ByggNett (BuildNetwork) – Norwegian project for Web-based collaboration between public authorities and the construction industry

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ABSTRACT

This study explores the system architecture of "ByggNett" ("BuildNetwork"), an initiative from the Norwegian government for the development of a new collaboration platform for exchange of information among all private and public actors in the entire construction industry. The study explores the ongoing Concept Evaluation project. The Norwegian initiative has a very inclusive approach and combines services and solutions from both public and commercial actors. Public projects do not focus on external information, and proliferation of this initiative can enable collaboration and exchange of experiences.

INTRODUCTION

Norwegian government has taken the initiative to develop a new collaboration platform called "ByggNett" ("BuildNetwork") for exchange of information between and within public and commercial actors. The government by the Ministry of Local Government and Modernisation (KMD) has in its White Paper "Improved building quality for a better society" to the Norwegian Parliament "BuildNetwork" elaborated this initiative as follows:

> *"The Government will initiate the development of a strategy for establishing the 'BuildNetwork.' The strategy will be based on positive experiences drawn from other industries as well as in the construction industry. The future vision might be to develop 'BuildNetwork' as the common interaction platform for the construction industry and the public authorities."*
> (Stortingsmelding 2012, translated by the author)

Further in the White Paper, "BuildNetwork" was presented as the platform for digitalization of processes in the building sector (commercial industry and public authorities). Solutions for digital processing of building permit applications and digital public case/archive solution is on the priority list. Utilization of building information modeling (BIM) is listed as an enabler.

The National Building Authority was given the task to implement "BuildNetwork" by the KMD. The first step was to manage development of a Concept Evaluation report (DIBK 2014). Development of a Concept Evaluation report (KVU) is a mandatory exercise for all large investments above 100 million

euros and follows a structure defined by the Ministry of Finance. However, the investments in "BuildNetwork" are expected to be much lower and over several years. The work with the Concept Evaluation report started at the beginning 2013 and will terminate in the second quartile of 2014. The intention is then to follow with research work during 2014 to prepare for the 2015 budget.

The Concept Evaluation report states two major goals;
- Plain, efficient and flexible spatial and building processes.
- An innovative, competitive and quality-focused construction industry aimed at a climate-neutral and sustainably built environment.

The target groups are: construction industry (architecture, engineering, construction), professional facility managers (public and commercial), private builders and public authority. "BuildNetwork," as a collaboration platform, can in this respect play a very important role for increased collaboration within and between the target groups.

The Concept Evaluation report includes system architecture, an economy model, an organization model and business models. This paper emphasizes system architecture. However, no solution exists by itself, nor can it exist without awareness of the context of enterprise architecture, including maturity, political situation and priority.

The research question. This paper gives an overview of "BuildNetwork" as a collaboration platform with focus on the system architecture – and how this can support increased collaboration and development of services. It will identify relevant components and their functions. Relevance for BIM-based solutions will be the focus in addition to framework for development based on use of open standards and reuse of public registry and digital service components.

"BuildNetwork" is emphasized as a collaboration platform to support both outcome (collaboration between organizations and people) and performance (exchange of data between different systems). The government states that increased collaboration between municipalities is a priority, and the political intention is a significant reduction in the number of small municipalities with populations of under 5,000. The building permits applications are processed by the local municipalities. Norway, with a population of 5 million, has 428 municipalities. Collaboration between local building authorities in small municipalities is established. Digital collaboration through "BuildNetwork" can be regarded as an enabler for reduction in the number of local building offices. Development of "BuildNetwork" can be regarded as an enabler for these intentions. The perspective of "BuildNetwork" is therefore wider that providing technical solutions for public digital services.

Status and perspectives of the Norwegian "BuildNetwork" project. The roadmap for "BuildNetwork" is illustrated in Figure 1 with three different milestones. This way of presenting a roadmap is based on the "The Wedge," , (Bew and Richards 2008) used in UK. The Norwegian approach has similarities to the UK Government Construction Strategy.

Superior ByggNett roadmap (proposal)

Level 1   Level 2   Level 3

Increasing effort and outcome

Improve internal processing by local authorities

Introduce automatic processing

Maximize outcome of all projects

Time   2013   2015   2017   2021
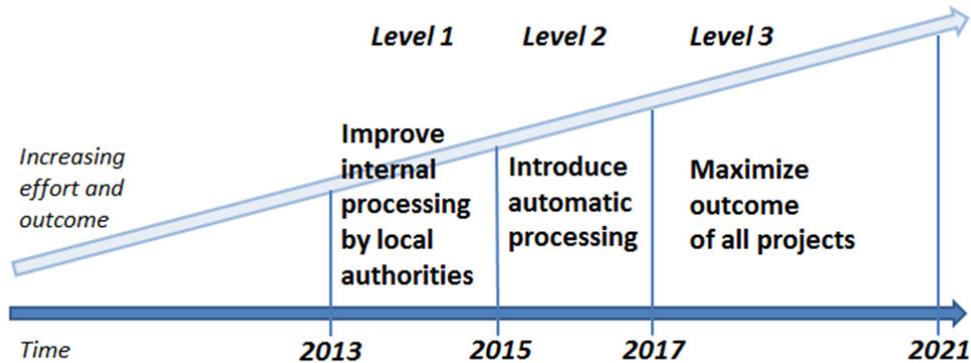
Figure 1. Roadmap for development of "BuildNetwork" (KVU, 2014).

The expected outcome from implementation of the "BuildNetwork" project is expressed as:

Level 1 shall be accomplished by 2015. This focuses on solutions for digital processing of building applications.

Level 2 shall be accomplished by 2017. This focuses on solutions for automatic processing of 40% of applications for buildings with simple complexity and minor consequences for the society. Garages and buildings of under 50 m^2 for privately owned cars are examples of these types of applications.

Level 3 shall be accomplished by of 2021. This stage contains a number of defined targets; 80% automatic decision of all applications, and further 80% reduction in construction errors, use of energy, production of waste and in use of resources in general.

SYSTEM ARCHITECTURE OF "BUILDNETWORK" (BYGGNETT)

Overview. The system architecture is presented in Figure 2. The separate components and tiers are presented in later sections. This paper is based on an ongoing project, and the facts in this study can and will be modified and updated. 2013 was for planning and 2014 for pre-engineering. Development of practical solutions will start in 2015 or later, depending of governmental funding, and on support from the commercial industry and private users. The conclusion in this paper can therefore not be interpreted as a final answer for the "BuildNetwork" project.
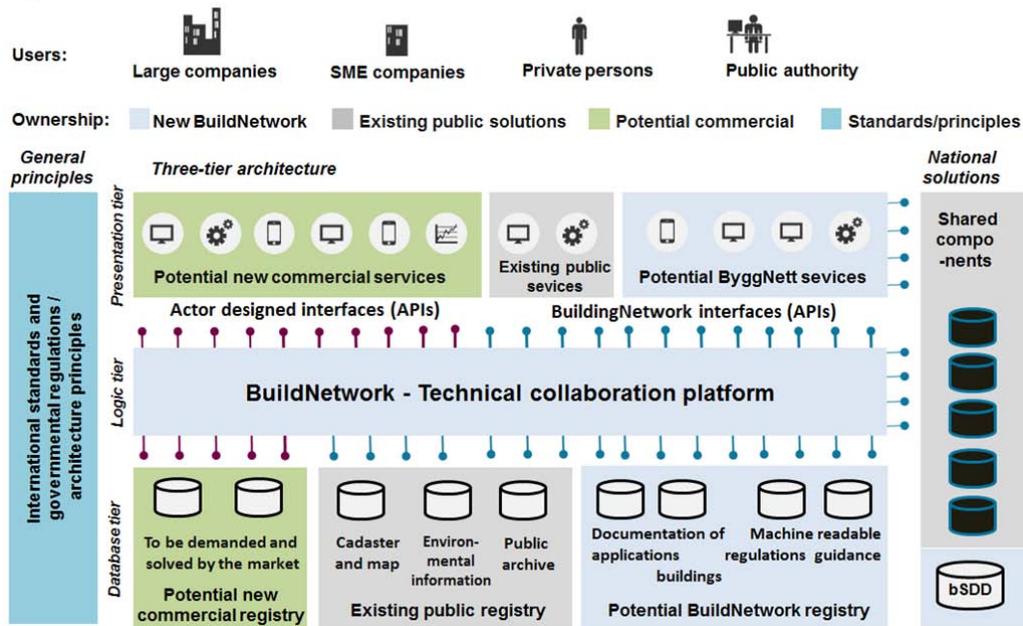
Figure 2. System architecture of "BuildNetwork" (KVU 2014).

GENERAL PRINCIPLES

International standards, government regulations and architecture principles are cornerstones of "BuildNetwork." As an inclusive network No proprietary solutions are allowed. The "BuildNetwork" Concept Evaluation report gives signal of some type of standards to be used. The Norwegian Building Authority is member of buildingSMART and has supported this work financially and with roles in the organization at national and international levels. Focus on openBIM is done by signalizing use of the IFC-based international based on ISO16739 standard. OpenBIM approach is further emphasized by proposal of IFD (International Framework for Dictionaries, based on ISO12006-3) as part of national components. Geographic information systems (GIS) will be specified by references to the ISO19100 series. Web Services will be specified by references to W3C standards.

THREE-TIER ARCHITECTURE

"BuildNetwork" is using an approach related to three-tier architecture, where:
- public and commercial services represent presentation tier
- technical collaboration platform with rule-engine represent business logic tier
- public and commercial registry represent database tier

SERVICE – PRESENTATION TIER

Service. The presentation tier consists of two existing public services – "ByggSøk" ("BuildApply") and "Building regulations on one site" – in addition to plans for public services and, last but not least, commercial solutions. It is very important that "BuildNetwork" does not only become regarded as an extension of the current "BuildApply" solution, or public services. Getting the construction industry to demand and the software providers to develop solutions for improved collaboration is crucial for success.

"BuildApply" – oldest existing public services. "BuildApply" is a web-based solution for digital submission of building permit applications. The system was launched in 2003 and can roughly be described as: "27 forms (for manually filling in) are integrated into one single web-based service." The system performs a verification that all forms and categories are filled in, but no check of the content. Drawings and other documents can be included as pdf files. The entire application can then be digitally submitted to your local building authority, or printed out and sent by mail/delivered personally to the local building office. I all cases, the application is processed manually. Approximately 70% of all applications are filled in by use of this system, but only approximately 25% of the applications are submitted digitally.

"ByggApply" will of course be developed further in "BuildNetwork." As the roadmap in Figure 1 shows, development will focus on automatic processing of applications by the local authorities, to be accomplished by 2015. The next step is to develop solutions for automatic processing by 2017. The objective is automatic processing of 40% of applications for buildings with simple complexity and minor consequences for society. By the end of 2021, this will rise to 80% automatic processing of all applications. These ambitions include use of BIM and GIS. Realizations for this service will require interaction with all other parts of the system architecture.

"Building regulation in one site" – service under development. This is a site containing an overview of regulations: act, code and guidelines. The current version includes a simple text-based search service. It does not search for synonyms or other sematic functions.

Proposed public services. The Concept Evaluation report listed some examples of public services. However, an important perspective of "BuildNetwork" is that it shall not be regarded as only a portal with a limited number of public services to support the authorities' activities for processing of building permit applications. Enabling the industry to require new services, and the software industry to develop new solutions, is an important part of the "BuildNetwork" strategy.

- *Development of digital public case/archive solution.* A digital solution for administration of building applications should be specified by the end of 2015. However, no funding supported this proposal, so the work is therefore related to planning. Digitalization of the public sector is a challenge since only approximately 60 of 428 municipalities in Norway have implemented digital support for processing of applications (KVU 2014). Digitalization of internal processes will be a foundation for automatic processing of simple applications and for decision support for more complicated applications.

Potential new services initiated and developed by commercial companies. This is perhaps one of the most pervasive challenges in developing an emergent "BuildNetwork." This aspect also focuses on competence to stimulate demand for more advanced and adapted services. In a fully developed "BuildNetwork," the public sector will only have a minor share of the network. Software as a service (SaaS) can be used as a principle in further development.

- *Open access to public data.* This service will provide a foundation for commercial software developers to offer new solutions for both the industry and the public authority. The "apps4norway" project was launched by the Minister of Government Administration and intends to offer open access public data to software developers. "BuildNetwork" can support these types of initiatives. This aspect is very relevant for motivating the industry to demand new solutions – and for software developers to implement solutions. Examples of public authorities offering free data are the Norwegian Meteorological Institute, Norwegian Biodiversity Information Centre, Norwegian Public Roads Administration and the Norwegian Mapping Authority, both of which have released certain types of maps.

COLLABORATION – LOGIC TIER

Technical collaboration platform. The purpose of the business logic is just to serve the applications at the presentation tier with relevant data from the registries, and inversely, to distribute data from the application to the relevant registry. The outcome is improved use and reuse of relevant data. Details about technical solutions are not specified in a concept evaluation report, but the strong lead for use of shared national common components and development based on international standards is in compliance with the national architecture principles specified by the Agency for Public Management and eGovernment (DIFI 2009). This will establish a framework that intends to be sustainable to future changes. This will also stimulate both public and commercial actors to invest in development of new applications.

REGISTRY – DATA TIER

Existing and potential public and commercial registry. Registries are databases for storage of large amounts of data. Specified databases will be accessible through API (application programming interface) and routed from the collaboration platform. Existing solutions include registry of: cadaster and map, environmental information, and public archive. The potential solutions are so far ideas that can be implemented.

Potential public solutions. These registries contain documentation from applications and of functions or status for buildings, such as grade of accessibility. Collection of this information can be related to initial stage of a building project (to achieve certification of completion) or to change of ownership of existing buildings. The application registry will support digital public case/archive solution (see Service).

Machine-readable regulations and guidance. The intention with this is to enable technology-independent realization of model-checking and guidance solutions. The commercial software industry does not have to interpret the regulations manually and can be used as a basis for development of software solutions.

Potential commercial registry. "BuildNetwork" shall support both public and commercial providers of data – as long as they follow the specified standards. This is briefly presented in the "General principles" section above.

SHARED NATIONAL COMPONENTS

Shared national components. The Norwegian public ICT strategy focuses on development and use of common components. National common components are defined as components solutions that can be used jointly or reused in multiple ICT solutions in the public sector, where following are established (DIFI 2012):
• Registry of organizations (information about companies, their owners and board)
• National Population Register (basic information about persons)
• Cadaster (basic information about property)
• Altinn (information about tax)
• Common infrastructure for eID in the public sector

Reference Library. Establishment of a reference library has been proposed as a national common component to realize "BuildNetwork" as a collaboration platform. A reference library is a method to connect different concepts with the same understanding when searching for information. For a reference library, it is very important that different systems can exchange information and be mutually understood without the need to change their data. Increased interoperability will support international trade and product documentation. The reference library will be based on IFD/bSDD as new national common components (IFD – International Framework for Dictionary / bSDD – buildingSMART Data Dictionary, based on ISO12006-3). This will be a major step forward for implementing bSDD as a component in utilization of BIM-based services.

CONCLUSION

The system architecture of "BuildNetwork" is comprehensive and designed for ambitious aims. The open approach is based on use of standards and can enable extensive development of different services, both public and commercial. Use of national components ensures that the development can be included in the national program for digitalization. Including development of a reference library indicates international perspectives. However, digitalization of the public sector and construction industry is demanding. The building authority will only have priority on services for processing of building application permits. The challenge is to get the construction industry to demand new services from commercial software developers. In this respect, "BuildNetwork" must be regarded as a project for development of the public sector and construction industry. Collaborating and learning from other nations can be an important contribution for further development.

ACKNOWLEDGMENT

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