



Agile Methodologies



Greg Watson (he/him)
Oak Ridge National Laboratory



Better Scientific Software tutorial @ ISC 2022

Contributors: David E. Bernholdt (ORNL), Patricia A. Grubel (LANL),
Rinku K. Gupta (ANL), Michael A. Heroux (SNL), Mark C. Miller (LLNL),
James M. Willenbring (SNL)




See slide 2 for
license details

LA-UR-22-23061



License, Citation and Acknowledgements

License and Citation

- This work is licensed under a [Creative Commons Attribution 4.0 International License](https://creativecommons.org/licenses/by/4.0/) (CC BY 4.0). 
- **The requested citation the overall tutorial is: Anshu Dubey and Gregory R. Watson, Better Scientific Software Tutorial, in ISC High Performance, 2022, Hamburg Germany. DOI: 10.6084/m9.figshare.19781752**
- Individual modules may be cited as *Speaker, Module Title*, in Better Scientific Software tutorial, ISC, 2022 ...

Acknowledgements

- This work was supported by the U.S. Department of Energy Office of Science, Office of Advanced Scientific Computing Research (ASCR), and by the Exascale Computing Project (17-SC-20-SC), a collaborative effort of the U.S. Department of Energy Office of Science and the National Nuclear Security Administration.
- This work was performed in part at the Argonne National Laboratory, which is managed by UChicago Argonne, LLC for the U.S. Department of Energy under Contract No. DE-AC02-06CH11357.
- This work was performed in part at the Oak Ridge National Laboratory, which is managed by UT-Battelle, LLC for the U.S. Department of Energy under Contract No. DE-AC05-00OR22725.
- This work was performed in part at the Lawrence Livermore National Laboratory, which is managed by Lawrence Livermore National Security, LLC for the U.S. Department of Energy under Contract No. DE-AC52-07NA27344.
- This work was performed in part at the Los Alamos National Laboratory, which is managed by Triad National Security, LLC for the U.S. Department of Energy under Contract No.89233218CNA000001
- This work was performed in part at Sandia National Laboratories. Sandia National Laboratories is a multi-mission laboratory managed and operated by National Technology and Engineering Solutions of Sandia, LLC., a wholly owned subsidiary of Honeywell International, Inc., for the U.S. Department of Energy's National Nuclear Security Administration under contract DE-NA0003525.

Outline

- Intro to terminology and approaches
- Overview of Kanban
- A bit about Scrum

Why Agile?

- Fits the research experience better than heavier-weight approaches
 - Aligns more naturally with how scientific progress is made
- Well-suited for scientific software efforts (when tailored correctly)
 - Works well for small teams
 - Provides meaningful, beneficial structure that promotes
 - Productivity
 - Productization
 - Sustainability
 - Flexibility in requirements
 - Communication

What is Agile?

- Agile is not a software development lifecycle model
- Agile is informally defined as
 - I don't write documentation
 - I don't do formal requirements, design, or really test...
 - Agile is not an excuse to do sloppy work
- Some people consider agile to be synonymous with Scrum
 - From Atlassian: Scrum is a framework that helps teams work together
 - Scrum is Agile, Agile is not (only) Scrum
 - A square is a rectangle, not all rectangles are squares
 - Agile is not Kanban either

What is Agile?

<http://agilemanifesto.org/>

Manifesto for Agile Software Development

We are uncovering better ways of developing software by doing it and helping others do it.
Through this work we have come to value:

Individuals and interactions over processes and tools
Working software over comprehensive documentation
Customer collaboration over contract negotiation
Responding to change over following a plan

That is, while there is value in the items on the right, we value the items on the left more.

Kent Beck
Mike Beedle
Arie van Bennekum
Alistair Cockburn
Ward Cunningham
Martin Fowler

James Grenning
Jim Highsmith
Andrew Hunt
Ron Jeffries
Jon Kern
Brian Marick

Robert C. Martin
Steve Mellor
Ken Schwaber
Jeff Sutherland
Dave Thomas

Principles behind the Agile Manifesto

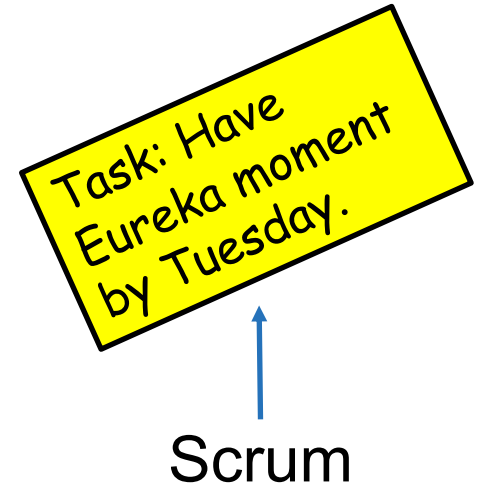
- Our highest priority is to **satisfy the customer** through **early and continuous delivery** of valuable software.
 - **Welcome changing requirements**, even late in development. Agile processes harness change for the customer's competitive advantage.
 - Deliver working software frequently, from a couple of weeks to a couple of months, with a preference to the shorter timescale.
- Business people and developers must work together daily throughout the project.
 - Build projects around motivated individuals. Give them the environment and support they need, and trust them to get the job done.
 - The most efficient and effective method of conveying information to and within a development team is face-to-face conversation.

Principles behind the Agile Manifesto

- Working software is the primary measure of progress.
 - Agile processes promote **sustainable development**. The sponsors, developers, and users should be able to **maintain a constant pace indefinitely**.
 - Continuous attention to technical excellence and good design enhances agility.
- Simplicity--the art of **maximizing the amount of work not done-** is essential.
 - The best architectures, requirements, and designs emerge from self-organizing teams.
 - At regular intervals, **the team reflects on how to become more effective**, then tunes and adjusts its behavior accordingly.

Getting Started with Agile

- Agile principles are not hard and fast rules
- Try adopting a few Agile practices
 - Following a rigid, ill-fit framework usually leads to failure
- Kanban is a good starting framework
 - Follow basic principles, add practices when advantageous
 - Better than removing elements from Scrum



Basic Kanban

Backlog	Ready	In Progress	Done
<ul style="list-style-type: none">• Any task idea• Trim occasionally• Source for other columns	<ul style="list-style-type: none">• Task + description of how to do it.• Could be pulled when slot opens.• Typically comes from backlog.	<ul style="list-style-type: none">• Task you are working on <i>right now</i>.• The only Kanban rule: Can have only so many “In Progress” tasks.• Limit is based on experience, calibration.• Key: Work is <i>pulled</i>. You are in charge!	<ul style="list-style-type: none">• Completed tasks.• Record of your life activities.• Rate of completion is your “velocity”.

Notes:

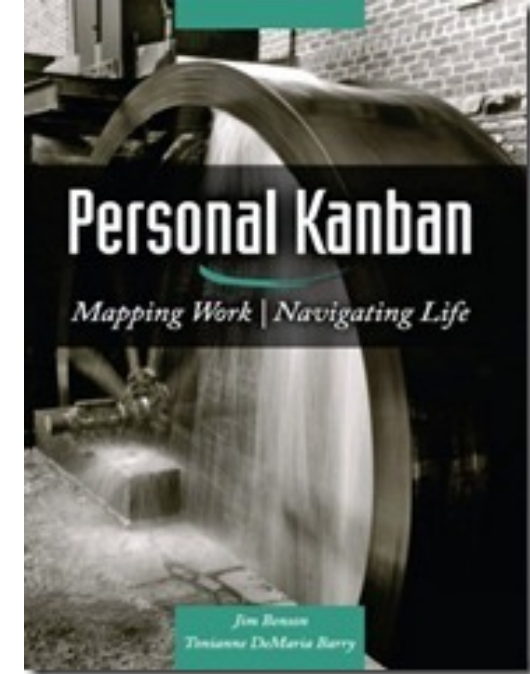
- Ready column is not strictly required, sometimes called “Selected for development”.
- Other common column: In Review
- Can be creative with columns:
 - Waiting on Advisor Confirmation.
 - Blocked

Kanban principles

- Limit number of “In Progress” tasks
 - Must be tuned by each team
 - Common convention: $2n-1$ tasks where $n = \#$ team members
- Productivity improvement:
 - Optimize “flexibility vs swap overhead” balance. No overcommitting.
 - Productivity weakness exposed as bottleneck. Team must identify and fix the bottleneck.
 - Effective in R&D setting. Avoids a deadline-based approach. Deadlines are dealt with in a different way.
- Provides a board for viewing and managing issues

Personal Kanban

- Personal Kanban: Kanban applied to one person.
 - Apply Kanban principles to your life.
 - Fully adaptable.
- Personal Kanban: Commercial book/website.
 - Useful, but not necessary.

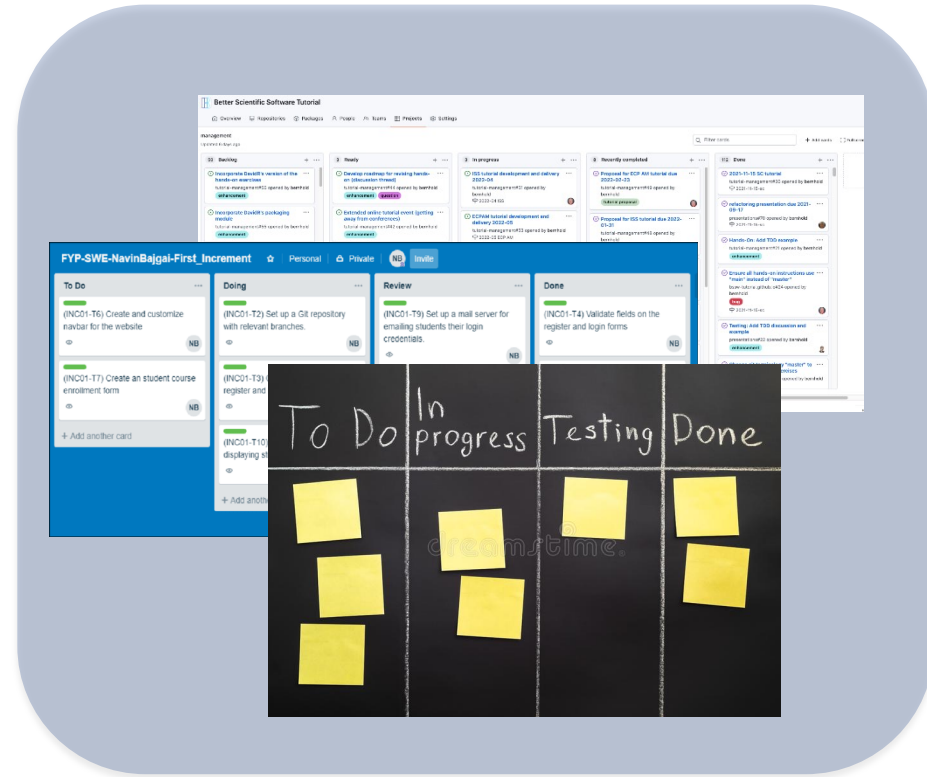


<https://bssw.io/items/using-personal-kanban-for-productivity>

<http://www.personalkanban.com>

Kanban tools

- Wall, whiteboard, blackboard: Basic approach.
- Software, cloud-based:
 - Trello, JIRA, GitHub or GitLab Issues & Project Boards
 - Many more.
- Trello (browser, Android, iPhone, iPad).
 - Can add, view, update, anytime, anywhere.
 - Different boards for different contexts
 - Effective when people are split on multiple projects



Big question: How many tasks?

- No single answer. Choose something and adjust from there.
- Personal Kanban approach: Start with 2 or 3.
- Use a freeway traffic analogy:
 - Does traffic flow best when fully packed? No.
 - Same thing with your effectiveness.
- Spend time consulting board regularly.
 - Brings focus.
 - Enables reflection, retrospection.
 - Use slack time effectively.
 - When you get out of the habit, start up again.
 - Steers towards previously started tasks

Importance of “In Progress” concept for you

- Junior community members:
 - Less control over tasks.
 - Given by supervisor.
- In Progress column: Protects you.
 - If asked to take on another task, respond:
 - Is this important enough to
 - back-burner a, b, and c?
 - become less efficient?
 - Sometimes it is.

Building on Kanban

- Focus: Solve issues!
 - (not add process)
- 15 minute stand-ups
 - Maybe not daily
- Planning meetings
- Retrospectives
- Scrum Master
- Product Owner
- **Epic, story, task**
- Definition of Done



Building on Kanban

- Epic, Story, Task
 - Formal or informal
 - Start with high-level requirements
 - Break down and refine when and as needed
 - Close to when the work will be done
 - Only for work that will take place
 - Can be valuable for estimating
 - There is no “correct” level of granularity
 - Epics are very high level objectives
 - Stories should represent an increment of value to the customer
 - “Done” criteria – understandable to user
 - Tasks are the steps necessary to complete a story
 - May not individually provide value to the customer

Building on Kanban

- User stories (optional)

- Form: **As a** <stakeholder>, **I want** <describe what is needed> **so that** <why do you want this?>
- Can be useful to improve communication and requirements elicitation

- In heat example:

- User stories collected

- **As a** developer, **I want** to modularize the heat equation utilities **so that** I can more easily make use of the utilities for other projects.
- **As a** developer, **I want** to be able to use multiple integration functions easily **so that** I can utilize the function best suited for the problem I am solving.

Samples from Collegeville Org: Kanban Board

Collegeville / Labora Private Un

Code Issues 25 Pull requests 0 Projects 1 Wiki Settings Insights

Collegeville team Kanban board Filter cards Show

Backlog 6	Ready 2	In progress 14	In Review 5	Done 24
<ul style="list-style-type: none">Evaluate Zapier for automated workflows #6 opened by maherouEvaluate JuliaSparse #8 opened by maherouCreate Julia evaluation repo #4 opened by maherouExplore the use of composition of containers with Tramonto and Trilinos	<ul style="list-style-type: none">Develop Sagatagan New Team Member Checklist #11 opened by maheroAssess the use of TensorFlow for parameter value selection in scientific codes #14 opened by maherou	<ul style="list-style-type: none">Trilinos metadata block #49 opened by duongdo27Explore possibility of moving download files for Trilinos and Mantevo to GitHub #47 opened by jwillenbringMake expandable map for Better Scientific Software #46 opened by	<ul style="list-style-type: none">Migrate mantevo.org to mantevo.github.io 3 of 3 #45 opened by maherouConcept map project for better scientific software #35 opened by duongdo27Assess requirements for using github.io as host platform for Trilinos.org	<ul style="list-style-type: none">Regard the outlook of the concept map #39 opened by duongdo27Handle markdown file without links in Better Scientific Software #42 opened by duongdo27Finding correspond links for the Github files in the Better Scientific Software #41 opened by duongdo27

Kanban in GitHub (or GitLab)

- GitHub supports basic Agile development workflows
 - Filing issues
 - @mention
 - Kanban board
 - Projects
- GitHub lacks more advanced features
 - Dependencies between issues
 - You can reference one issue in another
 - Advanced notification schemes
 - Custom fields
 - You can create custom labels

Building on Kanban

- **A-Team Tools**: A collection of resources for understanding and applying lightweight agile practices to your scientific SW project
 - Especially useful for
 - Small teams
 - Teams of teams
 - Teams that frequently have members come and go
 - <https://betterscientificsoftware.github.io/A-Team-Tools/>



What is Scrum?

- A light-weight framework based on the scientific method of empiricism
- *Not* a methodology
- Key attributes are incremental and iterative
- Assumes
 - Customer will change their requirements
 - There will be unpredictable changes

A Bit about Scrum: Roles

Scrum team

Product Owner

- Interface between development team and stakeholders.
- Responsible for defining and managing work backlog.
- Needs good domain knowledge.
- Needs adequate time to do job well.

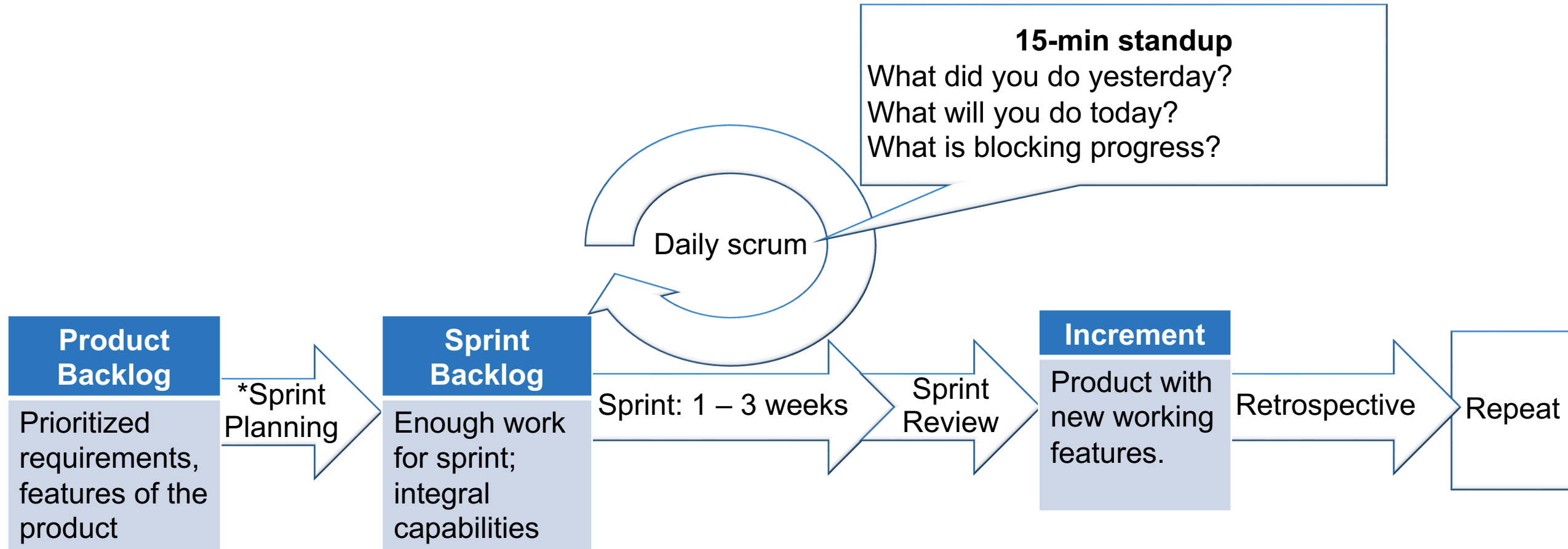
Scrum Master

- Leads and coaches development team.
- Assures scrum processes followed.
- Needs good Scrum knowledge and discipline.
- Can be a developer if sufficient time.

Development Team

- Cross-functional group of 3 – 9 that develops product.
- Completes all work necessary to be done-done.
- Collectively need design, development, testing, documentation skills.
- Works in collaboration with product owner, scrum master.

A Bit about Scrum: Process



* Sprint planning happens during previous sprint

Summary

- Agile is an approach to software development, not a methodology
- Popular frameworks for Agile
 - Kanban
 - Scrum
- Many tools are now available
 - Many free and commercially available
 - GitHub, GitLab, JIRA, Trello, etc.

Other Resources

- **The Agile Samurai: How Agile Masters Deliver Great Software (Pragmatic Programmers), Jonathan Rasmusson.**
 - <http://a.co/eUGle95>
 - Excellent, readable book on Agile methodologies.
 - *Also available on Audible.*
- **Code Complete: A Practical Handbook of Software Construction, Steve McConnell.**
 - <http://a.co/eEgWvKj>
 - Great text on software.
 - *Construx website has large collection of content.*
- **More Effective Agile: A Roadmap for Software Leaders, Steve McConnell.**
 - <http://a.co/22EPvt6>
 - New: A realistic view of Agile effectiveness with great advice for project leaders.

