Infrastructure Lifecycle Management

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ABSTRACT: Over the last ten years, the Architecture Engineering and Construction Industry (AEC) came under the growing influence of web based project portals and hereon constitutive software services. At first, research projects utilized the internet as an infrastructure to distribute collaborative environments to dedicated communities (e.g. research, development, application in practice [Kohler 1997]). Soon after, the most promising rudiments found their way into the real world and became - in many ways - supplement to the existing world of desktop- and client server based software structures. As a niche entity, many project portals world wide gained momentum and became every day tools for project collaboration, process support and embedded applications.
We witnessed the birth of a new generation of software, where principles of application service providing (ASP), platform embedded services (service oriented architecture (SOA)) and central data, information and document management took over [Erl 2004]. At the mean time this new generation of software started a process of extinction to classical client server based software architecture.
This keynote shall focus on the potential and major side effects of this development, where data integration over the object live cycle becomes natural and single services disclose more and more useless, if not integrated in an object life cycle oriented approach. More over, the introduced concept of Infrastructure Lifecycle Management (ILM) has the potential to reshape the general approach of developers, owners, service providers and software vendors.

1 THIRD GENERATION SOFTWARE

To better understand the current paradigm shift we briefly need to take a look at past and present software concepts. *First generation software* was workstation- or single CPU centred and is well known as application software for all sorts of office applications (MS-Standard), games and data storage in a stand alone environment. Underlying data or documents are proprietary and hard to exchange with other applications or users in different locations.

Second generation software is enterprise centred. Typical client server technology enables the distribution of software among different users in a concluded network. Enterprise resource planning (ERP) systems are exemplary and currently dominate the IT world in medium and large enterprises. There is a large correlation between industrial production concepts, the underlying line organisation and this software approach, focused on application within an organisation. Recurrent processes dominate production, accounting, billing, time recording (e.g. automotive, durable goods).

Third generation software is project oriented and focused on inter organisational integration. Flexible user management, communication and information interchange among highly distributed teams in real time are key. We are no longer talking about single applications or monolithic software, instead underlying platform structures emerge into project centred operating systems. Again, there is a correlation between a major shift in the economical world and this technical development.

Whereas large and line based organisations dominated the economical world 30 years ago (44%) they are since then on a constant decline. On the opposite, medium sized and project centred organisations since then have gained more then 100% in share (figure 1). Even within large corporations, line based production structures vanish in favour of project oriented approaches under participation of many external participants (e.g. chip design, pharmaceutical research, software development).

It is evident that in single, line based organisations, it was a tempting OPTION to work on one platform (ERP) in order to allow standardisation, portfolio analysis, or to reduce ramp up costs for new employees. In project teams, composed of participants from many different organisations, it is rather a MUST to utilize a single platform structure in order to avoid fragmentation, redundancies or waste of time in ramp up and coordination.

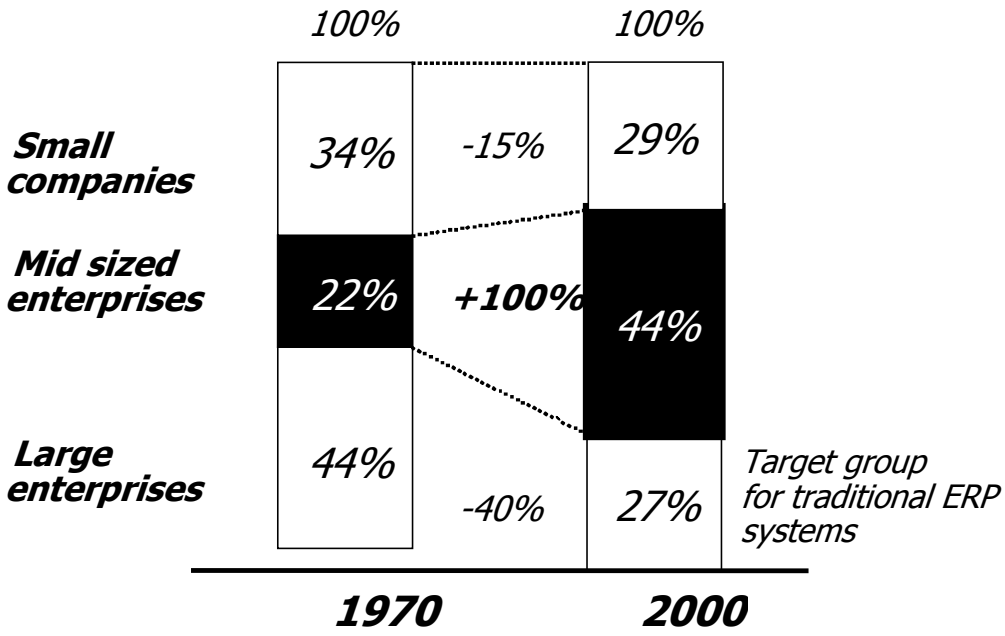

Figure 1. Employees by company size in Germany (source: conject AG)

2 INFRASTRUCTURE LIFE CYCLE MANAGEMENT

Platform structures for project work must consider all phases of the project life cycle. In AEC projects, this makes perfect sense if one considers integration from the project point of view. Project participants join and leave over the phases develop-, plan & build- or operation. But they all share the need for consistent data and transparent general conditions. An infrastructure life cycle management approach addresses these needs by providing a platform over all life cycles of the project.

With early approaches of project portals or the currently emerging ILM platform structures one can recognize this development on the process- and data management level. Even though progress over the last 5 years was very different from what many of us – mostly the academic observer – hoped or expected, ongoing changes in the AEC industry where and still are very fundamental. Ten years ago, did anyone talk about business process automation in planning and construction? Ten years ago, did anyone seriously talk about data integration over the project life cycle? In the academic world YES! In the practice world NO! It was not even technically possible. Here it was no topic at all! With emerging platform technology [Gawer 2002] the generation of ILM will conduct the final transition to integrated data management and services.

To better understand the impact of this transition it is worthwhile to look also at the overall marked size for software. Currently, the marked for application software is about 30 billion €. This is about half of the marked for enterprise internal software (e.g. ERP) which stands globally for abut 60 billion € per annum. ILM addresses a totally new software marked, as we discussed previously now focused on projects and their participants. With a few reasonable assumptions (figure 2) it makes sense this marked will be by far larger then the previous two. This is not only because of the share of the work-

	approximation	comment
Employee	348 million	Only in top ten regions (15% of all employees)
times		
Potential share of users	48% of all employees	User share for inter organizational platform
times		
Turnover per customer	50-100 € per month	Experience conject, Salesforce
=		
Marked potential		Marked at 100% saturation

Figure 2. 100-200 billion marked potential in top 10 regions (source: conject AG f

force affected (app. 350 million people in all industries world wide) but also because of the integration potential of platform structures. ILM platform structures have the nature of operating systems and therefore integrate already additional services (and will much more in the future) that also generate revenue. It is thus plausible to assume that in the future revenue will be generated per user.

3 COMMUNITY BUILDING

Unhindered development of next generation ILM platform structures requires communities of significant size. Over the last years, professional web portals created and expanded such communities. How do communities grow? In the AEC industry this mainly happened in the periphery of large scale projects, such as the BMW plant in Leipzig, Germany where more then 700 hundred project participants where coordinated through a single platform and over 4 years. In fact, large scale projects have already adopted platform structures at first for data exchange and communication as a standard. Subsequent, more and more value gets altered such as print services, bidding or proprietary services e.g. for cost control.

However, the focus is still limited to a.) large- and more and more medium sized projects and b.) to the phases of *development- design and build*. There is still a disruption between the *design- and build* phase and the phase of *operation*. Technically, this disruption is no longer necessary. But in practice, the user communities of the phase *design- and build* and the phase of *operation,* are in tradition almost not interconnected in terms of processes and integrated planning approaches. This downside can now be overcome through technical enhancements [Keller 2004]. Especially questions of document structuring and data modelling – that typically arise during early project stages– trigger advanced concepts and the community interchange in a broader sense. Therefore, lanners, engineers and their clients more and more take into account the requirements of the phase of *operation* – the communities get more and more interweaved.

For the AEC industry it can be summarized that demanding communities (as driving force for ILM platform structure development) emerge in three steps:

- *Critical Mass Achieved:* Complex problems in large projects require adequate technology
- *Additional Value Provided:* Platform with critical mass attracts additional services
- *Life Cycle Addressed:* Centralized data structuring requires a life cycle oriented approach

4 THE NEXT TEN YEARS

Over the next ten years we will witness a sustainable development of platform structures towards a project life cycle oriented environment. In the near future this development will be feasible through more competition among existing and new providers of platform structures [Gawer 2002]. The technology will be pure web based respectively attached to mobile devices of all types. Competition and further demand will lead through several phases of consolidation to only a few remaining providers of operating system like platform structures.

This software world will not be a reborn, monolithic - Microsoft like - world. Instead it will be much more infrastructure oriented. The impact for our professional life in the AEC industry is and further will be three fold, namely there will be:

- a revolution in software infrastructure
- an entirely new class of software applications in form of web services
- a new generation of consulting services providers.

The revolution in software infrastructure will be characterized by integration. Today collaboration is document- and communication centric. Over the next years, documents will be constantly replaced by modelled data (digital object files), not too far by integrated product model approaches such as today's IFC's. The product model kernel of a project will be part of the infrastructure, accessible to process engines and third party services (e.g. web services). In addition, communication will be entirely integrated into this new world. The future ILM platform will comprise all sorts of channels for communication such as today's IP telephony, video conferencing, desktop sharing and blog bound instant messaging.

Today's software applications do not take advantage of centralized data. Through the aggregation of project information in a single environment, application developers will shift there efforts to the development of web services that take advantage of platform centric stocks of data and the opportunity to interconnect with platform processes. Also, structures for GRID computing (currently under development in several international research projects [inteliGrid]) will be utilized to leverage computing power available over the net [Kurzweil 2000]. This will lead to the gradual disappearance of "install software". Users will get used to this "pay per use" terms and conditions.

How will this impact the professional life of traditional service providers and consultants in the AEC industry? Technology is not everything and human expertise will not be replaced over the next ten years. However, the emerging ILM technology already has significant impact on traditional job descriptions and professional opportunities. At this point only two opportunities shall be discussed.

Most needed is the redefinition of current service profiles, which are also subject to a more life cycle oriented approach. For example engineers do have a usually good understanding of later phases of a building but typically do not (or are not allowed to) utilize this knowledge in their work. The more life cycle oriented the central object file or later object model will be, the easier the redefinition of service profiles will become. They are – in significant respect – dependent on the level of data integration.

The availability of ILM platform structures – the only limit is net access – again brings in the global scale [Kelly 1994]. Future contract assignment will be much less dominated by geographic restrictions then by compatibility to required experience in networked work structures, given service profiles and process standards.

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