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STAR

A Cloud-based Innovative Tool for Software Quality Analysis

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Introduction

Kazuhira (Kazu) Okumoto, Ph. D.

- Former Bell Labs Scientist with 40 years of experience in the field

- Pioneer in Software Reliability Engineering

- Creator of **Goel-Okumoto Reliability Model**

- Co-author of a book, **Software Reliability: Measurement, Prediction, Application**

- Former Professor @ Rutgers University

- Previous Experience with **Air Force, Navy, NSF** projects

- Developed and productized an innovative software quality assessment tool for **Nokia** - BRACE

- Creator of an innovative on-line tool for software quality assurance, **STAR**

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Introducing STAR

Software Quality Assurance-as-a-Service

SaaS

Cloud-based tool available anytime, anywhere, to anyone!

Automated Prediction Model

Proven Automation & Innovative Analytics

Visualization

Several output views to suit all users from developers to executives

At the forefront of digital engineering practices aimed at delivering high-quality products on time.

Base your decisions on data-driven prediction methods and improve customer satisfaction!

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A revolutionary approach to software reliability modeling & software quality assurance. The prototype of STAR has been customized and is still being used by **Nokia** today.
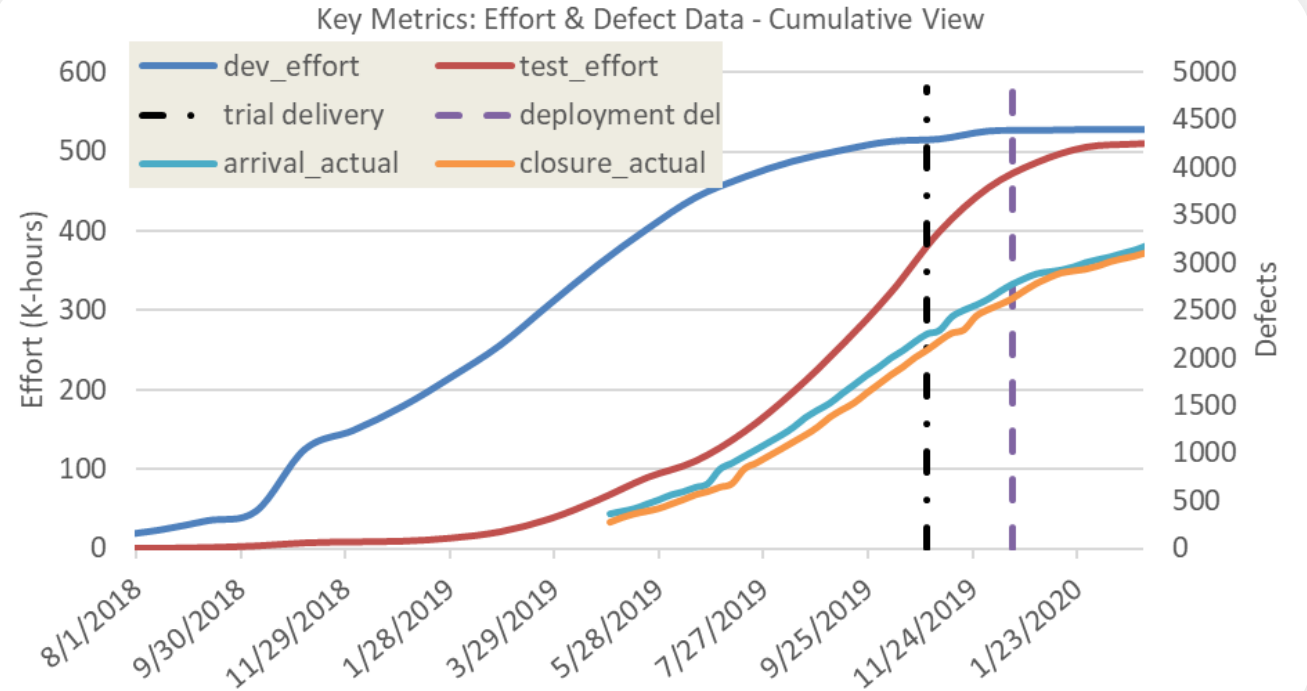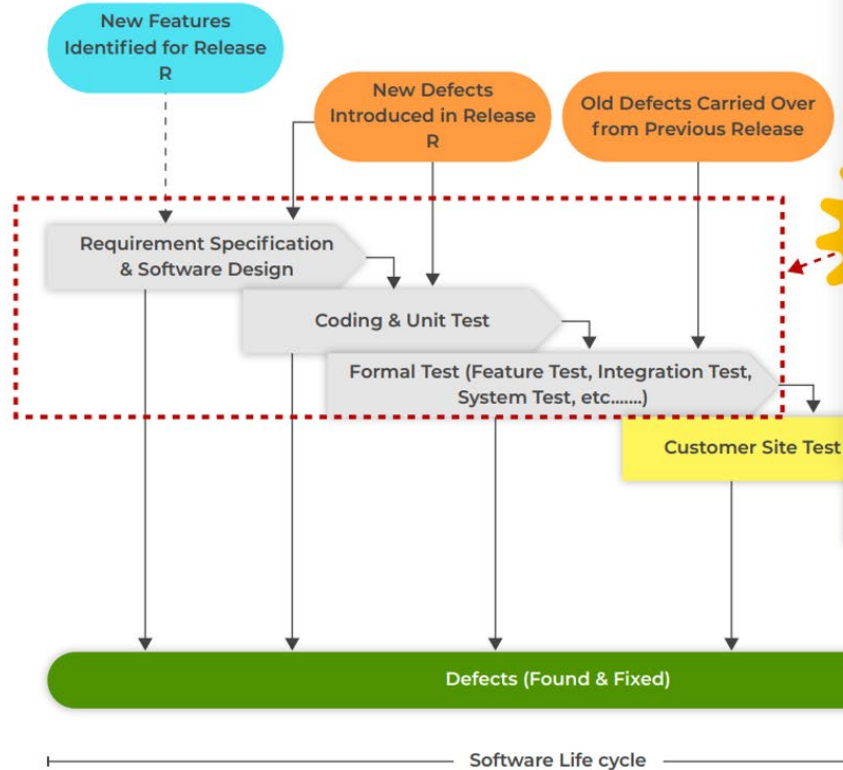
STAR is currently going through an extended trial with **NASA.**

We continue our collaboration with experts from the industry and academia to advance and improve STAR for real-world applications in the field.
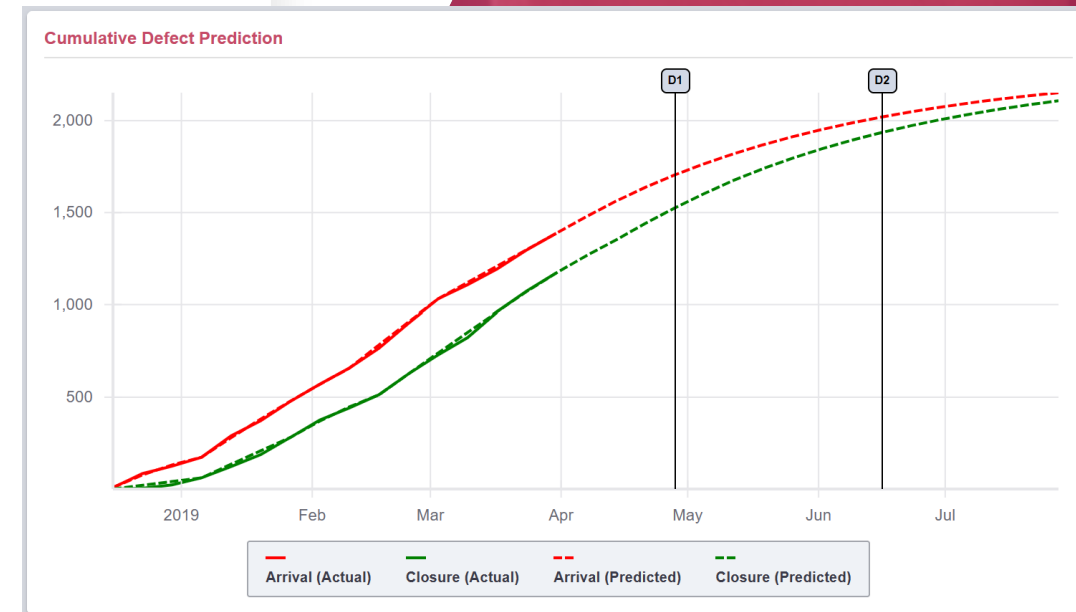
Background

Software Development Process

Background

Challenges of Current Software Reliability Modeling

- Focusing on the arrival curve prediction

- Use of a single curve fitting (e.g., S-curve, exponential)

- The goodness of fit is used for model comparison

- Mathematical complex modeling with little practical use

- Previous release experience is not yet incorporated

- Development & test effort data is not yet incorporated

Cumulative Defect Prediction

Arrival (Actual)   Closure (Actual)   Arrival (Predicted)   Closure (Predicted)

STAR's New Innovative Approach Overcomes Challenges of Current Software Reliability Modeling

STAR Demo

3S |(sakurasoftsolutions.com)

SAKURA Website Screenshot

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Service | Resources | About 3S

Customer Support | Sign In | Demo STAR Now

A service built to guide you

Introducing you to our SQA tool, STAR, that finally uses software defect predictions to schedule delivery dates.

Demo STAR Now

No payment required

Will we be ready for delivery on time with acceptable quality?

		D1	D3
Percentage Residual Defects (Will we find enough defects?)		28.3%	13.5%
Percentage Open Defects (Will we fix enough defects?)		11.5%	4.4%

Cumulative Defect Prediction

Arrival (Actual) | Closure (Actual) | Arrival (Predicted) | Closure (Predicted)

Watch here to answer the following questions:

- When will the product be ready to be delivered, and how many defects shall we find?
- How many additional defects could we find from now to delivery?
- Which of our software components are most defective?
- What can we do to improve the software quality? And what if we increased the number of developers or delayed the delivery?
- What if we don't have defect data early on in development? How can we make early quality estimates?

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Reference

STAR Technical Information & Guide

STAR Breakdown

01 **STAR Core Engine**

- Defect trend analysis
- Early defect prediction
- Closure curve prediction
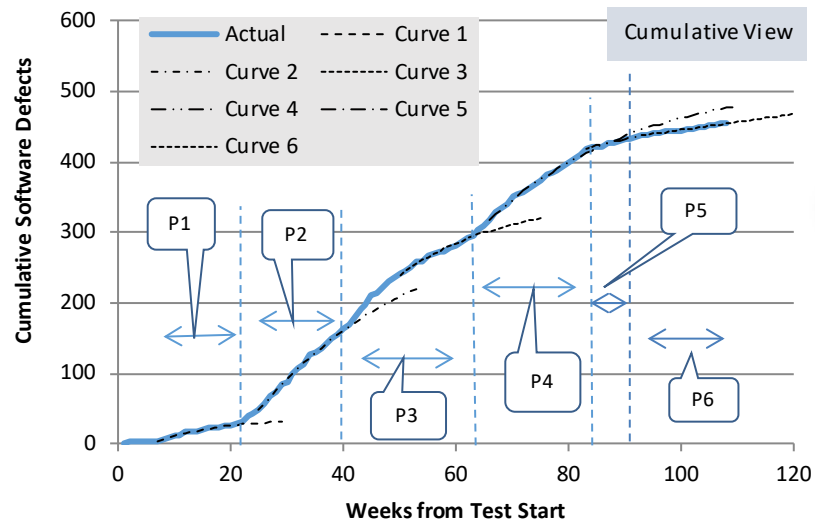- Prediction stability and accuracy
- Corrective actions

- -

02 **STAR User Input**

- -

03 **STAR Sample Output**

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STAR Core Engine (1)
Defect trend analysis STAR automatically identifies inflection points to generate multiple curves to describe the entire defect trend

No more single-curve fitting!

Software Defect Trend Analysis

STAR Defect Prediction vs. Actual

STAR automatically identifies the **inflection points** and generates a series of piece-wise exponential models: $m(t)=a\{1-\exp(-b\,t)\}$

STAR Core Engine (2) – Early defect prediction

STAR Automatically Generates An Early Defect Prediction Curve

- Calculates defect densities (defects / effort) at D1 & D2 from previous release and derive targets at D1 & D2 for current release
- Transform the effort curve into a defect prediction curve using a non-linear optimization method
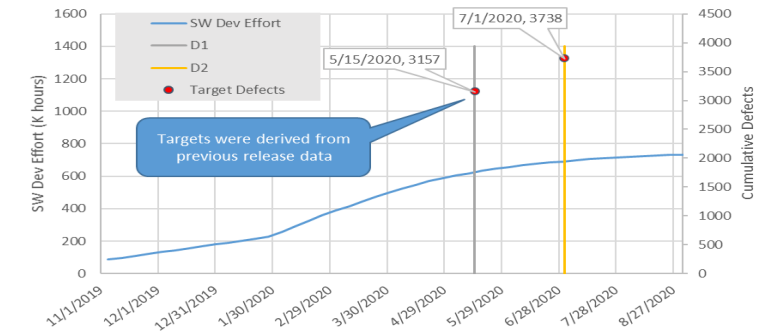
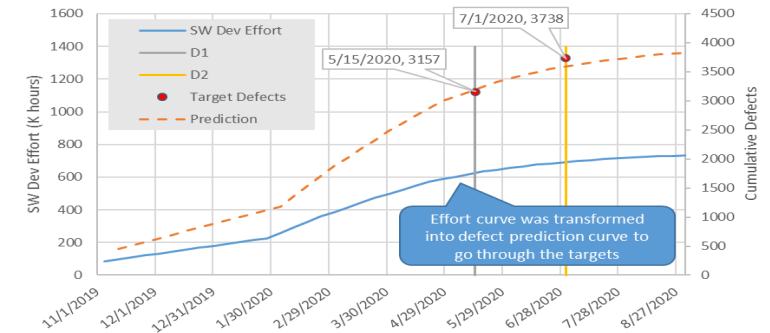**Transformation Function**

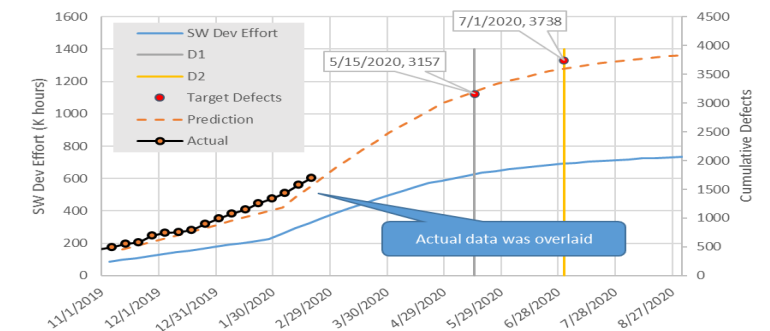Horizontal shift: $x_{new} = a + b \, x$

Vertical shift: $y_{new} = c \, y$

Target Defects vs. Effort Data

Early Detect Prediction vs. Effort Data

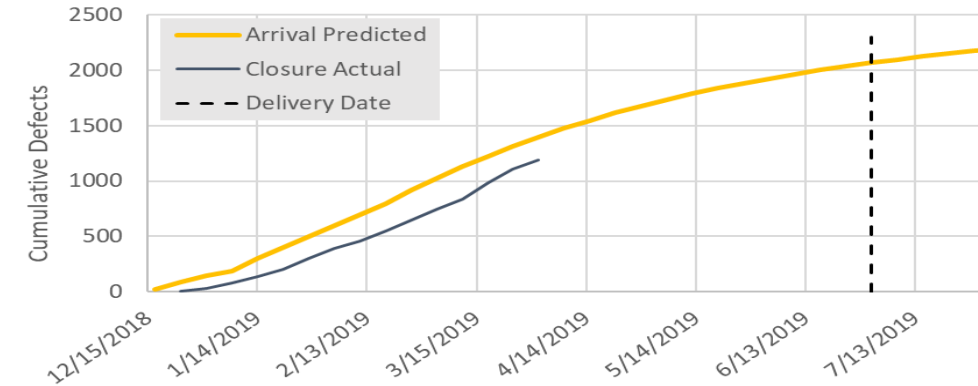**Early Defect Prediction vs. Actual Data Overlaid**
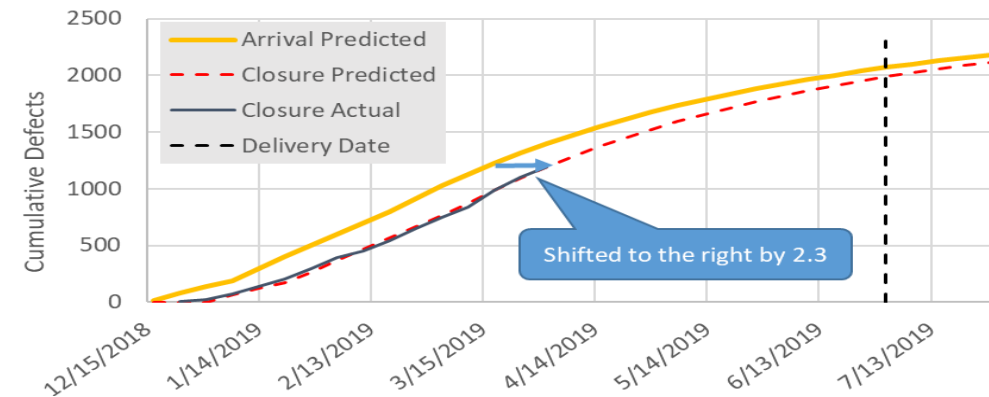
STAR Core Engine (3) – Closure Curve prediction

STAR Automatically Generates A Closure Prediction Curve

- Apply the same transformation algorithm using an arrival curve as the leading data

- This is a special case where b = 1 & c = 1

Project A:
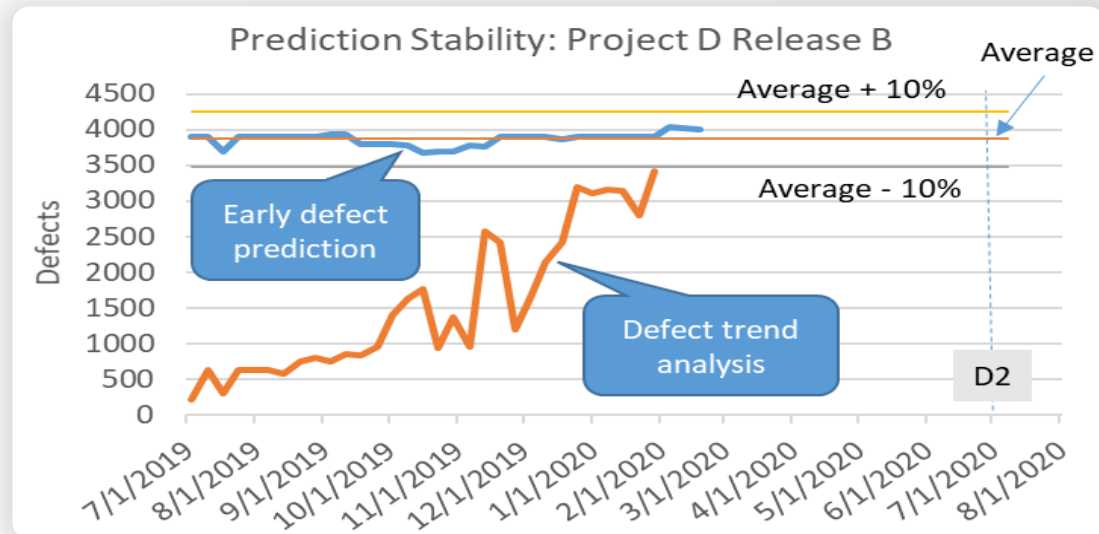**Arrival Prediction vs. Closure Actual**

Project A:
Closure Prediction vs. Actual

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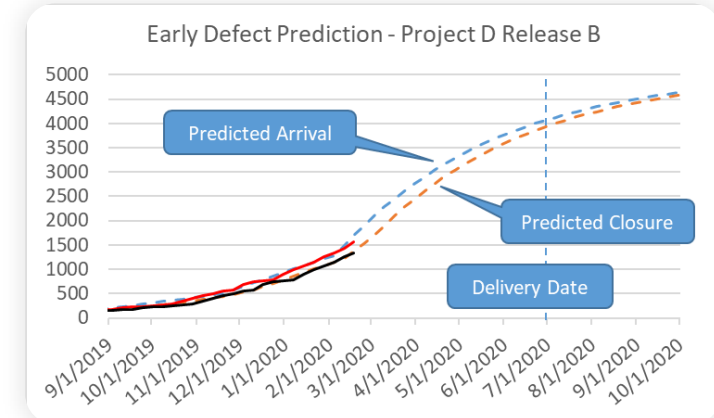
12

Prediction Stability And Accuracy

The power of development and test effort data with previous release data to improve the prediction stability and accuracy

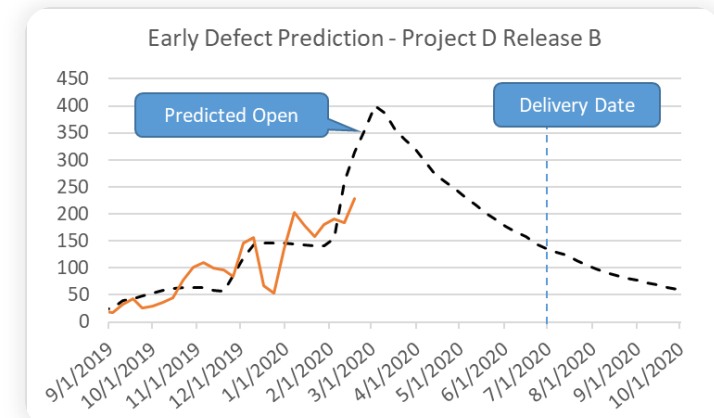**Tracking defects predicted at D2 as new data becomes available**

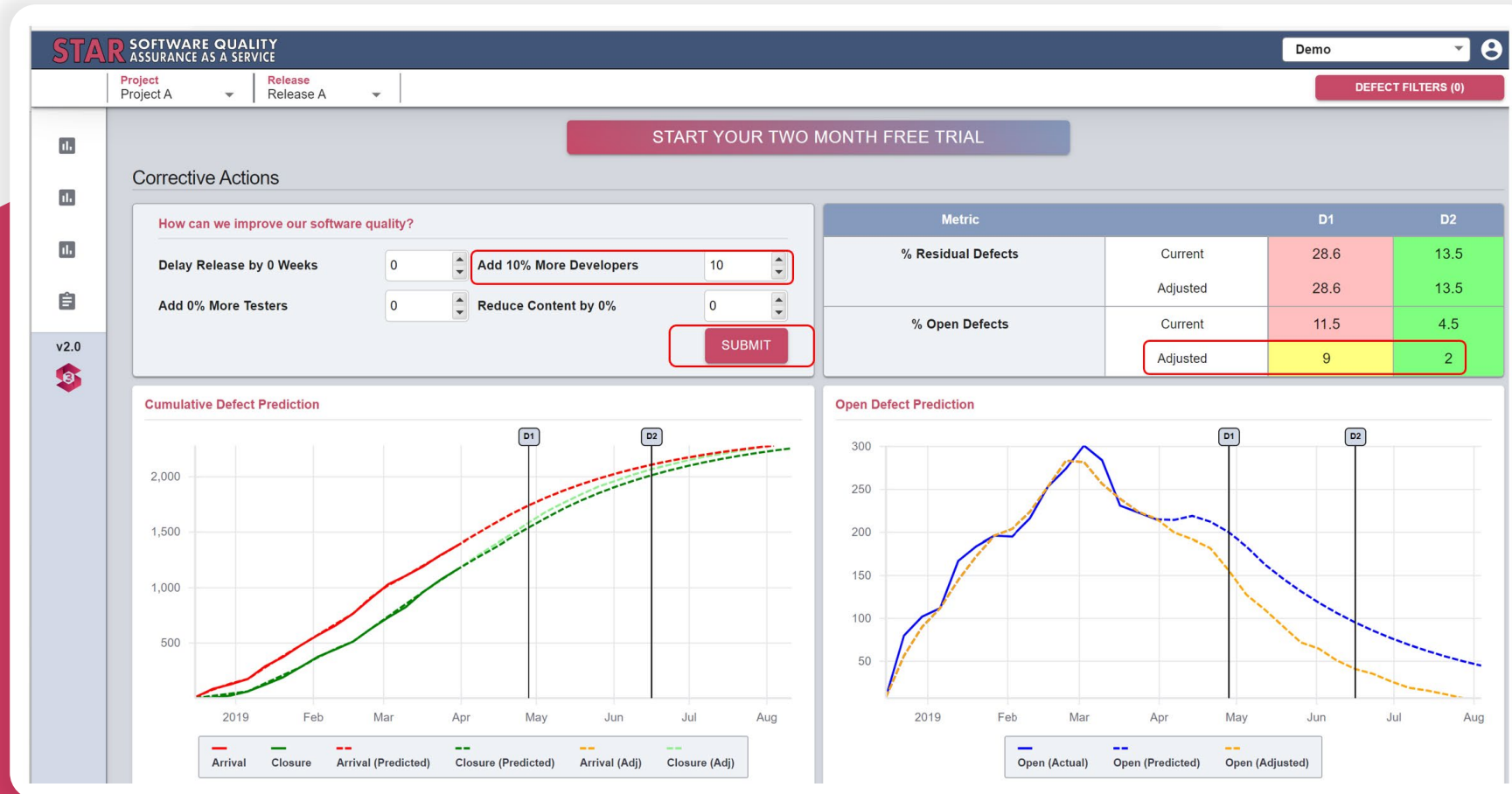**Arrival & Closure Defect Predictions**

Open Defect Prediction

Corrective Actions
What can you do to improve your software quality?

STAR quantifies the quality impact of four corrective actions in real-time

User Inputs - Release Parameters

Under our User Input Menu, follow our Release Config tab to enter your release parameters

By clicking under the "D1 Date" or "D2 Date" fields you will be prompted with a calendar box which will help you specify the desired dates. (You can manually enter the dates as well)

User Inputs - Uploading Defect & Effort Data

01 Create a .csv file with your own defect data following the template format.

02 Click "Choose CSV File".

03 Following the instruction, identify the folder location and select the csv file to upload.

04 Click "Open" & "Upload Defects/Effort" for STAR to upload the csv file(s).

05 You are now ready to specify D1 & D2 dates in Input Parameters if it's not done so.

Under our User Input Menu you will find our Release Config page

STAR SOFTWARE QUALITY ASSURANCE AS A SERVICE

Project	Release
Project C	Release B

Defect Trend

Leading Data (PPM)

Leading Data (IPM)

User Inputs

Release Config

v1.3

Privacy Policy

Contact Us

Free Trial

Upload Defect Data   Download Sample Defects

CHOOSE CSV FILE   Template_Defect_Input_Data.csv

UPLOAD DEFECTS

✓ Uploaded Successfully @ *2021-10-19 14:53:37 UTC*
Template_Defect_Input_Data.csv has been uploaded and **133 items** have been processed. *(3de253f2-4962-42b9-ac92-dabae86eb8dd)*

Upload Effort Data   Download Sample Effort

CHOOSE CSV FILE   No file chosen

UPLOAD EFFORT

⚠ No Data Uploaded
It looks like you haven't uploaded any effort data yet. Use the uploader above to get your first dataset uploaded! If you require any assistance you can Contact Us at any time.

Download sample Defect/Effort data with template formatting here

Consolidate the data you're importing into an CSV file then upload it here

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16

User Inputs – Sample Defect Data Format

defect_id	component	severity	arrival_date	closure_date
B1-1	Component A	Major	2018-11-20	
B1-2	Component G	Major	2018-11-30	
B1-3	Component D	Major	2018-12-05	2018-12-11
B1-4	Component G	Critical	2018-12-13	
B1-5	Component B	Major	2018-12-15	2018-12-27
B1-6	Component C	Major	2018-12-15	
B1-7	Component A	Major	2018-12-15	
B1-8	Component G	Critical	2018-12-16	
B1-9	Component A	Major	2018-12-16	2018-12-20
B1-10	Component B	Major	2018-12-17	2018-12-21
B1-11	Component B	Major	2018-12-17	2018-12-27
B1-12	Component E	Major	2018-12-17	
B1-13	Component B	Major	2018-12-17	2018-12-25

STAR in Action – Sample Outputs

Main Page - Executive Summary

Select your company. By default, every user has access to the Demo company data. After signing up for an account you will have the ability to try STAR with your own company data.

Executive Summary Info

D1
Delivery for trial.*

D2
Delivery for commercial deployment.*

Defects
Frequently referred to as faults or bugs, a defect represents an error, flaw, or failure in a computer program or system that causes it to produce an incorrect or unexpected result, or to behave in an unintended way.

Arrival
Defects found or reported by testers or customers.

Closure
Software fixes completed and verified.

Open Defects
Defects that are still open - i.e. Arrival - Closure

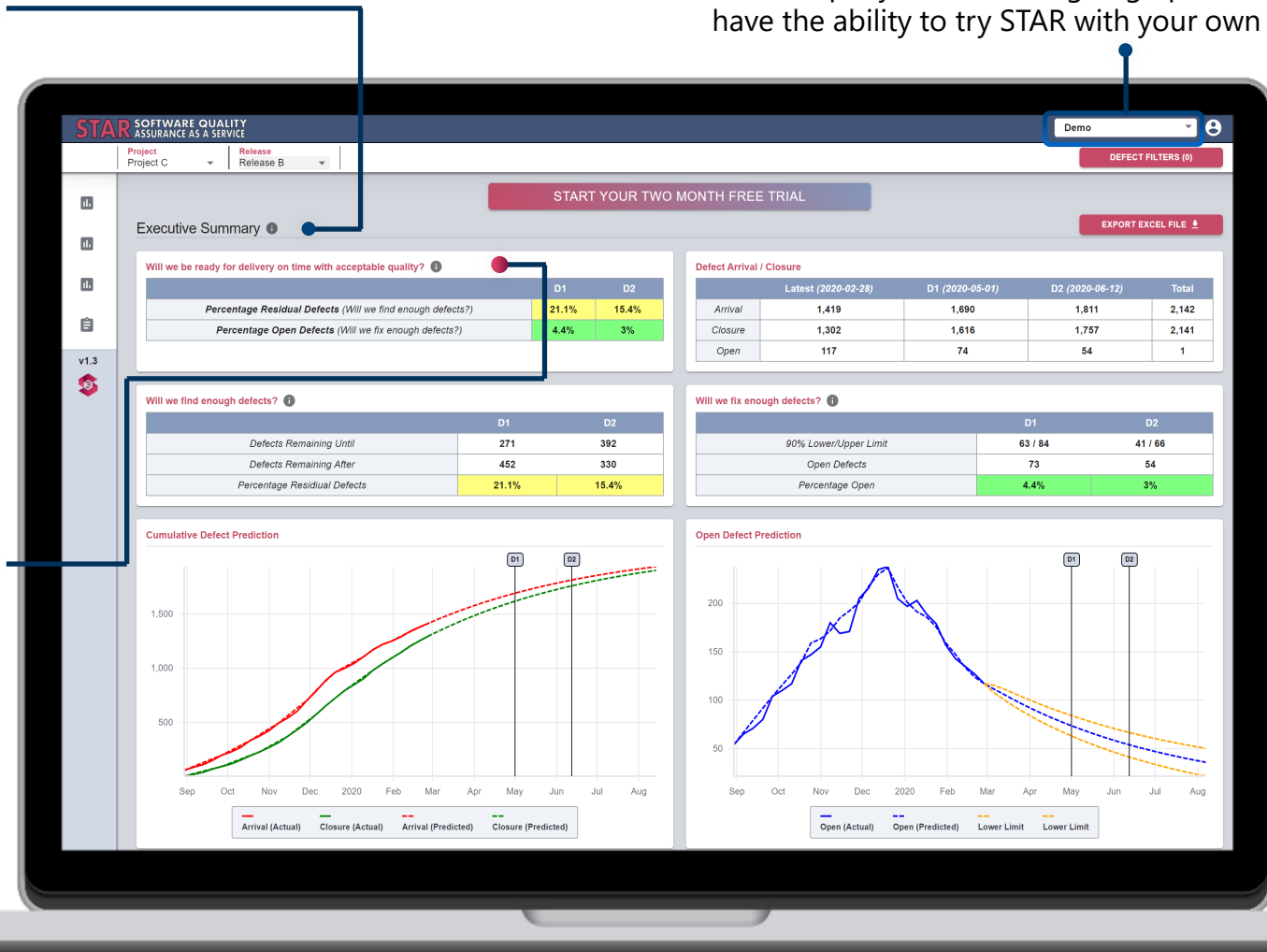* To facilitate prediction, dates may not align exactly with dates set in configuration.

Will we be ready for delivery on time with acceptable quality?

Color	Meaning
Red	At Risk
Yellow	Warning
Green	Acceptable

Note:
Percentage Residual Defects = Defects Remaining After / Total Defects
Percentage Open = Open Defects / Defects Arrived

STAR in Action

Main Page - Executive Summary (Continued..)

Software Quality Assurance Metrics:

A table with an overall quality summary: It summarizes an overall assessment of release quality based on currently available data

%Residual defects and %Open defects at delivery are used to compare against the target values, where we use two delivery milestones (D1 & D2):

Target values for "Green (Acceptable)", "Yellow (Warning)" and "Red (At Risk)" in %Residual and %Open are chosen based on our past experience with various projects and releases. These target values can be adjusted based on specific project expectations.

Visual presentation of defect arrival, closure and open will help capture the trends and the tables will help identify values at key milestones.

Will we be ready for delivery on time with acceptable quality?

	D1	D2
Will we find enough defects? - % Residual Defects	19	15
Will we fix enough defects? - % Open	5.7	3.5

Notes: % Residual Defects = [Defects Remaining After] / [Total Defects]   % Open = [Open Defects] / [Defects Arrived]

Will we find enough defects?

	D1	D2
Defects Remaining Until	NA	NA
Defects Remaining After	360	284
% Residual Defects	19	15

Dates		Current 2019-12-27	D1 2019-11-15	D2 2019-12-13	Total Infinity
Defects	Arrival	1,645	1,538	1,614	1,898
	Closure	1,586	1,450	1,558	-1,417
	Open	59	88	56	3,315

Will we fix enough defects?

	D1	D2
90% Lower/Upper Limit	NA	NA
Open Defects	87	55
% Open	5.7	3.5

Will we be ready for delivery on time with acceptable quality?

Color	Meaning
Red	At Risk
Yellow	Warning
Green	Acceptable

Will we find enough defects?

Color	Threshold
Red	> 25
Yellow	>= 15
Green	< 15

Will we fix enough defects?

Color	Threshold
Red	> 10
Yellow	>= 5
Green	< 5

STAR in Action

Defect Filters for Components & Severity

DEFECT FILTERS (2)

Components	Severities
☐ Component A	☑ Critical
☑ Component B	☐ Major
☐ Component C	☐ Minor

Project
Project A

Release
Release A

START YOUR TWO MONTH FREE TRIAL

Executive Summary ⓘ

Will we be ready for delivery on time with acceptable quality? ⓘ

	D1	D2
Will we find enough defects? - % Residual Defects		
Will we fix enough defects? - % Open		

Notes: % Residual Defects = [Defects Remaining After] / [Total Defects]   % Open = [Open Defects] / [Defects

Dates

Defects

For each view, additional filters for **component** and **severity** are provided for a given **project & release** to Suit All Users from Developers to Exec.

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STAR in Action
Defect Trend Menu - Multiple Output Views Available

01 **Executive summary**
Provides a summary of key software quality assurance metrics

02 **Corrective actions**
Includes two corrective actions: delay delivery date and add developers for bugfixes. It will interactively quantify the improvement in %Residual and %Open for respective actions.

03 **Arrival/closure**
Provides a weekly view of arrival and closure defects with actual and prediction.

04 **Defects by component**
Provides a breakdown to help identify problematic components.

05 **Defects by severity**
Provides a breakdown to help focus on critical and major defects.

06 **Release over release**
Provides the previous and current release defect data that is normalized by the delivery date. We will provide a visual output for users to compare the Current vs. Previous release data.

07 **Prediction stability**
This showcases the accuracy of the STAR model. It should show that our predictions for the final number of defects in your software on deployment becomes very close to the final actual value many weeks before the actual deployment.

Thank you!

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3S (sakurasoftsolutions.com)