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Evaluating Service Computing Framework with Scrum through a Case Study

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ABSTRACT

The Service Computing Framework with Scrum (SCFS) is a framework that combines Services Computing Systems Engineering (SCSE) with the Scrum Framework. This framework was created to produce a system with a good service concept by following the SCSE workflow in an agile manner through the application of Scrum principles. This paper will provide an overview of how to evaluate the SCFS framework using SOA and Agile principles through a case study. The research methodology used in this paper is a Design Science Research Methodology (DSRM). This research results in project evaluations using SCFS with good Service Oriented Architecture (SOA) parameter results. The SCFS framework can also be used in Agile development environments with fairly good parameters of velocity, story points, sprint burn down, release burn up, value delivered, and job satisfaction. In case studies conducted, this framework can help accelerate the release of service systems. The first release on the test only took 34 working days, 18 working days to get the second release, and 21 working days to get the third release. If done as a whole in one cycle, the service system will take approximately 73 working days to be used.

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1. Introduction

Organizations need to be able to provide software solutions that are quicker, better, and more inexpensive to survive [1]. Researchers have provided a variety of improvement studies, such as those that standardize and evaluate software processes, tools, methods, and concrete practices [2]. One way to provide better software solutions is to implement service computing. Service computing is a technique for creating application systems with services as its fundamental components [3]. A group of technologies known as "service computing" merge service concepts, service system architecture, service technology, and service infrastructure to give instructions for utilizing these services [4].

The concept of information technology (IT) service is a process that includes services for collecting, processing, storing, presenting, and transmitting data, technical equipment support provided by IT systems and infrastructure for the benefit of and according to the needs of organizations and service users [5]. The usage of IT services also enables the improvement of corporate operation efficiency by automating specific activities and interactions between processes. Additionally, these IT services can be grouped into larger packages to help a corporation manage its business activities effectively [6]. The use of IT services is also very important to be applied to the government sector. The use of IT can encourage the government to make decisions that will improve the quality of public services by helping it comprehend society's requirements and demands [7]. Success in developing IT services is inseparable from the framework used as a tool to guide the service development process. Frameworks are integrations of reusable engineering components to facilitate the development of many types of applications [8]. According to the Cambridge Dictionary, a framework is a foundation upon which something can be built. A series of rules, theories, or beliefs applied in planning or making decisions is another way to understand the word "framework" [9].

The main purpose of creating the Service Computing Framework with Scrum (SCFS) [10] is to help organizations to create systems for service computing that comply with the SCSE (Service Computing Systems Engineering) framework's requirements [11] and also take advantage of a software development framework. Agile from Scrum [12]. The SCFS framework was created by analyzing service systems built with SCSE using the PIECES framework [13] and finding opportunities to increase efficiency [10]. This increase in efficiency is obtained from dividing the service system development project into several parts and then working on these parts using the Scrum framework. A job reporting service system (JRSS) was developed as a proof-of-concept SCFS framework as a service computing system development approach in an agile manner. JRSS development is carried out by implementing SCFS from start to finish and is measured using SOA and Agile principles.

2. Related Works

2.1. Services Computing Systems Engineering Framework

Service Computing System Engineering (SCSE) collaborates with various engineering research including service and service system engineering and software engineering in service-orientation scope. [14]–[17]. SCSE was described as an engineering methodology for creating service computing systems [11]. This framework was created using the lifecycle model of the service computing system and a meta-analysis of the platform reference model for services computing

systems. The SCSE framework's characteristic is described as a lifecycle function of stages, phases, and artifacts based on the platform's reference model for services computing systems. The systems construction process also follows the reference model's instructions.

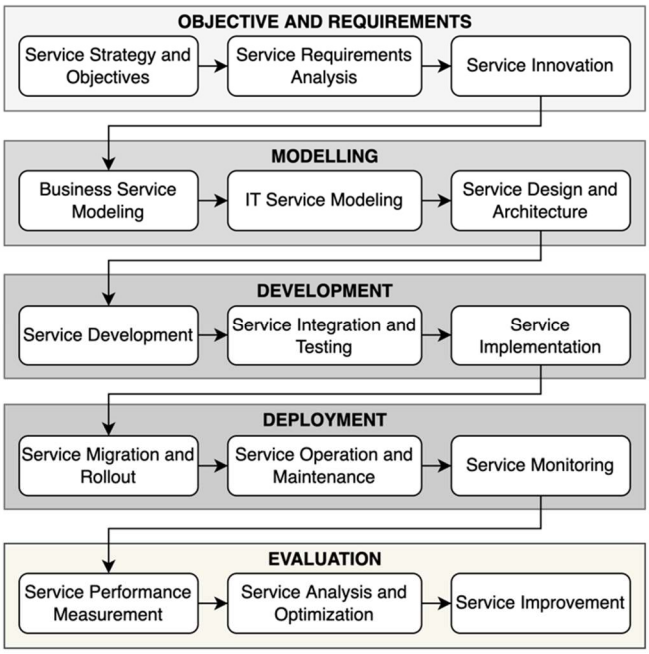

Figure 1 SCSE Framework [11]

As described in Figure 1, every SCSE phase follows a sequential procedure that starts at the beginning (with the objective and requirements) and ends at the finish (evaluation). If we examine each stage's specifics [11], even though there are iterations, the phases are generally completed inside a single cycle timeline. This framework works well for systems that do not require a quick initial release. However, depending on the size of the system itself, the release procedure will take a long time for systems that need a speedy first release. The SCSE framework is useful for breaking down service systems. Service interaction diagram artifacts are present at the services design and architecture stage of SCSE's phase 2 modeling. This diagram shows the interaction between a service and other services. The development team can use this diagram to read the level of interdependence between services and use that information as a guide for services that can be released independently of other services.

It is simpler to decide which services can be given priority for release because the SCSE architecture defines loosely connected services. This indicates a chance to improve SCSE for agile development in several processes and iterate such that it may be agile in the modeling, development, and deployment phases.

2.2. Service Computing Framework with Scrum (SCFS)

SCFS [10] is a framework that combines Services Computing Systems Engineering (SCSE) with the Scrum Framework. SCSF was created to produce a system with a good service concept by following the SCSE workflow in an agile manner through the application of Scrum principles. By using this framework, the service system can be divided into several parts and worked on in parallel to speed up the release time. This framework can also help development teams and product owners to track completed and incomplete work.

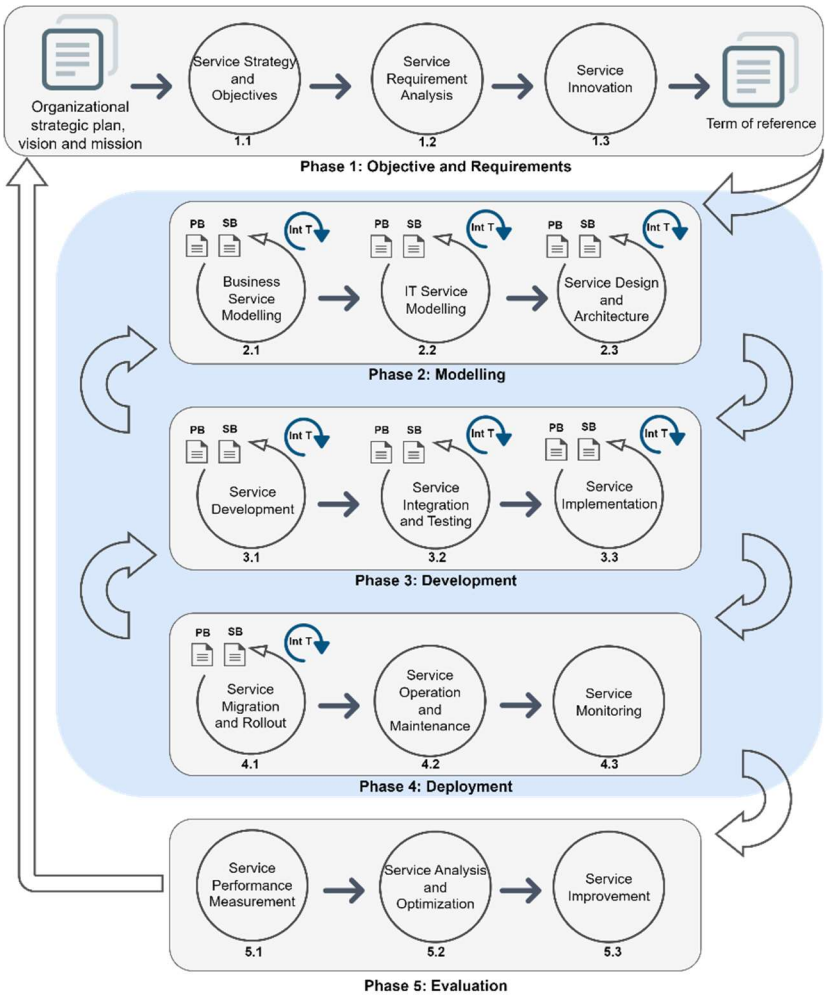

Figure 2 SCSF Framework

As shown in Figure 2, process iterations are carried out intensively from the modeling stage to the deployment stage and general terms of reference. At the modeling step, SCSE creates artifacts for the IT services catalog and services system architecture. These artifacts can be used to determine which services can be made available initially without relying on other services. The development process can then concentrate on creating service solutions that will be swiftly released for deployment. The team developer can start making any necessary updates to the current release version as soon as the service system is available. Until the terms of reference are satisfied, this iteration process will continue.

2.3. Service-Oriented Architecture (SOA)

The term "Service Oriented Architecture" (SOA) technology describes the design of distributed systems [18]. Service Orientation Architecture (SOA) can also be described as an architectural technique that supports service orientation [19]. SOA facilitates service-oriented solutions where resources are distributed in networked computer systems [20]. This architecture is a way to reorganize legacy application portfolios into services that define their own computing elements, are platform-independent, use standard interfaces to access, composable to solve complex requirements based on standard messaging protocols [21].

Using SOA, software components improve flexibility, interoperability, and abstraction along with loose coupling and discoverability being the main principles achieved [22]. According to SOA, logic must be contained within a service that can

only be accessible through messages. Loosely connected software components ensure future expansion across many platforms and emerging technologies. The complex logic concealed in services provides an abstraction for system-level review.

2.4. Scrum Framework

The agile development methodology known as Scrum, which derives its name from a rugby match, was developed in the 1990s by J. Sutherland and his team [23]. Scrum is an agile software development paradigm for controlling incremental and iterative product development [24]. Scrum methodology is one of the most widespread agile approaches [25]. Product owner, development team or scrum team, and scrum masters are the three roles that are specified inside the scrum framework [26]. The project owner first treads the team through each function that has to be developed. User Stories (US) are the name given to this capability. The process's most challenging step is figuring out how much work is needed to develop each US. Several approaches are utilized to resolve this issue. Most agile approaches advise using planning poker to estimate the necessary US team size [27].

3. Research Method

The major goal of this research is to make SCSE more agile. As a methodical framework for integrating the two frameworks with the steps of problem identification, solution design, implementation, evaluation, and communication, Design Science Research Methodology (DSRM) [28] was chosen.

3.1. Identify Problems & Motivate

SCSE is a great platform for creating service computing systems. SCSE defines stages and required artifacts to be created in every single phase. This method works well for system development with clear needs released in one cycle. However, following the criteria of the SCSE Framework makes it challenging to create a quickly launched service computing system. The framework needs to be modified to create service systems in an agile setting, allowing for speedy development and many releases. This reason primarily drives the SCSE framework's integration with Scrum.

3.2. Define The Objectives of A Solution

The SCSE framework for agile development needs to be enhanced as a solution. This includes identifying the SCSE framework's strengths and weaknesses and examining Scrum's potential. Analyzing research that has incorporated the SCSE framework [29], [30], PIECES [13] is utilized as a framework to assess the need for SCSE framework improvement.

3.3. Design and Development

At this point, a combined research project using the software engineering technique [31], the PIECES Framework, and a literature review was carried out to identify prospects for SCSE improvement and to examine the viability of integrating the Scrum process into SCSE. Scrum can be used to boost the efficiency of numerous processes in the SCSE framework based on the findings of needs identification utilizing the PIECES framework. These procedures can be completed in a time frame that is shorter and more planned. Additionally, modeling,

development, and deployment processes can be repeated to produce software with enough functionalities that users used in the initial version to move on to the deployment phase. Following the initial release, the modeling step for creating the following version can start. This can continue until all of the software's features can be finished within a few release cycles.

The release procedure should go more quickly if you take the above-described route. While working on the upcoming features, the service system's primary business operations can be released sooner.

3.4. Demonstration

Participants in the demonstration of the suggested framework include professionals in system development, academia, the government, and software product companies. The suggested framework can be improved and adjusted as a result, with some of the modifications being part of the iterative process that moves back to phase two. It is nearly impossible to change the terms of reference for system development that leverages resources from third parties (outsourcing), is bound by a contract, and serves as references and directions for project implementation. Changes to the system development being done by the internal team are still conceivable in the first phase.

3.5. Evaluation

The suggested framework is evaluated to determine how well it can be applied and customized as a framework for creating a service system in an agile manner. A service system project is used for testing to demonstrate whether the created service system can rapidly carry out an initial release with the bare minimum of functionality for the system to function on the first release.

3.6. Communication

The results of this study will be disseminated to the public, particularly for research purposes, through publications. It is intended that by publishing this research, it would be possible to use it as a basis for creating interoperable and flexible systems to deal with new difficulties as they arise.

4. Result and Discussion

A case study that uses the SCFS framework as a guide for developing service systems is used as material for evaluation. The service system built is a service system that is used to report employee work in a government organization. When the service system is designed, the design can be evaluated using SOA design quality measurements [32], [33]. The progress of working on the service system is also recorded based on the running Scrum process so that agility measurements in Scrum [34] can be carried out. Government organizations' employees use the service system evaluated in this paper to report their daily work as described in Table 1. After all phases in one JRSS development cycle are completed, agility can be measured using six parameters of Scrum dexterity in the JRSS development project: velocity, story point, sprint burn down, release burn up, value delivered, and job satisfaction. [34]. Following are the results of agility measurements from JRSS.

Table 1 JRSS Work Summary

Category		JRSS	
Role	Product Owner (PO)	- PO – Head of Field - PO – Application Coordinator	
	Scrum Master (SM)	1 IT department employee	
	Developer Team (DT)	3 IT department employees	
Process	Daily Scrums	20 minutes, twice a week	
	Sprints	24 Sprints	
Document	Sprint Backlogs	119 User Stories in 24 Sprints	
	Release Plan		
	Release 0.0.1-design	**Release 1.0.2**	
	Document details: - Context diagrams - BPMN Diagrams - Business process decomposition - Document services capabilities - Service candidates - Service interfaces - Service contracts - Service data models - IT service catalog - Service participants - Service interactions - Service Architecture - Release plan	Document details: - Get profile - Get Logbooks - Put Logbook - Post LogBook - Delete LogBook - Get activity - Get Logbooks - Get dupak - Put dupak - Dupak post - Delete dupak	
	Release 1.0.1	**Release 1.0.3**	
	Document details: - Get user - Put user - Post user - Delete user - Get position - Put position - Post position - Delete position - Get activity - Put activity - Post activity - Delete Activity	Document details: - Get PAK history - Get conversation - Conversation posts - Get rating - Put assessment - Assessment post - Delete rating - Get assignment - Put assignment - Post Assignment - Delete assignment - Get PAK - Put PAK - Post PAK - Delete PAK	

4.1. Velocity

Velocity is the total number of story points for all user stories that are completely "Completed" during one sprint [35]. Velocity is calculated at the end of each sprint. Equation 1 shows the velocity calculation formula.

$$\sum all\ accepted\ work \quad \text{Equation 1}$$

Table 2 shows the velocity report obtained in work on the job reporting service system, starting from version 1.0.1 to version 1.0.3. It shows that each version's highest story point is seen during development. During the process, a strategy to add a team can be implemented to speed up the development process. It is important not to compare speed between teams. This is because the story point estimation depends on the user story. Each team tends to have different user stories. Even if they have the same user story, team members can estimate different story points for that user story. For example, a team member with a speed of 35 is not necessarily better than a team member with a speed of 25.

Table 2 Velocity Data for JRSS V-1.0.1 to V-1.0.3

Sprints	Story Point
Sprints 1.1	32
Sprints 1.2	34
Sprints 1.3	46
Sprints 2.1-v1	34
Sprints 2.2-v1	49
Sprints 2.3-v1	37
Sprints 3.1-3.2-v1	252
Sprints 3.3-4.1-v1	52
Sprints 2.1-v2	32
Sprints 2.2-v2	33
Sprints 2.3-v2	29
Sprints 3.1-3.2-v2	189
Sprints 3.3-4.1-v2	52
Sprints 2.1-v3	32
Sprints 2.2-v3	33
Sprints 2.3-v3	29
Sprints 3.1-3.2-v3	231
Sprints 3.3-4.1-v3	52
Sprints 4.2-4.3	24
Sprints 5.1-5.3	39

Table 3 Example of JRSS Story Point Measurement Results

User Stories	Story Point
Create a strategy and business service goals	8
Create IT strategy and goals	8
Create a business service model	8
Create a business service context	8
Create a business process analysis	8
Create a service system analysis	8
Creating service gaps	5
Create business service requirements	5

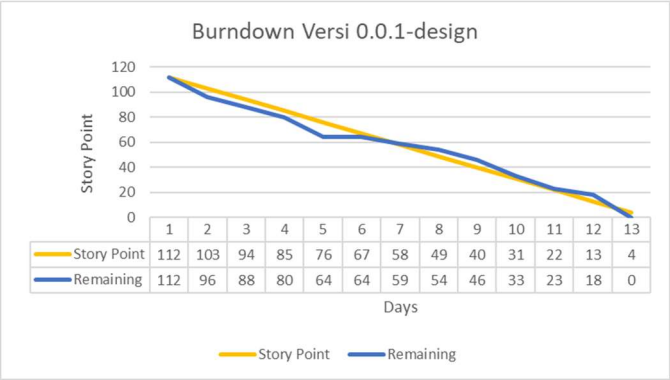

Figure 3 Sprint Burndown JRSS version 0.0.1-design

4.2. Story Point

Story points describe the level of difficulty of a user story using the Fibonacci format. Difficulties can be related to the complexity, risk, and effort involved. The measurement process is carried out to predict the size of the work and the effort required. The planning poker method determines story points in the JRSS process. As a fun and easy process, Planning Poker is used to estimate software costs by agile teams [36]. In this process, all stakeholders, such as the product owner, scrum

master, and developer team, must be involved. Planning Poker works on team consensus. Table 3 shows the measuring story points in JRSS using the planning poker technique.

4.3. Sprint Burn-Down

The sprint burn-down chart is an optical measurement tool that shows work completed per day against the projected completion rate for the current project release [37]. The aim is to enable the project to be on track to deliver the expected solution on the desired schedule. As shown in Figure 3, the sprint burndown chart for JRSS version 0.0.1-design shows quite good results. This can be seen in all the completed story points and the work elasticity of goals and done, which is also quite good. On jobs that take several days, the team needs time to report until the work is finished.

Usually, the burndown for the initial sprints will only look good for teams used to Scrum. However, the job graph will improve as the team's knowledge of Scrum increases. When the team has begun to adapt to using the Scrum method as a way of completing the SCSE stages, every story point is always completed before the deadline. These indicate good progress in adapting to the experience of working with Scrum.

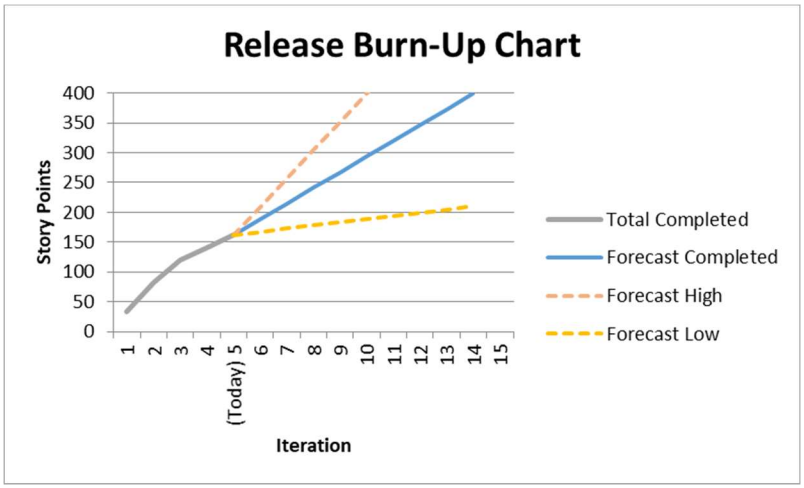

Figure 4 Release Burn-up Chart

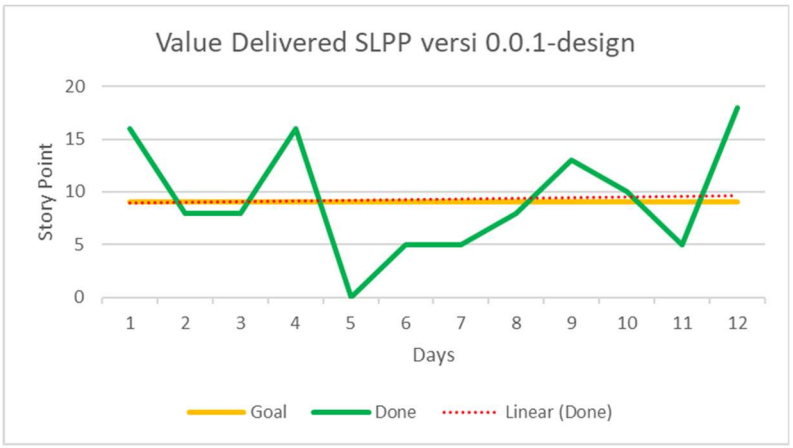

Figure 5 Value Delivered JRSS v-0.0.1-Design

4.4. Release Burn-Up

Release burn-up tracks team progress and develops data-driven forecasts that can help balance trade-offs in achieving release plans [38]. The release burn-up chart is created using work measurements that are summed up over time which in the Scrum framework is called story point per sprint. From this data, we will get an estimate of when the next job will be completed and can be released. Typically, estimates will be available after three Sprints have been completed. In our case study, as shown in Figure 4, adopting Scrum could accelerate the completion of story points.

4.5. Value Delivered

Value delivered is measured in terms of story points, the number of stories, or other abstract measurements to describe the business value achieved [39]. In measuring the value conveyed in the JRSS work, a measurement based on the planned-to-done ratio is used [40]. The following is data for each sprint that has been done, along with a graph of the planned-to-done ratio. Value delivered during the work process will experience elasticity depending on the work reporting from the team. However, overall the value that can be delivered will increase as the story points are completed by the team as shown in Figure 5.

4.6. Job Satisfaction

This metric is obtained by conducting a survey using a questionnaire related to the work performed, which is the personal satisfaction of the development team with their work [34]. In this JRSS development work, five people were on the development team. The following are data and results of a satisfaction survey for each sprint as measured using a Likert scale. As shown in Figure 5, almost all of the development teams agreed that they experienced satisfaction in working on the JRSS project, although some team members were hesitant in several sprints.

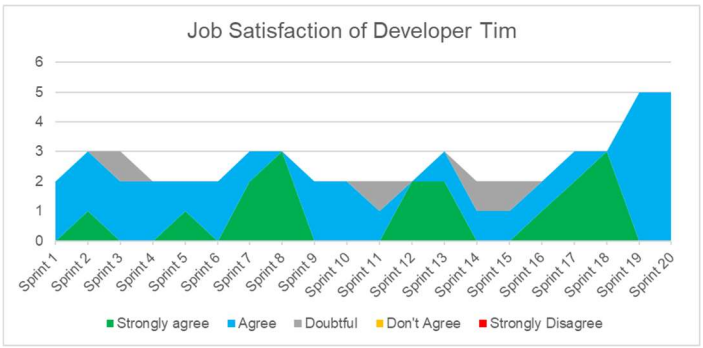

Figure 6 Development Team Satisfaction with JRSS Work

5. Conclusion

This research has measured a framework called SCFS that can help accelerate the release of service systems, as seen during the case study. The first release in testing only takes 34 (thirty-four) working days, 18 (eighteen) working days to get the second release, and 21 (twenty-one) working days to get the third release. If done as a whole in one cycle, the service system takes approximately 73 (seventy-three) working days to be used. Subsequent research can be carried out by creating a project management system that applies key performance indicators based on this framework.

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