Transitioning of IT Companies from Waterfall to Agile Methodologies

Aleksandra Zhbajnova-Mircheska[1] and Ljupcho Antovski[2]

[1] Makedonski Telekom AD - Skopje, Macedonia
[2] Faculty of Computer Sciences and Engineering, University "Ss. Cyril and Methodius", Skopje, Macedonia
aleksandra.mirceska@gmail.com, ljupcho.antovski@finki.ukim.mk

Abstract. Flexibility and quick response to demands are imperative in today's business environment, as the rapid pace of technology, innovation and development requires organizations to deliver results faster than ever.
The traditional development methodologies, like waterfall, cannot respond to the rapid increase of the business needs. Numerous organizations are starting to move towards new agile methodologies. Overspend budgets, missed deadlines, solutions that did not met the business requirements, are some of the main reasons that forced organizations to transition to agile.
The goal of this paper is to elaborate the transition phases of the organization from waterfall to agile methodologies. We have presented the characteristics of an agile/digital organization and introduced the microservices architecture as phase in the agile progression. Finally, we showcase the results of the analysis of the current IT architecture in Makedonski Telekom and how it fits in the new digital world, as well as the process of creation of the transition roadmap in Makedonski Telekom towards creating the new IT microservices based architecture.

Keywords: Agile · Digital organization · Agile transformation

1 Introduction

Transitioning to agile methods can be challenging and it requires significant effort from all areas within the organization. There is no 'one-size-fits-all' approach to an agile adoption and it may take several attempts to reach the organization's goal.

Taking into consideration the benefits of agile, more and more organizations are starting their agile transformation. If the organization has been traditionally managed, it will include radical shifts in attitudes, values, mindsets, ways of thinking and ways of interacting with the world, in order to reach a change in organizational culture [1].

Based on research done by Forbes and Scrum Alliance (2018) [2], which was focused on C-level management, it was discovered that Agile frameworks, Scrum in particular which 77% of leading organizations currently leverage, can help stimulate growth and support in the era of digital transformation. For organizations that succeed at achieving greater agility, the benefits are overwhelming, including:

- faster time to market (60%),
- faster innovation (59%),
- improved non-financial results such as customer experience and product quality (58%), and
- improved employee morale (57%)

One of the major challenge for the organizations using Waterfall is the speed of change in the market. Business requirements rapidly change and the original requirements and design set at the beginning of the project may no longer apply to customer's needs.

Resistance to change is one of the major challenges in adopting agile. Changing mindset of people and their organizational culture is not an easy process. Cultural barriers can appear, due to long periods of working with traditional development. Agile transformation changes the role of managers from managing to leading; their style is changed from "command and control" to "leadership and collaboration". Maybe one of the most important challenge is not having full support from the upper management. The management gives the "green light" to move forward and can help to remove project barriers.

Some of the reasons that organizations are deciding to adopt agile methods are: accelerate software delivery, enhancing the ability to manage changing priorities, increased productivity, improve business/IT alignment, enhance software quality, improved team morale and many more.

Before transitioning to Agile, it is very important to have a clear objective about the need for considering Agile, what results the organization expects to get from the transition and see if there are some other alternatives that can give similar result in less effort. As agile is rapidly becoming the standard software development process, the real question the organizations face is when and how they will implement agile rather than if.

This paper focuses on the phases of the transformation that one organization needs to follow on its journey of transitioning from Waterfall to Agile.

2 Phases of transformation

When considering a transition from traditional Waterfall development to Agile practices, it is important to be aware that the organization's existing size and culture will have a big impact on the strategy to use.

In general, the transformation process should go through the following stages [3]:

Understand. It is important the organization at first to understand what it wants to change, where it is now and where it wants to be in the future, have clear understanding of the business objectives and organizational culture.

Educate. Employees should be first educated about the concept of the new methodologies that are going to be implemented during the transition.

Execute. Then the organization needs to take action towards creating that change.

Execution does not end the cycle, but it continues to the other iteration, where the understanding and knowledge increases.

The Agile transformation usually starts with conducting an initial assessment to understand the as-is situation, by identifying current business processes and identifying the ongoing business initiatives and key performance indicators [4].
The audit should begin with deep dive into the current processes in order to identify the blockers and pain points that the transformation will need to address, as unclear requirements and not well-defined priorities or lack of collaboration, resulting in deliverables that not satisfy the business needs [5].
Once the organization has captured its current situation, it should identify the most suitable approach for introducing Agile. During this phase, the organization should make a decision how they will approach the adaptation – to move all teams to agile at once, start with just a few agile practices and gradually add more as they mature, or start "small" - with a pilot team or project. [6]

Mike Cohn [7], explains the two possible patterns:

Start small pattern. The organization selects usually, one to three teams, each with 5-9 team members, and focuses on making these teams successful and then expands the adoption from there. This approach is less expensive, it almost guarantees early success, avoids the big risk of going all-in, less stressful and it can be done without big reorganization.

Going all-in pattern. This approach has several advantages: reduced resistance among employees and it avoids problems created by having agile and waterfall teams work together.

It is recommended by most experienced agile experts to start small with running a pilot project, because there is lower risk for failure and high possibility for success.
Goals of the next organizational transformation phase are to establish an agile organizational structure, top to bottom, including establishing teams, defining processes, and determine how teams will work with each other.
Big change during the transition to agile is the change in the departments and the separation of duties. In agile environment, small teams exist with cross-functional skills that are able to self-organize and solve issues proactively (**Fig. 1**).

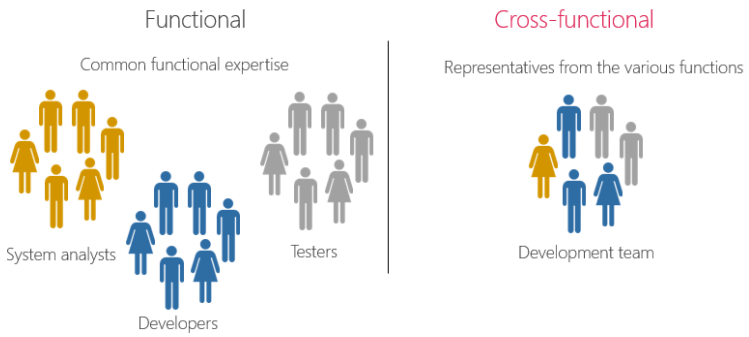

Fig. 1. Functional vs. Cross-functional teams [4]

Management support is crucial during the transition. Management needs to understand the benefits of the change as well as the details of how the change will affect operational

aspects of the business. The organization's executive usually is the program sponsor who promotes the transition and is responsible for providing the resources (budget, people, facilitates, etc.) and delivering the benefits. They should help in securing commitment from both business and IT department and establish communication strategy to facilitate communications top to bottom [8]. Middle management's commitment is needed to reorganize employees according the new way of working, assignment of the tasks to the project as a team instead as individuals and continuous prioritization of the requirements.

Since agile methodology during the transition is new, both management and the teams involved should take trainings scaled to their needs. It is often recommended to take a 'top-down' approach to the training, in order to engage key management in the process at an early stage.

If the organization is planning to roll out Agile across the entire organization, it is recommended to have trial approach with a single department or team first. It is important to carefully select the trial group, as it is important first step in ensuring that the organization gets the greatest possible insight from the initiative. The trial period should follow the Agile principles regarding continuous inspection and iteration by doing project retrospectives.

The rollout step starts the "Execute" stage in the transformation process. The investment in small pilot project prior to wider organization rollout will be a good example to follow for the other teams that will start to work in Agile mode. The trial team will be the gold standard for Agile implementation within the organization and a reference point for additional teams that will transition to the new approach [5]. The retrospectives conducted during the pilot period can be also a great source of support to the other teams with highlighting which parts worked well and which areas were challenging, and use these points for generating ideas for further improvements and refinements to the approach.

The most effective way of normalizing and implementing all these changes is to hire an in-house Agile Coach. The Agile Coach will enforce the principles and processes, ensuring that everyone understands why the changes were made, when they are supposed to happen, and what results are expected. He must be empowered to monitor how effectively the transformation is progressing and stay aware of any old patterns and behaviors that might start holding back across the whole organization [4].

3 How to create an agile organization

Agile organization focuses on the customer's needs and uses advanced processes and technology tools, like introducing DevOps principles and open communication. Organizations should reorganize the teams so they include people from different departments who are responsive to problems, as they arise [9]. One type of successful creation of agile organization is the tribe/squad model described below.

The success of Spotify [12] is due to their deeply embedded agile methodologies and utilization of the Agile Scaling they have invented, called Spotify Tribe. Tribe/squad

model splits the teams up into very small ones that own a certain part of end-to-end functionality.

Many organizations followed this model invented by Spotify during their agile transformation. The ING Banking group from Nederland as one of them, in 2015 shifted their traditional organization to this agile model, reconfiguring the company into 350 nine-person squads in 13 tribes. This approach has not only improved time-to-market, but also increased productivity and employee engagement. The new structure has enabled ING to dramatically improve speed-to-market through more frequent releases, and increase the rate of innovation to help position them as the primary mobile bank in the Netherlands [10].

Tribe. Tribe (**Fig. 2**) is a collection of teams (squads) based on the same business area. The squads within a tribe sit in the same area, and there are usually 100 or less per tribe. Tribe Leader is responsible for providing productive and innovative environment for all the squads. Each Tribe also has an Agile Coach, who is responsible for the retrospectives and to support high performance [10][11][12].

Squad. The Squads are autonomous multidisciplinary teams (up to nine people) which are able to define their work and make business decisions quickly and flexibly. Each squad has end-to-end responsibility for achieving customer-related objective. A squad has dedicated Product Owner that is responsible for coordinating the activities of the squad and managing the backlog and priorities, but they are a squad member rather than leader [10][11][12].

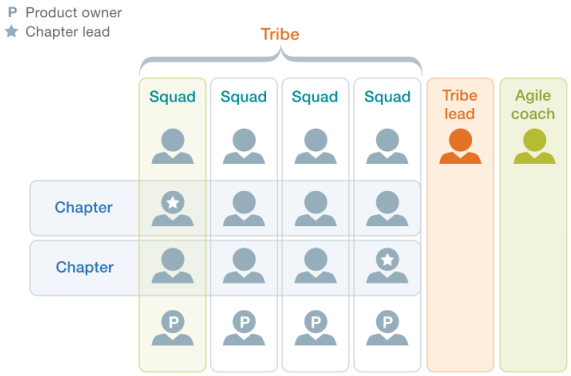

Fig. 2. Tribe/Squad example organization in ING bank, Nederland [10]

Chapter. Chapters are a group or team members – specialists, working within a special area. For example, a squad might be made up of front office developers, back-end developers, database administrator and testers [10].

Guilds. A guild is a community of members, may be from different tribes, with shared interests. These are a group of people across the organization who want to share knowledge, tools code and practices. They can be web technology guild, test automation guild or even an agile coaching guild [12].

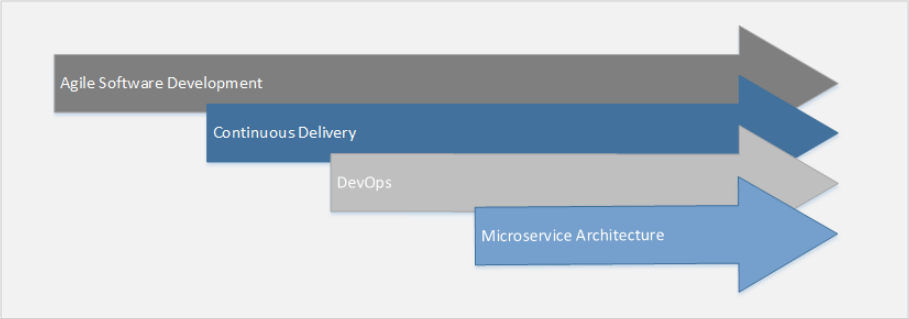

Fig. 3. Microservices as architecture phase in the Agile progression [14]

The agile software architecture usually consists of a collection of small, loosely merged components, called microservices that communicate with each other to achieve a specific goal. This style of architecture provides agility in many ways. Small components/services can be developed, modified and tested in isolation, and even easily replaced depending on how user requirements change. This style of architecture adapts to the flexible and adaptable model for developing and setting up services, as the services themselves can be added or changed if necessary [13].

Amazon and Netflix have established the basis of the microservices architecture, by evolving their monolithic applications over time into separate services that communicate through the REST API. They realized that segregating monolithic applications into business-focused services was more appropriate for the agile methodology and DevOps culture they used. Microservices (**Fig. 3**) are an architecture phase in the agile progression [14].

4 New agile IT Architecture in Makedonski Telekom

Current rapid changes in the IT industry, the constant demand imposed by the business, the need to offer customers more digital services, are just some of the reasons for Makedonski Telekom to start its digital transformation. The goal is to reach the current market and technological trends, and in order to achieve that it is necessary to make a transformation, primarily in IT, because inevitably change must begin here. The IT department is key to providing the functionalities that business sectors need to serve end users in the most efficient way. To accomplish this, IT architecture needs to change and simplify, to prepare existing systems to support new functionalities.

The existing IT architecture is domain-based (CRM, Billing, ERP) and a separate team is responsible for each of them. The systems are mostly robust and most of them are COTS (commercial off the shelf) products. They are partially developed within the company or developed by external suppliers. Existing IT architecture cannot quickly respond to the changes required by the business. The development of each new service or change of an existing service entails changes not only in the specific system, but also in the surrounding systems, as they are interdependent. Current architecture consists of

monolithic applications that are tightly connected and there are strong dependencies between them.

Any major changes that need to be made within the systems that are implemented and operated by a particular supplier require change request towards the supplier itself. The process that follows, which is according to the waterfall methodology, starting from the analysis of the requirements, the long process of implementation, testing, integration with the surrounding systems, can take significantly a lot of time.

Guided by the need for digitalization, a new European IT reference architecture has been introduced within the group [15]. The new IT Architecture is designed to support digital services, allowing operators to be digital in all channels. The realization of this micro-service-based architecture is expected to bring greater flexibility, simplification and greater scalability of services. If this is followed by the introduction of work following DevOps principles, then we would get greater automation of processes such as automatic testing, automatic code building and automatic integration.

Initially, in Makedonski Telekom we have started with a project for assessment and analysis of the current and future situation. Project aim was to prepare a transition map for the next years, which will give us direction on how to reach the target goal of implementing the newly defined IT reference architecture. As input for the analysis, we identified the key business and technology drivers for change and how they fit with the local and central business strategy. The project was originally divided into two weeks sprints and with the completion of each sprint, we had visible results that could be presented to the management. The project included the following sprints:

Business and technology context quick assessment. The first sprint goal was to consolidate business and IT priorities for the Digital transformation. This sprint was done by IT and local business, and we identified the ongoing and planned initiatives that can bring the organization closer to company's vision: to provide superior customer experience through digital channels, having fully convergent mobile/fix products and automate the processes related to digital transactions.

Business and Technical capability gap / fit analysis vs referent architecture. The next phase was related to mapping the new defined Business capabilities of the reference architecture to the current architecture landscape for each value stream (sales, customer engagement and loyalty, delivery, assurance and revenue management) and evaluation of the current and future fitness vs future vision. In addition, we captured the technology capabilities and analyzed the technical fitness of the most relevant applications mapped.

Prioritization analysis and initiatives envisioning and Transition architecture solution and initiative charters. In the existing application catalog, we captured the transition patterns (defined by the reference architecture) for each relevant application. The initiatives (the selected seven) were detailed in work streams, where we made assumptions which business capabilities will be provided during the given timeline for each of them.

Transition Architecture Roadmap. Next phase was focused on capturing planned delivery dates for business and technical capabilities as well as capability evolution. We have created decommissioning plan with the years of retirement for the legacy systems that will be replaced by the new components. This resulted in overview of the roadmap for the next 3-5 years, again detailed with the digital platform services that will be delivered by each initiative.

Refinement and consolidation. Final sprint was about consolidating and refinement of the deliverables produced, ensuring consistency and comprehensiveness. We prepared an executive summary of the key deliverables and summarized the conclusions and next steps.

5 Results of the Analysis

During the project for assessment of the current state and how it fits to the future defined with the new defined Europe IT reference architecture, we have performed detailed analysis of the current IT Architecture landscape. The results showed that the architecture landscape fitness according new architecture is beyond satisfactory level.

In the upcoming period, it is necessary to start thinking in more detail about how the transition from monolithic to micro-service architecture will be made. Given the current situation, the existence of key systems that are robust in nature, it will take a long time to achieve the desired goal. The process will take place gradually, starting with the decomposition of the functionalities of the systems affected by the key projects. When one functionality is developed as microservice, it will be necessary to integrate it with existing legacy systems.

The analysis showed that the concept of micro-services and digital services is at a very early stage. 18% of applications have a limited range that adheres to micro-service-based architecture, compared to 82% of applications that are monolithic.

Current organizational structure in IT is far traditional silo-based, and establishment of the agile operating model is at the initial level. Only 3% of the applications can be considered as being developed in fully agile way, in contrast to the 92% of the applications that are no agile nor DevOps ready. Regarding the API readiness, 20% of the applications most of their scope adhere to API exposure principles, 56% have limited scope and 22% are not API ready at all.

The analysis showed that, in order to be able to deliver new features such as micro-services, quickly and efficiently according to the business requests, the structure of the teams must change. It is necessary to make teams that will have "end-to-end" responsibility for specific business functionalities, teams that will consist of members with knowledge from different fields (business analysis, developers, testers, DevOps engineers, security experts, etc.).

After the initial analysis, Makedonski Telekom started implementing the necessary DevOps tools that will become the basic environment for development and maintenance of the newly developed micro-services. Some of them have already been placed in our infrastructure, and some of them are still being analyzed to be selected for the appropriate purpose. The use of all these tools will certainly increase the speed of development and delivery of services. With the introduction of automatic tests, the possible code errors will be detected in a timely manner, which will contribute to the improvement of the quality of the developed software. Introducing continuous integration, continuous automatic code setup in production, as well as constant monitoring of infrastructure and application components and setting alarms in case of errors, we expect to have greater overall stability of the infrastructure.

6 Conclusion

We proposed a strategy for smooth transition to agile, covering the necessary steps that the organizations should follow (current assessment, choosing approach, organizational/process/people transformation). We focus on the digital transformation in the telecommunication industry. Telecommunications operators must be digitally transformed to be able to offer completely new services to customers and improve their efficiency. We have showcased the ongoing IT transformation and definition of the target IT architecture in Makedonski Telekom.

Finally, we can say that in order for the transformation process to succeed, in addition to the previously described steps of transition and facing the challenges, it is necessary to devote enough time and great perseverance. Organizations will certainly face a number of challenges, but the most important thing is to remain persistent even in the moments when it seems that the transition will not succeed.

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