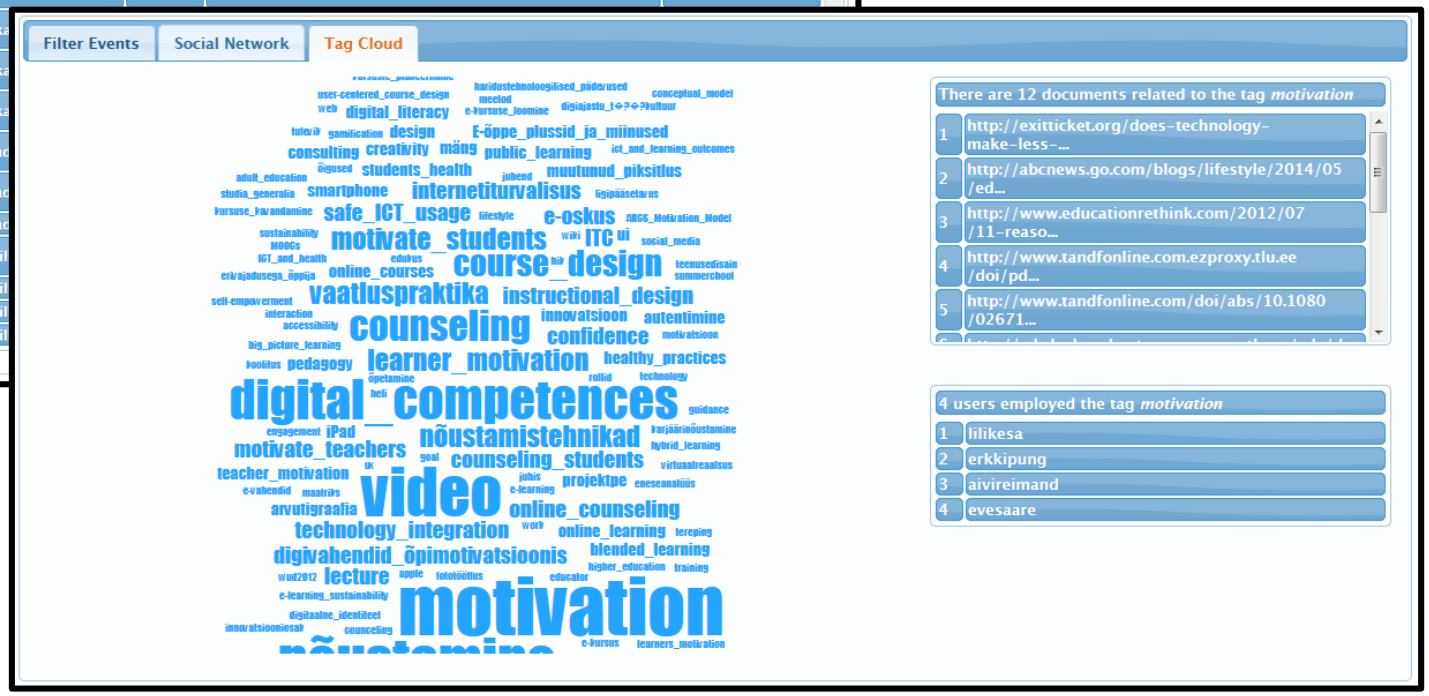
- … is a **flexible technical infrastructure** to integrate tools for informal workplace learning.
- … has been conceptualized and designed based on principles gained from theories of **Distributed Cognition** and **Meaning Making.**
- … supports meaning making in artefact-mediated communication.

Future Work: Workplace Learning Analytics

Giving learners the power to understand and analyse their learning process!

Monitoring

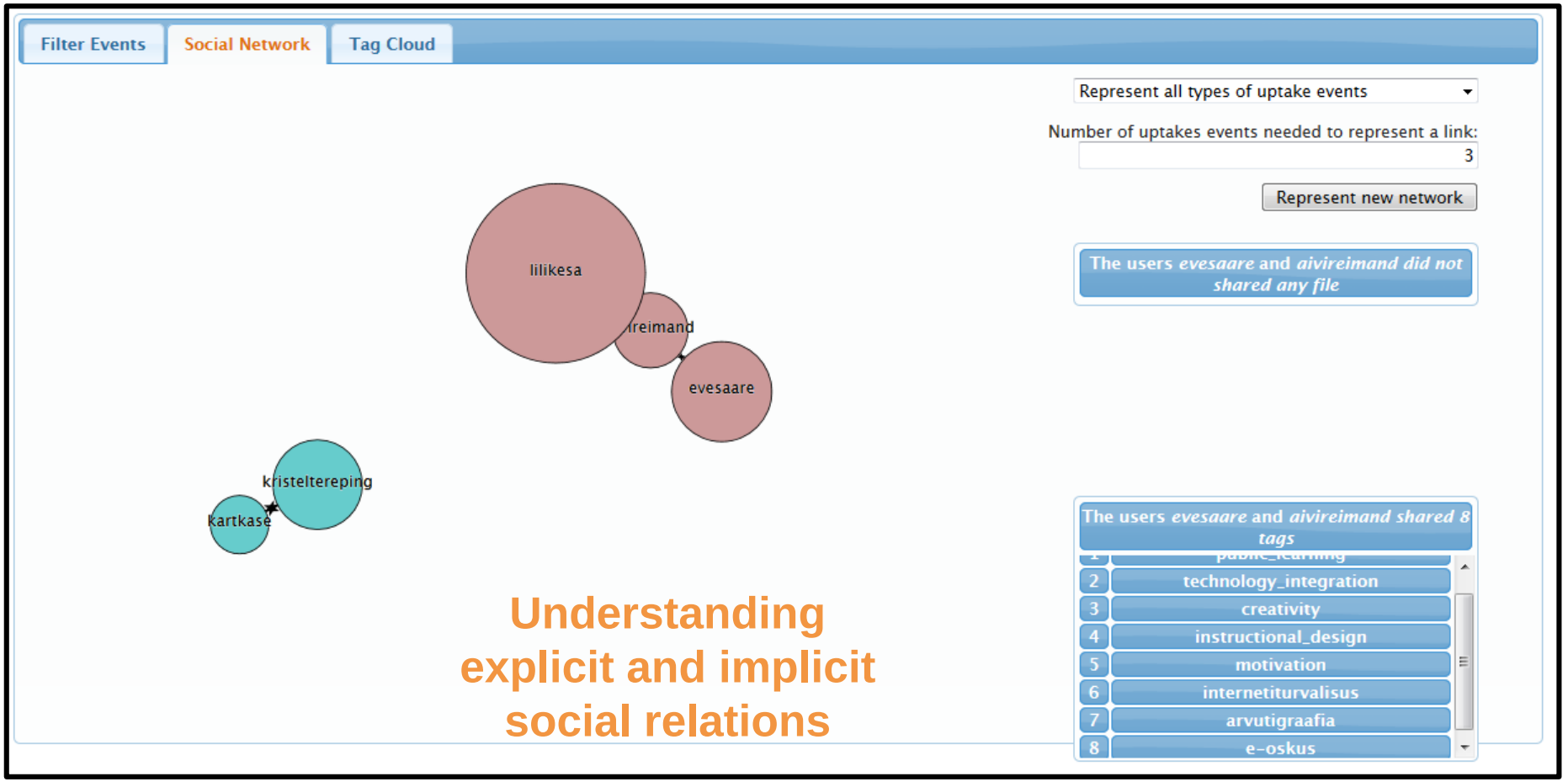
Activities



Exploring

Topics

Future Work: Workplace Learning Analytics



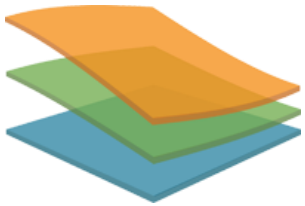
Thank you for your attention

Tobias Ley
Tallinn University
Institute of Informatics
tley@tlu.ee
skype tobias_ley
Twitter @tobold
http://tobiasley.wordpress.com

TALLINN UNIVERSITY

Learning Layers Project
ICT EU-FP7, 12mEUR, 2012-2016
Web: http://learning-layers.eu
Source Code: http://github.com/learning-layers

TALLINN UNIVERSITY KNOW Center TU Graz



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Coverage of Informal Learning?

The resulting tools demonstrate that the SSS is capable of **supporting different informal learning practices at the workplace** (Ley et al., 2014).