SAND2021-4395PE

EXASCALE COMPUTING PROJECT

IDEAS productivity

better scientific software

So your code will see the future.

psip

Hands-on Tutorial with PSIP Progress Tracking Cards: A Lightweight Method for Improving Software Practices

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Tutorial Format

Introduction to PSIP Session	5	PSIP Tutorial Lead
Participant Introductions	5	All
Overview of PSIP	15	PSIP Facilitator
Overview of self survey	5	PSIP Facilitator
Self Survey	10	On-your-own
Review Survey Results	15	PSIP Facilitator
Break	10	All
Overview of PTCs	15	PSIP Facilitator
Team Example	15	PSIP Facilitator
Construct a PTC	30	Facilitated Breakout (All)
Debrief	15	All, led by PSIP Facilitators
Tutorial Conclusion, Q&A	10	PSIP Tutorial Lead
	150 minutes	

Focus of this Tutorial

PSIP allows you to realize process improvements without disruption to any current development.

- *Introducing…*
- A practice that can help your team mitigate technical risk and develop software with confidence. (PSIP)
- How to identify topics for improvement by rating your project
- Progress tracking cards (PTC)
- Progress tracking card (PTC) catalog
- Integrating PTCs into your projects

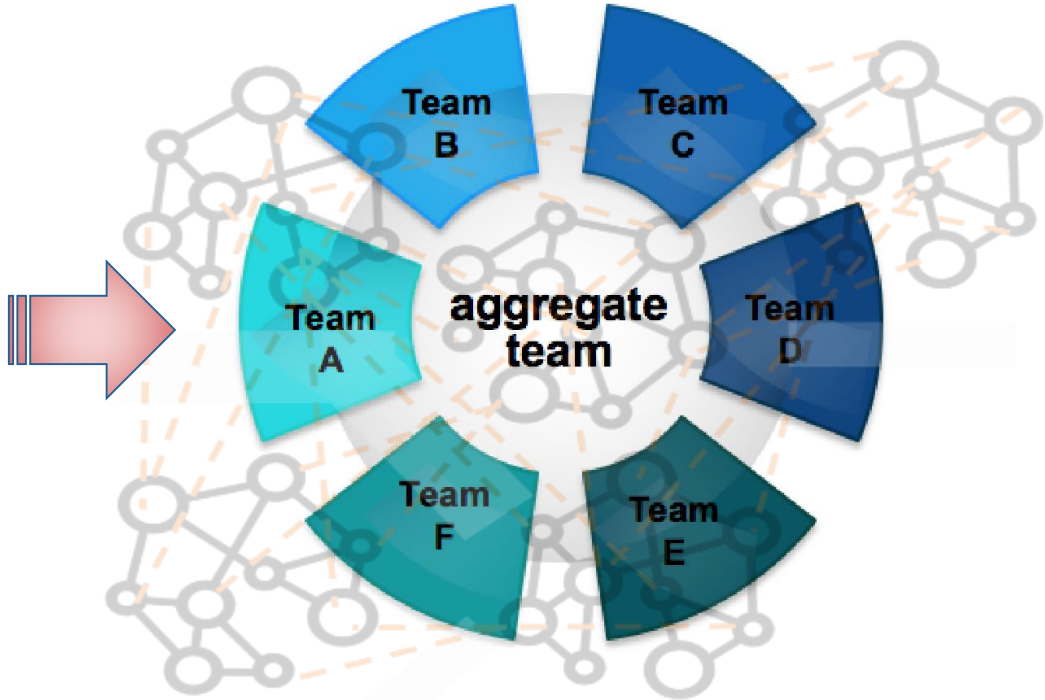
Enabling Software Quality

https://bssw.io/psip/

PSIP: Productivity and Sustainability Improvement Planning

- PSIP is a lightweight workflow that can be used on its own or alongside frameworks you may currently use such as Kanban, Agile, etc.
- You *implement PSIP* by creating and using Progress Tracking Cards (PTCs) to achieve quality goals.

PSIP helps software teams to **IDENTIFY** opportunities to iteratively and incrementally **IMPROVE** software team practices and processes.



Who is using PSIP?

The HDF Group

Improvements to documentation to create reference manual, setting code style standards, transition to GitHub

ALPINE/ZFP

Create a VTK-m filter for APLINE in situ algorithm users

OAK RIDGE National Laboratory

Using a more detailed version for internal project assessment

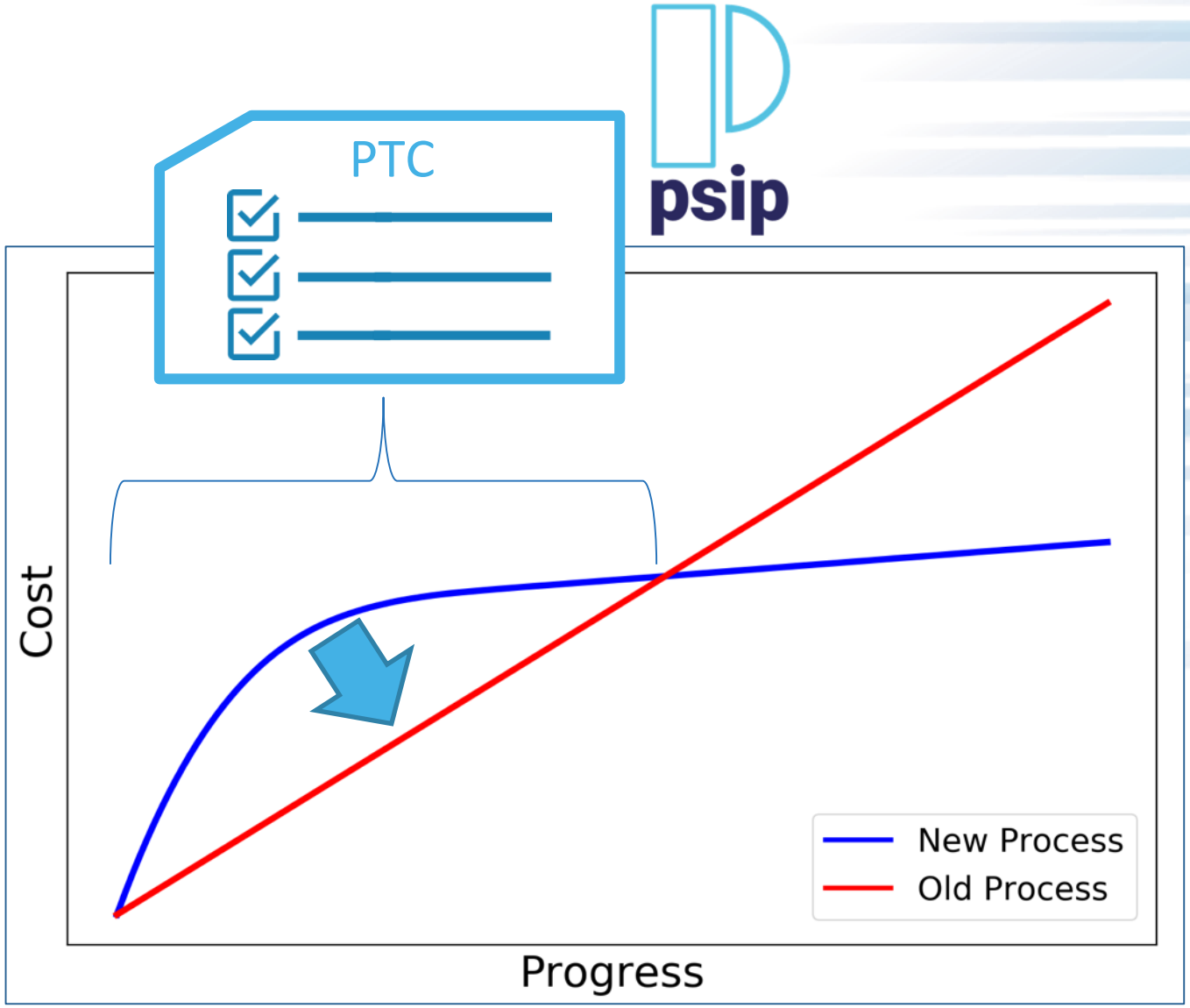
Sandia National Laboratories

Using internally for updating version control systems, updating documentation to support better onboarding

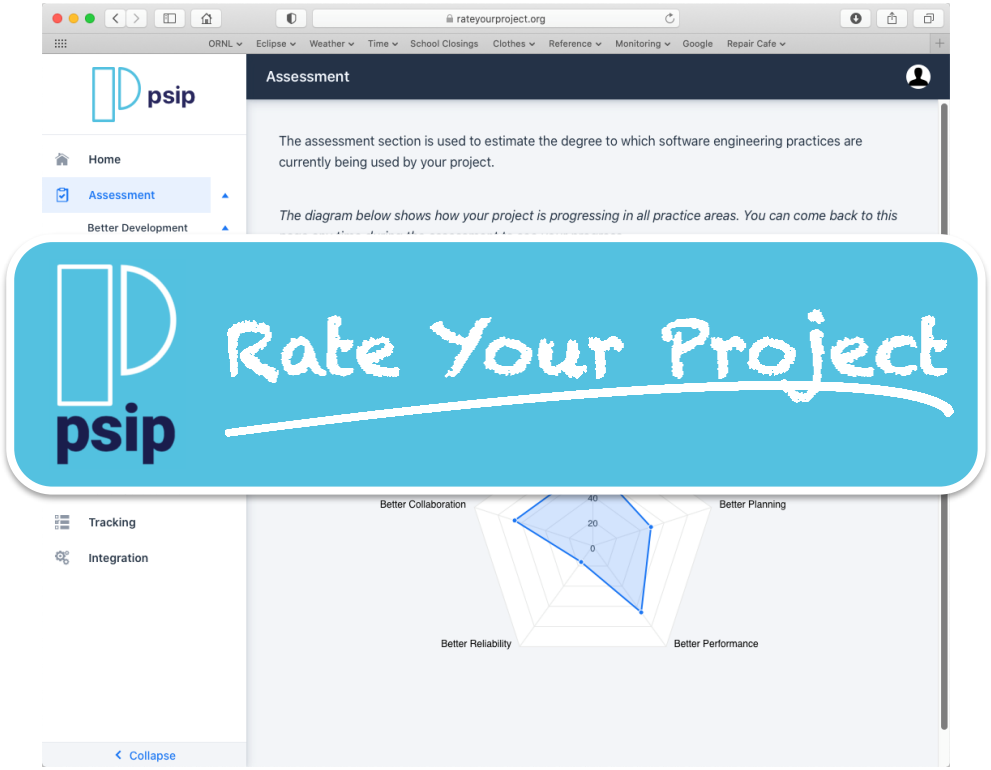
Completed PSIP tutorial, investigating how it can be used in academic context—not using yet

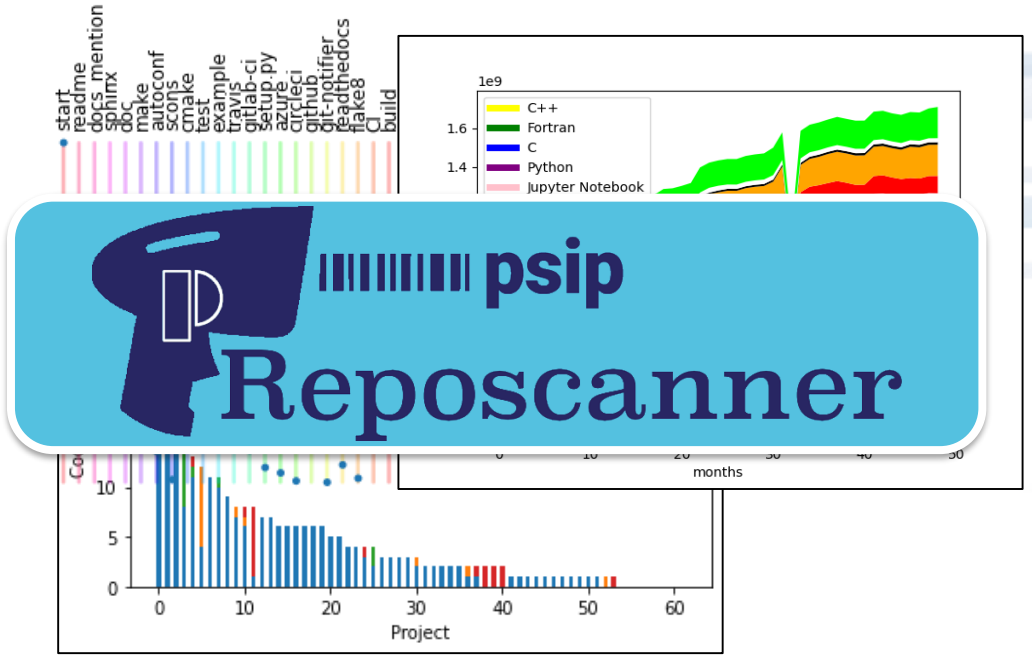
PSIP: At A High Level

- Why **not** improve?
  - Software process improvement often carries upfront costs.
  - It can introduce uncertainty and risk into a project. You can't control what you can't measure.
- PSIP provides tools and resources to set, measure, and realize improvement goals.

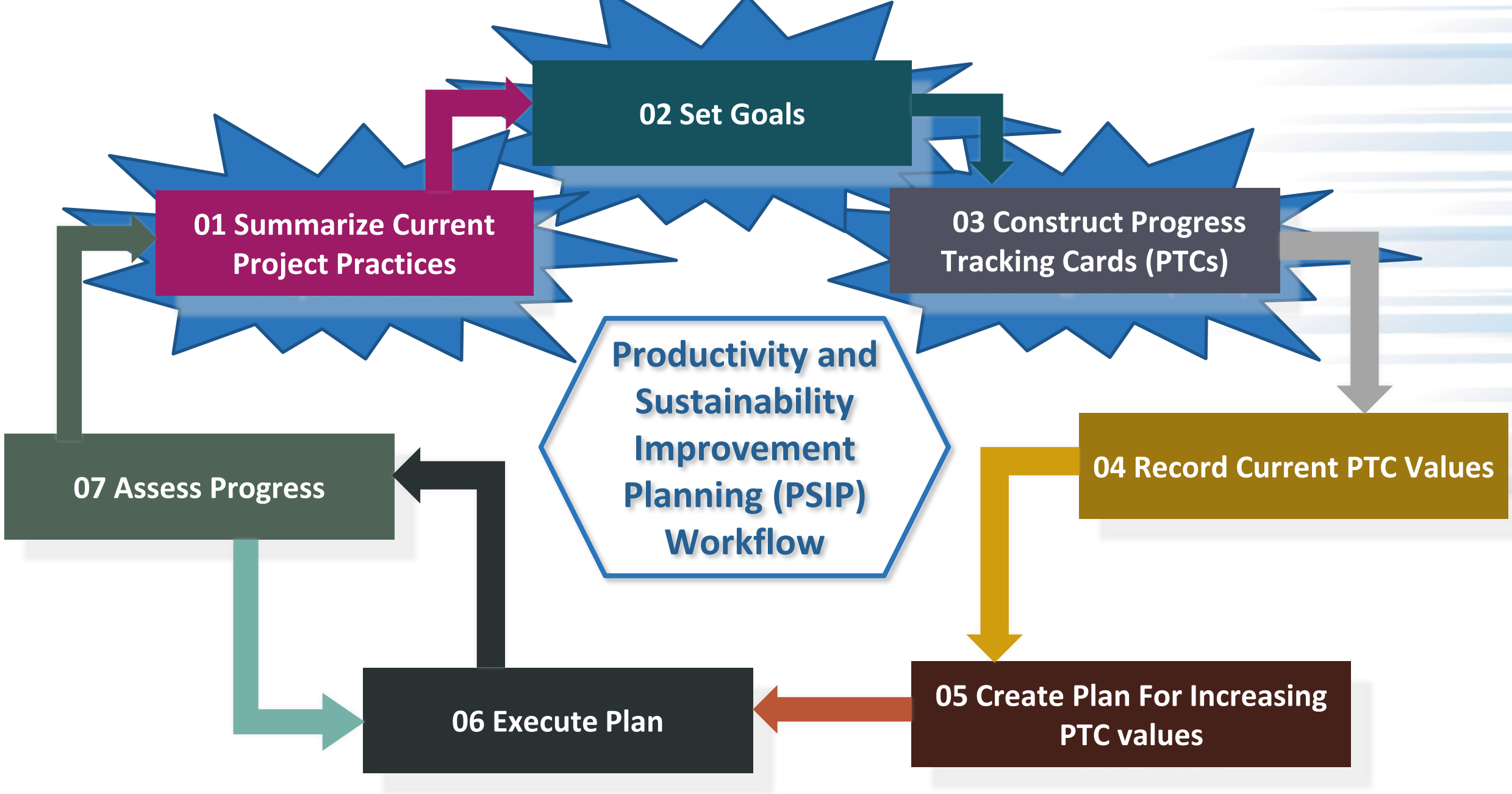


The PSIP Team is Using Automation and Data-Driven Analysis to Deliver Value to ECP Teams





- Our team is actively working on several tools and technologies for software process improvement that your team can start using now to
  - Realize process improvements **without disrupting current development.**
  - Mitigate **technical risk** so that you can develop software with ***confidence***.

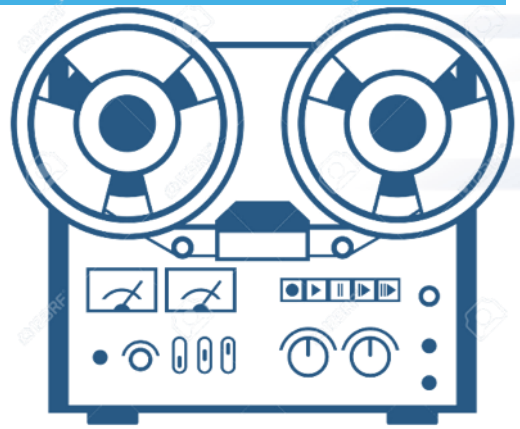

02 Set Goals
01 Summarize Current Project Practices
03 Construct Progress Tracking Cards (PTCs)
Productivity and Sustainability Improvement Planning (PSIP) Workflow
07 Assess Progress
04 Record Current PTC Values
06 Execute Plan
05 Create Plan For Increasing PTC values

Reflect: How does your software deliver value to your users?

Reflect

Q: If the new software requires teaching other how to use it, how does that happen?

A: Our project tasks students and postdocs with formulating their own tutorial for how to build and run the code […]



01 Summarize Current Project Practices

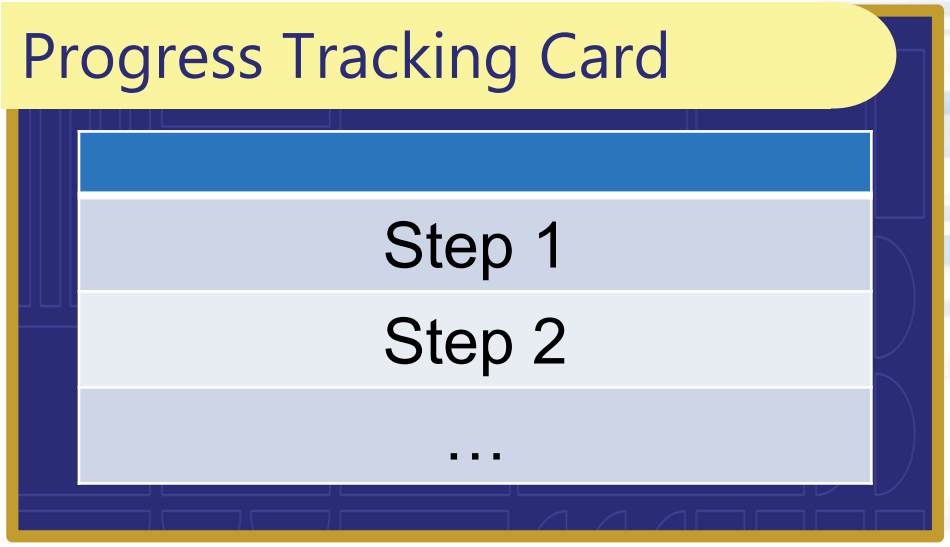
- Generate brief practices summary
- High level description

Scope: What are the barriers to quality and efficiency?

www.github.com/bssw-psip/ptc-catalog

02 Set Goals

- Identify practices ready for improvement.
- Select those with near-term payoff.



03 Construct Progress Tracking Card (PTC)

- Construct from PTC catalog or on your own.
- Select only a few items.

Plan: What actions can you take in a predictable span of time?

Plan

04 Record Current PTC Values

- Set baseline values for future reference.

05 Create Plan For Increasing PTC Values

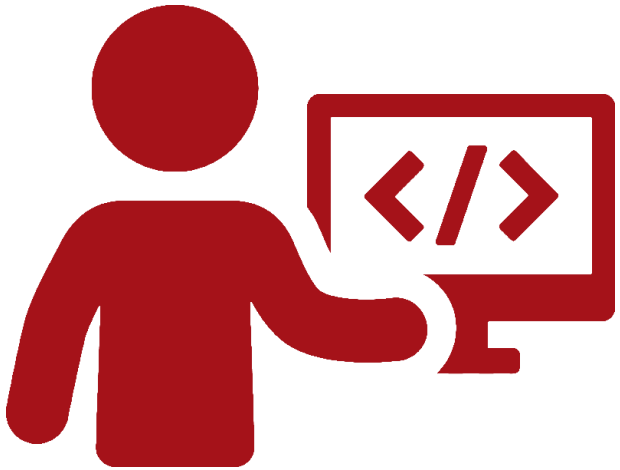
- Define practice improvement steps.
- Be specific, track issues.

Enact: Can you execute on the plan? Are these changes impactful?

Enact

06 Execute Plan

- Increase PTC values by improving selected practices.
- Track issues progress.



07 Assess Progress

- Track PTC values.
- Adjust strategy if needed.

Recall: What is PSIP?

- Software process improvement can carry **upfront costs** and introduce **risk** and **uncertainty** into your project, and should be approached carefully and intentionally.
- The **Productivity and Sustainability Improvement Planning** (PSIP) is a lightweight workflow for software process improvement.
- PSIP is implemented via **identifying improvements** and executing plans based on **Progress Tracking Cards** (PTCs).

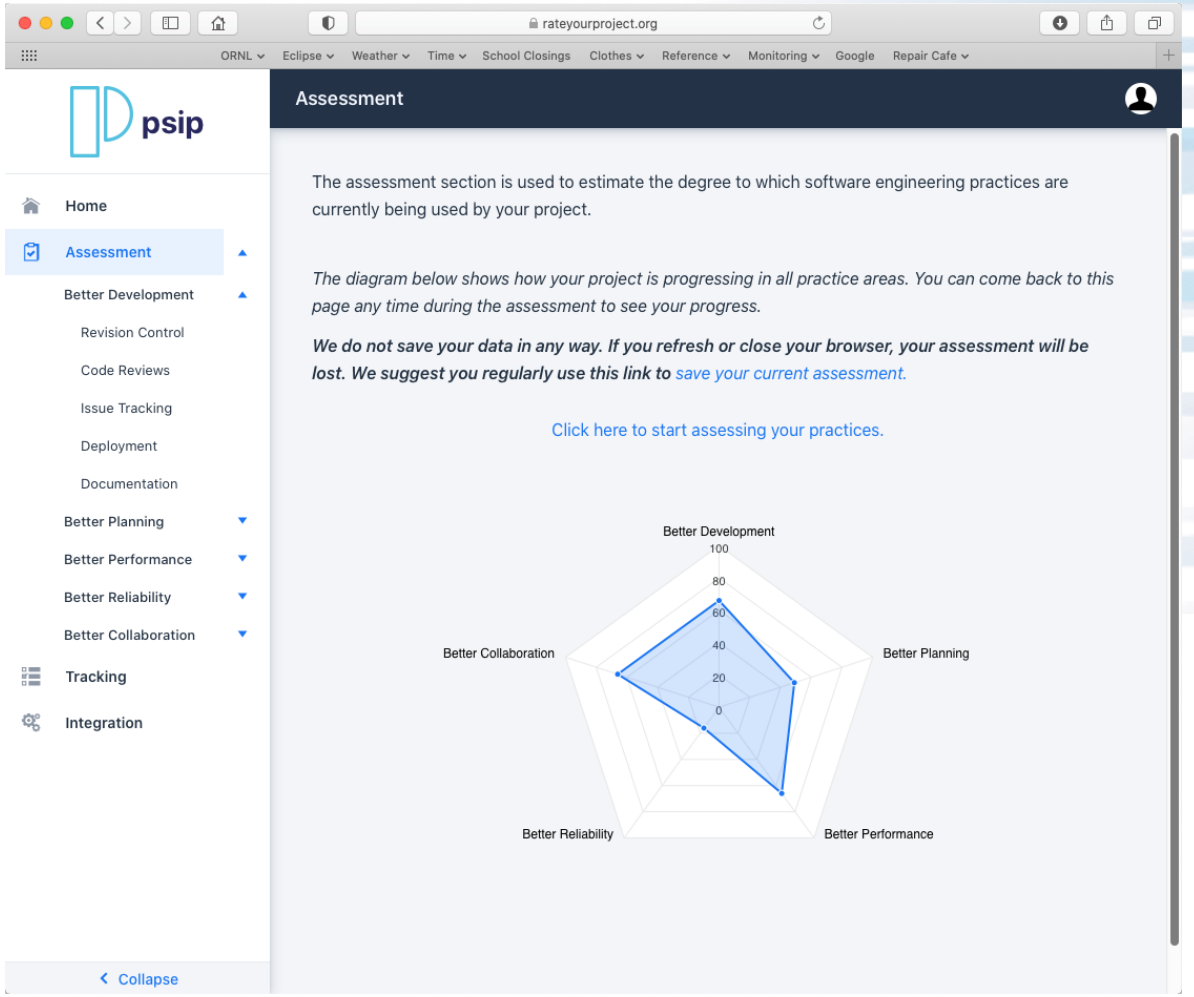
Enabling Software Quality

What is RateYourProject?

- In the past, assessment of team practices to identify improvement goals was a labor intensive practice for both the teams and their facilitators.
- Our solution: a guided self-assessment that enables the examination of software development, planning, performance, reliability, and collaboration practices.

RateYourProject Provides Resources for Setting Improvement Goals

- RateYourProject (https://rateyourproject.org) aims to automate phases of the PSIP process, from self-assessment to PTC creation to integration of PTCs into a project.
- Practices are rated using a modified four-point Likert scale, which forces one of four responses (none, basic, intermediate, advanced) and no neutral response. Scores are aggregated in each practice area, and then used to generate a visual indication of overall progress using a spider chart.



Activity: Summarize team practices by rating the current state of your project

Rate your projects' software practices: https://rateyourproject.org

Time limit: 25 minutes

1 (10 minutes) Fill out the survey **individually**

2 (15 minutes) Review together

3 Identify a practice to focus on for next exercise

10 minute break

What Are PTCs?

Title The topic of the card

Target Practice is changed

User Story As a ___, I want to ___, so that ___.

Card

Score	Description
0	Initial State
1	Intermediate state of practice (+)
2	Intermediate state of practice (++)
3	Intermediate state of practice (+++)
4	Desired state of practice

Comments: Relevant links or details

Creating a PTC Can Be Challenging!

Title	X
Target	We Achieve X!
User Story	As a developer, I want X, so that our project has higher values of X-related-quality.

Score	Description
0	We Are Here
1	
2	
3	
4	Where We Want To Be

Comments: Some notes about X

Creating a PTC Can Be Challenging!

1. Did team actually reach a consensus that X was important?

Title	X
Target	We Achieve X!
User Story	As a developer, I want X, so that our project has higher values of X-related-quality.

Score	Description
0	We Are Here
1	
2	
3	
4	Where We Want To Be

Comments: Some notes about X

2. Is everyone in agreement about **why** X is important?

3. What does achieving X entail in practice, and how do you get there?

What Makes for a Good Process Improvement Goal?

1. **Collaborative** and **team-oriented** (think project policies).
2. **Measurable** and **specific** (think artifacts).
3. **Realistic** and able to be realized in **increments** (over weeks, months)

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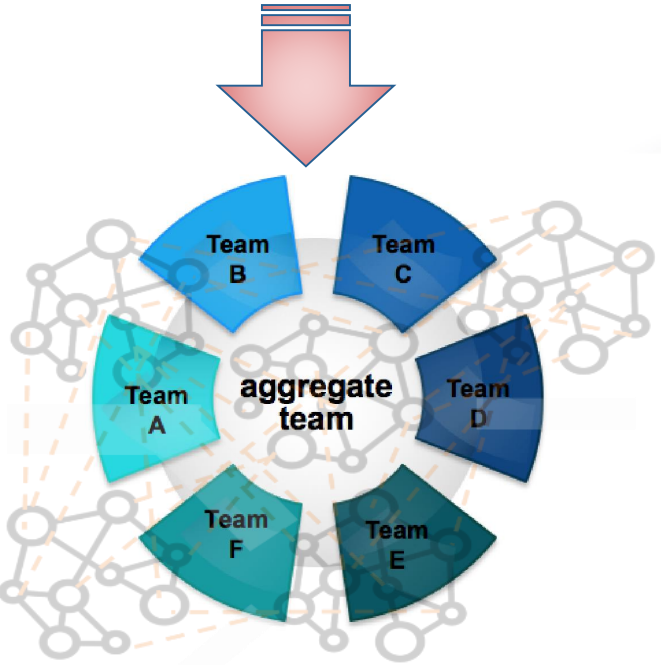
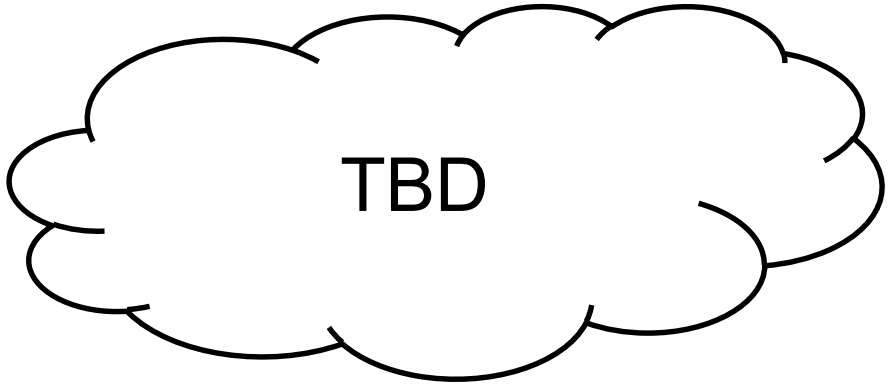


Making A Card for Continuous Integration

Title	Continuous Integration
Target	Testing is run at appropriate times without human involvement and reports are direct and concise.
User Story	As a person responsible for software quality and correctness for my project, I want code regularly tested so that regressions are guarded against and new code is tested against itself and other commits the developer might not have had.

Making A Card for Continuous Integration

Score	Description
0	Regression and unit tests exist but are only run when requested by a developer.
1	
2	
3	
4	Code may not be integrated if automated tests fail.



We have to have tests in place before we can approach CI.

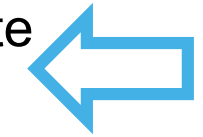
The end goal is to guard against regressions.

Making A Card for Continuous Integration

Score	Description
0	Regression and unit tests exist but are only run when requested by a developer.
1	Tests are run automatically according to the teams' policy.
2	Test reports are generated as needed and archived.
3	Archived reports are posted to appropriate maintainers.
4	Code may not be integrated if automated tests fail.
5	A mechanism and policy exists to integrate code without passing tests in rare circumstances.

implies

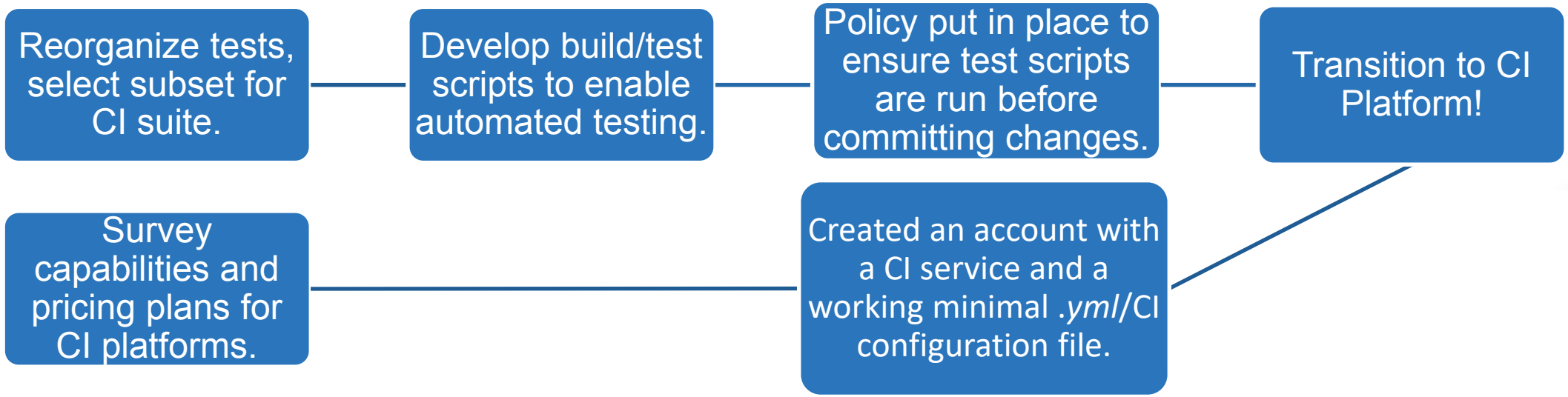
Reviewing and consistently acting on feedback is key.



The CI process should only be circumvented in a disciplined, cautious manner.

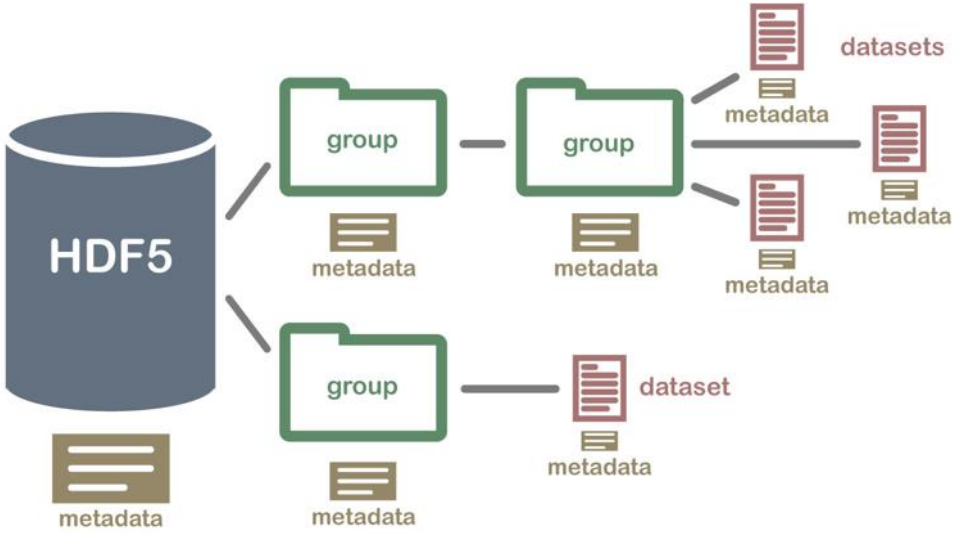
Tasks Needed To Reach Score of 1

Tests are run automatically according to the teams' policy.



Team Example: The HDF Group (THG)

- Last year, LLNL had a contract with THG to study the effectiveness of PSIP in helping a team to bring about software process improvements
- THG identified 3 areas of improvement: adopting a workflow for updating their reference manual, migrating to GitHub, and adopting code standards.
- Progress was made on all fronts! In particular, coding standards were agreed upon, something that had eluded the team for 20+ years.



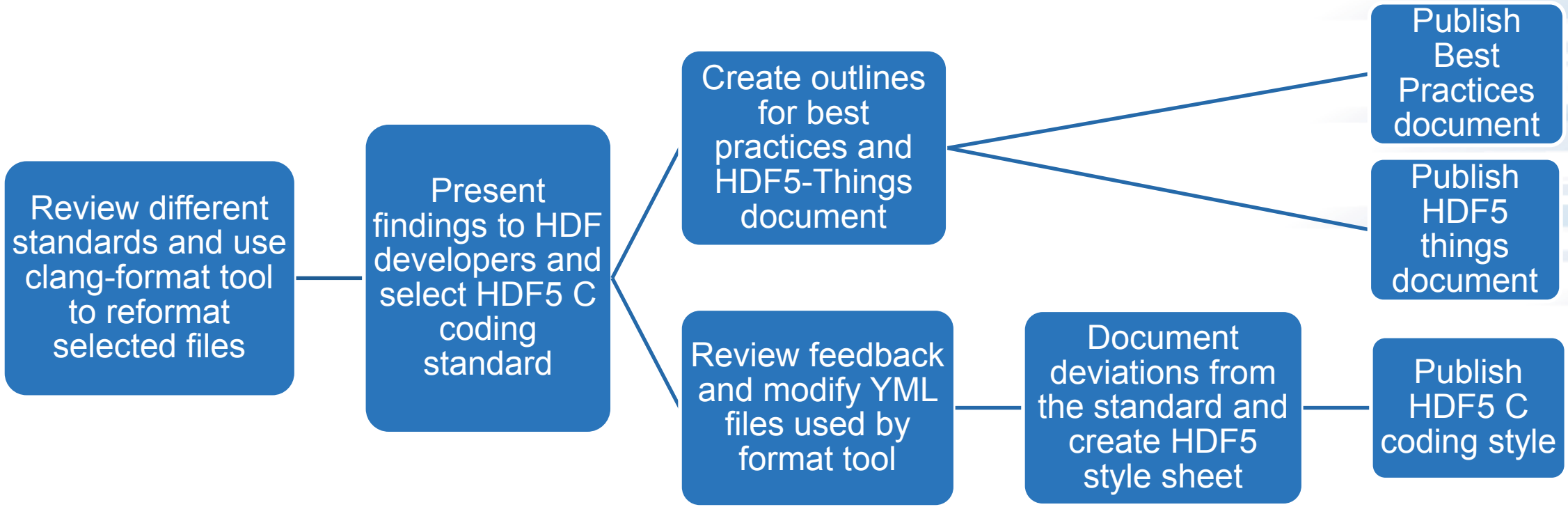
Real-World Example: THG Coding Standards PTC

Title	THG Coding Standards
Target	Steadily convert the codebase over to an agreed-upon standard.
User Story	**As a** person responsible for software quality and correctness for the HDF5 library, **I want** guidance on selecting and implementing coding standards **so that** we can make our code easy for everyone to read and understand. **As an** HDF5 library developer or community contributor, **I want** support **so that** I am complying with the standards with minimal additional effort or ambiguity.

Real-World Example: THG Coding Standards PTC

Score	Description
0	No coding standard adopted.
1	The team has selected and documented an agreed-upon standard.
2	New code that is written is required to comply with the standard, and the team has conducted a feedback session to assess and revise the standard.
3	The team has developed and put into place a refactoring plan to bring preexisting code into compliance with the standard.
4	Tool support has been put in place to help ensure compliance, and running the tool is made part of the contribution process.

Real-World Example: HDF5 Tasks Needed To Reach Score of 1



The team has selected
and documented an agreed-upon standard.

How to Get Started

1 As a team, identify a practices to improve

2 Construct the PTC

- Select from the example catalog
- Work with a facilitator to build one from scratch

3 Adapt the card for the team, filling in any specific technologies and possible deadlines.

4 Add the card to the team's work tracking system

How to Use a PTC

- Once the card is constructed, it should be integrated into the team's work-tracking/planning system and referenced frequently
- Review it during team meetings
- Continually assess progress towards each step

Activity: Breakout in rooms to create PTCs

Activity: Debrief

- What card did you create?
- What do you plan to do next?

Recap: Why PSIP?

- Lightweight
- Easy to Adopt
- Encourages Reflection and Communication
- Can Reveal Differences in Assumptions and Priorities
- Can Help Team Converge on a Consensus

Tutorial Conclusion

PSIP allows you to realize process improvements without disruption to any current development.

- *By now you should understand …*
- A practice that can help your team mitigate technical risk and develop software with confidence. (PSIP)
- How to identify topics for improvement by rating your project
- Progress tracking cards (PTC)
- Progress tracking card (PTC) catalog
- Integrating PTCs into your projects

Enabling Software Quality

https://bssw.io/psip/

Next Steps

- Point-of-Contact: Elaine Raybourn emraybo@sandia.gov
- Follow-up questions about PSIP & PTCs
  - Contact PSIP via https://bssw.io
  - PSIP team on Gitter https://gitter.im/bssw-psip/community
- Additional Resources:
  - Learn more at https://bssw.io/psip
- View PTC Example Catalog at https://github.com/bssw-psip/ptc-catalog
- Take the first steps on your own at https://rateyourproject.org

License and acknowledgements

License

Acknowledgements

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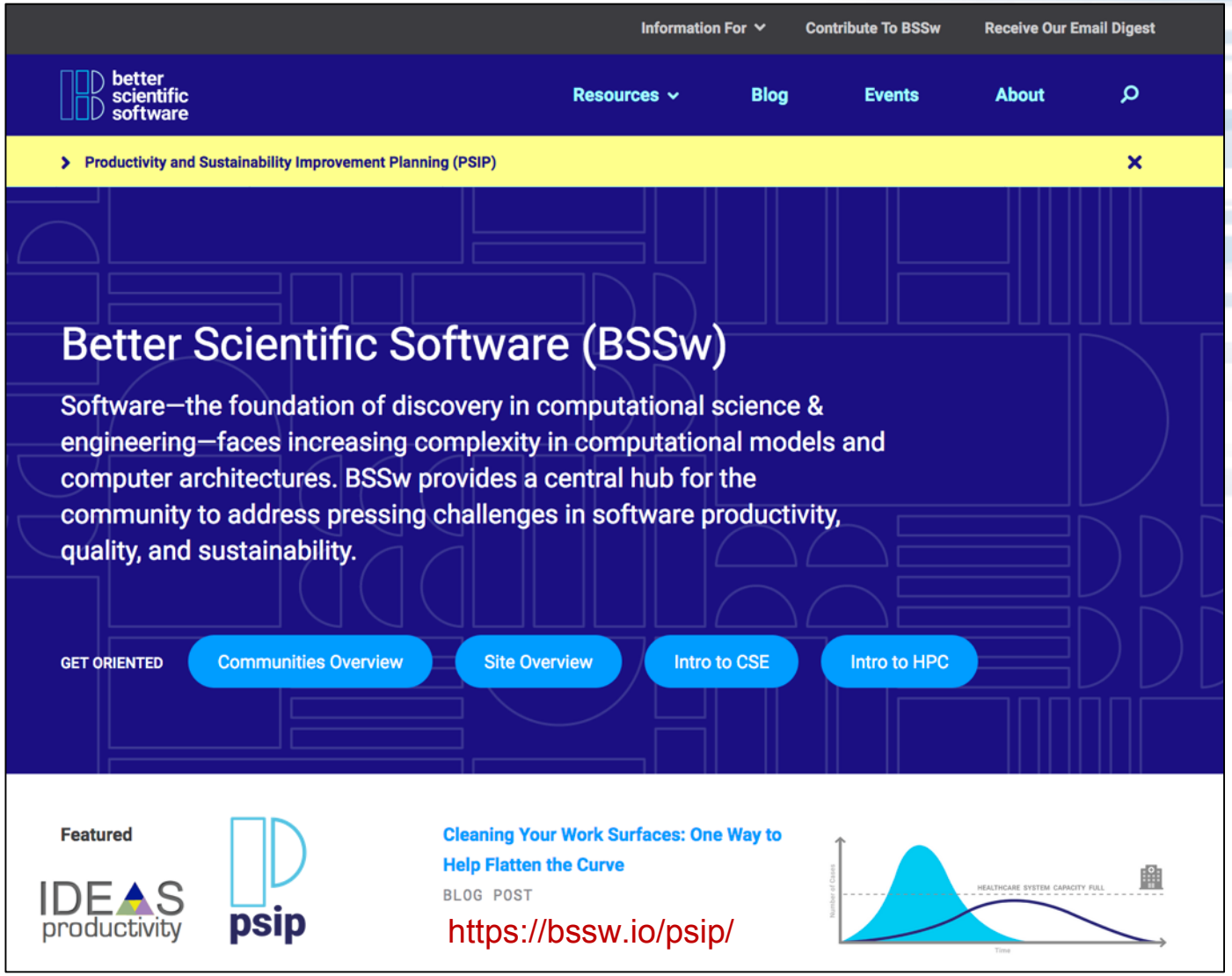
- Sandia National Laboratories is a multimission laboratory managed and operated by National Technology and Engineering Solutions of Sandia, LLC, a wholly owned subsidiary of Honeywell International, Inc., for the U.S. Department of Energy's National Nuclear Security Administration under contract DE-NA-0003525. Images used by permission.
- Special thanks to The HDF5 Group and Elena Pourmal (THG Director of Engineering) for sharing their team example in this tutorial, and Mark Miller (LLNL). For more information see M. C. Miller, E. Pourmal, E. Gonsiorowski, PSIP For HDF5Pilot Project Final Report, October 30, 2020, LLNL-TR-816216.

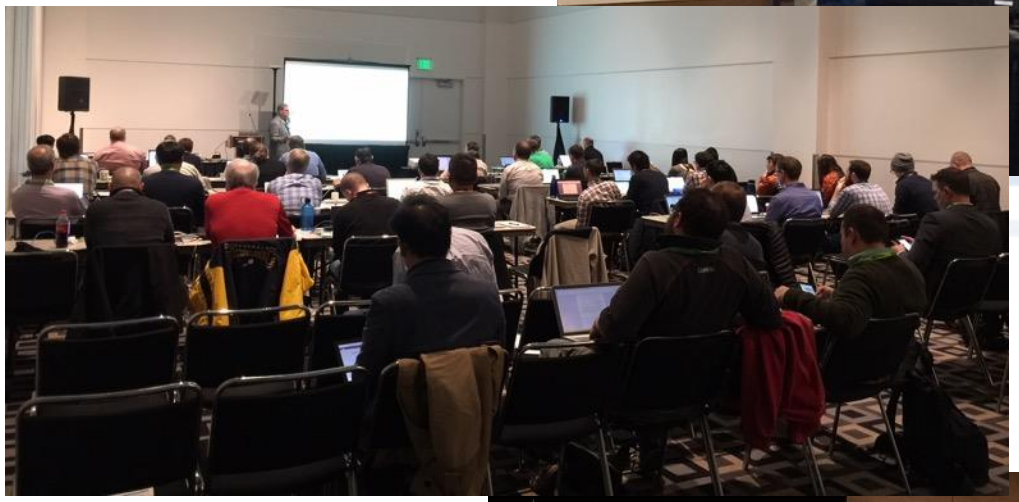
Additional Resources: Better Scientific Software Hub

- **What Makes PSIP Suitable?**
  R. Gupta, E. Raybourn, 1/31/2020, podcast
- **PSIP Tools**
  R. Gupta, 1/28/2020, curated content
- **Recent Success with HDF5**
  M. Miller, Pourmal, E., Gonsiorowski, E. 11/16/2020, blog post
- **PSIP and CI: EXAALT**
  R. Zamora, 9/25/2018, blog post
- **What is PSIP?**
  PSIP team, 1/28/2020, blog post
- **Working Remotely Panel Series Video Archive**
- **Working Remotely: The Exascale Computing Project (ECP) Panel Series**
  E. Raybourn et al., 7/30/2020, blog post



Additional Resources: Better Scientific Software Tutorials

- Full-day and half-day variants
  - Hands-on in full-day
- Recent venues
  - ATPESC (2016-2020)
  - ECP Annual Meeting (2017-2020)
  - ISC (2017-2019)
  - SIAM CSE17
  - Supercomputing (2016-2020)
- **Slides (and some recordings) of past tutorials**
  - https://ideas-productivity.org/events/
- Current tutorial modules
  - Motivation and Overview of Best Practices in HPC Software Development, Agile Methodologies, Git Workflows, Software Design, Software Testing, Refactoring, Continuous Integration, Reproducibility, Software Licensing



Additional Resources: Best Practices for HPC Software Developers Webinar Series (HPC-BP)

- Monthly series, since May 2016
  - Traditionally 1-2pm ET on a Wednesday
  - Which Wednesday varies
- Offered live and archived
- Presented by the community to the community
  - Not just IDEAS
- 45 webinars to date
  - 77 per webinar on average
  - 3214 attendees total, to date
- **Series info, archives, and mailing list for announcements**
  - https://ideas-productivity.org/events/hpc-best-practices-webinars/

Additional Resources: Technical Meetings and Birds of a Feather Sessions

- We help create opportunities to talk about software development, productivity, and sustainability in more traditional “academic” settings
  - https://ideas-productivity.org/events/
- Minisymposia
  - SIAM Computational Science and Engineering (2015, 2017, 2019, 2021)
  - PASC (2018, 2019)
- Thematic poster sessions
  - SIAM CSE (2017, 2019, 2021)
- Birds of a Feather sessions
  - Software Engineering and Reuse for Computational Science and Engineering
    - SC15, SC16, SC17, SC18, ISC19, SC19, SC20 see http://bit.ly/swe-cse-bof

SIAM CSE19 Miniposterium posters, archived on FigShare