Extreme Enterprise Architecture Planning (XEAP)
Extrapolating Agile Characteristics to the Development of Enterprise Architectures

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Abstract: When developing enterprise architectures, in the same way as software products, companies have to deal a constant growth on the clients demand for faster results, while facing, at the same time, a big uncertainty on the requirements surrounding the project. This paper tries to investigate the similarities between the difficulties faced in both industries of enterprise architecture (EA) and software development, and propose an extension to an existent EA development methodology, in order to address those difficulties using particular agile software development methodologies characteristics. This new extension tries to introduce agile characteristics such as several iterations, solution partitioning and constant client feedback in order to deliver faster results and have a bigger capacity of response to the change of requirements, when compared with the standard methodologies. To do so, the first iteration is based on a reference model and the next ones follow the Enterprise Architecture Planning (EAP) methodology steps and are adaptable to the business itself. After presenting our proposal we make the demonstration of the methodology developed, applying it to a real-world problem of local organization called Cascais Ambiente, responsible for the maintenance of the environmental health in Cascais city.

1 INTRODUCTION

Nowadays all enterprises, ones more than others, face big difficulties that come from their surrounding environments. With relentless competition in almost all sectors, comes the increase of new offers, substitute and competitor products and consequently the growing necessity for faster results while constantly facing uncertain requirements.

Software development industry is a particular example of an area where those problems had always been quite obvious. Natural, he companies started felling the necessity to use new and innovative ways of developing their products, once the traditional and standard ones were not able to answer the market expectations that were increasing in a really fast way. Those necessities were fulfilled by the introduction of the called “agile software development methodologies”, such as Extreme Programming (XP) and Scrum. Both Scrum and XP, are based on the motivation to deliver fast results to the client in an incremental and partitioned way while having an inside-costumer involved on the process in order to have a constant feedback, allowing to easily overcome the requirements uncertainty that are typical in such projects.

When observing closely, we can identify some similarities between the needs of both software development and enterprise architectures development industries, expectedly concerning the client’s needs for faster results while having a big requirements uncertainty originated by the surrounding environment. With the similarity between needs and the success achieved by the agile approaches on the fulfilment of those needs in the software industry, we intend to extrapolate some of the main agile characteristics of those approaches into a well-known traditional enterprise architecture development methodology, in order to overcome the demands described above.

Our proposal will be based on EAP methodology of Steven Spewak (Spewak, S. and Hill, S., 1992), to which we intend to make some “agile” changes,

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transforming it into an iterative process, while introducing characteristics such as solution partitioning and constant client feedback, with the clear objectives of reaching a methodology capable of deliver faster results to the clients, while dealing with a big requirements uncertainty (when compared with the standard methodologies).

2 PROBLEM

The uncertain environment which the enterprises face nowadays, are closely connected with the clients own changing requirements and visions of the business. Not surprisingly, maintaining control over the requirements process is nearly impossible as each customer group pushes for its own interests and the changing technologies lure customers into escalating demands (Brooks, JoAnn M. and all, 2008).

The surrounding environments and the competitiveness of the markets originate enormous difficulties when trying to clearly define requirements, making the development of enterprise architectures an even more difficult process. Not rarely, this problem leads projects into a two way path, where either the project continues its normal pace, keeps all the original plans ignoring the changing environment and requirements ending in a completely failed project unable to achieve the expected results, either it tries to answer in an appropriate way to the changes and uncertainty of the requirements and ends up completely failing the predicted and agreed time schedule and/or budget.

Alongside with this uncertain environment it is the organizations increasing needs and expectations for shorter cycles with production of return, as well as faster results (Spewak, S. and Tiemann, M., 2006). The constant changing environment and relentless competition that enterprises face today brings them a high necessity for fast results in all the areas evolving the business in order to adapt and create new opportunities (Land, Martin O., and all, 2009).

Some years ago, the problems identified above (environment uncertainty and demand for faster results), were deeply evident on the software development industry, while this started being one of the most competitive and fast-growing industries. At this time started being globally recognized the urgent need for efficient methods and practices capable of facing the recognized demands. As an attempt to answer those demands, the notion of agile approaches started rising, where instead of developing software as a big complex and flat process ending in a big delivery, it would be done in an iterative way with several small deliveries in order to embrace and manage the possible changes that may happen along the process, while dividing a big problem into smaller ones (Sommerville, I, 2010).

Analysing in a more particular way, the projects of enterprise architecture development are not different from the generality and in this case there are some problems that with the growing of the companies had become more and more difficult to deal which reclaim for a methodology capable of dealing with those problems in the same way agile approaches did on the software development projects.

Quite often in EA projects, the clients find themselves obligated to choose from their business functions, the ones that must be actually considered on the architecture. Other functions that may also be important and critical end up being left behind, due to the limited amount of time allocated to the completion of the project (Townsend, J., and all, 2008). Those cases show us that we can achieve a level of independency between systems, capable of being explored in a way that delivering the results of different systems separately and in several iterations becomes a requirement and success factor instead of an obligation due to the tight schedules or complexity of the project.

As a way to summarize our problem we present the questions that we try to answer with our work:

- Are the demands for ability to support uncertain environments and delivery of fast results, in Enterprise Architecture, achievable by extrapolating Agile Software Development approaches characteristics?
- Are process iterations, small releases and continuous client feedback the correct characteristics able to achieve faster results and bigger response capacity to changing requirements?
- Is a standard and traditional enterprise architecture methodology capable of "accepting" the introduction of agile characteristics?

3 RELATED WORK

3.1 Agile Software Development

Agile Software Development appeared has an answer to the fast changing, uncertain and unpredictable environments that surrounded the

projects of software development. These environments include client uncertain requirements, new target markets, substitute and competitor products/services and even economic changes. With all the difficulties, this competitive and restless industry started demanding for methodologies capable of delivering fast results, once this started emerging as the main requirement of the clients, leaving behind important requirements like software quality (Sommerville, I., 2010).

The most famous and used agile methodologies are Scrum (Schwaber, K., 1995) and Extreme Programming (Beck, K., 1999), which introduced some new concepts and characteristics to the software development process. From those characteristics we can highlight the introduction of iterations with releases and deliverables to the client at each one of them, the constant client feedback with a huge involvement in the project and the short-term goals over the long-term ones.

3.2 Enterprise Architecture

Enterprise architecture can be described as a governance and decision making instrument with the capacity to fulfil the gap between enterprise's vision, strategy, and change projects. Enterprise architecture tries to deal with this gap, by achieving a common, shared and unanimous comprehension about what are the company structure, business model and the necessary systems to support that model (Land, Martin O., and all, 2009).

Some of the most used enterprise architecture development methodologies are Enterprise Architecture Planning (Spewak, S. and Hill, S., 1992) and TOGAF ADM (The Open Group, 2009). EAP is an older methodology especially focused on the information systems and that does not go further than the planning of the "TO-BE" state of the client. Contrarily, ADM is a wider methodology, not only capable of planning all the enterprise architecture, but also with concerning on the actual implementation process and its governance as well as on the change management. Being an overall simpler and shorter methodology, EAP constitutes a more suitable process for our purposes of adding some new agile characteristics, and therefore is the basis for our proposal and the general steps involved.

3.3 Reference Models

Reference models are prototypes of some application domain. Those models intend to reduce significantly the trouble inherent to the creation of application-specific systems, where we can select the more important parts of the model and adapt them to a specific problem. When applicable, this possibility gives us a huge advantage in terms of both cost and time saving, on the development of the projects (Ramesh, B. and Jarke, M., 1999).

On our work in particular, we will use the reference models with the clear objective of presenting results to the client as soon as possible, through the delivery of a first high-level architecture based on one specific model, considered suitable for our project, once this models can be used as a starting point to construct project-specific models (Becker, J., and all, 2007).

4 PROPOSAL

Our proposal consists on extrapolating some characteristics of the agile approaches used in software development, as Extreme Programming and Scrum, to the domain of the enterprise architecture. We will base our process on the Enterprise Architecture Planning (EAP) methodology where we will introduce agile characteristics.

We will give special attention to the inclusion of several iterations in the process, as a way to transform a slow, big and complex process into several sequenced simpler iterations while exploring the possible independence between components of the solution, which in this case are the information systems that support different business functions.

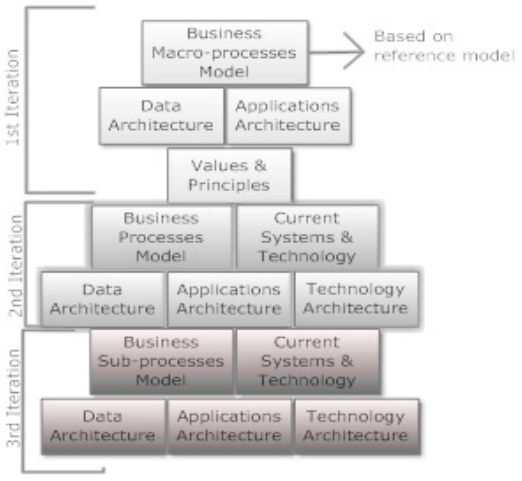

Figure 1: Extreme Enterprise Architecture Planning.

4.1 Differences/New Characteristics

4.1.1 Step-by-Step Process

First Iteration

In the first iteration we will have the first contact with the client and the business. One of the main goals of our proposal is to deliver results as fast as possible. As a way to accelerate the process without losing accuracy, we adopted and adapted a business reference model to our specific client. With this first architecture we will give the client a high-level view of what their architecture should look like, and which systems are the more suitable to support their business.

Business Macro-processes Model
In this first step we present a reference model containing macro-processes considered suitable for the type of business we are dealing with, relating them with the main information entities that we are able to identify through a simple analysis of general information.

Data Architecture
After identifying the more important information entities on the previous step, we must do a data architecture capable of describing in a first high-level the relation between those entities and their characteristics showing the structure that is achieved when relating all of them.

Applications Architecture
By relating the reference macro-processes and information entities identified in the first step, we are now able to understand which applications should be supporting the model described. As a result of this step, we are able to provide to the client, since the very first meeting, a description of the applications and systems he must have, representing an ideal "TO-BE" state and a difficult, but clear objective for the future.

Second Iteration

On the second iteration we start performing a complete cycle of EAP process, purposely missing the last step of implementation/migration plan, which we will do only once in the end of the last iteration.

Values & Principles
This step defines the basis for the EA and for all its future decisions. This phase is performed only on this second iteration, once it defines values and principles that must be followed during the rest of the process.

Business Processes Model
This step marks the beginning of the organization "AS-IS" state definition. Firstly we will need to identify and relate the processes of the business and the information entities used by those processes in order to achieve an accurate model of their reality.

Current Systems & Technology
This step completes the definition of the present state of the company. This phase is not only important to define which systems the client have in the present, but also to help us understanding what we can or cannot have in the future, once will give us the possibility to do a later evaluation of the impact that the architected systems and technologies will have on the current ones.

Data Architecture
With the information entities identified before, we are able to formulate a data architecture that shows how those entities must be connected and structured in order to have the most efficiency possible when manipulating the data that supports the business.

Applications Architecture
Through the understanding of how the business processes use each information entity, we are able to formulate and present a first group of candidate applications, which together can effectively support the organization activity. The result of this step is achieved using a CRUD matrix.

Technology Architecture
After defining the more suitable applications for the business we must define the technology that will support those applications. Having into account that we are already on the second iteration, we will have to understand how the existing technology can or cannot handle those applications and what are the necessities, if any, of the organization in terms of technology infrastructure.

Third Iteration

The third iteration is in every way similar to the second one. The main difference between them lies on the business processes level of detail. On the third iteration we will decompose the previous processes into sub-processes and find some more information entities that they may use, going even deeper on the clients business model.

Business Sub-processes Model
On this step of the third iteration we will start redefining the "AS-IS" state of the organization, now with some detail about their processes and information entities. We can now decompose the processes identified on the previous iteration into

sub-processes and therefore identity new information entities.

Current Systems & Technology
On this particular step we identify the systems that support the business sub-processes and information entities identified. Having into account that we are on the last iteration, we expect to have identified the complete set of systems that the organization currently use.

Data Architecture
This step corresponds to the final data architecture, representing the necessary and more suitable structure of the complete set of information supporting the business.

Application Architecture
This step corresponds to the final applications architecture. The relation between the most detailed sub-processes and all the information entities of the business will allow us to identify the final set of applications capable of supporting the complete organization activity.

Technology Architecture
On this step we will finish our architecture definition with the presentation of the technology capable of supporting the applications identified on the previous step.

Implementation/Migration Plan
Finishing our methodology and the project is the Implementation/Migration plan, where we make a planning of the systems that need to be implemented and installed, where we include effort, resources and benefits estimates, alongside with an impact analysis on the current systems.

5 CASE STUDY

In order to demonstrate our proposed solution, we applied our artefact to a real-world problem form a local organization called Cascais Ambiente.

5.1 Applying the Methodology

First Iteration

Business macro-processes model
In order to achieve a preliminary business model we relate the macro-processes, based on the PCF reference model (APQC, 2012.) chosen for this specific project, with the information entities that are common to almost all businesses in general and are suitable to this one in particular.

	Request	Client	Employee	Partner	Lot	Purchase	Asset	Supplier	Project
Operation processes									
1.0. Develop vision and strategy		x		x	x				x
2.0. Develop and manage products and services		x		x	x				x
3.0. Market and sell products and services		x		x	x				x
4.0. Deliver products and services	x	x			x				
5.0. Manage customer service	x	x	x						
Management and support processes									
6.0. Develop and manage human capital			x						
7.0. Manage information technology						x	x		
8.0. Manage financial resources			x			x	x	x	
9.0. Acquire, construct and manage property						x	x		
10.0. Manage environmental health and safety				x					x
11.0. Manage external relationships				x				x	
12.0. Manage knowledge improvement and change	x	x		x					x

Figure 2: Relations between business macro-processes and information entities on the first iteration.

Data Architecture
On this step we relate all the data entities identified before. We are now able to provide a general view of the data structure that is more suitable for the business with special attention to the information being shared by more than one entity.

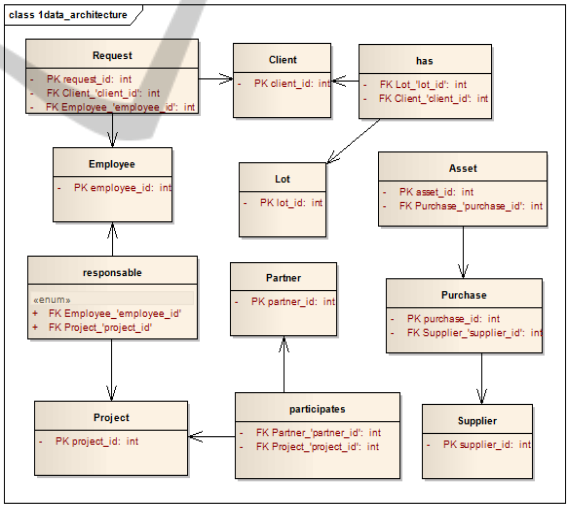

Figure 3: First iteration relations between information entities.

Application Architecture
The CRUD matrix provides us an understanding of the applications capable of supporting the client activity in the most effective and sustainable way possible. During this process we must keep in mind that we are working with a reference model, and therefore, we are presenting an ideal situation to the client of how his IS architecture should look like, and not yet representing is actual situation, which will be addressed later on.

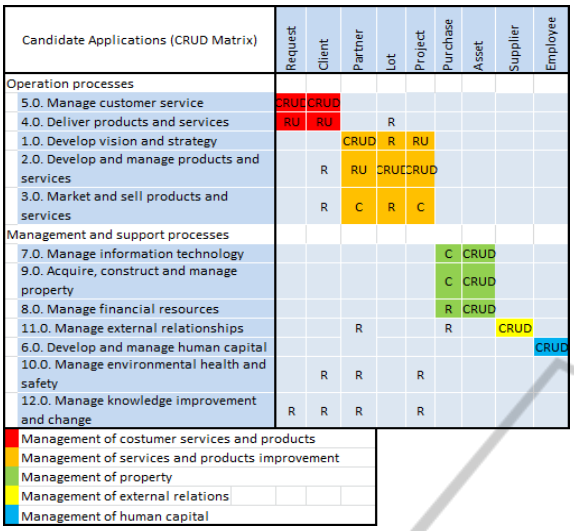

Figure 4: First iteration CRUD matrix.

Second iteration

Values & principles

The project will have the maximum duration of 3 months. In agreement with the client, was decided that this work would start by addressing only the Operational side of the business, once it is considered to be the most fragile one. Furthermore, we expect a continuous contribution and feedback of the client in order to keep our work as informed has possible at all time.

Business Processes Model

Relation between business processes and information entities	Request	Client	Project	Partner	Georeference	Lot	Purchase	Asset	Supplier	CA Place	Employee
Operational processes											
Urban cleaning and waste collection	x				x	x				x	x
Management of public green spaces			x		x					x	
Management of natural resources and shoreline					x					x	
Collaboration with municipal agencies			x	x		x					
Support processes											
External relations							x		x		
Financial and patrimony							x	x			
Information Systems							x	x			
Human resources											x
Statistics	x		x		x	x				x	

Figure 5: Relations between business processes and information entities on the second iteration.

After doing a survey of the enterprise business processes and information entities we started describing the "AS-IS" state. On the process of gathering all the processes, we tried to make correspondence between them and the macro-processes defined on the first iteration, as a way to understand how far the reality of the organization is from the reference model. We must keep in mind that although the reference model constitutes an example of good structure for the business, it is not the only possibility.

Current Systems & Technology

Relation between business processes and current systems	MOBA	GisMedia	QuantumGis	Recycling bins management system	SGEV	PHC (ERP)	SIL (Financial)
Operational processes							
Urban cleaning and waste collection	x			x		x	
Management of public green spaces		x	x		x		
Management of natural resources and shoreline				x	x		
Collaboration with municipal agencies						x	
Support processes							
External relations						x	x
Financial and patrimony							x
Information Systems	x	x	x	x	x	x	x
Human resources						x	
Statistics	x	x	x			x	

Figure 6: Relations between business processes and current systems on the second iteration.

After performing some interviews and research we were able to identify the main systems supporting the business. On this iteration we tried to include only the critical systems and the ones that are considered by the stakeholders as being the most important ones.

Data Architecture

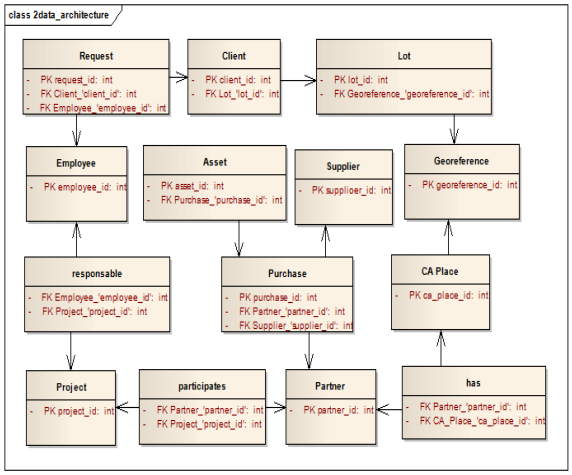

Figure 7: Relations between information entities on the second iteration.

After analyzing the information entities identified before, and reaching a clear understanding of their characteristics, purposes and use cases, we can achieve a new and more detailed data architecture

that shows a suitable structure capable of fulfilling the business demands in an effective way, free of incompatibilities between entities.

Applications Architecture

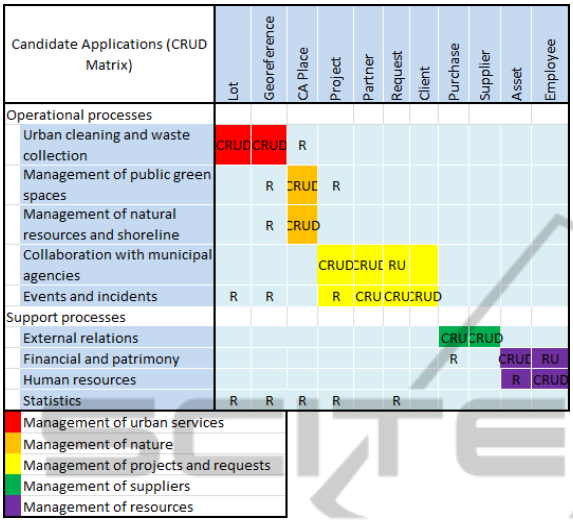

Figure 8: Second iteration CRUD matrix.

On this second iteration with a new CRUD matrix, we were able to identify 5 main systems that can support in an efficient way the business processes and information entities described on the previous steps.

Technology Architecture

We don't have, yet, enough information to present this step.

Third iteration

We don't have yet enough information to present the third and last iteration.

5.2 Analysing Preliminary Results

The methodology used by GFI is based on the standard flat methodologies, such as EAP where they describe the entire "AS-IS" state of the client with a big level of detail in first place, and then move to the final definition of the "TO-BE" state. With this approach is easy to understand that the time to value of the project is as much as the total duration of that same project (3 months). On the case of our proposal we were able to deliver results on the first meeting with the client through the presentation of the work developed during the first iteration described before on this document, as a way to start the discussion and get some valuable feedback from the client. Soon on the project, we will be able to present an accurate architecture to the client with reasonable level of detail, although not final, with the description of the work developed during the second iteration. At the end of the project, both we and the consulting company will be able to present the final architecture with the same level of detail concerning the business processes and information entities of the organization, varying only the time that each one will take to achieve it.

6 CONCLUSION

On this work we tried to do a concise overall description of the artefact that we have been developing. Our work consists on an iterative process capable of delivering faster results when compared with the traditional and most used methodologies. XEAP minimizes the negative impact that uncertain requests tend to have on the standard methodologies, by using iterations that can access previous feedback, and use it as a way to drive the project into the right path with constant adjustments. The combination of those iterations and the reference models, brings the capacity of delivering results to the client a really early stage, that despite not being final results, are preponderant on the feedback necessary to correctly conduct the project.

The fact that we are applying our proposal to a real world case study currently happening didn't allow us to present the entire final results, and therefore the final evaluation process. Although being a limitation to this document, this can also be seen as good way to show XEAP effectiveness on the delivery of fast results, once the client is already in possession of valuable information which will certainly be used to guide them on their transformation process.

As we said before, we were not able to get all the final results from the XEAP process. This means that although the faster results achieved at the half-point of the process, as future work, it will be necessary to compare both the quality and the delivery time of the final results, once that will be the most important test to the effectiveness of the methodology.

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