Step-by-Step
MAHD
Modified Agile for Hardware Development

The Smart Coffee Maker Project

Part 3 of a 9-part series to walk through an agile development project from concept to launch
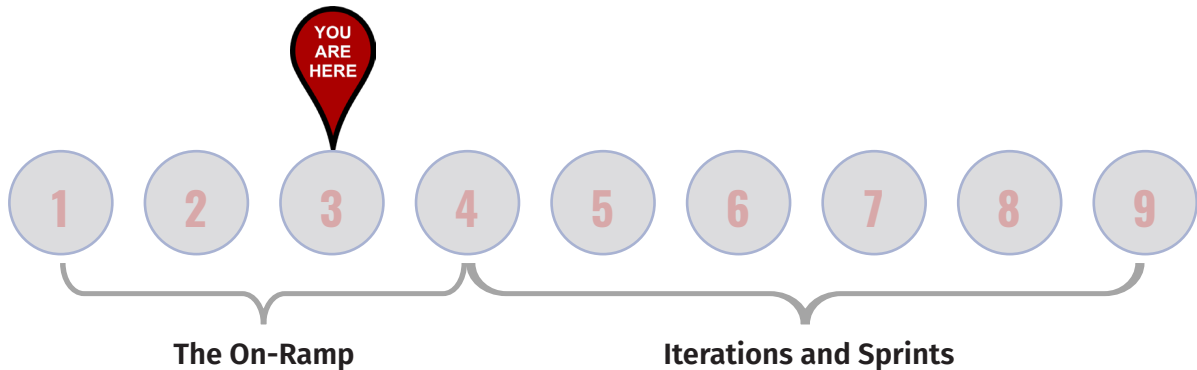
Step 3:

Iteration Planning

By Dorian Simpson and Gary Hinkle

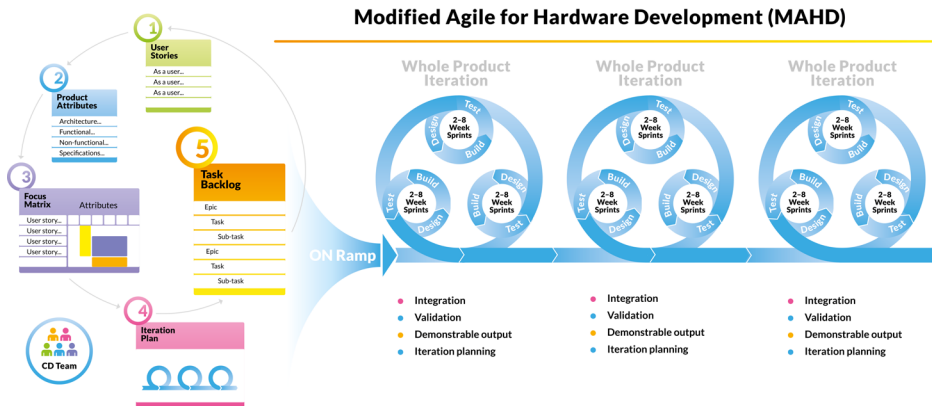**INTRO TO MAHD**

A Quick Intro to MAHD

Agile methods have proven superior over traditional product developement processes to quickly adapt to customer needs, reduce waste and accelerate development. However, the application of agile requires significant changes to support the needs of hardware products. This led to the development of the Modified Agile for Hardware Development (MAHD) Framework — an open-source initiative to embrace the principles of agile while recognizing hardware's unique needs.

THE COFFEE MAKER PROJECT: STEP-BY-STEP AGILE IN NINE STEPS

To help practitioners visualize the MAHD Framework, we have developed a series of nine articles to explain how agile methods and tools can be used for physical products, who should be involved, the deliverables for each step and tips for how to overcome challenges. We hope you'll join us on this journey as JavaBrew uses the MAHD Framework to develop an innovative new coffee maker.

The MAHD Framework: Similar to Agile for Software, but with Important Differences

Learn More

To learn more about the MAHD Framework, download related ebooks and whitepapers, or sign up for e-learning opportunities, visit **www.agileforhardware.org.**

STEP 3: SITUATION

Step 3: Iteration Planning - Creating the Big Picture

THE SITUATION

In the previous step, Lynda, the Product Owner and Jordan, the Agile Project Manager, kicked off their smart coffee maker agile project. Lynda shared an Agile Product Brief and high level user stories with her team. The team also captured product attributes, requirements and planning elements to sufficiently to get the project going in the right direction.

For step 3, the team must come together to develop an Iteration Plan that will outline the overall project plan and guide progress toward the final product.

Once completed, their Iteration Plan will include these elements:
- Project milestones
- Timing of key deliverables
- An estimate of the entire project duration
- A prototype plan
- Major dependencies that determine the schedule
- Early focus areas (opportunities for innovation, risks to manage, key questions, etc.)

The Iteration Plan will take all the high-level information developed about the project so far, including user stories, product attributes, requirements and planning considerations, to determine areas of early focus. The results will be a rough timeline for major goals on the path toward the finished product. Each major goal will become an iteration. As learning occurs, future iterations will be re-assessed. Sprints, which will be described in a later step, are the agile mechanism for getting work done in short cycles to complete the objectives of the iteration. Each sprint will also have its own sub-goals leading to success of each major iteration.

Based on the previous step, the team has concerns about the release date given the scope of the project as well as concerns about voice control, skills and if they can hit the cost target. The Iteration Plan must include steps to resolve these concerns.

It's Tuesday afternoon and the team has gathered in their project room ready for action.

STEP 3: ACTIVITIES

AGILE ACTIVITIES

Once the team meets, Jordan explains that the goal of the meeting is to build consensus for the overall project milestones, preliminary schedule and where to focus in terms of risk, questions that need answers and opportunities for innovation. He kicks off the meeting by leading the team to develop a focus matrix to identify the most critical areas of risk and areas where innovation must happen to satisfy critical user stories.

Once the critical areas of are identified, as shown in Exhibit 1, the team is ready for Iteration Planning. The team draws a table on a large whiteboard that looks something like the diagram shown here:

	Iteration 1	Iteration 2	Iteration 3	Iteration 4
Major Deliverables				
Prototypes				
Key Questions				
Milestones/ Approvals?				
Risk Mitigation				
Target Date				
# of Sprints				

The team then identifies the major goals for each iteration, including:
- Major milestones they want to define, plus any required approvals
- Major risks to mitigate
- Key questions they need answered by customers, users and stakeholders
- Their prototype plan for each iteration
- Major deliverables that aren't "prototypes"
- Consideration of training, management buy-in and other activities that might be needed

Using markers and sticky notes, the team works through each goal, writes down ideas and places them roughly where they think they should occur. Initial thinking is very rough, such as early, late or in the middle of the project. As they add more detail they rearrange activities and establish the number of iterations needed. To determine the project timeline and the timing of each iteration, they start with a rough estimate of how long the project should take using past experience and data

STEP 3: ACTIVITIES

about previous similar projects. As the Iteration Plan is developed, they reach consensus about the feasibility of the timing for each iteration and whether the entire plan fits within the overall timeline needed. On this project they have a business need for a release date in 18 months, which is shorter than previous projects that had less complexity. When they agree that the timeline isn't achievable as is, they attempt to figure out how to make the plan realistic to meet the necessary launch date.

Jordan leads the team through consideration of the Triple Constraint – a project management method for prioritizing scope, time and cost. Since time is fixed and clearly most important, they look for ways to achieve success by possibly reducing scope or adding resources. The team has lively discussion about the how resources could be added and intense debate about reduction in scope.

Lynda, the Product Owner, is reluctant to give in on major attributes at this point since she knows little about what the team can deliver and if they can create a smart experience customers will love. However, she realizes the team has serious concerns about the project feasibility and is open to reduction of scope as they learn more from customers. The team discusses the concept of a Minimum Viable Product (MVP) and classifies additional features as nice to have. Lynda will help by clarifiying and reprioritizing user stories in the Agile Product Brief.

After discussion about reduced scope to achieve the MVP, the team has major questions that need answers, yet they complete their Iteration Plan with an adequate level of confidence to get started. The last step in this planning is to consider the duration of their sprints and how many sprints will be needed to complete each iteration. They decide that sprints will be two weeks, knowing that they can easily change sprint duration later if needed. They are now prepared to develop their backlog and will quickly be able to start their first sprint toward completion of the first iteration.

STEP 3: OUTCOMES

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The Exhibits on the following pages show the results of iteration planning.

Exhibit 1: Focus Matrix

Jordan led the team to highlight critical relationships between user stories and product attributes. Matrix thinking – a common product development practice – helped the team to quickly determine work that must be done early in development. The red and yellow areas in the matrix are areas of concern where work is needed to resolve questions and remove risks. The team has many questions about what "ease of use" means and what smart features users will truly value. It's questionable whether a physical interface is needed, and if voice control would be widely used. They know decisions about the smart features and the app must be made soon. They must also learn how the grinding mechanism and water dispensing attributes will effect product cost and what tradeoffs will be acceptable.

Exhibit 2: Iteration Plan

Since the team used a project room and whiteboard shared with another team, they took a picture of their Iteration Plan and then captured it in Excel. Later they will use an online agile management tool, Jira, to plan sprints and track their progress. The Iteration Plan will be used as the overall plan to communicate progress to management and they'll continue to refine it as they learn.

Exhibit 3: Risk Mitigation Plan

The team quickly brainstormed major risks, determined probability and impact on a 1 to 3 scale, prioritized accordingly, then came up with a plan for the highest priority risks. Note that all identified high-priority risks are management and team member execution risks. These types of risks might not have surfaced, or might have been disregarded as "typical problems" without this emphasis on risk mitigation as part of the overall planning process.

NEXT STEP

They are nearing the end of the MAHD On-ramp and almost ready to dive into execution. However, before they begin, all the work described at the high level in our first three steps must be captured in the project backlog.

The team will meet again next Tuesday to develop their initial backlog. Before they meet, each functional lead will think about all of the tasks needed to complete the project with an emphasis on the first iteration. Soon they will need to define their first sprint and begin execution.

EXHIBIT 1

Exhibit 1: The Focus Matrix

Areas of concern between user stories and potential attributes

		Attributes				
		Grinding mechanism	Water reservoir	Physical interface	Smart phone interface	Voice control
User Stories	Easily control all functions			🟥	🟥	🟥
	Set the maker from anywhere in my home				🟥	🟥
	Set the maker while I'm not at home				🟥	🟥
	To automatically add coffee and water as needed	🟨	🟨			
	To control the strength of the coffee	🟨	🟨			

Exhibit 2: The Iteration Plan

Preparing the big picture in readiness for sprint planning

EXHIBIT 2

	Iteration 1	Iteration 2	Iteration 3	Iteration 4	Iteration 5	Iteration 6
Major Deliverables	• Preliminary concepts • Preliminary features scoped	• Cost estimates, initial industrial design, electronics design • Smart features defined – app / voice	• Coffee making mechanism design • Integrated device with smart control for testing	• Integrated device with ~80% target feature set • Smart app 90% complete	• Mechanical and electronics designs complete • Packaging design compete • BOM complete	• Production drawings, user guide, website, materials, packaging • Forecasts, marketing plan
Prototypes	Preliminary brochure	3D video highlighting smart features and ease of use	Rough working prototype – smart features + physical design	Fully working prototype	Production-ready prototype	Production starts
Key Questions	• Is value proposition right? • Which features drive value? • Physical interface needed?	• Value of voice control? • App features? • Can cost meet targets?	• Do customers love it? • Any design showstoppers? • Can we hit the market window?	• Can we really lock down features? • Are retailers on board? • Can we create demand?	• Is it ready for production? • Is the quality "good enough?" • Are costs under control?	• Are retailers ready to take orders? • Can we hit the forecast? • Is sales engaged?
Milestones / Approvals?	Concept and plan approved	Cost estimates approved	Major feature lockdown	Design/feature lockdown, prototype tooling approved / ordered early in iteration	BOM complete, launch plan, final tooling, compliance & certifications	Pricing, sales and channel ready
Risk Mitigation	• Team momentum – need committed resources. • Early customer engagement.	• Schedule risk – team velocity on target? • FCC compliance.	Design approvals	• Prototype tooling approvals. • Final feature set approval.	Production tooling approvals.	• Sales and marketing risks. • Engage with channel partners.
Target Date	3/15/19	5/24/19	8/2/19	12/6/19	4/10/20	7/3/20
Number of Sprints	3	5	5	9	9	6 (2 sprint buffer for 7/31 launch)

Exhibit 3: Risk Mitigation Plan

Identification of major risks, prioritized with risk reduction strategy

Priority	Description	Probability	Impact	Plan
1	Necessary team members not available when needed	3	3	Full commitment by start of iteration 3
2	Schedule is not achievable based on our history	3	3	Agree on MVP by end of iteration 2
3	Customer/user feedback will be too slow	3	3	Commitment from key customer/user group by start of iteration 2
4	Tooling won't be ready when needed	3	3	Understand lead times early and get approvals in time
5	Manufacturing cost too high	3	2	Determine cost of MVP in iteration 2
6	Stakeholder disagreement about necessary features	3	2	TBD
7	FCC Compliance	2	3	Schedule testing in iteration 2
8	Marketing won't reach or resonate with target customers	2	2	TBD
9	"Attractive" appliance is too subjective and might not have market appeal	2	2	Early feedback about design concepts

EXHIBIT 3

To Be Continued...

GET THE SERIES

To see the previous steps and receive each new step of this project as it is published, visit **www.AgileForHardware.org**. Each step will be available for download and sent directly to your email.

ABOUT THE AUTHORS

The MAHD framework is an open-source process, available for all to use, build on and improve. We look forward to hearing from you and your experiences with agile, waterfall and other processes. The MAHD framework was developed by Gary Hinkle and Dorian Simpson to address the needs of hardware development.

To learn more, get involved, or just join our community for discussion, visit:

www.AgileforHardware.org

About Gary Hinkle

Electronics, mechanical and software engineering are all part of Gary Hinkle's background, working in design, management and executive leadership of communication, industrial, telemetry, audio, avionics, computers, test & measurement, among other industries. Today, he's principal consultant at Auxilium, a company he founded to help engineering-oriented businesses increase productivity.

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Dorian Simpson is an innovation and product development consultant, trainer, speaker and author of *The Savvy Corporate Innovator*. Companies he's worked with include ABB, Tyco, Owens Corning, Technicolor, FEI, VTech and Freightliner. Before consulting, Dorian held positions at Motorola and AT&T in product management, sales, marketing, business development, and engineering.

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