



Automated Continuous Estimation for Pipelines of Pipelines

QuARP FY 2023 #3 Workshop

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Bill Nichols
Chris Miller
Brent Clausner
Luiz Antunes
Brigid O'Hearn
Julie Cohen
Anandi Hira

Software Engineering Institute
Carnegie Mellon University
Pittsburgh, PA 15213

Automated Continuous Estimation for Pipelines of Pipelines

Automation drives continuous integration and delivery of software, but outpaces program control

To solve this problem:

Automate data collection
Model DSO systems with **Monte Carlo**, and provide continuous reporting.

- Determine status
- Project future events
- Provide evidence for corrective actions

Goal: Programs using DSO(DevSecOps) have constant access to information needed to monitor and control schedule and cost commitments.

Status and projection models should be available in real time.

Model and simulate pipeline-of-pipeline systems.

Automate data collection and Program Management Status Reporting for DevSecOps pipelines.

Directly collect data from DevSecOps pipeline tools

- Automate data collection, storage, and reporting
- Correlate data to project outcomes
- Present completion to-date and milestone predictions to Program Management in smart dashboards

Introductions

The Quartey Advisory Review Panel (QuARP)

- SEI
- Industry
- Government

Purpose Review progress and direction of ACE/PoPs

Agenda

Topic	Time (min)
Introductions	5
Milestones Accomplishments and Work in Progress Publications and presentations Gap Analysis Task Updates on Indicators from Industrial Pipeline Additional Indicators	30
Summarize Next Steps <ul style="list-style-type: none">• Document data and GQIM templates• Analyze projection accuracy and precision	10
Wrap-up	10

FY23 Milestones

Quarter	Milestone	Status
FY23 Q1	White Paper M3. Validate PoPs data for multiple scenarios	Complete
FY23 Q2	Specify initial on-Site PoPs Objectives and measurement plan	Complete
FY23 Q3	Review initial pilot PoPs outputs	In progress
FY23 Q4	Review GQIM Templates and Experience Report	For closeout

Accomplishments

- Presented **Automated Continuous Estimation for Pipelines of Pipelines** at Barry Boehm Research Review
- Proposals accepted to NDIA Conference and Joint IT and Software Cost Forum (formerly IT-CAST)
- Status Indicators have been prototyped and are being validated,
- Status **analysis** indicators have been prototyped

Joint IT and Software Cost Forum

Abstract: This presentation describes how to leverage DevSecOps data to provide valuable insights to inform decision-making in software intensive Department of Defense (DoD) programs. The discussion includes relevant decision areas, the information needed, how decisions can be made using DevSecOps pipeline data, and experiences of the SEI's Automated Cost Estimation in a Pipeline of Pipelines (ACE/PoPs) research project in gathering, analyzing, and presenting this data.

Gap Analysis Task

Artifacts will include requirements document for ACE/PoPs implementation (for example a GQIM template) and a user guidance document including

- Capability Literature summary
- Normal scenarios,
- Information needs
- Data needed by stakeholders
- Typical tools used that can supply data
- consequences of missing data during monitoring and tracking, and
- recommendations for entering and maintaining the data

Gap Analysis Task Status

Capability estimation literature summary

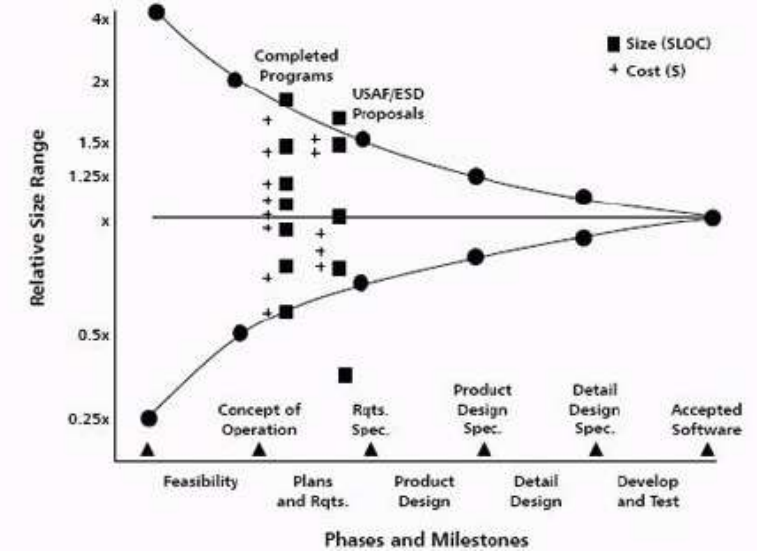
- A literature review is in progress
- Artifacts: Presentation and review survey document

What information do different stakeholders at different times in the program

- Table listing information needed, stakeholder, and ASOT
- Currently at 13 types of information

Technical Performance Measures

- Identified candidate technical measures to be tracked through the ACE/PoPs pipeline
- Developed a notional Acquisition pipeline to show how early information supports downstream needs



Boehm, Barry. Software Engineering Economics. Prentice Hall. 1981.

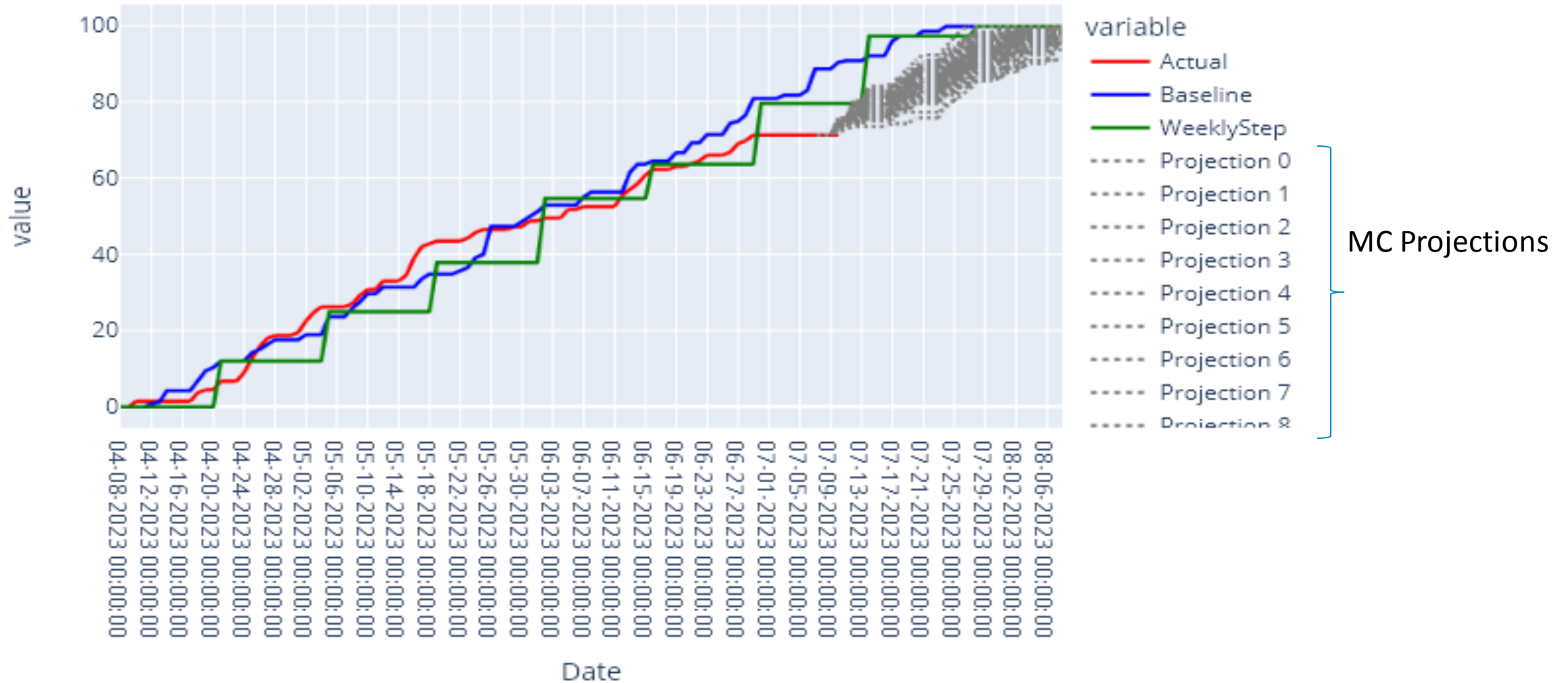
Indicators

Software Engineering Institute
Carnegie Mellon University
Pittsburgh, PA 15213



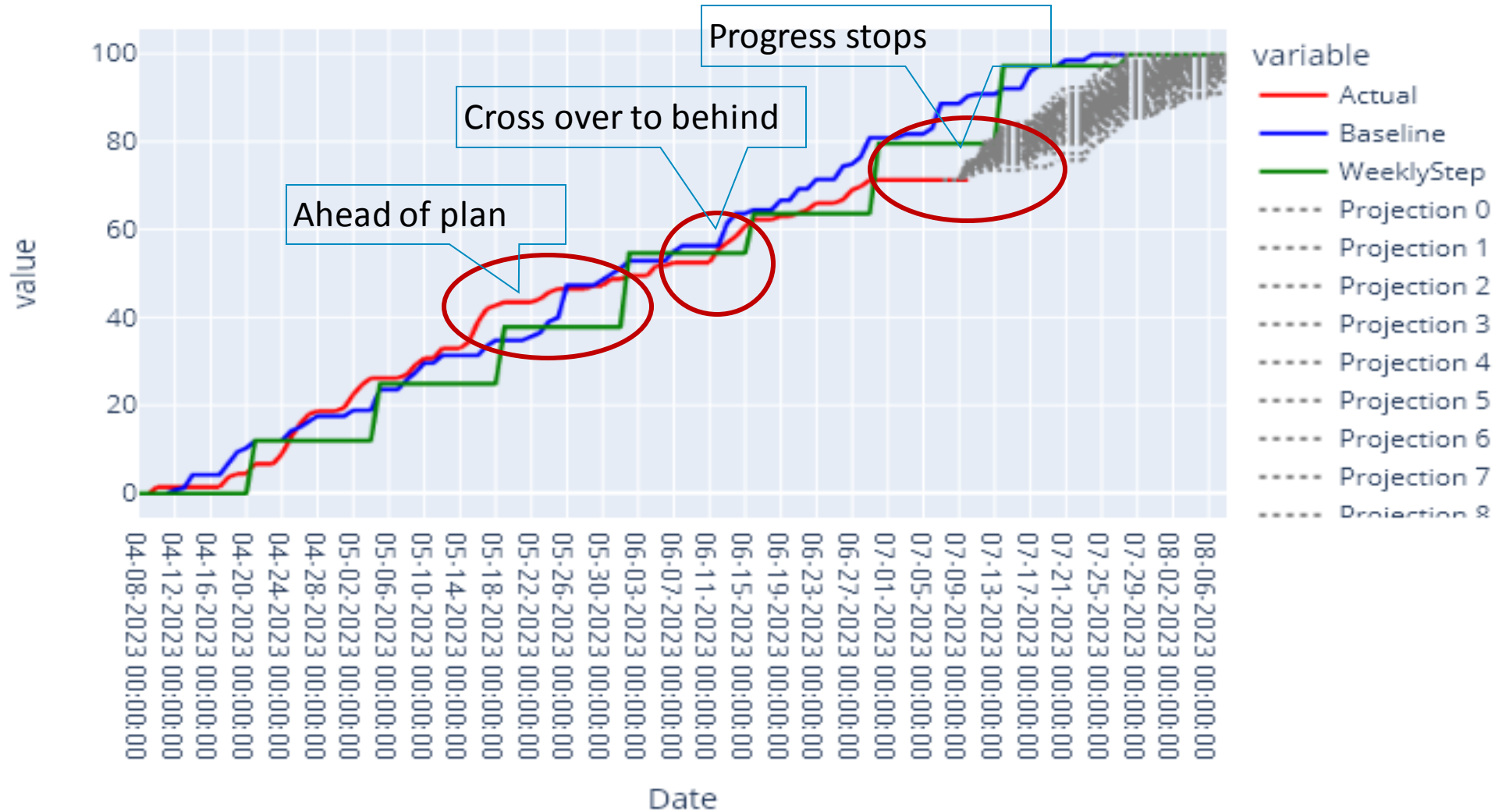
Tracking and Projection of Completion

Status and Projection Product Increment



Observations in a Tracking and Projection

Status and Projection Product Increment

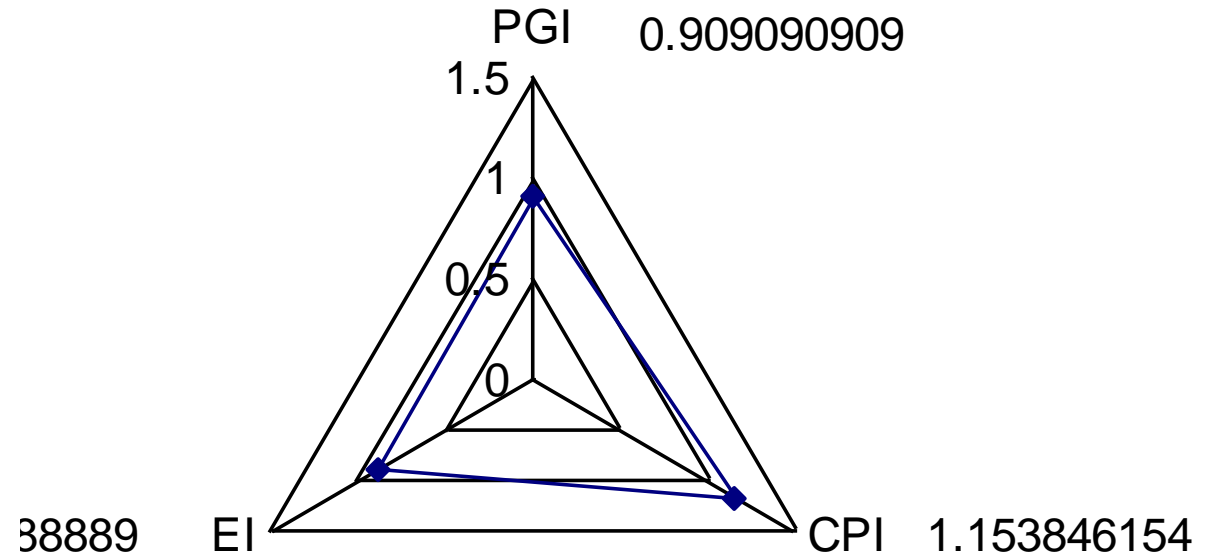


What Happened? Visualizing Plan Performance Dimensions

The axes provide ratios of planned vs actuals,

- The **Effort Index** - (EI)
Effort(Actual)/Effort(Planned) to date
- **Cost Performance Index** (CPI) -
BCWP/ACWP for completed tasks
- **Plan Growth Index** (PGI) -
 $BAC(t_0)/BAC(t)$ baseline and current budgets at completion

Plan Performance



Probing Questions

Do completion rates change?

- Are the changes variation or a change?

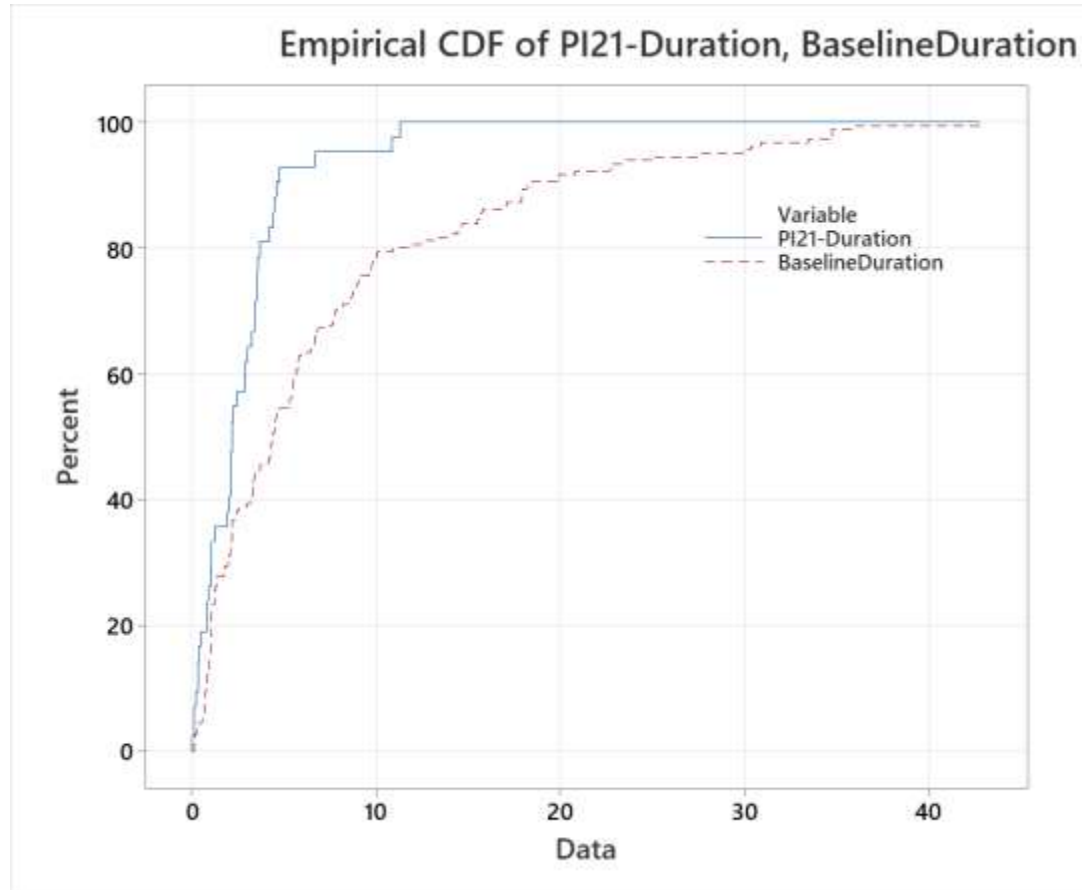
Why do rates change?

- Is the problem effort?
 - Is the total team effort reduced?
 - Does the story mix (open stories, bugs, spikes) reduce effective time for stories?
- Is the problem estimation?
 - Is story estimation accuracy stable?
 - Has average story duration or variation changed?

Has the plan changed?

- New work
- Changed work order

Do the story duration distributions differ from plan? Is the difference random or systematic?



Descriptive Statistics

Variable	N	Mean	StDev	SE Mean
PI21-Duration	42	2.7224	2.4564	0.37903
BaselineDuration	180	7.4006	8.5461	0.63699

Diff means = 4.68, $2\sigma \sim 2.0$

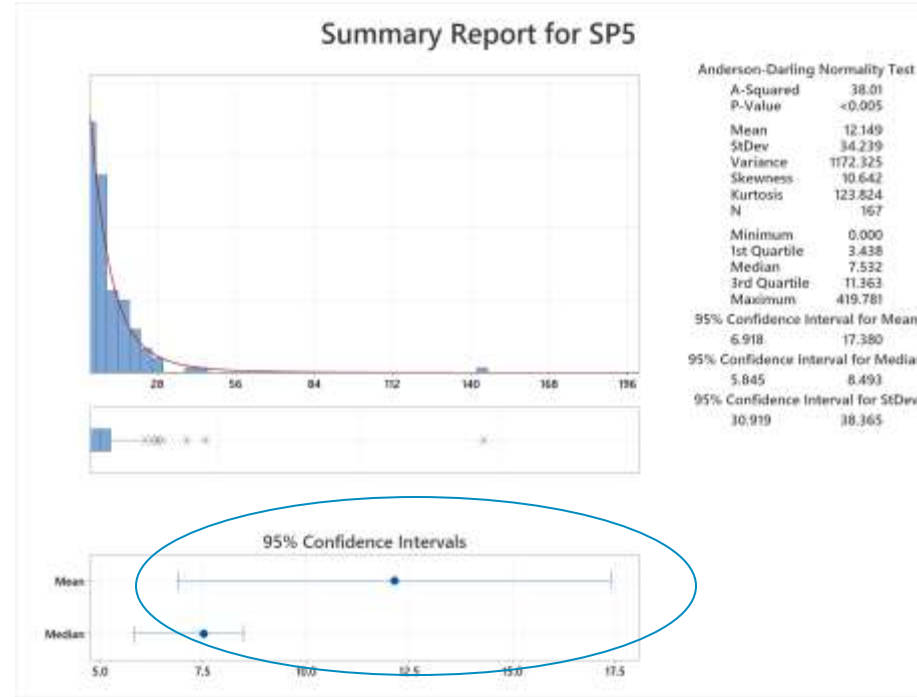
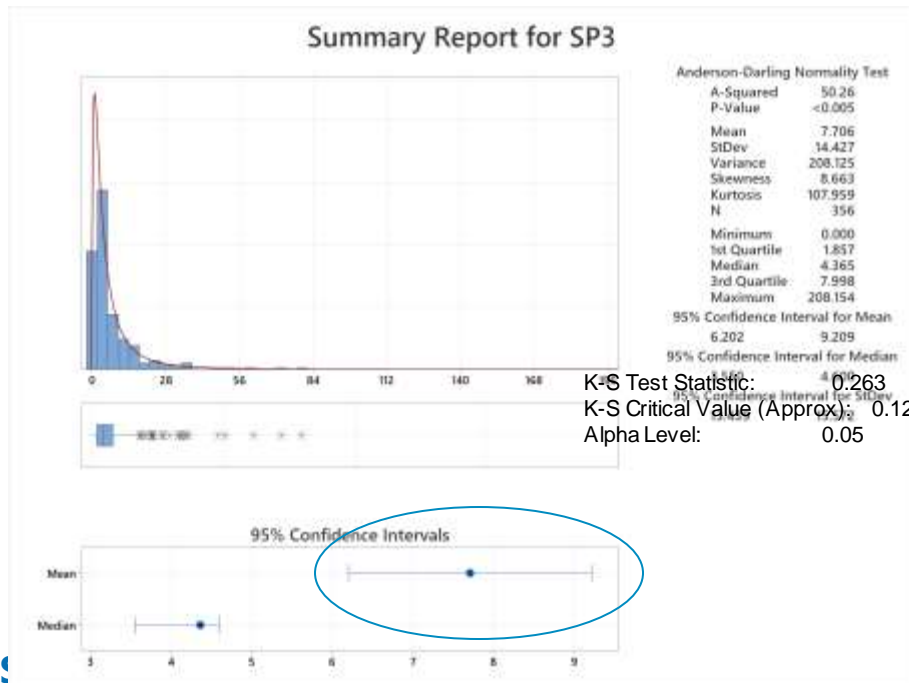
K-S Test Statistic: 0.389

K-S Critical Value (Approx): 0.279

Alpha Level: 0.01

The test statistic is greater than or equal to the critical value.
There is sufficient evidence to conclude that the underlying distributions **are different**.

Compare Side by Side

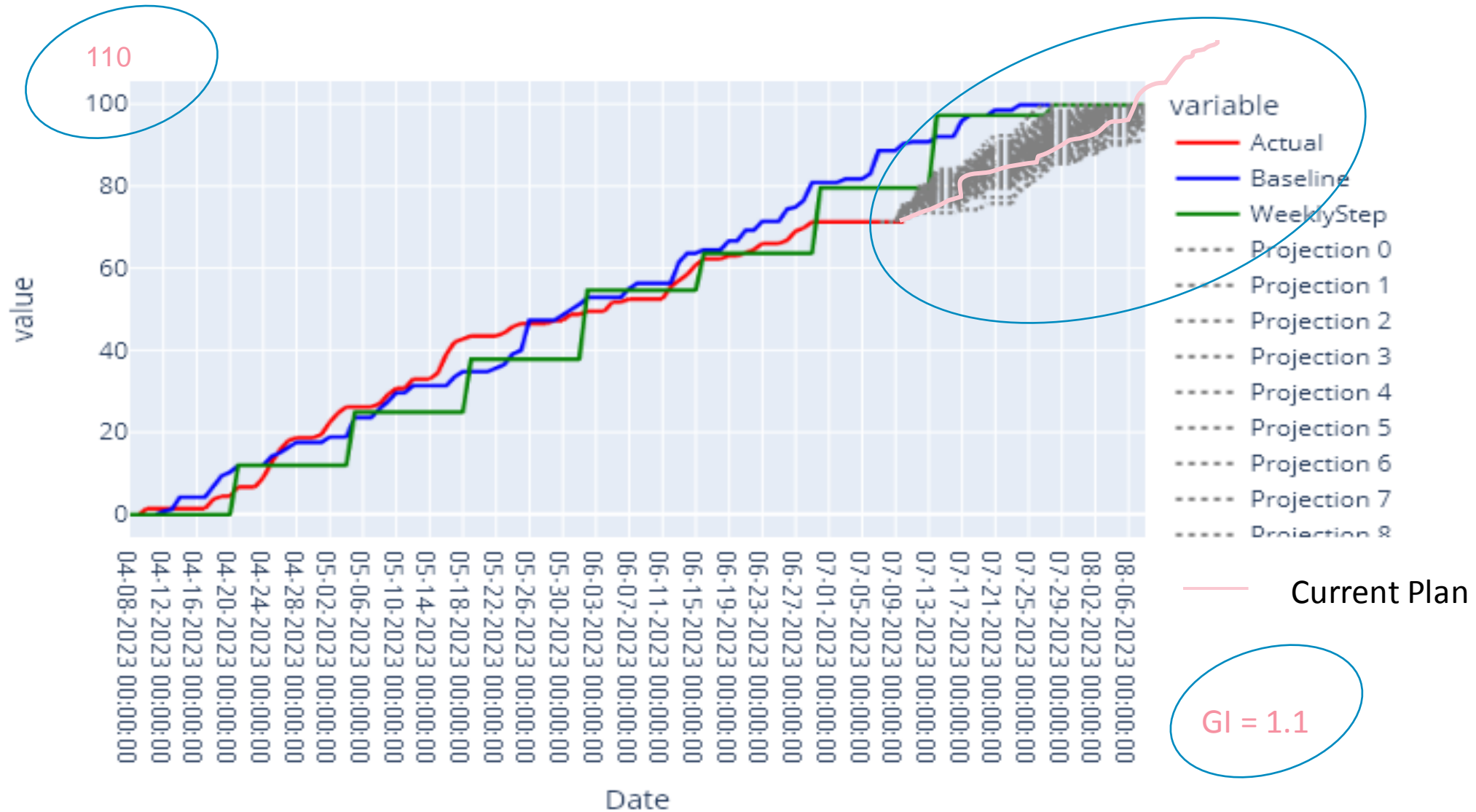


Variable	Count	Mean	SE Mean	StDev	Min	Q1	Median	Q3	Max	IQR
SP3	356	7.70	0.765	14.427	0.000	1.857	4.365	7.998	208.2	6.1
SP5	176	12.15	2.65	34.24	0	3.44	7.53	11.36	419.8	7.92

Different Distributions, but
Overlapping confidence intervals
On the Mean,
Distinct on Median

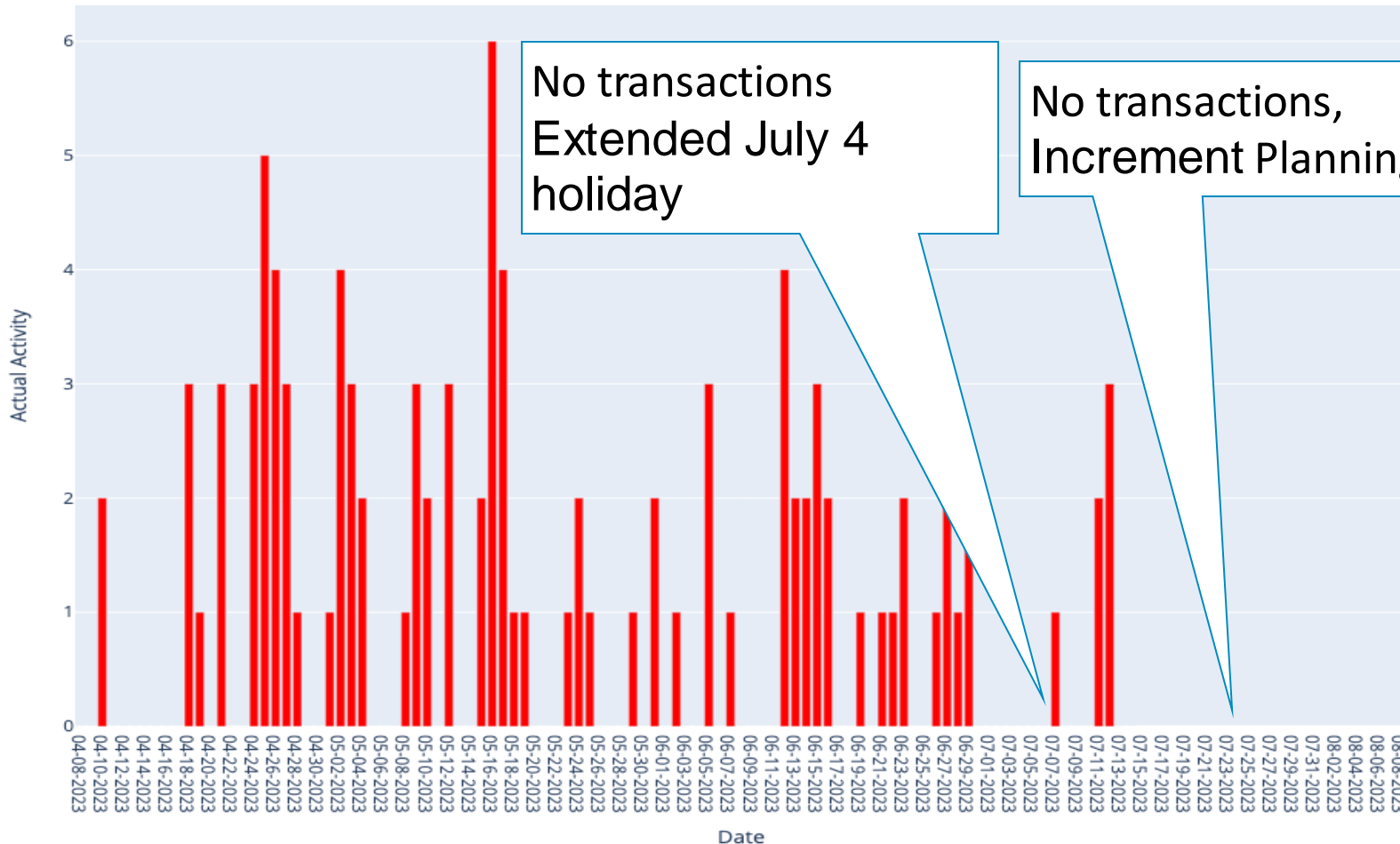
Has the Plan Grown? Growth Index Indicator

Status and Projection Product Increment



Is a resource problem? Was **any** work been performed?

Transactions by day are a proxy for non-work days



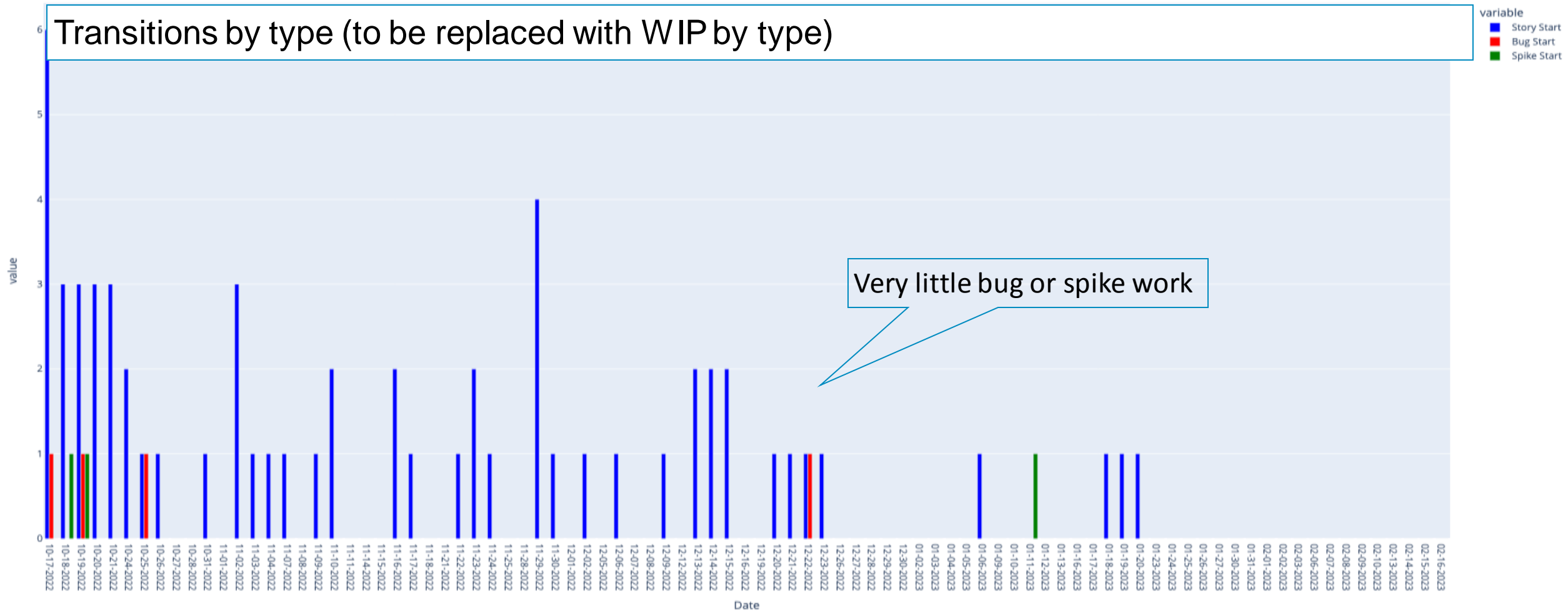
Daily Effort is difficult to infer from the pipeline. External sources include payroll.

Internal sources include repository activity or other activity with PID logs.

We have avoided anything PID

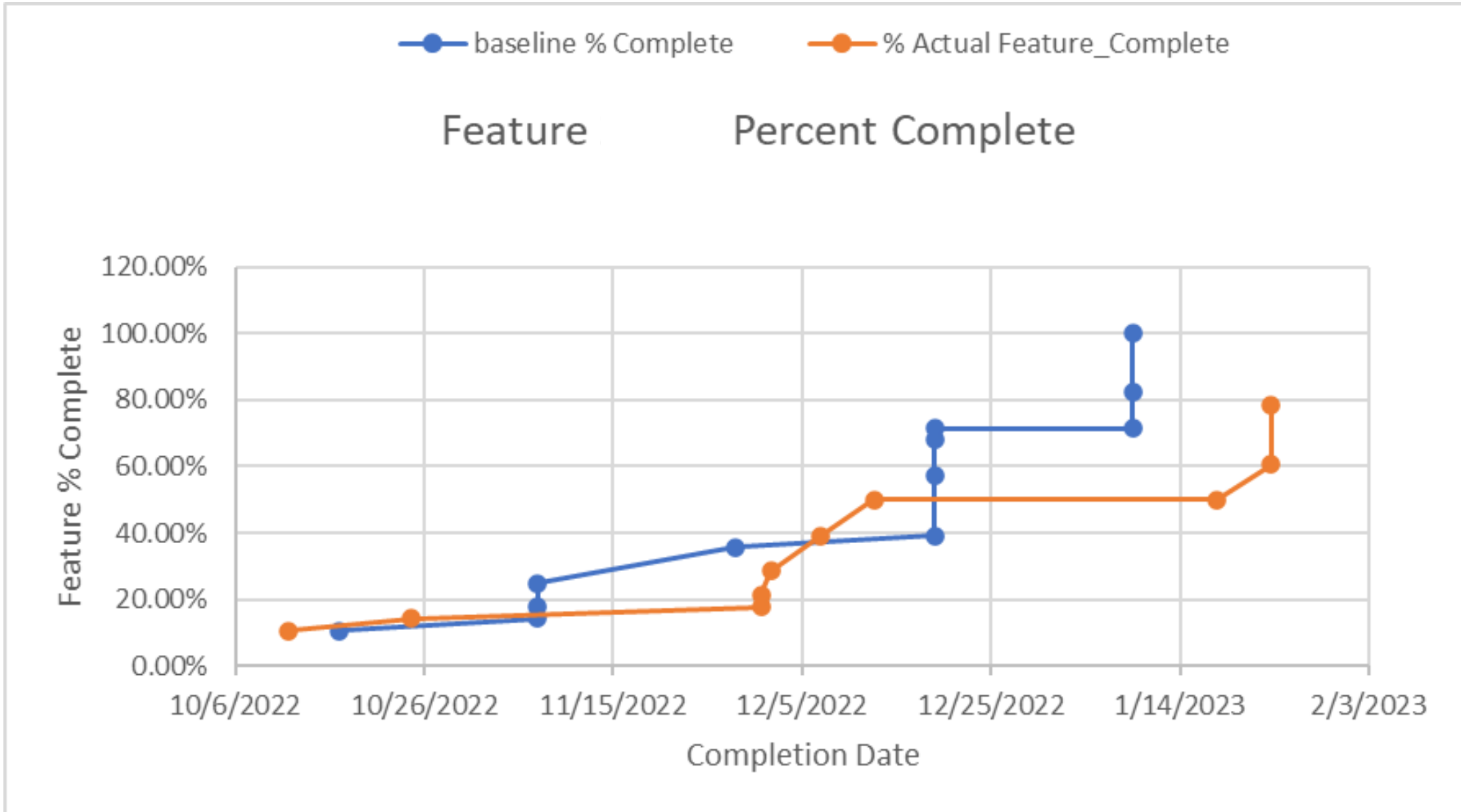
Resource Problem? Is Development Work Crowded Out?

Run Start Plot Transition Events Thestrals for PI-19



Very little bug or spike work

TBD, Complete the Features Projections (prototyped)



Next Steps

- Complete GQIM indicator Templates
- Analyze projection accuracy
- Complete analysis of gaps identified during Year 1

Closeout Package

- Experience Report
 - Scenarios
 - Measurement gaps
- GQIM Templates
- Life Cycle Gap Report

Prepare for a Transition, search for transition partners

Joint us at Joint IT Software Cost Forum

IT-Virtual

<https://www.dhs.gov/joint-it-and-software-cost-forum>

Discussion

Contact Sample



FirstName LastName
Title

Brent Clausner
Title

Melissa Ludwick
Title

Julie Cohen
Title

Telephone: +1 412.268.XXXX

Email: info@sei.cmu.edu

To change the image, follow these instructions.

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1. Select the placeholder image.
2. Select the Picture Image tab.
3. Choose the appropriate option (e.g., "From a File," "This Device").
4. Select the new image. (It will resize automatically.)

PC Instructions

1. Right-click the placeholder image.
 2. Select Change Picture.
 3. Choose the appropriate option (e.g., "This Device," "From Stock Images").
 4. Select the new image. (It will resize automatically.)
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The photos should be in grayscale. To convert a color image to grayscale, follow these instructions.

Mac Instructions

1. Select the placeholder image.
2. Select the Picture Format tab.
3. Choose Color.
4. Select the rightmost image under Color Saturation.

PC Instructions

1. Select the placeholder image.
 2. Select the Picture Format tab.
 3. Choose the Color dropdown.
 4. Select the first image under Color Saturation.
-

Contact Sample



Brigid O'Hearn

Telephone: +1 412.268.XXXX

Email: info@sei.cmu.edu



Chris Miller

Title



Anandi Hira

Title



Michael Bandor

Title