A Next Step Towards FabML: A narrative for knowledge sharing use cases in Fab Labs

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Abstract

Fab Labs aim for projects to be shared within the global network. Yet the number of shared projects is small for various reasons – sharing is the responsibility of individual users who may encounter various barriers to sharing, and the rapid growth of the network rendered informal ways of sharing ineffective. Creating a central repository has failed on several occasions. Fab Labs often choose their own website as the primary repository for their project documentation, also known as FabMoments. FabML has been proposed as a meta language to describe FabMoments across repositories. This proposal has been validated at the FabFuse2 conference in Amersfoort in 2013, and a narrative of a possible use scenario has been developed to further detail the initial FabML proposal. This article presents the initial FabML use context, as proposed earlier, which consists of a sharing part, a retrieval part, and some initial enhancements to the repository and retrieval system. The article then describes the FabMoment use scenario as developed at FabFuse2 and applies it to the initial FabML proposal. This results in four extensions to the initial description of the FabML use context. The article concludes with a summary of the requirements for the semantic design of a FabMoment, and it outlines the next steps for the development of the semantics of FabML. It also sketches the steps needed for the development of the technical and practical implementation of FabML.

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which consists of a sharing part, a retrieval part, and some initial enhancements to the repository and retrieval system. The article then describes the FabMoment use scenario as developed at FabFuse2 and applies it to the initial FabML proposal. This results in four extensions to the initial description of the FabML use context.

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Introduction

Fab Labs are a global network of local labs. They enable invention by providing access to tools for digital fabrication. Fab Labs share an evolving inventory of core capabilities to make almost anything. They aim for projects to be shared. Sharing of projects, however, faces a twofold challenge: one of sharing practice and one of network size.

First, the responsibility to contribute to the common body of knowledge that is shared by all Fab Labs is put into the hands of individual Fab Lab users. However, only a minority of users take that responsibility seriously. There is so far no single study analyzing the reasons for a lack of sharing. Motivational issues could be a cause – personal disinterest in documenting or a lack of social rewards for it – as could be technical barriers.

Informally, it is often suggested, that also a disjoint between the realm of digital fabrication itself (I.e. making) and the realm of documenting could make sharing particularly difficult in maker communities. Making focuses on materialisation, fabrication, scaling and the interaction of materials. Moreover, as a consequence of the hands-on prototyping approach that is core to making, changes on designs regularly happen as part of the making – and not as part of designing. Hence it would require an extra step post factum to re-integrate them into the design documentation.

Second, The global network of labs is growing rapidly. In 2004 the count of labs was at 32 [1]; in 2013 there are between 200 and 250 labs globally [2] with an estimated user population of 200.000 people or above [3]. Informal sharing of projects through narratives at national and international conferences or through workshops becomes increasingly ineffective for

various reasons – conferences and workshops reach only a limited audience, content is often shared as pictures, slideshows and video recordings which renders it hard to search, etc.

Individual labs strive to facilitate and stimulate sharing of projects in various ways. For example, check-in/check-out systems have been installed requiring users to file minimal information as exchange for using the lab; wifi equipped cameras have been deployed that automatically feed pictures taken to the lab's online photo stream; documentation stations have been provided to make documenting projects simpler and aesthetically satisfactory; some Fab Labs even offer free lab use in return for sharing. Still the yield of shared projects is poor, even within the context of single labs.

Propositions and Earlier Developments

Repositories for sharing content have been proposed on multiple occasions [e.g. 4, 5, 6]. However, such attempts have not been successful so far. One could be the fact that various labs already have their own sharing solutions and migration costs of existing collections to any new solution are considerable. Another reason could be that local control of a platform is preferred to central control. A third reason might be that different labs have designed their business processes differently and integrated project documentation accordingly, so a unified platform might not be able to cater for these needs. From these early suggestions only the term 'FabMoment' for the description of a project realised in a FabLab has survived [7].

Some labs have started to use existing sharing platforms (Flickr, Thingiverse, Instructables). However, these have been criticized for not being open source, for creating dependencies, uncertainty regarding ownership of project descriptions, and fear of initially free platforms turning into paid-for services at an unknown point in the future. Furthermore, those platforms do not specifically support retrieval of FabLab specific projects. Others use Facebook and Twitter to publicize events and progress on projects. Yet retrieving historical data (even if only a few weeks back) from these services is anything else than fast and straight forward.

Any sharing solution would probably require a fair amount of flexibility for integration into a labs' business processes [8]. Hence a Fab Lab's own

website is often chosen as the best place for a repository for the FabMoments created by the users of that lab.

As a remedy to the absence of a central repository, the FabML common description language was proposed in 2011 [7]. FabML is envisaged to be an set of metadata descriptors for shared Fab Lab projects or FabMoments. FabML is information about a FabMoment that is not part of the project itself. Examples could be the name of the creator of the FabMoment, machines, processes, settings and materials used in realizing the project, types of source files available, etc.

Validation of the Need

The development of FabML has stalled over the past couple of years. However, at the recent FabFuse conference in Amersfoort [9] the proposal has been validated in a couple of workshops. Participants confirmed that they would wish to be able to access the FabMoments of other labs – without having to navigate to and consult an increasing number of websites.

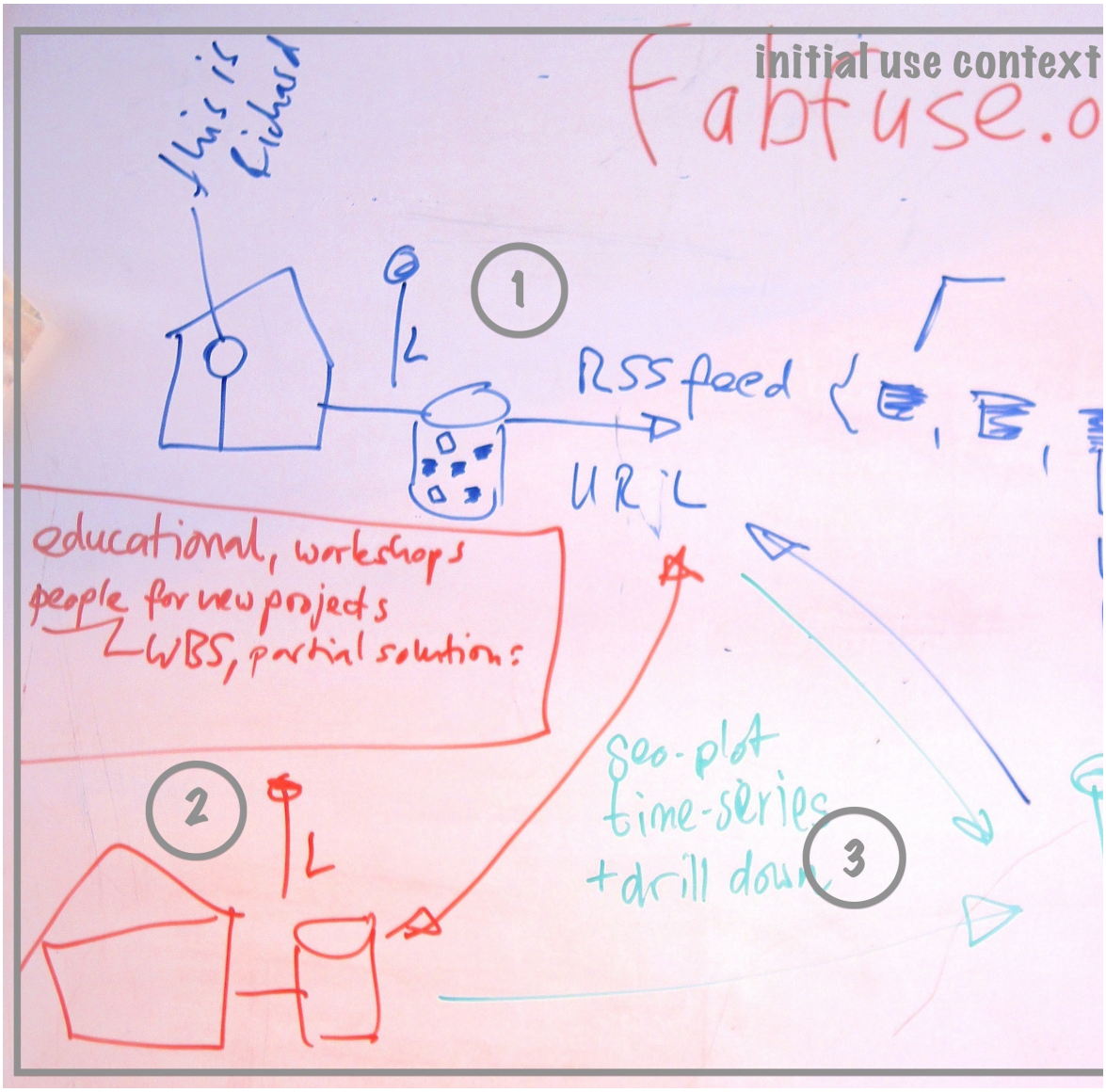
At the same time they indicated that they were not too keen to relinquish their existing systems of sharing FabMoments locally. Mainly two reasons were mentioned for this. First, the existing local systems were closely adapted to the particular circumstances and practices in the local labs, and the systems had often been developed as needs emerged. With a new, common platform participants feared to have to relinquish substantial amounts of functionality of their existing solutions. Second, participants feared that local users might have difficulties to adapt to a new system after having accommodated to the existing local system currently in place.

Given such confirmation of a wish to being able to use an overarching system to find FabMoments and a reluctancy to relinquish local solutions we decided to restart the development of FabML as a common descriptor language that would enhance local solutions so they would become searchable globally. The proposed approach did not appear to fundamentally clash with users' wishes. Yet in order to develop a more specific set of requirements it was decided to develop a narrative of how FabLab users would possibly use a system that would give them access to FabMoments irrespective of if they were developed locally or elsewhere.

FabML Use Context

To move the development of FabML forward, a narrative has been developed on which to base possible use cases for FabML. This narrative describes three parts of a sharing and retrieval scenario (cf. figure 1):

1. The first part consists of a FabLab user, 'Richard', sharing his projects in a local repository and possibly a labmanager (L) intervening as curator to highlight certain projects. That local repository is supposed to be published on the web as an RSS-enabled website.
2. The second part consists of other labs searching for projects for various reasons: educational purposes, looking for topics for a workshop, trying to find contributors to a project or practical solutions based on a work-breakdown structure (WBS)
3. The third part consists of more 'cleverness' added to the repositories and the retrieval system, such as geographical or timeline plots, a facility to drill down into project documentation, or third-party curation.



Caption: blue: first part: (curated) sharing via RSS-enabled website; red: second part: retrieval; green: third part: added cleverness.

FabMoment Use Narrative

A user of a FabLab is typically a person having an idea and being conscious of the fact that she would not be able to realise the idea on her own. So she would need to get experience from other people or to collaborate with other people, she might need to access specific tools, use

existing blueprints and generally get insight into similar projects that have been done before.

She probably would start at a FabLab, which is supposed to not have its own large community yet but probably a few motivated people to help initially. The lab itself could be located in Mexico or Alkmaar (The Netherlands) – geographical location is not seen as a particular issue.

The idea would probably be a solution to a local problem, maybe somewhat idealistic – say a a window cleaning robot for old ladies (in the case of Alkmaar), the desire to quickly master that new machine that the lab just received, or a sensor to monitor milk quality.

The user would probably initially revert to Google to search for 'window cleaning robot'. She then would find a lot of items about highly advanced military robots that cost a lot, however, she would not want to ask DARPA to help her build that window cleaning robot for her grannie. So imagine, she would find out that there is Kees at the lab in Zwolle (The Netherlands, about an hours drive from Alkmaar) … but how would she find that out?

The global direction of her search probably would be along the keywords of: robotics, DIY, software, materials, chemicals to use, cleaning exercises, electricity/power, batteries, grandma (to make sure it's ok), and it should NOT look humanoid, but needs a proper design. Then she would have to start her work and find examples, that are close to her project. Google could help, as could the local library or an online book retailer where she could buy books on building robots.

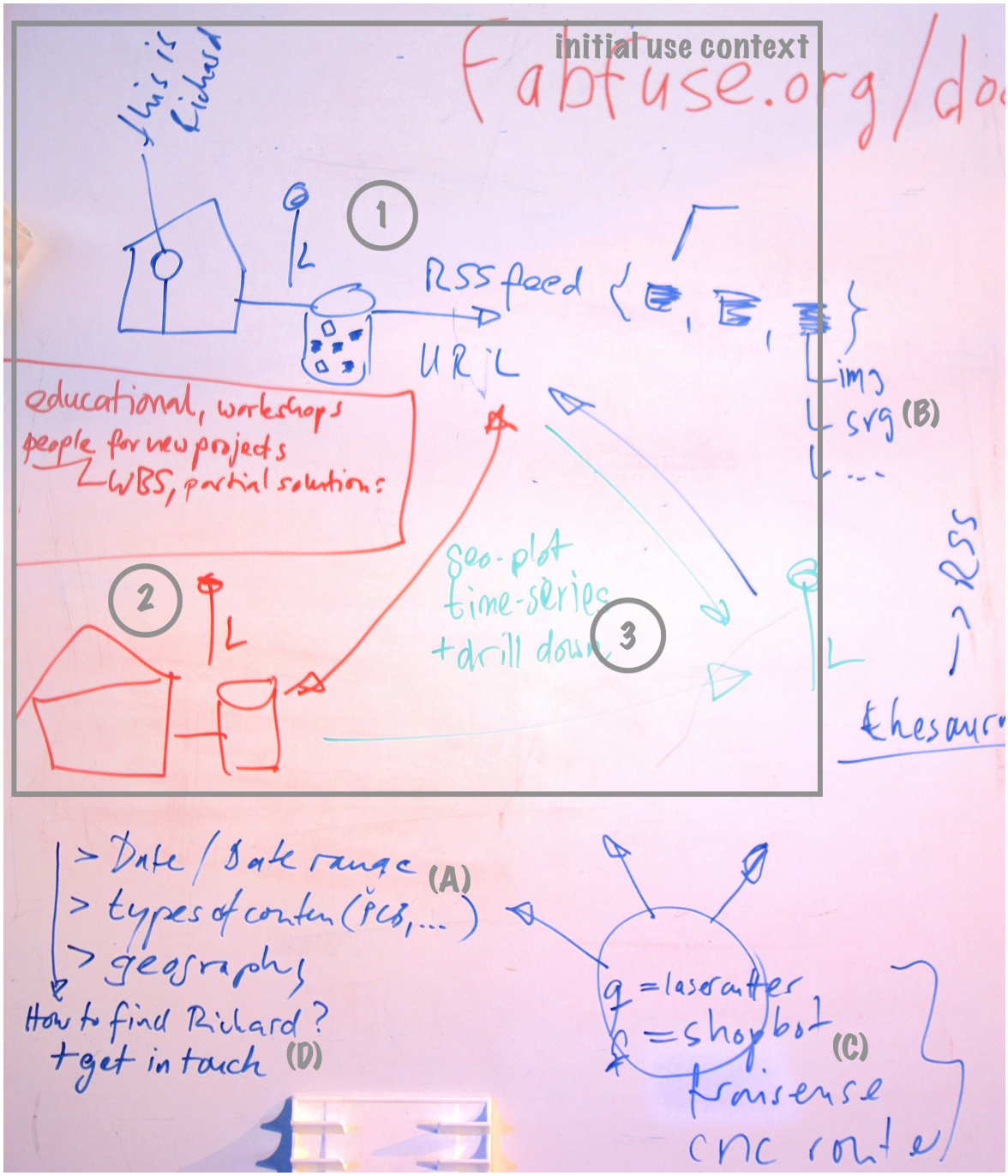
Now imagine, she could go also to a window to the distributed repositories of FabMoments where she could search for DIY-robot-electronics, with schematics, but not using SMD components (because they scare her off) ...

The Use Narrative in the FabML Context

In more abstract terms, a user who is embarking on a project – be it the development of a new device, as described above, be it for educational reasons, because he is preparing a workshop or needs to detail his work break-down structure with partial solutions, would be able to use a federated search across multiple FabML enabled repositories to find previous related projects from the FabLab network.

For the federated search, the user would probably use a combination of full-text search in the project titles and descriptions and more structured information, e.g. file-types of attachments to the project description or the presence or absence of specific parts in the bill of materials if available.

Through those related projects the user would possibly also be able to connect to the corresponding project owners and in that way also to tap into their (tacit) knowledge about their previous project.



Caption: extensions to the initial FabML use context from the FabMoment

use narrative

Regarding the FabML context, the FabMoment use narrative added some specific or additional requirements particularly to the search part (cf. figure 1). For instance (A), it would be desirable to be able to search for dates or date ranges, for types of content (e.g. design files for PCBs), or for geography. The second requirement would probably (partly) translate to specifying the types of attachments to a shared project (B). As another example, the issue of language was mentioned, as e.g. the same machine could be described as ‘shopbot’, ‘fraisuese’, or ‘CNC router’ (C), so the retrieval system would work better using some sort of thesaurus. Finally, people who search for projects rather than being interested in documentation might want to find ‘Richard’ and know how to get in touch (D). In that way, such an approach could lead to cross-lab collaboration.

Requirements from the Narrative and Future Work

Defining metadata descriptors – such as FabML – typically is faced with two challenges, a semantic one and a technical one. Semantically, metadata descriptors form a vocabulary to describe a project. Establishing a vocabulary defines and limits what can be expressed about the project.

The demands to FabML from the FabMoment use narrative essentially boil down to three groups of requirements for the semantic design of FabML:

1. FabML needs to represent the anatomy of a FabMoment [7], for example including title, author, an image, a description, materials processes and machines used, including machine settings, and with design and production files attached (cf. [6]);
2. FabML needs to convey extra information about any attachments to the FabMoment (pictures, design an production files, etc.), such as file types, size, resolution, etc.;
3. FabML needs to convey information on the provenance of the FabMoment (lab, location, author, creation date, etc.).

Technically, metadata descriptors can either be embedded in the project files or published separately to the files in so called “registries”. The FabMoment use narrative is agnostic to the technical implementation of FabML.

Further work is needed to develop a first, more succinct semantic sketch of FabML. A particular problem that needs to be addressed is the broad variety of the scope of any FabMoment – ranging from a laser-cut keychain to much more complex projects such as a for instance the FabFi project which consist of a whole wireless Internet infrastructure complete with self-configuring routers and antennas and spans a wide range of electronics, electrical, telecommunications and physical hardware design.

A discussion has to follow in order to move towards a shared semantic standard. Equally, the advantages and disadvantages of the technical implementation of FabML have to be studied, corresponding discussions to be held, and design decisions to be made. A prototype implementation of FabML and work on the query mechanism are further needed to complement the proposal.

However, the FabLab ecosystem does not currently provide many meaningful ways for having such discussions or facilitating design decisions. It is therefore a requirement to find such ways of communicating, discussing and deciding parallel to the technical development of FabML in order to include the community (and its often somewhat idiosyncratic exponents) in the development. Eventually, ways to integrate FabML into existing repositories have to be shown in order to deploy FabML in the existing Fab Lab ecosystem. It is conceivable that this implementation could also face some of the organisational, cultural and psychological barriers that the impeded the implementation of a centralised repository.

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