



Agile Methodologies

David E. Bernholdt
Oak Ridge National Laboratory

Michael A. Heroux, James M. Willenbring
Sandia National Laboratories

Software Productivity Track, ATPESC 2020



See slide 2 for
license details

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: David E. Bernholdt, Anshu Dubey, Mark C. Miller, Katherine M. Riley, and James M. Willenbring, Software Productivity Track, in Argonne Training Program for Extreme Scale Computing (ATPESC), online. DOI: [10.6084/m9.figshare.12719834](https://doi.org/10.6084/m9.figshare.12719834)**
- Individual modules may be cited as *Speaker, Module Title*, in Software Productivity Track...

Acknowledgements

- Additional contributors include: Patricia Grubel, Rinku Gupta, Mike Heroux, Alicia Klinvex, Jared O'Neal, David Rogers
- 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 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

- Small Team Models, Challenges
- Agile workflow management for small teams.
 - Intro to terminology and approaches
 - Overview of Kanban
 - Building on Kanban
 - Free tools: Trello, GitHub

Small Teams

Ideas for managing transitions and steady work.

Small team interaction model

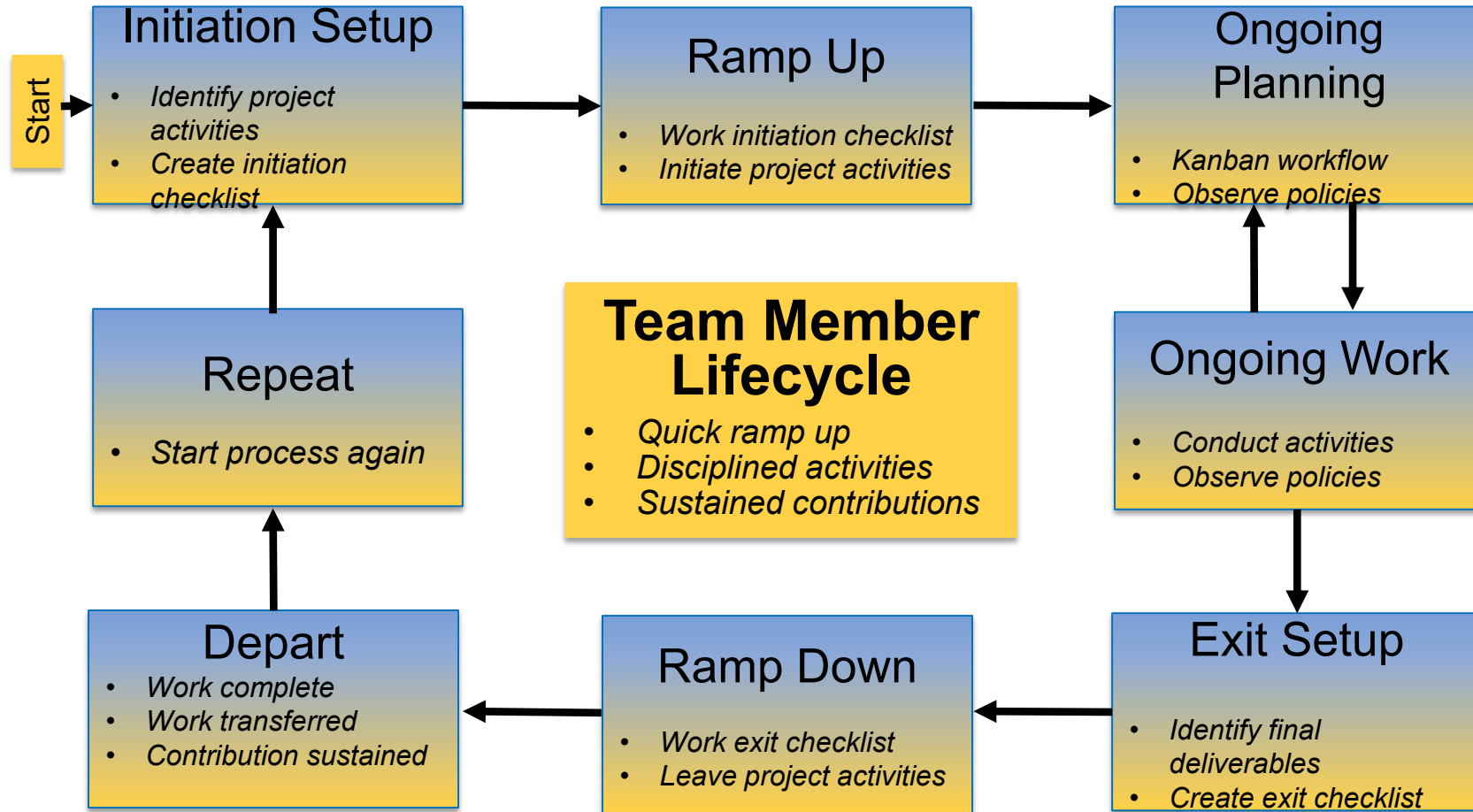
- Team composition:
 - Senior staff, faculty:
 - Stable presence, in charge of science questions, experiments.
 - Know the conceptual models well.
 - Spend less time writing code, fuzzy on details.
 - Junior staff, students:
 - Transient, dual focus (science results, next position).
 - Staged experience: New, experienced, departing.
 - Learning conceptual models.
 - Write most code, know details.

Large teams have additional interaction challenges, and are often composed of smaller sub-teams.

Small team challenges

- Heavy processes are often neither necessary nor appropriate
 - Adopt only those processes that add value
- Ramping up new junior members:
 - Background.
 - Conceptual models.
 - Software practices, processes, tools.
- Preparing for departure of experienced juniors.
 - Doing today those things needed for retaining work value.
 - Managing dual focus.

Research Team Member Lifecycle



Checklists & Policies

Team Member Phase		
New Team Member	Steady Contributor	Departing Member
Checklist	Policies	Checklist

- New, departing team member checklists:
 - ▣ Example: Trilinos New Developer Checklist.
 - ▣ Simple – prevents omissions
 - ▣ <https://github.com/trilinos/Trilinos/wiki/New-Trilinos-Developers>
- Steady state: Policy-driven.
 - ▣ Example: xSDK Community policies.
 - ▣ <https://xsdk.info/policies/>

New developer checklist snippet

- _x_ Verify familiarity with and configure git. Each machine requires base configuration:
<https://github.com/trilinos/Trilinos/wiki/VC-%7C-Initial-Git-Setup>
 Introductory material available at:
<https://github.com/trilinos/Trilinos/wiki/Tools--%7C-Git>
 Date completed:
- _x_ Learn about the Trilinos develop / master branch workflow:
[https://github.com/trilinos/Trilinos/wiki/VC-\(VERSION-CONTROL\)](https://github.com/trilinos/Trilinos/wiki/VC-(VERSION-CONTROL))
<https://github.com/trilinos/Trilinos/wiki/VC-%7C-develop-'master'-workflow>
 Date completed:
- _x_ Become familiar with the Trilinos Policies page and review relevant policies:
<https://github.com/trilinos/Trilinos/wiki/POLICIES>
 Date completed:
- _x_ Complete a GitHub pull request with a mentor:
 + Fork Trilinos and issue a pull request from a branch on your fork.
 + Remember that all pushes to the Trilinos repository and modifications to Trilinos webpages are world-wide releases of information, so institution-specific copyright, review, approval and other appropriate policies must be followed.
 + Make any necessary changes to GitHub Issues (also after the next day's test harness results, if appropriate).
 Date completed:

Agile Methodologies

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
- I've seen Agile 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:

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

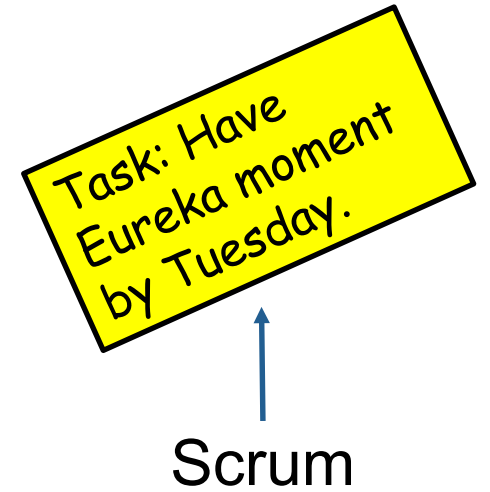
- Our highest priority is to **satisfy the customer** through **early and continuous delivery** of valuable software.
- **Welcome changing requirements**, even late in development. Agile processes harness change for the customer's competitive advantage.
- Deliver working software frequently, from a couple 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



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

Basic Kanban

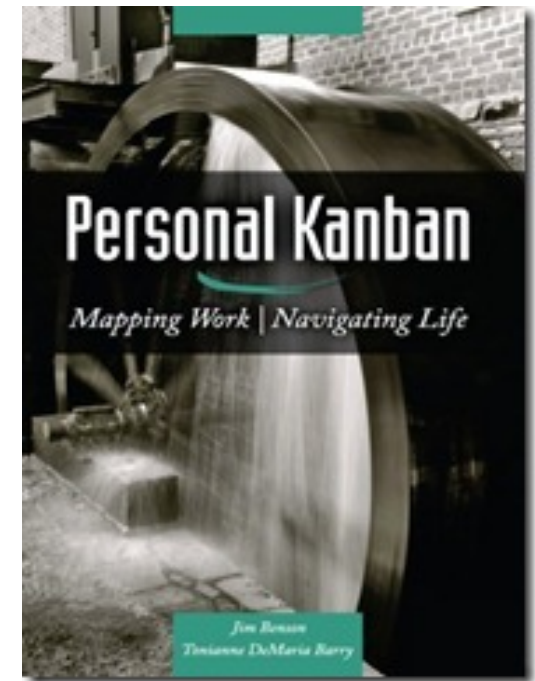
Backlog	Ready	In Progress	Done
<ul style="list-style-type: none">• Any task idea• Trim occasionally• Source for other columns	<ul style="list-style-type: none">• Task + description of how to do it.• Could be pulled when slot opens.• Typically comes from backlog.	<ul style="list-style-type: none">• Task 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

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 Issues & Project Board.
 - Many more.
- I use 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.
- Teams: Consider $2n-1$, where n =number of team members.
- 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.

Building on Kanban

- Epic (derived from user stories): Refactor code for enhanced modularity
 - Description: The heat equation code needs refactoring to improve modularity. Specifically, there are utilities that could be generalized and used with for other applications. Also, the integration function is currently hard-coded. In the future, we want to use alternative integration functions, so we should generalize the interface for this function.
 - Story 1: Separate out utilities
 - Story 2: Separate out integration function
- This idea needs to be socialized with stakeholders
- No staffing/funding currently available

Samples from Collegeville Org: Kanban Board

Collegeville / Labora Private

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

- 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

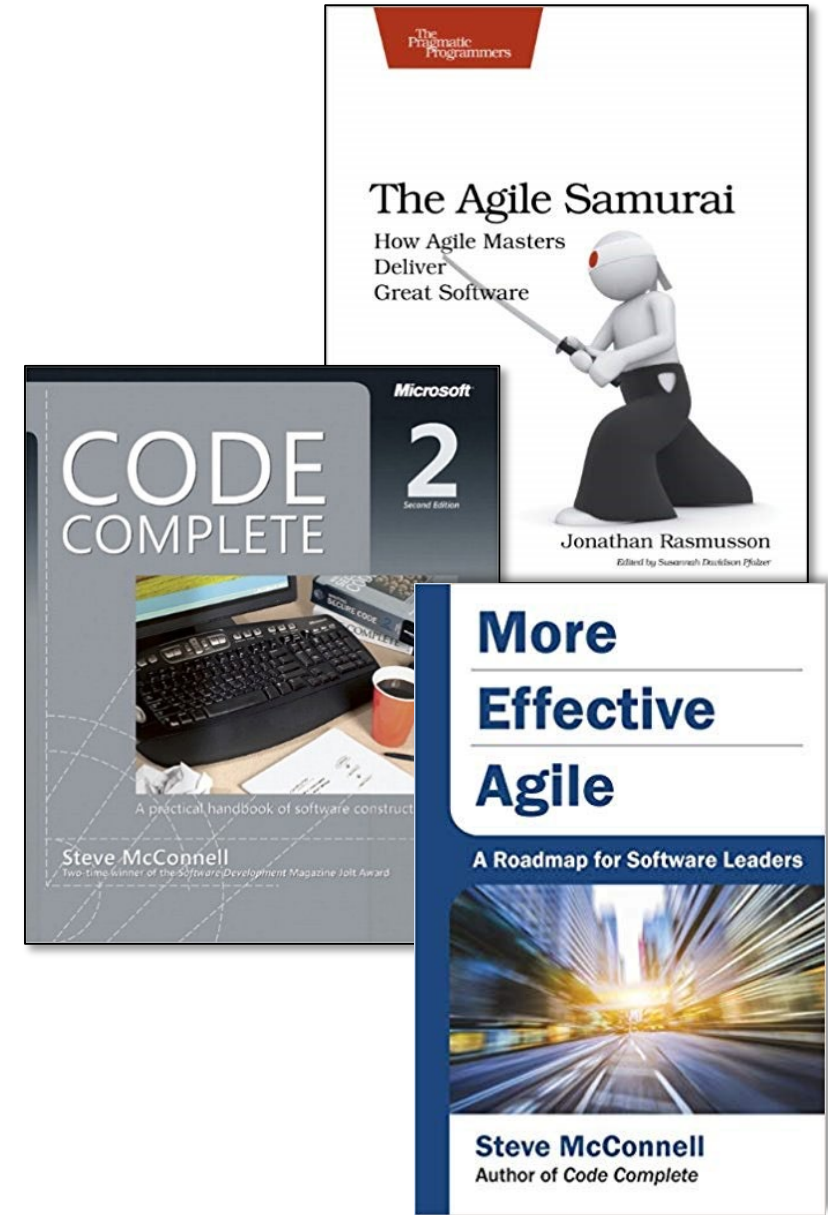
Building on Kanban

- **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/>



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.



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.

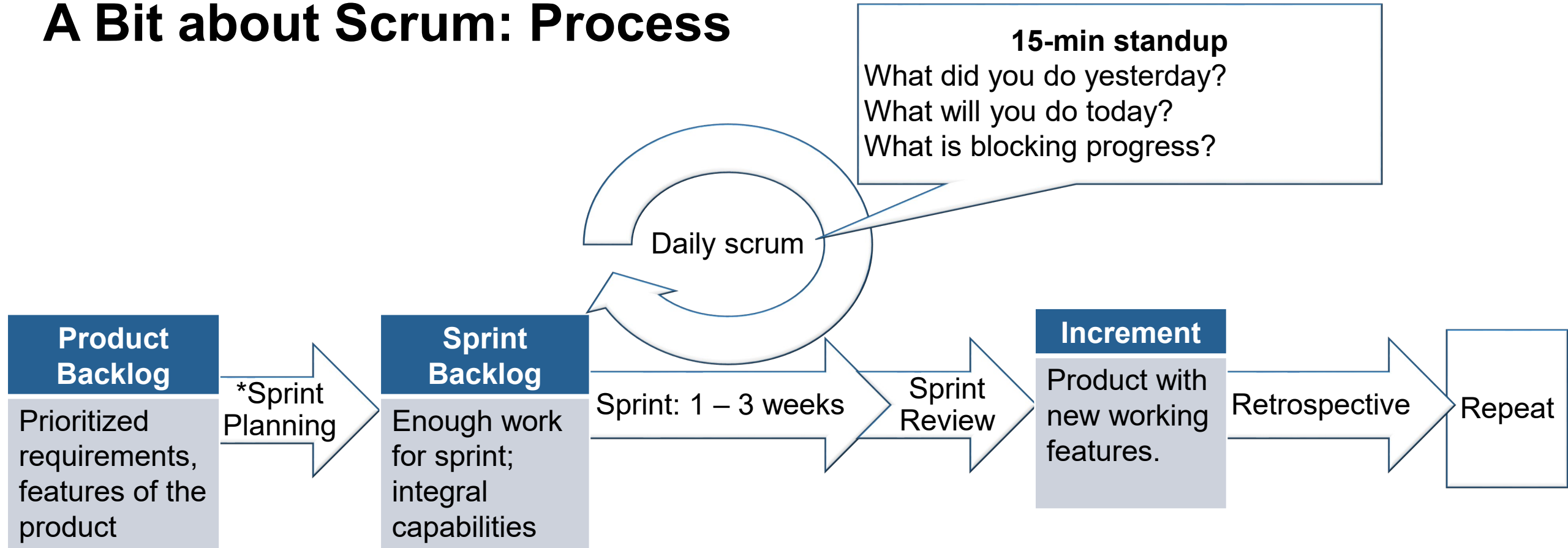
Scrum Master

- 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

Team Management Example

Team Policy

Checklists

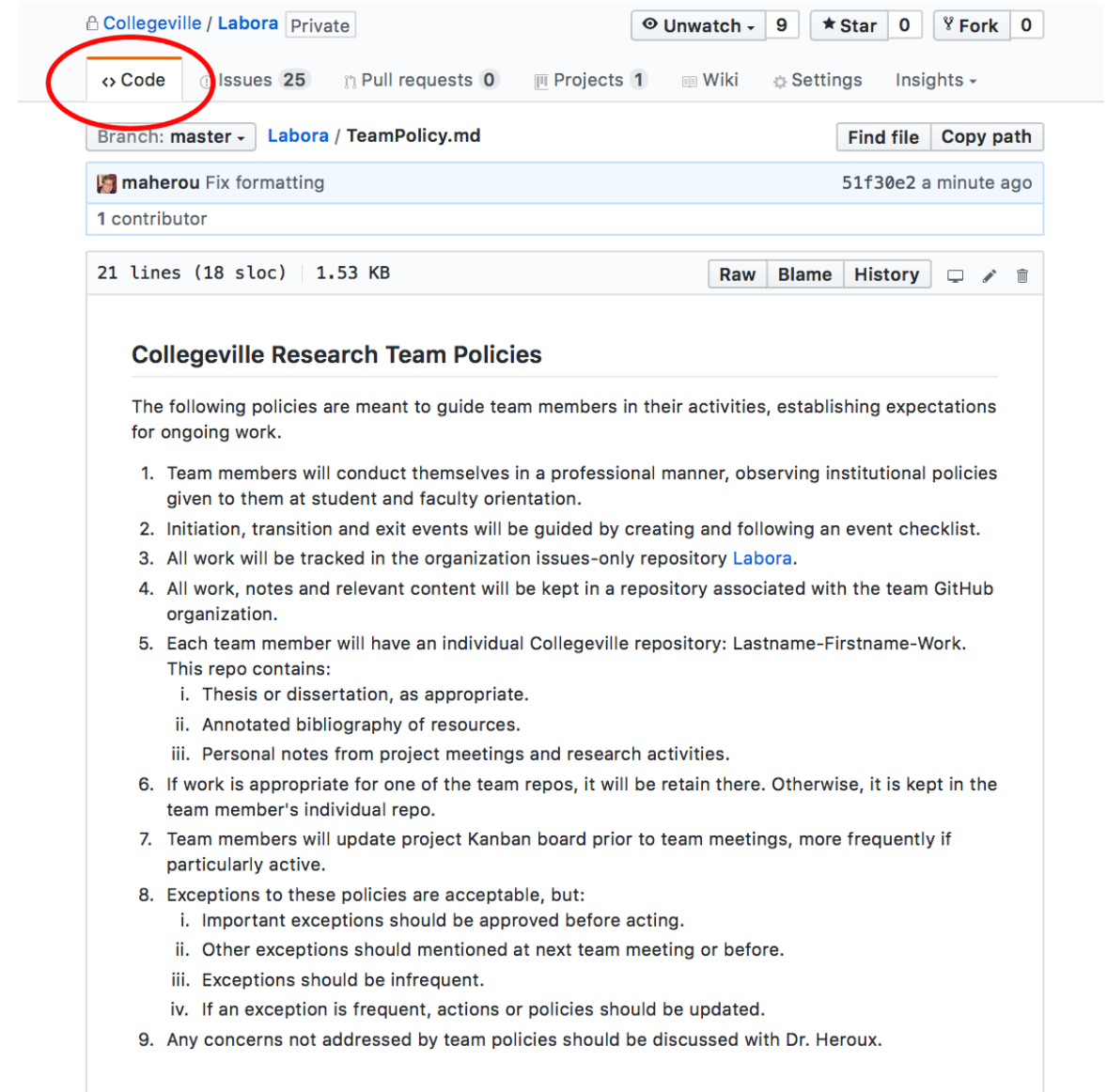
Kanban Board

Step 1: Create Issues-only GitHub repo

- Go to <https://github.com/username>
 - Example: <https://github.com/maherou>
- Create new repo:
 - Click on “+” (upper right).
 - Select New repository...
 - Give repo a name, e.g., **Issues**
 - Select Public. In real life, this repo is often private (requires \$ or special status)
 - Init with README.
 - Don't add .gitignore or license.
 - Click Create Repository.

Step 2: Define Team Policy

- Create file:
 - Go to new repo: Issues.
 - Select <> Code tab.
 - Select Create new file TeamPolicy.md
- Questions to address:
 - How members support team?
 - How team supports members?
- Community version:
 - <http://contributor-covenant.org>
- Policy is living document:
 - Informal good practices added.
 - Avoidable bad situations addressed.



The screenshot shows the GitHub interface for the 'Collegeville / Labora' repository. The 'Code' tab is selected and circled in red. Below the repository name, the file 'TeamPolicy.md' is shown, with a commit by 'maherou' and a contributor count of 1. The file content is displayed, showing a list of team policies for 'Collegeville Research Team Policies'.

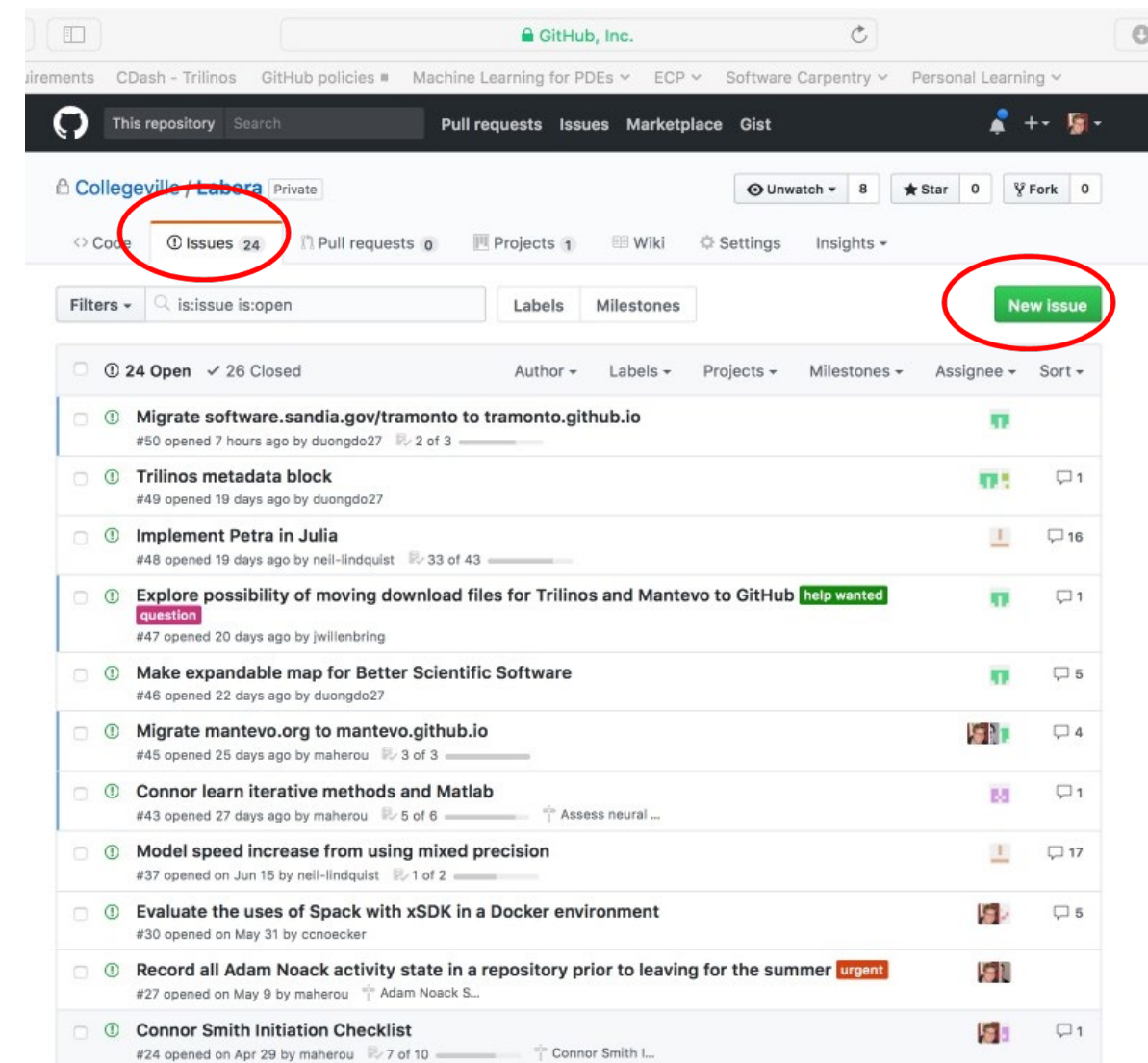
Collegeville Research Team Policies

The following policies are meant to guide team members in their activities, establishing expectations for ongoing work.

1. Team members will conduct themselves in a professional manner, observing institutional policies given to them at student and faculty orientation.
2. Initiation, transition and exit events will be guided by creating and following an event checklist.
3. All work will be tracked in the organization issues-only repository [Labora](#).
4. All work, notes and relevant content will be kept in a repository associated with the team GitHub organization.
5. Each team member will have an individual Collegeville repository: Lastname-Firstname-Work. This repo contains:
 - i. Thesis or dissertation, as appropriate.
 - ii. Annotated bibliography of resources.
 - iii. Personal notes from project meetings and research activities.
6. If work is appropriate for one of the team repos, it will be retain there. Otherwise, it is kept in the team member's individual repo.
7. Team members will update project Kanban board prior to team meetings, more frequently if particularly active.
8. Exceptions to these policies are acceptable, but:
 - i. Important exceptions should be approved before acting.
 - ii. Other exceptions should mentioned at next team meeting or before.
 - iii. Exceptions should be infrequent.
 - iv. If an exception is frequent, actions or policies should be updated.
9. Any concerns not addressed by team policies should be discussed with Dr. Heroux.

Step 3a: Create Issues

- Select the Issues tab.
- Click on New Issue.
- Type in task statement 1 (from list).
 - Type in title only.
- Click Submit new issue
- Repeat.



Step 3b: Create Initiation Checklist

- Select the Issues tab.
- Click on New Issue.
- Select a classmate.
- Type in title: Pat Evans Initiation Checklist
- Add checklist items:
 - Use syntax:
 - [] Description

Spaces required

The screenshot shows a GitHub repository for 'Collegeville / Labors' with a red circle around the 'Issues' tab, which has 25 items. The issue 'Neil Lindquist Initiation Checklist #17' is shown as 'Closed', opened by 'maherou' on Mar 31. The issue body contains a checklist for Neil's initiation into the Collegeville research project, with items like 'Create a GitHub account', 'Become a member of all appropriate repositories', 'Identify any new repos', 'Learn LaTeX', 'Sign up for a Udacity online learning account', 'Take the Udacity course Software Development Process', 'Take the Udacity course How to Use Git and GitHub', 'Take the online courses in C++', and 'Redo CS200 lab exercises in C++'. The issue history shows 'maherou' assigned 'maherou' and 'neil-lindquist' on Mar 31, added to the 'Neil Lindquist Initiation' milestone, added to the 'Ready in Collegeville team Kanban board', and moved from 'Ready' to 'In progress' on May 15.

Collegeville / Labors Private

Unwatch 9

Code Issues 25 Pull requests 0 Projects 1 Wiki Settings

Neil Lindquist Initiation Checklist #17

Closed maherou opened this issue on Mar 31 · 0 comments

maherou commented on Mar 31 • edited by neil-lindquist

This is the initial checklist for Neil's initiation into the Collegeville research project:

- ✓ Create a GitHub account (if you don't have one) and ask Dr Heroux to add you to the Collegeville organization.
- ✓ Become a member of all appropriate repositories in the Collegeville organization.
- ✓ Identify any new repos that should be created, especially if your research topic is new.
- ✓ Learn LaTeX using the <https://github.com/Collegeville/Scribe> repository.
- ✓ At least one of your repos will be a LaTeX collection that will contain your annotated bibliography and the starting point for at least one technical report, which will be an ongoing record of your progress.
- ✓ Sign up for a Udacity online learning account at <https://www.udacity.com>, if you don't have one already. You will use Udacity for some of your introductory training.
- ✓ Take the Udacity course Software Development Process at <https://classroom.udacity.com/courses/ud805>.
- ✓ Take the Udacity course How to Use Git and GitHub at <https://classroom.udacity.com/courses/ud775>.
- ✓ Take the online courses in C++: <http://www.cprogramming.com/tutorial/c++-tutorial.html> and <http://www.cplusplus.com/doc/tutorial>
- ✓ Redo CS200 lab exercises in C++

maherou assigned maherou and neil-lindquist on Mar 31

maherou added this to the Neil Lindquist Initiation milestone on Mar 31

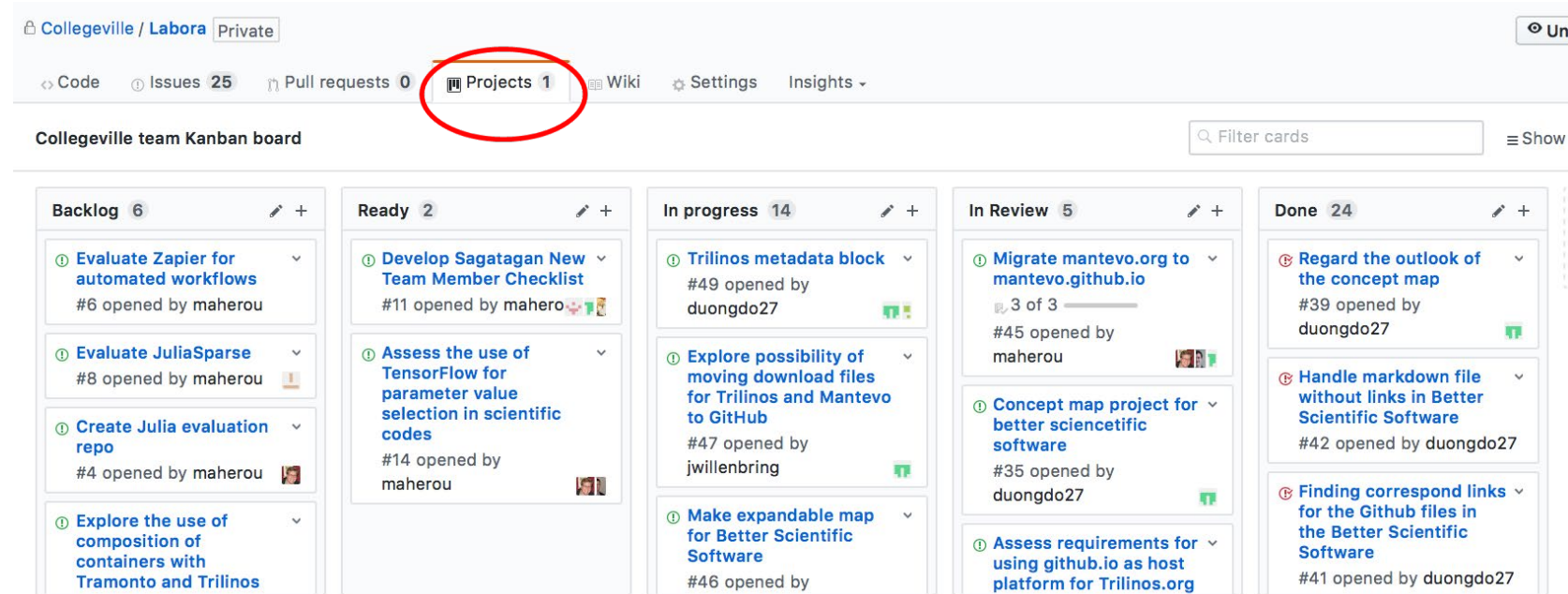
maherou added to Ready in Collegeville team Kanban board on Mar 31

maherou moved from Ready to In progress in Collegeville team Kanban board on May 15

neil-lindquist moved from In progress to Done in Collegeville team

Step 4: Create Kanban Board

- Select Projects tab
- Click New Project
- Use title
 - Team Kanban board
- Add these columns:
 - Backlog, Ready, In progress, In review, Done.
- Click on +Add cards (upper right).
 - Move each issue to the proper Kanban column



Next Steps: Real Life

- Create a GitHub Org and set of repos for your team:
 - Each team member has an individual repo.
 - Each project has a repo.
 - One special repo for issues.
- Track all work:
 - Use checklists for initiation, exit, any big new effort.
 - Create Kanban board. Keep it current.
 - Aggregate related issues using milestones.
- Drive meetings using Kanban board.
- Adapt this approach to meet your needs.
- When you start to get sloppy, get back on track.