Explanatory note for C&C pilots

September/ October 2013

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Connect & Construct: Seamless and free-of-charge exchange of information online

Exchange information faster, waste less time on coordination, reduce failure costs – what's not to like? This is the goal of the Connect & Construct project, which is now looking for pioneer companies to pilot a free-of-charge information exchange framework. No new software is required, no investment in ICT tools is needed. Just an Internet connection.

This note provides background information on this EU-funded project and why the construction industry badly needs to exchange information more efficiently. If you are already familiar with the background to the project, you can jump to p.9 for an explanation of how our interoperability framework will work in practice. If you already know you want to reap the benefits of being an early adopter and take part in a pilot, then go straight to p. 13.

Connect & Construct: Building value through ICT in the construction sector

Connect & Construct is a project initiated by the European Commission to improve competitiveness and efficiency within the construction sector through ICT. Smart use of ICT can increase the productivity of construction companies, and can modernise and add value to their activities. It can help companies cooperate with each other more easily, and use and re-use information more effectively. SMEs in particular can benefit from ICT: research has shown they grow two-to-three times faster when they use the Internet in their daily operations.

Through the Connect & Construct framework companies can seamlessly exchange information online

Making digital information exchange easier through an online framework

The Connect & Construct project aims to help construction companies to make better use of ICT by making it easier for them to exchange information and data digitally. Therefore it has developed a free-of-charge information exchange framework which can be used by all construction companies within Europe, without having to install any new software or having to invest in ICT tools. It allows digital exchange of information internally or with other companies, regardless of what software they are using. The only thing needed is an Internet connection.

Connect and Construct pilots

As part of the project, Connect & Construct needs to test the information exchange framework with construction companies through pilots. These pilots have two objectives:

- to demonstrate the framework's functionalities under different scenarios;

- to gain more insights in the added value of the framework for construction companies.

During the pilots, construction companies will receive guidance on how to start or improve their digital information exchange. The results of the pilots will lead to further development of the framework.

About this document

This document aims to provide construction companies who are interested in testing the framework in the pilots with more information on what problems the Connect & Construct framework addresses, what the benefits are for construction companies, and how the pilots will be organised.

If you would like to join one of the pilots, please contact us via info@connectandconstruct.eu. For more information on the project please visit our website: www.connectandconstruct.eu.

Information exchange processes in construction are complex

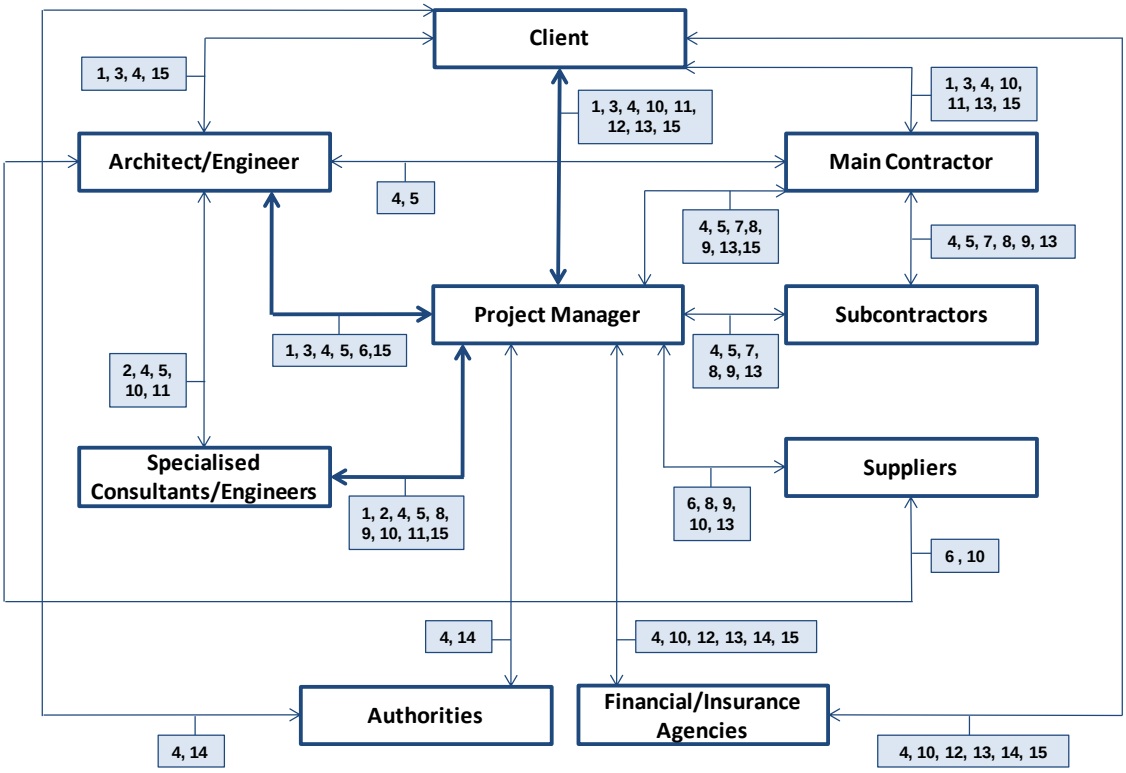
Construction companies need to exchange information in every phase of the construction lifecycle. Together with stakeholders, Connect & Construct has defined three main construction lifecycle phases:

1) **Pre-Construction phase:** processes that are conducted prior to actual construction, including the elicitation of client demand/requirements, conceptual and detailed design, the analysis of the project feasibility and project planning, as well as the preparation and/or execution of all the contracting, tendering, licensing and documenting activities.

2) **Construction phase:** execution of the core construction project, covering overall project management, work organisation, monitoring, procurement and the actual execution of the construction activities. Activities related to site preparation, as well as site cleaning, waste management and recycling are also included in the construction business scenario.

3) **Post-Construction phase:** activities conducted within the operation and maintenance, as well as the refurbishment and renovation. Among others, this includes activities for the final delivery and commissioning of the facility to the owner/client or the end user/tenant, facility operation, management and maintenance.

In each phase, a multitude of players exchange many different documents. Each provides different information and uses the information for different purposes. The figure below provides an example of the complex information exchange processes between construction companies. It is a schematic representation of the pre-construction phase. The numbers listed each represent a type of information. The thicker the line, the more intense the information exchange.



No.	Type of Data/Information Exchanged
1	Client's objectives, needs, requirements and specifications
2	Data/information regarding environmental/economic/community impacts as well as geotechnical, hydrological and archaeological restrictions
3	Concept studies
4	Engineering/architectural drawings/models
5	Building standards and construction requirements
6	Building product information/specifications
7	Task assignment/instructions
8	Terms of Reference (ToR)
9	Tender and contract documentation
10	Cost estimates/calculations
11	Feasibility and risk analysis
12	Business case (e.g. cost-benefit analysis)
13	Planning and delivery information
14	Licence applications/documents, approvals
15	Order/payment information and invoices

Companies experience multiple problems when exchanging information digitally

Connect & Construct market analysis shows that e-mail is still the pre-dominant means of information exchange (used by more than 75% of companies), while more advanced digital solutions, such as web portals or cloud services, and tools for collaborative design are used to a much lesser extent (by 20-30% of SMEs). In general it is concluded that the uptake of ICT in the construction industry is very low compared to other sectors.

Based on interviews and workshops with construction companies, Connect & Construct has identified multiple problems that prevent companies from exchanging information effectively and digitally:

Financial problems

The construction sector has to deal with delayed payments. This leads to cash flow problems and results in a general hesitation or even inability to invest in digital solutions.

File size

The data (e.g. 2D drawings, 3D models, visualisations, and other documents) cannot be easily exchanged because of the large file size. E-mail, the most common data exchange method, only allows the exchange of limited file sizes. Third-party file transfer services (e.g. WeTransfer) have limited security, limited file size and limited storage periods when using the free service.

Change management

Information exchange solutions often do not make it possible to keep track of initial agreements, changes and related expenditure.

Lack of version control

The history of changes in a drawing/model in a file is often not stored, and it is not possible to make automatic comparisons of different files to detect changes.

Duplicate information

As many players are involved during the construction life cycle, information needs to be sent to each separately each time data is revised. This can easily lead to players working with the wrong revision.

Lack of communication plans

Tasks and responsibilities, as well as the related work flows (who has to deliver what information to whom in which data format and when) are often not clear, resulting in inefficient and error-prone communication. Information may be sent incomplete, deadlines may be missed, and data may be unreadable or unusable. These problems are at least partly caused by the lack of a standard format for such communication plans. Another factor is the lack of integration of the communication plan (which could e.g. be contained in a spreadsheet file) with messaging and diary systems for automatic reminders of upcoming exchange moments.

Lack of commonly used exchange standards for models

The lack of commonly used exchange standards is a problem with two aspects: a technical aspect (lack of a universally accepted data format) and a semantic aspect (different definition of terms).

Vendor-specific data formats for drawings and models, such as DGN, DWG and RVT, dominate the construction sector due to the predominance of a small number of software vendors. These vendors sell complete product "suites" that cover a wide span of IT solutions required by construction professionals. This then leads to organisations using the proprietary formats of a single vendor. This causes problems when:

- one of the players wants to use this information in a software package by another vendor, or
- one of the players does not own the required viewing software.

As a result, drawings are often exchanged in generic formats that can be read by everyone. ***PDF*** is the most common format, but ***paper drawings*** are often requested as well. This of course leads to a huge loss of information, since intelligent 2D or 3D information is essentially reduced to a simple and static paper drawing.

Finding a solution to the problems

Commercial software packages to a large extent address the problems above (except for the problem of common exchange standards). However, SMEs often do not have the financial resources to buy such software packages. Open source software also provides a solution to some of these problems. However, the different functionalities needed are scattered across the Internet and the open source solutions still require companies to have extensive knowledge of software development.

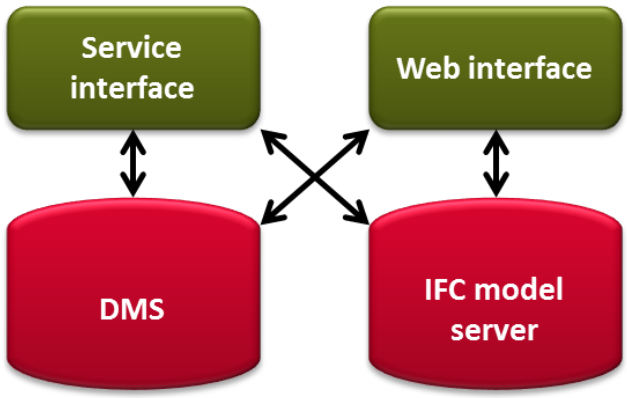
The Connect & Construct project has therefore developed a ready-to-use, free of charge, online framework, which provides the functionalities needed to address these problems via one single web interface. A more detailed description of the framework is provided in the next section.

The C&C framework enables easy, affordable and seamless digital information exchange

To solve the problems of digital information exchange between construction companies, Connect & Construct has developed the Connect & Construct framework. The framework consists of four main elements:

- Document Management System (DMS)
- Model server (based on IFC)
- Web interface
- Service interface

The connection between the four elements is visualised in below figure.



The four main framework elements are explained in more detail below.

Document Management System (DMS)

The DMS will allow central storage and exchange of all generally used document formats (i.e. Word, Excel, PDF, HTML) and 2D drawings (DWG, DGN).

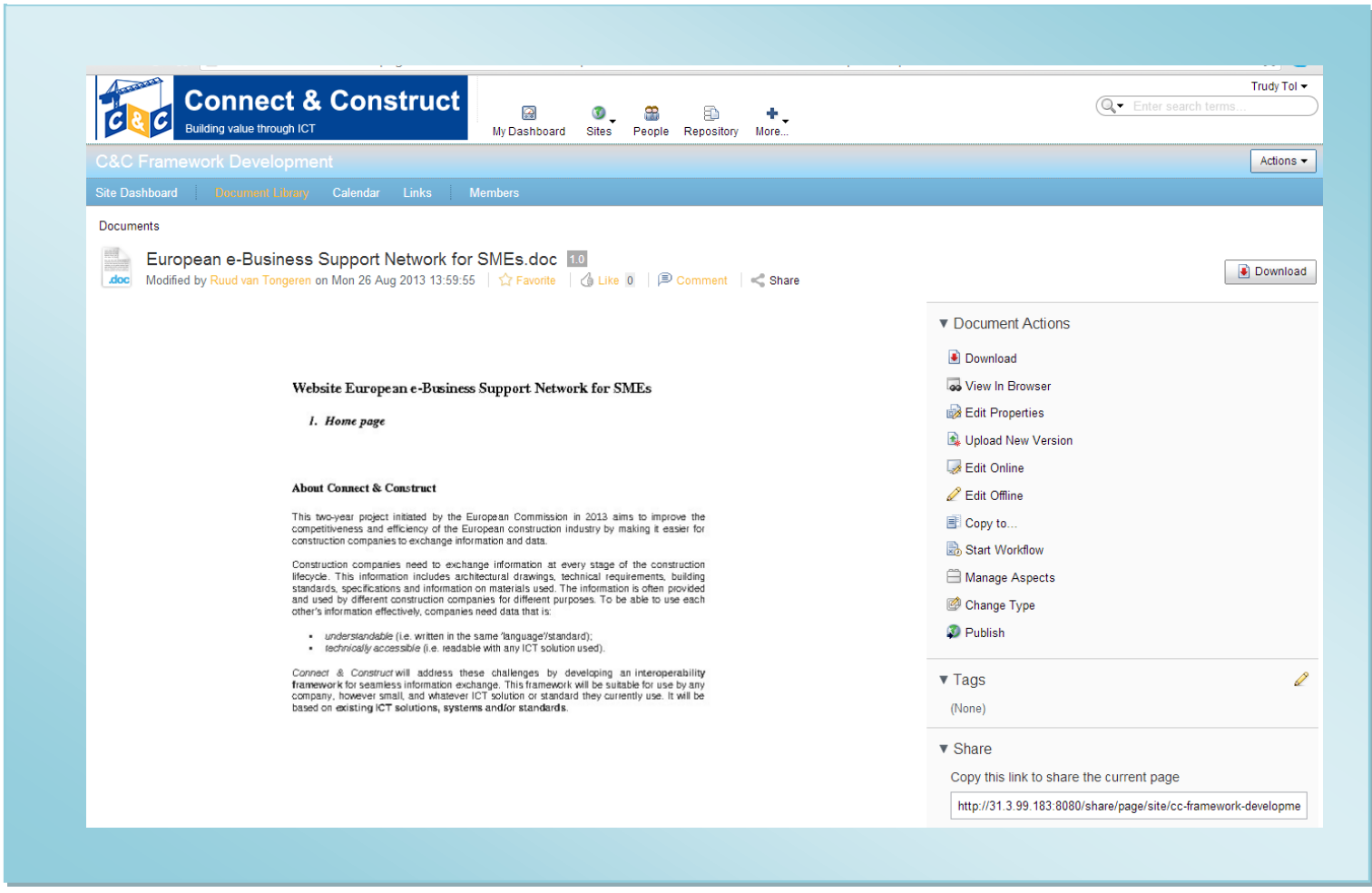
The DMS provides the following functionalities:

- *Version control*: Upload of a new version of a file does not delete the old file, but leads to an increment in version number. Older versions remain accessible. This tackles the problem *Lack of version control*.
- *Support for all file types*: The DMS has no limits with regards to the file types that it can store. This partly solves the problem of *Lack of exchange standards*, since all file-based information

can be exchanged via the DMS. It also helps with the problem of *As-built info unavailable*, since it makes it possible to store and access all information in its original format throughout a building's lifespan.

- *Unlimited file size*: There are no artificial limits to the file sizes, such as those imposed by a limit on e-mail attachment size. This eliminates the problem of *File sizes*.
- *Multi-project*: The DMS supports the use of multiple projects with different users and document trees.
- *Access right/authorisations*: The access to documents can be governed by access rights, making sure that only people who should be able to do so can view and modify documents.

Figure 1 Framework Document Management System, in which the company among others can up- and download new documents, view and edit documents, tag documents, edit properties and start workflows.



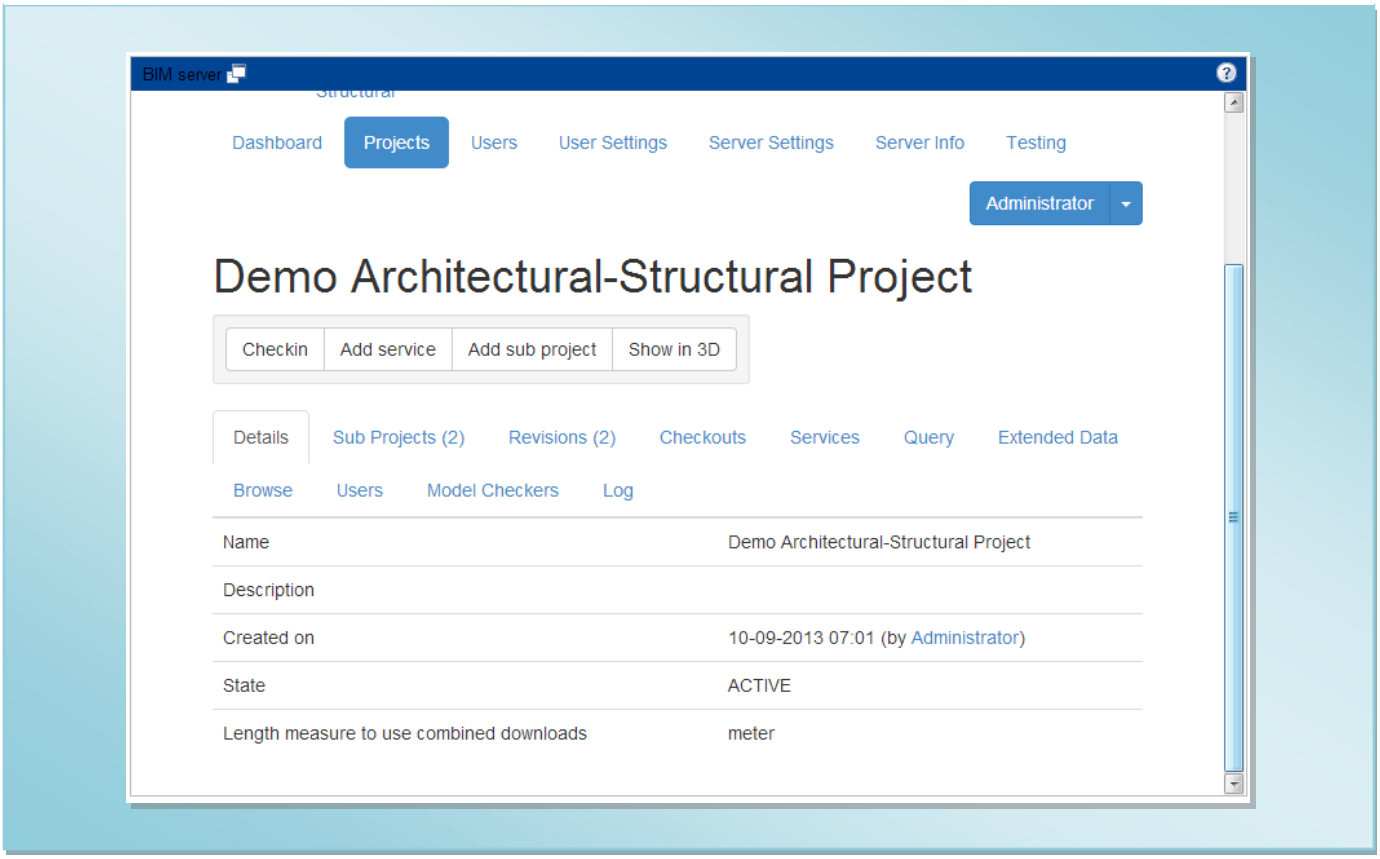
Model server

This is a server for central storage of IFC models. IFC is the open standard for 3D construction models, hosted by the Building Smart Community. This server also includes a version control and authorisation system.

The model server provides the following functionalities:

- *IFC support:* IFC is a widely accepted open standard for 3D construction models. Support of IFC addresses the problem of *Lack of exchange standards*.
- *Model exchange/merge:* The model server supports the upload, download, and merging of models in IFC format. This also deals with the *Lack of exchange standards* problem.
- *Version control:* Like the DMS, the model server uses version control for managing different versions of the same model to deal with *Lack of version control*.
- *Multi-project:* The model server supports the use of multiple projects with different users and document trees.
- *Access right/authorisations:* The access to models can be governed by access rights, making sure that only people who should be able to do so can view and modify documents.

Figure 2 Framework Model server, in which the company among others can see what models are uploaded by others and when, view the model in 3D, merge models and up-and download models.



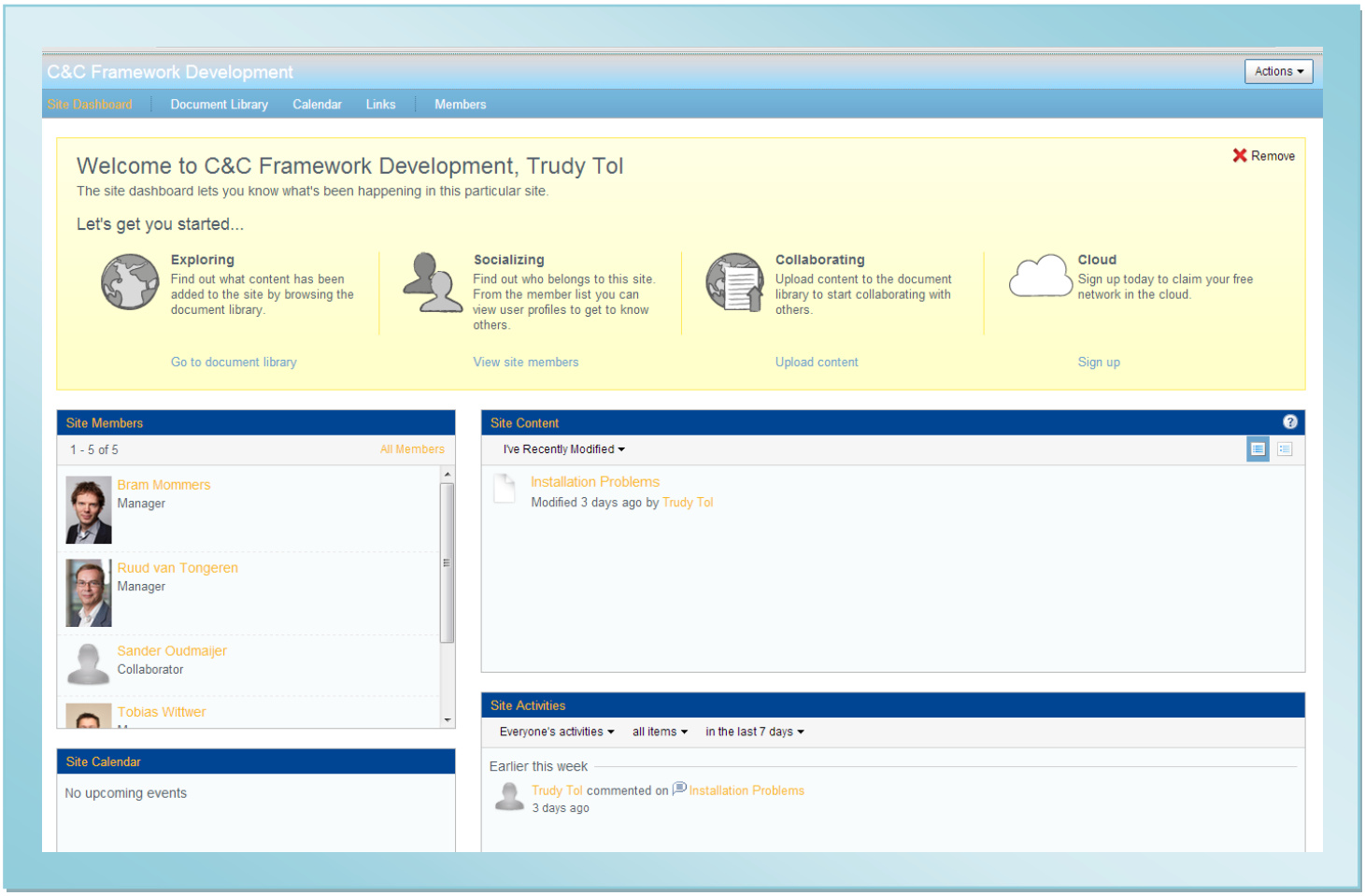
Web interface

The web interface provides users with access to the DMS and the model server. The user only needs Internet access and a standards-compliant web browser for using the web interface. No other software is required.

The web interface provides the following functionalities:

- *E-collaboration*: This includes several modules for electronic collaboration.
    - Assignment of workflow, such as review and approval processes, to documents.
    - Automatic notification of new or updated files and models. This, together with central storage, addresses the problem of *Duplicate information*.
    - Commenting and issue tracking for documents.
    - A calendar for meetings, deadlines, etc.
    - A planning view that shows the project planning.
    - A module for assigning tasks and responsibilities. This addresses the problem of *Tasks & responsibilities.*
    - Change management, i.e. keeping track of changes in the client's requirements and their status. This addresses the problem of *Change Management*.
    - A discussion feature that allows for general 'discussions' in a centralised place.
- *DMS repository access*: The web interface grants full access to the DMS repository for uploading and downloading documents, and editing and viewing document metadata. This partly deals with the *Lack of exchange standards* problem.
- *Model server access*: The web interface grants access to the IFC server for up- and download of IFC models. This also partly deals with the *Lack of exchange standards* problem.
- *Communication plan*: This feature makes it possible to user a pre-defined communication plan for determining when to exchange what information with whom. This deals with the *Lack of communication plan* problem.
- *File viewer*: The web interface includes a web-based file viewer for common file formats. This eliminates the need to print files or convert them to PDF (*Paper and PDF* problem) and makes sure that information stored in the DMS remains accessible in the future (*As-built info unavailable* problem).

Figure 3 Framework web interface: Site dashboard, in which the company among others can see what activities have taken place (who has changed or added what), who the project members are, what documents are added, what activities are planned and what tasks have been assigned.



Service interface

The service interface provides direct access for software to the DMS and the model server. This makes it possible to use information contained in the framework in the user's other external software without the need to download and upload it manually.

Join our pilots and see for yourself!

The functionalities of the framework described above will be tested in pilots. The pilots will give us practical evidence of the effectiveness (strengths and flaws) of the framework and will allow us to improve it. For participating construction companies, the pilots provide an opportunity to start exchanging information digitally in an effective and affordable way. This section describes the benefits pilot participants can obtain and how the pilots are organised.

Benefits for pilot participants

Pilot participation gives participants the opportunity to use the C&C framework at an early stage already. The benefits can be found in better coordination, cooperation and the easy exchange of information using open standards and systems. In this way, companies can be BIM-compliant vis-a-vis their clients and can improve their overall information management. From a qualitative point of view, the benefits of pilot participation can be characterised as:

- the opportunity to shape the framework;
- access to tools for electronic data exchange without the need for any structural financial investments;
- personal guidance on how to make rapid improvements to the way business data is exchanged with other companies, without having to make any radical changes to current ICT infrastructure;
- access to a network of European construction businesses;
- increased visibility by participating in an initiative officially supported by the European Commission.

Quantitative benefits from using the C&C framework come from:

- reduced failure costs;
- less coordination time;
- faster exchange of information.

Organisation of the pilots

The pilots are in two phases. The Phase One Pilots will run from October to the end of December 2013. These pilots will test the basic functionalities of the C&C framework (as described in this document). The pilots should answer three main questions:

1. Do the functionalities work for the participants?
2. What problems are encountered?
3. Which (basic) functionalities are missing?

The framework will then be updated on the basis of the results of the Phase 1 pilots. Phase 2 pilots will facilitate more complicated data exchanges and will provide a full demonstration of the functionalities/capabilities of the updated framework. Again, results will lead to a final update of the framework. The Phase 2 pilots will take place from March to June 2014.

Companies which are interested can participate in either one or both phases of the pilots. The selection of pilot participants for Phase 1 will take place in October 2013, on the basis of pre-defined selection criteria (i.e. lifecycle coverage, geographical coverage, various company sizes, various actors).

Content of the pilots

During the pilots, construction companies will test the framework within their own project environment. In other words, a company tests the framework with its business partners within the construction sector, either within an ongoing/starting project that could benefit from using the framework or with dummy data (data from a closed project or fictitious data). Using real data will, however, provide more useful insight in the actual effectiveness of the framework.

Pilot participants can choose which of the framework's functionalities and which information exchange processes they would like to test, based on the needs within their project. If the pilot participant wants to test the Model Server, this does require them to have software in place to build 3D models and convert to IFC format.

The use of the Model Server, Document Management System, Web interface and Service interface are free of charge.

What will be required of pilot participants?

Pilot participants have to take into account an investment in time . This mainly involves:

- the demarcation of the information files to be used for digital exchange;
- attendance at a half-day training session on the Connect & Construct framework (before the pilot starts).
- the execution of the information exchange;
- the evaluation of the information exchange process and usability of the Connect & Construct framework (two evaluation meetings are foreseen with the pilot participants and the project team, and an evaluation template needs to be filled out before the meeting takes place);
- the sharing of experiences with the Connect & Construct framework;
- communication with a member of the Connect & Construct project team (each pilot will be guided by one Connect & Construct project team member);

We estimate that pilot participants should expect to reserve four to eight days of their time, spread over the pilot period, to execute the pilot. However, the time needed depends to a great extent on the experience of the participant with digital exchange of information.

Interested in participating or want to know more? Please contact us via info@connectandconstruct.eu or visit our website: www.connectandconstruct.eu!