Agile Methodology (Scrum) for Avionics Software Development

Abstract

Software development using Agile methodology is one of the software development methodologies based on iterative development, where the requirements and code evolve through collaboration between self-organizing cross-functional teams. This paper can help you to use Scrum process even when the team is geographically dispersed.

1 INTRODUCTION

1.1 WHAT IS AGILE SOFTWARE DEVELOPMENT?

The dictionary meaning of agile is the ability to move quickly and easily in a well-coordinated manner. It means being nimble, active and lively.

Software development process comprises of computer programming, documenting, testing, and bug fixing involved in creating and maintaining applications and frameworks involved in a software release life cycle and resulting in a software product. There are various other software development methodologies like waterfall, prototyping, iterative, spiral development, and extreme programming. You can read more about them on Wikipedia.

Agile software development is a set of software development methods in which requirements and solutions are evolved through a collaboration between self-organizing, cross-functional teams. It promotes adaptive planning, evolutionary development, early delivery, continuous improvement, and encourages rapid and flexible response to change. It is characterized by the division of tasks into short phases of work and frequent reassessment and adaptation of plans to meet specific customer’s needs. Using Agile method, the development and testing phases can happen in the same phase, unlike in Waterfall model where there is a separate testing phase after coding.

1.2 WHAT IS SCRUM?

Scrum is a simple and flexible way of achieving Agile software development. This method is best suited when you have a hunch that the customers will change their minds about what they want/need and when there may be unpredictable challenges for which a predictive or planned approach is not suited. It depends on self-management by the team to build a verified and validated version of the product at each sprint. A sprint is a period of development typically lasting about two weeks which involves incremental development of product including its validation and verification (V&V). The team has a stand-up meeting daily for a few minutes to assess the status of the tasks performed on the previous day and then voluntarily takes up upcoming tasks to do till the next daily meeting. At the end of each sprint, the team meets for a couple of hours to review the progress in the current sprint; performs a
A retrospective meeting to discuss the things that were good or bad and how to improve them in future; and finally plan the activities for the upcoming sprint.

Scrum distinguishes the team members into three roles:

Product Owner: Is responsible to communicate with the customer and ensure that the team meets the customer’s needs. This person is also entrusted with the responsibility to review the progress at the end of each sprint.

Agile Master a.k.a. Scrum Master: Is responsible to resolve the issues that the team members face but is not responsible to allocate tasks to each member, as the team is self-managed. A person who is helpful to team members, has troubleshooting skills, is good at motivating people to self-organize and who can provide a sense of direction in the team can become a scrum master.

Delivery Team: As the role name mentions, the team is responsible to deliver the tested product to the Product Owner.

2 AGILE MODEL AND AVIONICS SOFTWARE

Agile method encourages every team member to take up any available task i.e. any member can take up any available task. Avionics software based on DO-178B guidelines includes various levels of software ranging from Level A to Level E. When the product involves a Level A software, it requires validation of the developed code, requirements and tests to be carried out only by a certain set of (experienced/authorized) people in the team. As a result, the team is required to manage itself such that the tasks are pipe-lined so that all the members are properly utilized.

3 TEAM SPREAD OVER MORE THAN ONE GEOGRAPHIC LOCATION

The Agile methodology requires the team to be working from one geographic location. The traditional methodology makes use of a physical information radiator board or scrum board to jot down the tasks to do and to allocate tasks. When the team is located at one place, the physical scrum board will suffice. However, in today's global village scenario, it is not always possible to have the team working from one location. Hence, when the team is located at different places, meeting together daily at one place is not practically feasible. In such a case, we can make use of a virtual scrum board which is nothing but a web-based e-scrum-board on a cloud. The team can meet daily over a Skype/WebEx meeting to discuss the status using the e-scrum board.
4 CASE STUDY

4.1.1 What are we doing?

Our current software development is an Avionics software project based on DO-178B standard that includes development as well as testing. The product of this project consists of about four tools out of which two tools are categorized as DO-178B Level-A software. The work involves enhancement and bug-fixing in the tools, which is tracked using Problem Reports (PRs) stored in a defect tracking tool. The defect tracking tool that we use is a web-based tool called ClearQuest from IBM. The PRs are communicated by the customer and created by the team in ClearQuest.

4.1.2 How did we start?

At the start of the project, we counted the number of PRs to be fixed and considered the duration of the project to calculate the rate of PRs to be fixed per sprint. Our current sprint duration is two weeks. Our team is geographically distributed over three places viz., Bangalore (India), Überlingen & Frankfurt (Germany). Since our team is located at different locations, we make use of an electronic version of the scrum board provided by upwave (earlier Symphonical.com) (a snapshot is shown below).

![Figure 1: Snapshot of a scrum board for a sprint](image)

This board is web-based and thus accessible over the Internet to all the team members. To perform the meetings, we make use of the WebEx application with which we can make use of webcams to see each other and share the desktops using the WebEx itself. At the beginning of each sprint, the team meets and picks about two to five PRs to fix in the current sprint. Our product owner normally
prioritizes the PRs to be fixed after discussing with the customer. We list down all the tasks per PR in the ToDo section. Once the plan is ready, the team members can scrum to solve the PRs in the sprint. Each PR will have a definition of done (DoD) which summarizes the job to perform in the PR.

4.1.3 What do we do daily?

We meet daily (without the Product Owner) for about 15 minutes to discuss what we did the previous day and to pick up tasks to do today. In this meeting, each team member tells the team what task s/he did the previous day, and moves the sticker associated with that task to the 'Done' section. S/he then picks up a new task sticker from the 'ToDo' section, puts his/her name on the sticker and moves it to the 'In Progress' section. The validation of the requirements of the two Level-A tools can be done only by the teams located in Überlingen or Frankfurt. Thus, we pick our daily tasks such that the dependency between the sub-team does not lead to an idling of any member.

Our agile master participates in the daily meetings and tries to resolve any non-technical issue that the team faces; s/he also takes up tasks from the 'ToDo' section as the agile master can function as a team member when s/he has no non-technical issue to resolve.

4.1.4 What do we do bi-weekly?

At the end of each sprint, our team meets (again over WebEx) together with the Product Owner, to demonstrate the 'better' product with the PRs fixed. Any PR that could not be solved is carried over to the next sprint and resolved on priority. After the demo, we hold a retrospective meeting to jot down things that went well and not so well in the sprint (a snapshot is shown below).

![Retrospective Sprint 2](https://www.symphonical.com/wwl/swB0IN)

**Figure 2:** Snapshot of a scrum board wall for a retrospective meeting
During the retrospective meeting, we also discuss on a plan to make things better and to work more efficiently in the future. Finally, we perform a planning meeting to obtain a list of PRs to solve in the upcoming sprint.

5 Conclusion

Agile methodology of software development can be used when the team size is small (less than 10 members) and all the team members can work on tasks outside of their specialization.

It helps a team to be agile during software development in order to deliver a tested product in an iterative fashion, which requires frequent reassessment and adaptation of plans.

6 Appendices

6.1 Appendix A – Authors
Rohan S. Rao – Principal Technical Leader at Accord Global Technology Solutions Pvt. Ltd., Bengaluru, India

6.2 Appendix B – References
http://www.thefreedictionary.com/agile
http://en.wikipedia.org/wiki/Software_development
http://en.wikipedia.org/wiki/Agile_software_development

About the Author
Rohan S Rao, Principal Technical Leader – Software, is associated with Accord for more than 15 years, with vast experience in Design, Development, and Verification activities - well-versed with databases, XML technologies and Scripting languages