

# Multi Agent System as Conceptual Model for Managing Scrum Process

Khamisa .A.Yousef –Dept. Computer Science– Faculty of Science

University of Tobruk, Liby –

Fatma H. Fazzani– Dept. of Computer Science Faculty of Education

University of Omar El–Mokhtar AL–Beda, Libya

## Abstract:

Multi agent systems have evolved to enter into many areas and researches, including many developments that have also appeared in software engineering development methodologies, including Agile, from which the Scrum methodology has descended. In this work, we have adapted the scrum methodology to fit the concepts of agent systems to develop software systems because of its advantages in improving the distribution of tasks among team members and facilitating ways of communication between them according to the specific system delivery time. Therefore, we have proposed a conceptual model to integrate multi agent systems and the scrum methodology in developing systems.

**Keywords:** Multi–agents system, Scrum process, Agile methodology.

## 1. Introduction

Scrum as one of most popular agile development methodologies all credit goes to Schwaber and Jeff they defined it as a method that includes all the people involved in making the decision towards developing the new system with an innovative mechanism that makes everyone participate in solving problems and proposing solutions to develop the desired system. There are many definitions of Scrum, the most highlight of which are: “Scrum is a

collaborative agile development framework describes a group of meetings, set of tools, and roles that supports teams work together to manage product development” [1].The Scrum methodology works by splitting the work into a set of segments with a specific time the called a “Sprint”. Each sprint is assigned a specific work and a certain time to receive the required work. At the end of the sprint all works had been extracted called "Artifacts". Scrum sprints are as follows: *Sprint Planning, Sprint Review, and Daily Scrum Meeting*, and sprint artifacts are as follows: *product backlog, sprint backlog, and increments*. The Scrum process is a team work that includes all the people involved in the development of the system, so it has developed a set of roles, and each role belongs to an individual from the Scrum team, and each role has a set of responsibilities. The roles of the Scrum are as follows: *Product Owner, Scrum Master, and Development Team*.The benefits of the scrum method are many, the most important of which are Customer satisfaction, flexibility and adaptability [2][5].

The Scrum process is a typical graphical visualization that shows the mechanism of Scrum work according to all the basics and principles of Scrum, including the workflow and interaction of all roles with each other to accomplish the required work according to a specific time and cost [3]. Scrum process model is shown as figure 1 in [4].

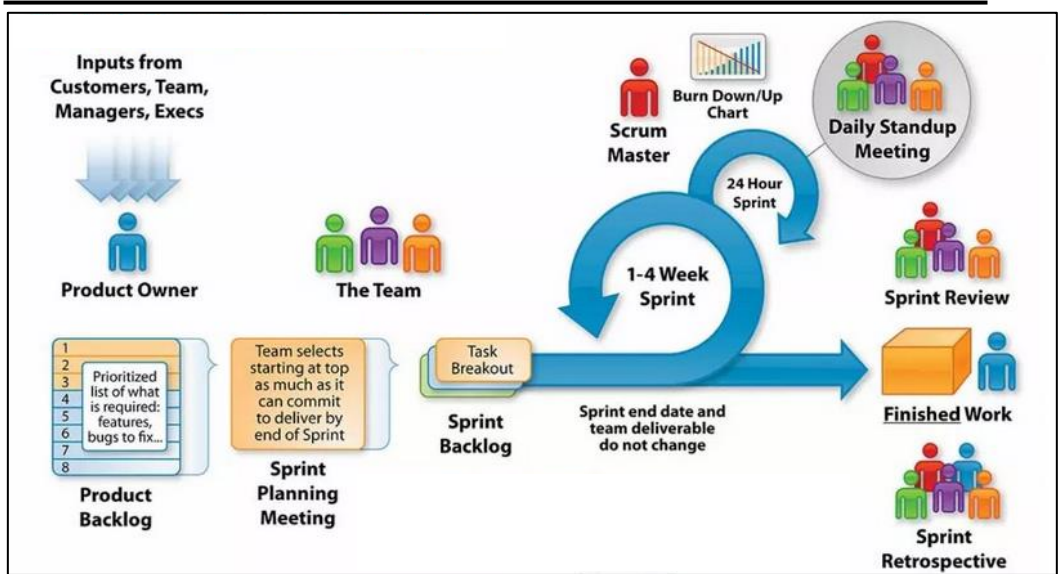


Figure.1. Scrum process model [4]

The secret of the success of this work is our proposal to use the concept of multiple agents, which had the most important role because it is a well-known software entity. Furthermore, the system is situated in an environment, autonomous, responsive to environmental changes, proactive in pursuing goals, and social, all of which are advantageous qualities for the system being developed here. Because of the following reasons, multi agent systems easily adapt to the Scrum system design:

1. The Scrum process is flexible and dynamic.
2. Agents are a common metaphor for human actions.
3. Control, expertise, and data distribution are all self-imposed.
4. The agent has the capacity to present a high-level graphic design of a behavior.

In addition to, an agents system are used in many applications because of their numerous features. Some of their primary characteristics are listed in [6] as follows:

1. **Autonomy:** This feature implies that the agent can act autonomously, i.e. requires little external input or intervention from humans and other agents, and it has actions and internal state for acts.
2. **Reactivity to Situations, or Sensing and Acting:** This characteristic refers to the agent's ability to react quickly, as it observes its environment and reacts to any changes in the environment.
3. **Pro-activeness or Goal-Directed Behavior:** This property describes the agent's ability not only to provide rapid reaction to the changes in the environment, but also initiates events and seeks to opportunities to create activity.
4. **Social Ability:** Agent's social ability describes system agents' ability to communicate with one another.

Given that the key benefit of multi agent systems is their ability to facilitate distributed problem solving, the agents included in the model must coordinate their actions. All one Agent communication facilitates agent coordination and cooperation by allowing individual agents to interact, which includes information sharing.

## 2. Literature Review

Many of the researches presented for applying guidelines of *the multi-agent systems on the scrum methodology* in area of software development. Shanawar Ali et al [7] they proposed a model this model that split into three agent model each model will perform a specific job, and at the end of each model there will be a set of outputs that will be documented in an SRS document. Also, Vishwaduthsingh Gunga1, et al [8] they designed architecture for and then used it on scrum methodology in which worked this architecture on design of agents specialized in

managing scrum work, which enabled the development team to accomplish its tasks. Moreover, IvánGarcía–Magariñoet al[9] they combined both the Engine and Scrum methodology and by proposed a technique that develops software based on the multi–agent system, as the INGENIAS methodology works on developing agents and scrum methodology works on developing the software. As a result, it is important to design a simple mechanism that combines both the agent and scrum concepts. This would help the development team to communicate and communicate easily according to a clear and simple mechanism. Because of this brevity, it is unequivocally necessary to find a mechanism for communication between team members to develop the system in accordance with the specified time and cost .Besides, considering that, the basis of the work of the Scrum process is teamwork to achieve the required goals, facilitating communication between team members within the Scrum and facilitating the role of controlling the control and work inputs according to the approved mechanism for the specified time and time is of great importance in the success of the Scrum goals. Difficulties always lie in communication and communication between the members of the human team and because of their obstacles such as late responses, conflicts of opinions, rest, and others that impede the progress of the process. The agent system, as an advanced system, works like an expert system, to which we can assign all procedures, orders, and functions in order to accomplish difficult and impossible tasks. Multiple agents systems in its composition will work on managing and following up the workflow in the scrum process, facilitating communication between team members, documenting all outputs from each sprint, and controlling the mechanism of access to them by the team.

### 3. Method Overview

In our proposed work, we have presented a conceptual model by describe how to the multi agent systems to manage and organize the workflow of Scrum. Figure 2 shows the general form of this model in this proposed model we demonstrate the nature of communication in remote work at all levels as well we described the mechanism that gives scrum teams all techniques they need to share motivations their work every day, every sprint, and every release.

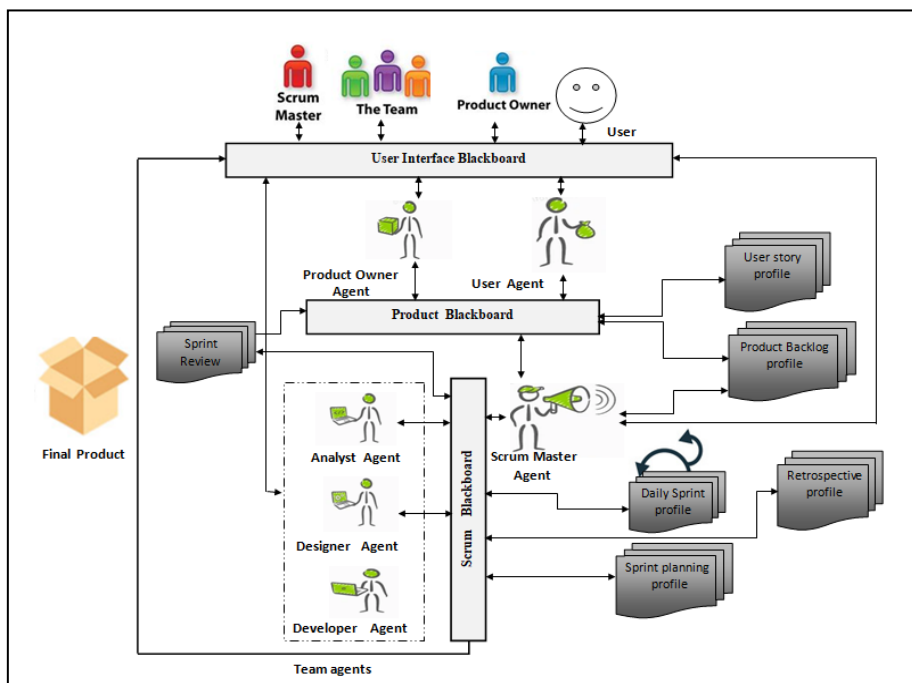


Figure.2. A proposed conceptual model

The proposed method consists of four main steps:

- Prioritizing of product backlog
- Implementing of Product Backlog
- Implementing of Each Sprint
- Reviewof Product Backlog

Before we go into listing the details of our work, we must first clarify the important structures on which our proposed model is based, as follows:

- *Multi agent system roles*

This proposed model contains of four main agents with their various feat responsibility, are succinctly described below in table 1.

Table1.Proposed Scrum Agent

No	Agent role	Responsibility
1	User agent	Is responsible for submit user stories of the product to product owner agents.
2	Product owner agent	Is responsible to receive user stories, and creating a product backlog, and saves it in a product backlog profile.
3	Scrum master agent	Is responsible for facilitating the following Sprint Planning, Daily Scrum, Sprint Review, and Sprint Retrospective meetings. It controls these events by storing these events, each of them in a profile where this is done through the use of scrum blackboard as shown the model, it is ensure that these meetings are productive and that the team is following the Scrum process.
4	Team development agents	They are in charge of requirement analyzing, designing, developing, integrating, and testing product backlog items into functional increments called sprint.

- *Scrum Smart Boards*

This proposed model contains of three main smart boards with their various features, are succinctly described below in table2.

No	Blackboard name	Description
1	User Interface Blackboard Agent	Is activated by an agent action and started by the scrum members. Then, it returns the results about all the actions in the session to all the participants..
2	Product Blackboard Agent	It mediates communication of the user agent, product owner agent, and scrum master agent including their corresponding databases. In more detail. It collects data from the agents and submits it to the appropriate database. It also executes the opposite procedure, retrieving pertinent data from the databases and sending it to the various agents in the product blackboard.
3	Scrum Blackboard agent	It mediates communication of the scrum master agent and team agents. In this blackboard, the scrum master agent is responsible of coordinating work among team members and controlling time sprint.

Table 2.Proposed Scrum Smart Boards

- *Scrum Profiles*

There are three main profiles that make up the MAS–based model for the Scrum development process: the user story profile, the product backlog profile, the sprint planning profile, and the daily sprint profile. These profiles are briefly discussed in table3.



Table3. Proposed Main Profiles

No	Profile name	Description
1	User story profile	is contains a user stories about new product, it is collected from the customer, it used to help keep the focus on the customer and their requirements.
2	Product backlog profile	is contains product to-do list called Product Backlog is created and maintained by the product owner agent and who is responsible for its priority.
3	Sprint planning profile	The sprint planning profile includes details about the work that can be completed in the sprint and how it will be done. It also includes the answers to the following questions. Why is this sprint essential? What is achievable in this sprint? How will the selected task be carried out?
4	Daily Sprint profile	is contains all information the team's progress towards the sprint goal, and answer the questions of team agents, what actions did we take yesterday to aid the development team members in achieving the sprint goal? How can I assist the Development Team members in achieving the Sprint Goal today? o I see anything that would prevent the Development Team members or me from achieving the Sprint Goal?
	Sprint Review profile	is contains status of the sprint and the product increment worked on in that Sprint to key customers. Benefits from this profile entire development team, the Scrum Master agent, the product owner agent, and customer.
	Retrospective profile	Describes what went well, what didn't, and what could be improved for the next sprint.

To represent and describe the interaction and communication between the roles of agents, we suggested using the serial model in this work, as it helps in following up the temporal time between communications [9].

1. *Prioritying of product backlog*

To illustrate the product backlog process, a sequence diagram is given in Figure 3, which demonstrates the process implicit in user story as indicated, when the user agent submit user story to product owner agent, Priorities are set based on the customer's desire and update product backlog by using product blackboard.

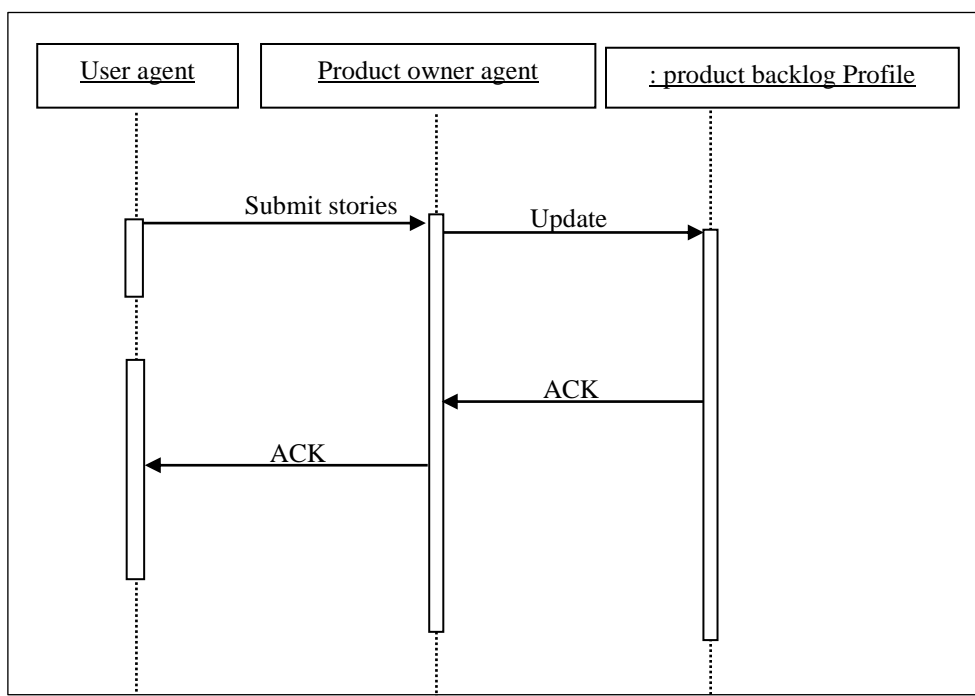


Figure 3. Sequence diagram for making Product Backlog priority

2. *Implementing of Product Backlog*

To clarify communication between the product owner agent, and scrum master agent, to start implementation first product backlog for customer,

and update product backlog by using product blackboard ,we using following sequence diagram in figure 4.

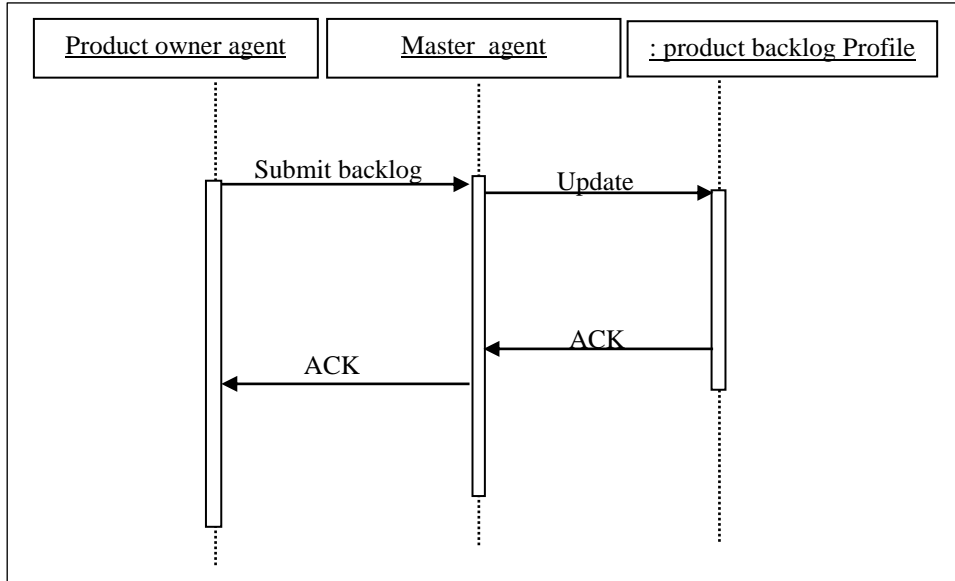


Figure 4. Sequence diagram for implementing Product Backlog

### 3. Implementing of Each Sprint

To clarify communication between the scrum master agent, and team scrum agent, to start implementation first sprint for product, and update daily sprint profile, sprint planning profile, and retrospective, controls all operations through a scrum board, the figure 6. Illustrates sequence diagram for this process.

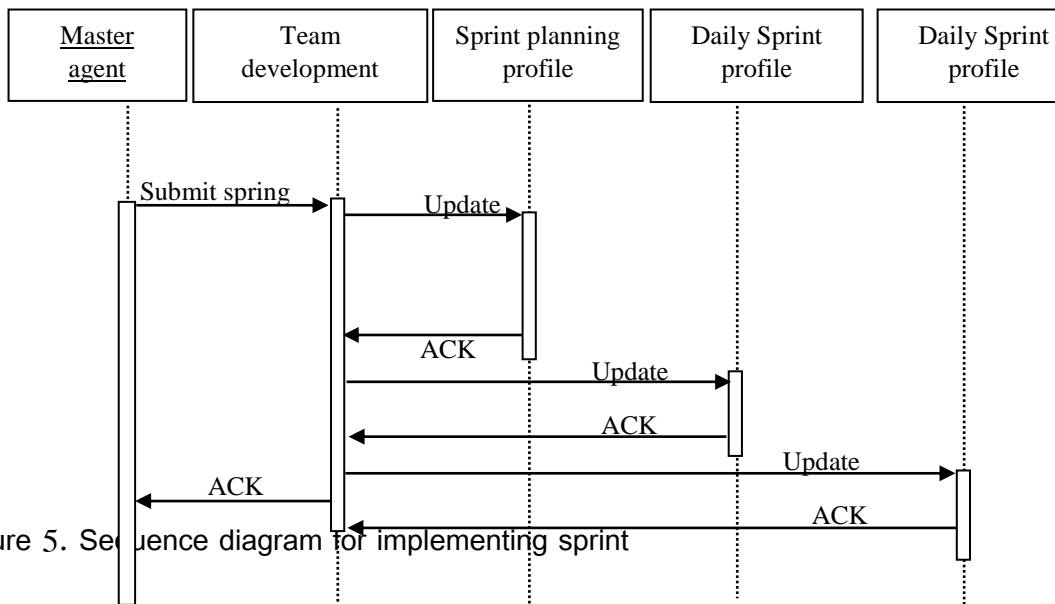


Figure 5. Sequence diagram for implementing sprint

#### 4. Review of Product Backlog

In the last stage of the first sprint, the development team agent, master scrum agent, the product owner agent, and customer are contacted for a first sprint review in product blackboard to evaluate finished work and decide if any additional changes are required the figure 6. Illustrates sequence diagram for this process.

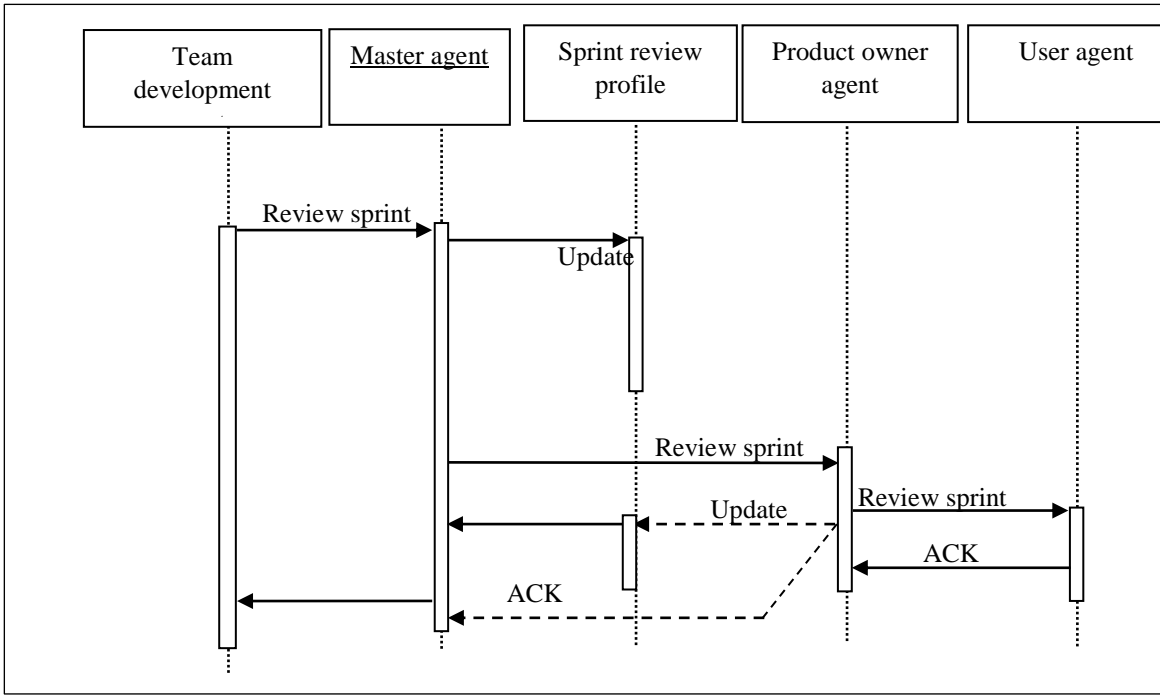


Figure 5. Sequence Diagram For Review Sprint

In the conclusion of the work, the agent that responsible of the development team will document the output of the last sprint and put it in one of the standard system requirements specification templates. Since, the agent structure differs from the other normal systems structure; its documentation differs in order to suit it. Therefore, we will use Table 4 in [10]

Table 4. Sample requirement table[10]

Name	
Description	
Cause	
Information Used	
Outputs	
Required Effect	
Identifier	

#### 4. Conclusion

The main contribution of this paper is a conceptual model for managing scrum process based on MAS. The work presented was motivated by the importance of scrum methodology based MAS, which were inadequately supported in extant scrum systems. This paper has reported the proposed processes carried out to build the support for scrum process based on MAS. In our proposed model based on MAS, scalability is a desirable property of a network, system, or process and refers to the ability of a system to accommodate an increasing number of elements or objects and handle the increasing volumes of work. Currently most designs do not support this concept and those that do are typically prone to expansion. The scalability of the proposed model has been examined against the number of users in the team. Using agents enriches the proposed structure, making it dynamic, as agent technology has this ability. These agents can easily connect and disconnect from a scrum process system. Further flexibility is an important factor in scrum development systems, as each the product owner agent must be able to understand the processes as gets the product backlog and user stories from the user. And scrum master agent is created in the proposed model to control for managing the

exchange of information between team agents member's and product owner agent and ensuring the scrum process is followed. Thus, by using an intelligent blackboard that can facilitate all the aforementioned functionalities, an agent can, at any moment, attain all the necessary information. The stages that the model goes through were represented using a sequence diagram.

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