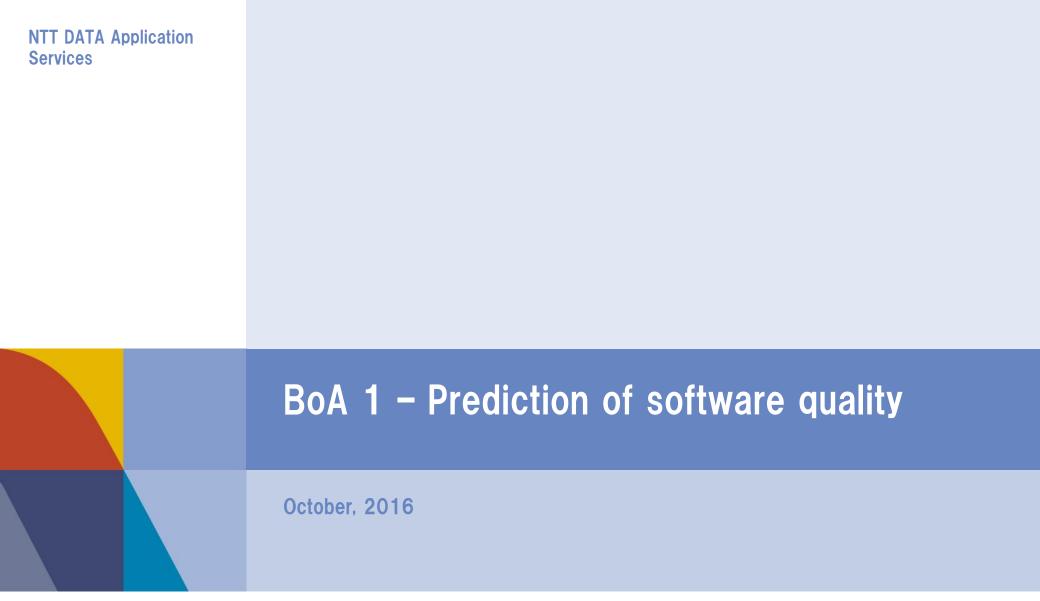
NTT DATA Application Services



CRESTA Use Cases

Oct - Nov, 2016







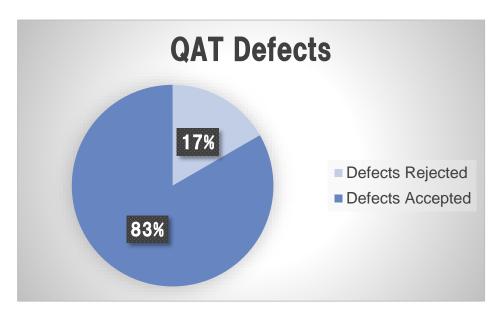
CRESTA - Questionnaire?

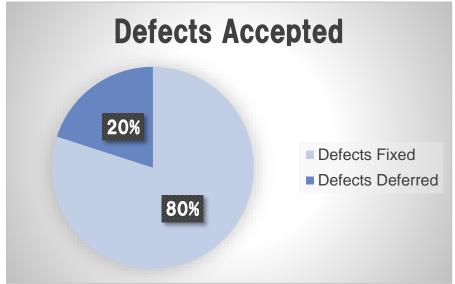


Use Case No.	Role	Question	Use Case Name
MVP¥1	Test Lead	What will be the defect density in future?	Predict defect metrics
1A	Test Lead	What will be the defect acceptance rate in future?	Predict defect metrics
1B	Test Lead	What will be the defect deferral rate in future?	Predict defect metrics
10	Test Lead	What will be the overall defects count in future?	Predicted All Defects vs. Actual All Defects
1D	Test Lead	What will be the functional defects count in future?	Predicted Functional Defects vs. Actual Functional Defects.

QAT Terminologies & Machine Learning algorithms







Machine Learning Algorithm:

1. Linear Regression

Linear Regression algorithm shows the relationship between 2 variables and how the change in one variable impacts the other. The algorithm shows the impact on the dependent variable on changing the independent variable.

Predictors - Parameters that decide predicted values



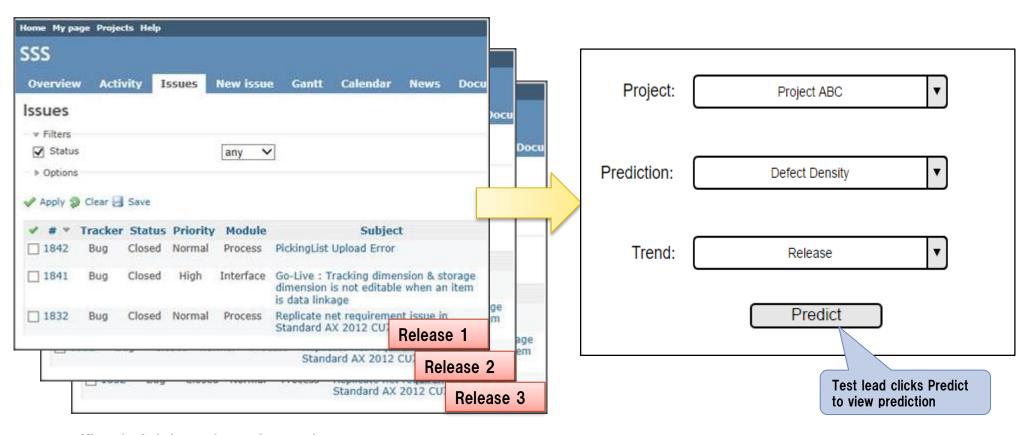
Defect Metrics	BoA 1A	BoA 1B	BoA 1C	BoA 1D
Predictors	Defect Acceptance Rate	Defect Deferral Rate	All Defects	Functional Defects
KLOC	✓	×	✓	✓
Test case count	✓	×	✓	✓
Application Complexity	✓	×	✓	✓
Domain knowledge	✓	×	✓	✓
Technical Skills	✓	×	✓	✓
Requirements Query count	✓	×	✓	✓
Code review comments	✓	*	✓	✓
Design review comments	✓	×	✓	✓
Defect Severity	*	✓	×	*
Defect Priority	*	✓	×	*
Effort to fix defect	*	✓	×	*
Cost to fix defect	*	✓	×	*
Availability of Budget to fix defect	*	✓	*	×
Feasibility within milestone	*	✓	*	*
Complexity of defect fix	*	✓	*	*
Impact of defect fix	*	✓	×	*

Trend Parameters
Sprint
Release
Module
Week
Month
Quarter
Year

MVP ¥ 1 - Predict defect density



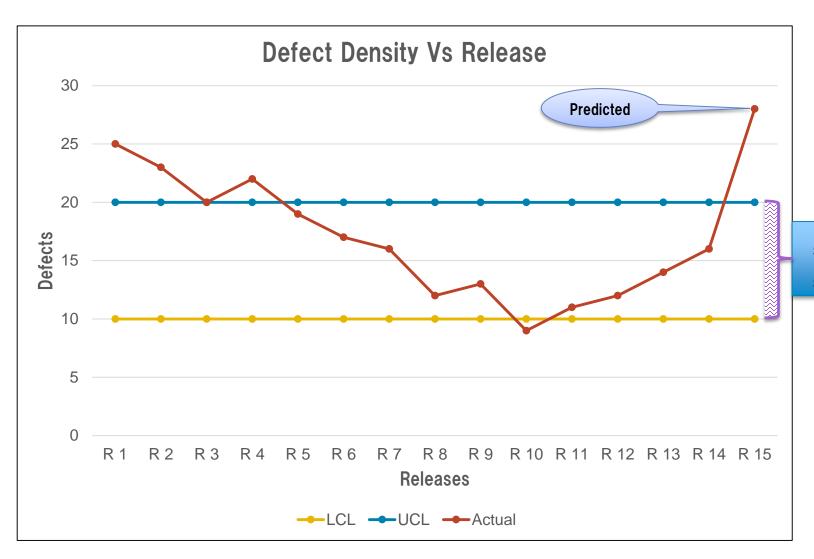
What will be the defect density in future?



Historical defects data release wise

MVP ¥ 1 - Predict defect density





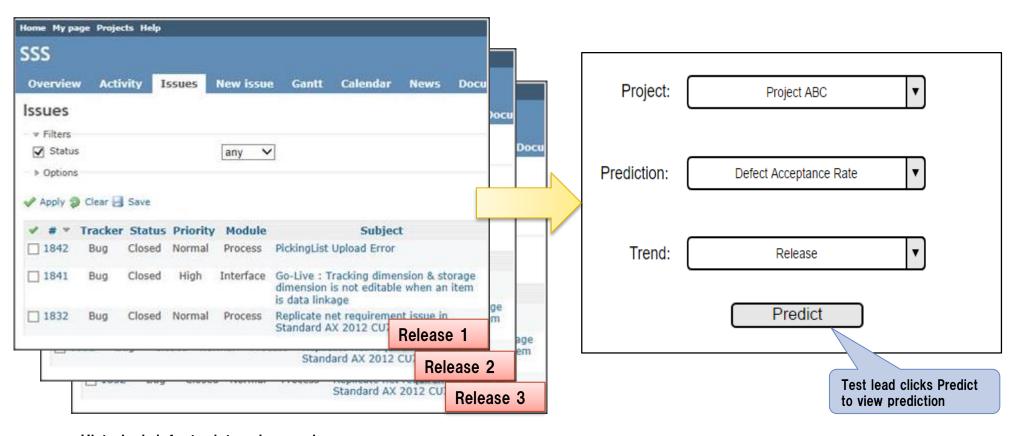
UCL: Mean + 3
Standard deviation
LCL: Mean - 3
Standard deviation

Note - Test lead will analyze based on above predictions

1A - Predict defect acceptance rate



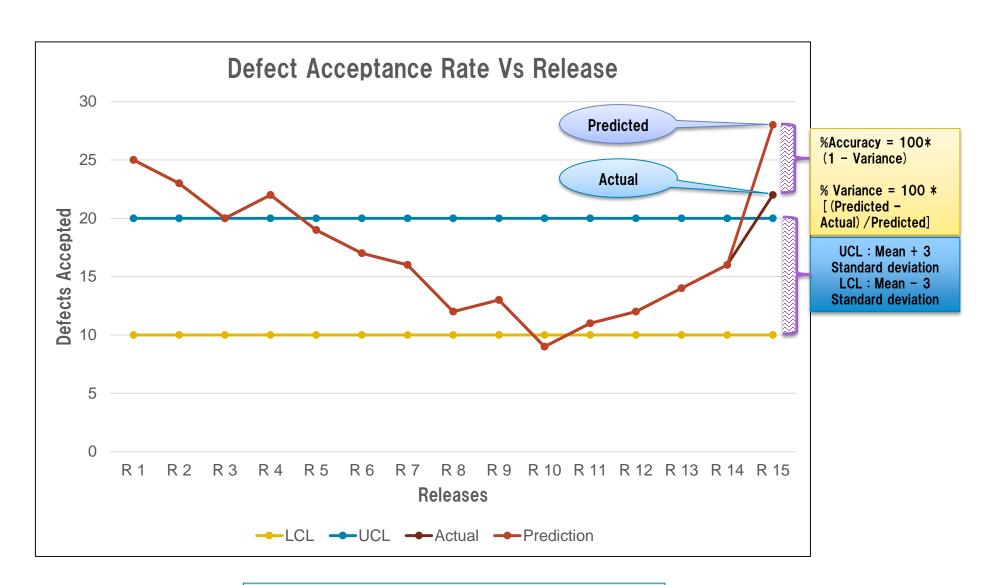
What will be the defect acceptance rate in future?



Historical defects data release wise

1A - Predict defect acceptance rate



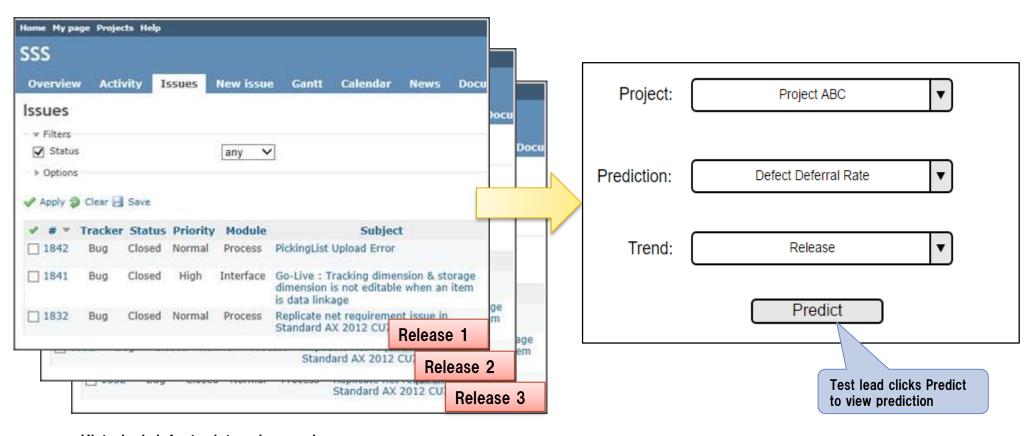


Note - Test lead will analyze based on above predictions

1B - Predict defect deferral rate



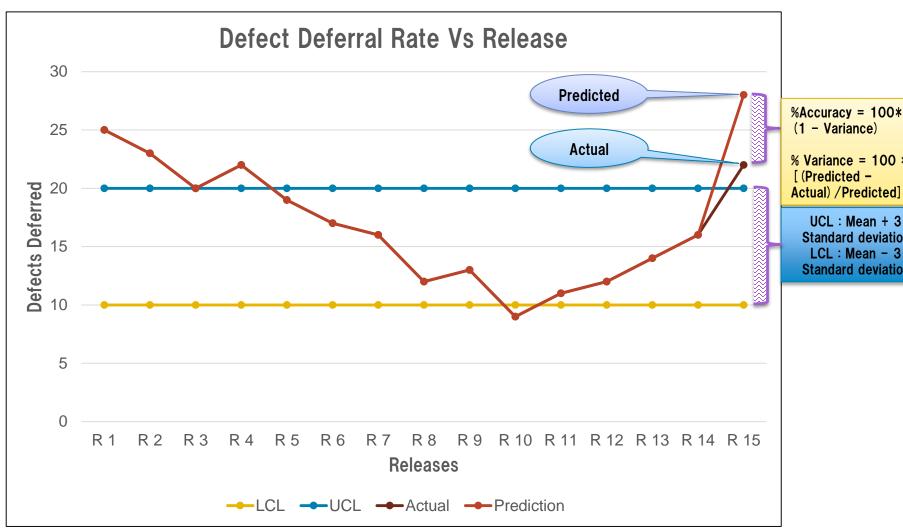
What will be the defect deferral rate in next release?



Historical defects data release wise

1B - Predict defect deferral rate





%Accuracy = 100*

% Variance = 100 * [(Predicted -Actual) / Predicted]

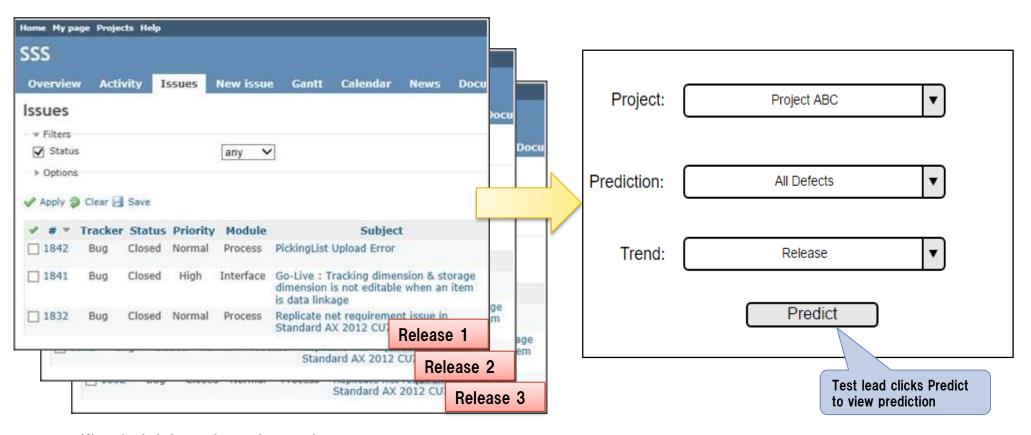
Standard deviation LCL: Mean - 3 Standard deviation

Note - Test lead will analyze based on above predictions

1C - Predicted all defects vs. Actual all defects



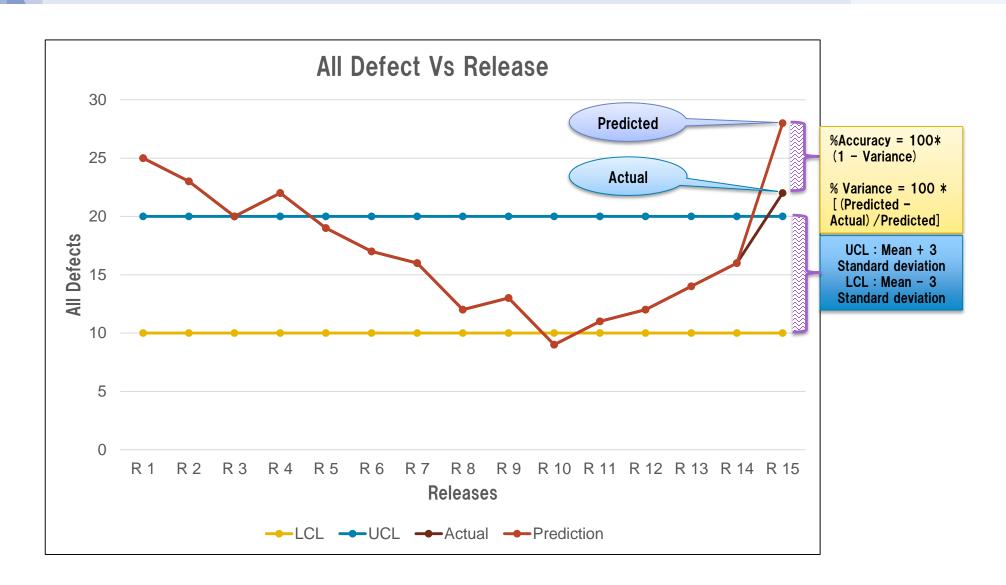
What will be the overall defects count in future?



Historical defects data release wise

1C - Predicted all defects vs. Actual all defects



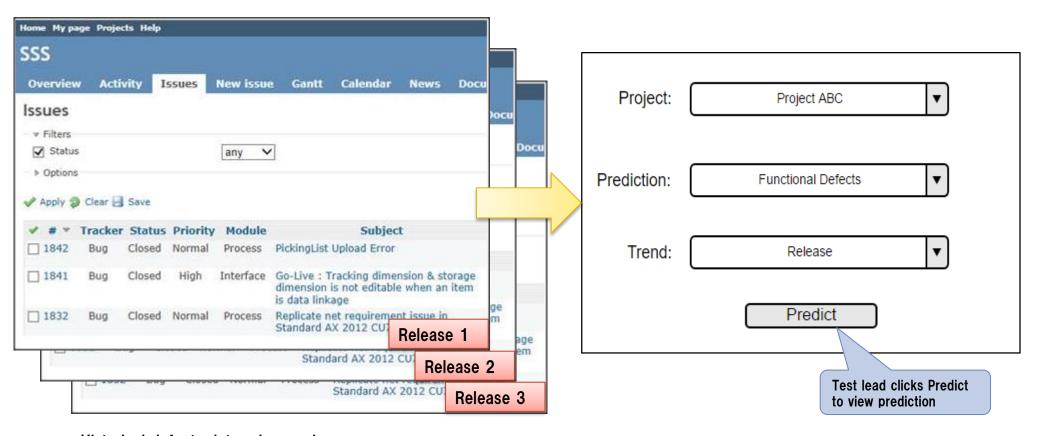


Note - Test lead will analyze based on above predictions

1D - Predicted functional defects vs. Actual functional defects



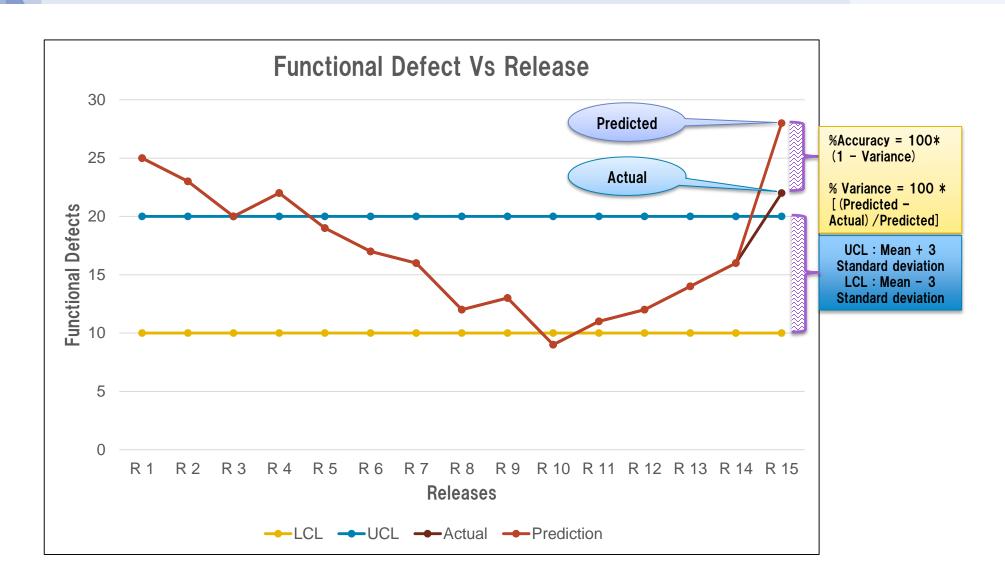
What will be the functional defects count in future?



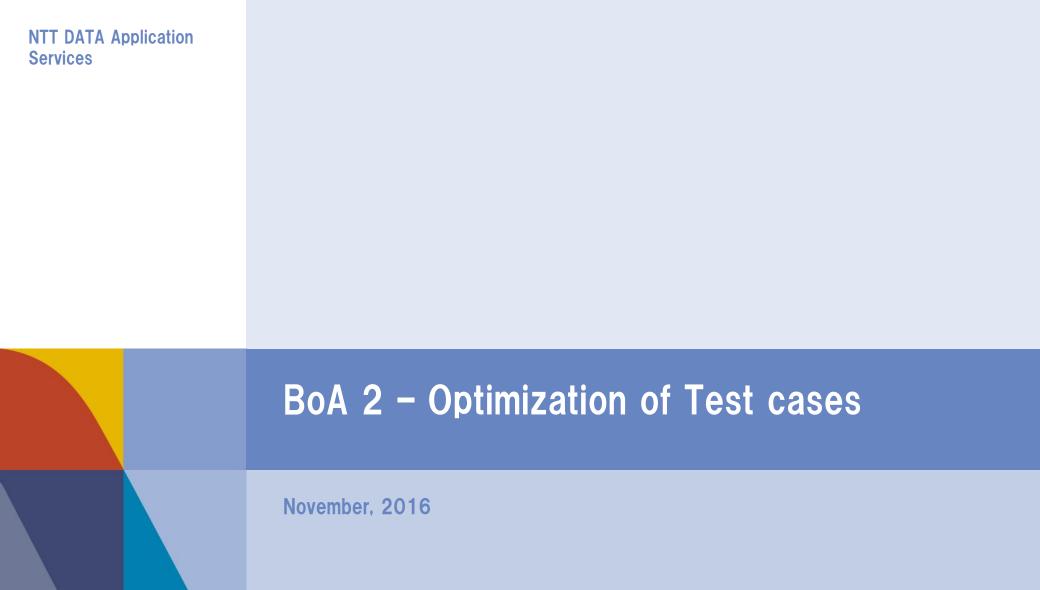
Historical defects data release wise

1D - Predicted functional defects vs. Actual functional defects





Note - Test lead will analyze based on above predictions





CRESTA - Questionnaire?



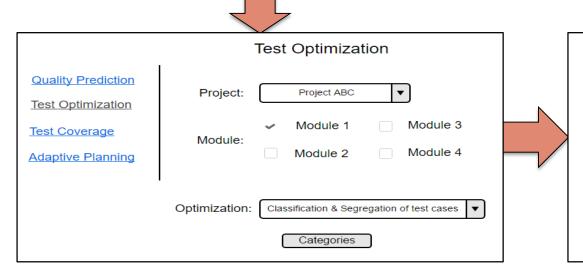
Use Case No.	Role	Question	Use Case Name
MVP	Test Manager	What is the percentage of functional test cases?	Segregate Test Cases
2	Test Lead	How much Testing Overlap is there in module 1?	Identify Testing Overlaps
2A	Test Manager	Is there any redundancy in testing efforts across modules?	Reduce duplicate testing efforts across modules.

MVP - Classify and Segregate Test cases



Test Cases

T (C D (ID	T C	B 154	T (C D)	T . C.	T . (C	5 (18 %
Test Case Reference ID	Test Scenario	Precondition	Test Case Description	Test Step	Test Case	Expected Results
1	User successfully predicts	1.User has logged	This is to verify that	1	TL user goes to "Home" page	On load of the Home page, system loads following
	Defect Density Release Wise.	into the system	the TL user can		to input prediction	data
		with TL/PM Role	predict using CRESTA		conditions.	1. Project dropdown with project list from the
		and is on the home	as per the Prediction			database applicable (accessible) to logged in User
		page.	"Defect Density" and			2. Prediction Questions dropdown with prediction
		2.CRESTA is	Trend "Release"			questions.
		connected to	selected			3. Trend Parameters dropdown is populated with
		external defect				either or both of the values "Release wise" and
		repository Red				"Module wise" depending upon the prediction
		mine				question selected.
				2	TL User selects project	Single project gets selected
				3	TL User selects "Defect	The prediction question "Defect Density" should get
					Density" as prediction	displayed
					question	
				4	TL User selects "Release" as	The trend parameter "Release" should get
					trend parameter	displayed.



Test Optimization Project - ABC Module - 1 Test case Type Automated Scenario Type Classify & Segregate

MVP - Classify and Segregate Test cases



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Project - ABC Module - 1

Classification & Segregation of test cases

Automated

Test case Type

Scenario Type

▼ Automated	▼ Manual
TC0012	TC0045
TC0111	TC0123
TC0188	TC0356
TC0656	TC04412

▼ Functional	▼ Usability	▼ Performance	▼ DB
TC0012	TC0045	TC0155	TC0456
TC0111	TC0123	TC0589	TC0328
TC0188	TC0356	TC0845	TC0578
TC0656	TC0412	TC0725	TC0752

▼ Positive	▼ Negative
TC0312	TC0041
TC0411	TC0143
TC0184	TC0326
TC0676	TC0422

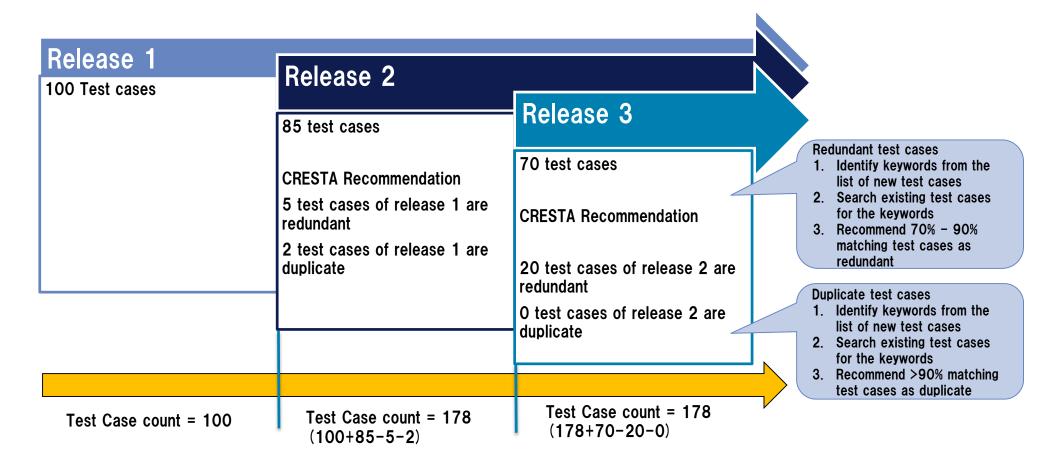
Export

Export

Export

Use case BoA 2 - Identify testing overlaps





Before increasing test suite size, CRESTA will identify & recommend to eliminate duplicate & redundant test cases with the help of text analytics classification algorithms of machine learning

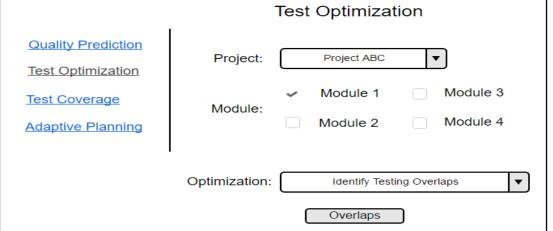
Accomplished by comparing new test cases (current release n) with existing suite of test cases (up to previous release n-1)

Reference: http://www0.cs.ucl.ac.uk/staff/M.Harman/stvr-shin-survey.pdf, Section 2.1 & 2.2

Use case BoA 2 - Identify testing overlaps



est Cases								
T (C D (ID	T . (C	D 199	T (C D) (T . C.	T 46	5 (10 %	Ţ	Expected Results
Test Case Reference ID	Test Scenario	Precondition	Test Case Description	Test Step	Test Case	Expected Results	e" page	On load of the Home page, system loads following
1	User successfully predicts Defect Density Release Wise.	with TL/PM Role and is on the home page. 2.CRESTA is	This is to verify that the TL user can predict using CRESTA as per the Prediction "Defect Density" and Trend "Release" selected	1	TL user goes to "Home" page to input prediction conditions.	On load of the Home page, system loads following data 1. Project dropdown with project list from the database applicable (accessible) to logged in User 2. Prediction Questions dropdown with prediction questions. 3. Trend Parameters dropdown is populated with either or both of the values "Release wise" and "Module wise" depending upon the prediction question selected.		data 1. Project dropdown with project list from the database applicable (accessible) to logged in User 2. Prediction Questions dropdown with prediction questions. 3. Trend Parameters dropdown is populated with either or both of the values "Release wise" and "Module wise" depending upon the prediction question selected.
				2	TL User selects project	Single project gets selected	ct	Single project gets selected
				3	TL User selects "Defect Density" as prediction question	The prediction question "Defect Density" should get displayed	ect n	The prediction question "Defect Density" should g displayed
				4	TL User selects "Release" as trend parameter	The trend parameter "Release" should get displayed.	ase" as	The trend parameter "Release" should get displayed.
New tes	t cases				Test Optim	nization		Existing test cases



Use case BoA 2 - Identify testing overlaps



Overlap inside Module 1 between Existing & New test cases

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Project - ABC Module - 1

Identify Testing Overlaps

Redundant test cases

- 1. If match of keywords is between 70 90%
- 2. Criterion is configurable

Redundant test cases

▼ New	▼ Existing
TC0012	TC0045
TC0111	TC0123
TC0188	TC0356
TC0656	TC04412

Export

Duplicate test cases

▼ New	▼ Existing
TC0312	TC0041
TC0411	TC0143
TC0184	TC0326
TC0676	TC0422

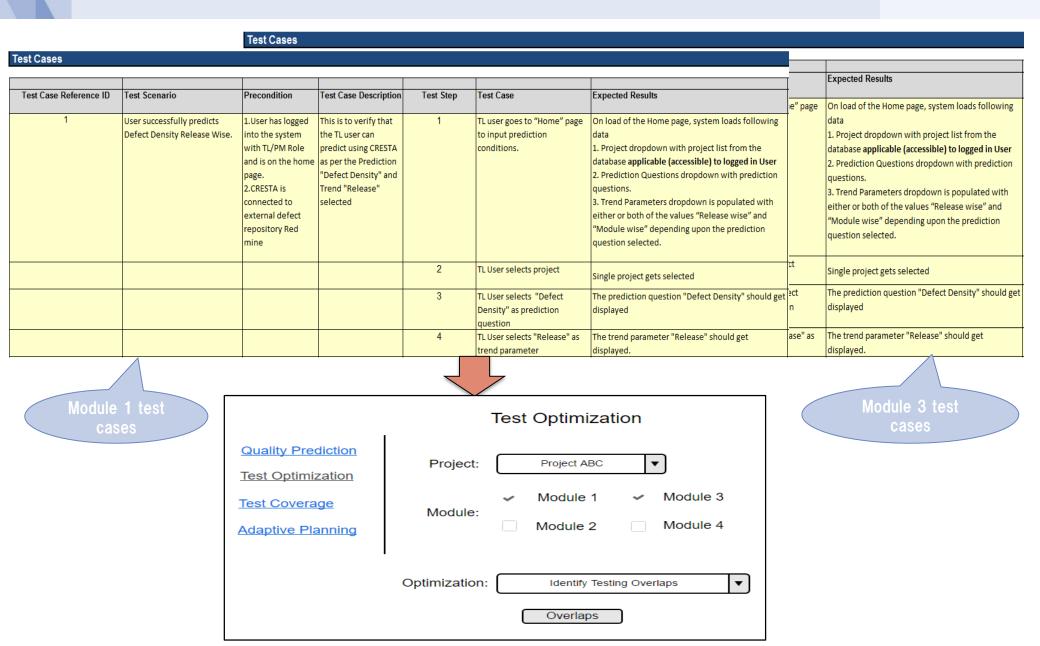
Export

Duplicate test cases

- 1. If match of keywords is > 90%
- 2. Criterion is configurable

Use case BoA 2A - Reduce duplicate testing efforts across teams





Use case BoA 2A - Reduce duplicate testing efforts across teams



Overlap between Module 1 & Module 3

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Project - ABC

Identify Testing Overlaps

Redundant test cases

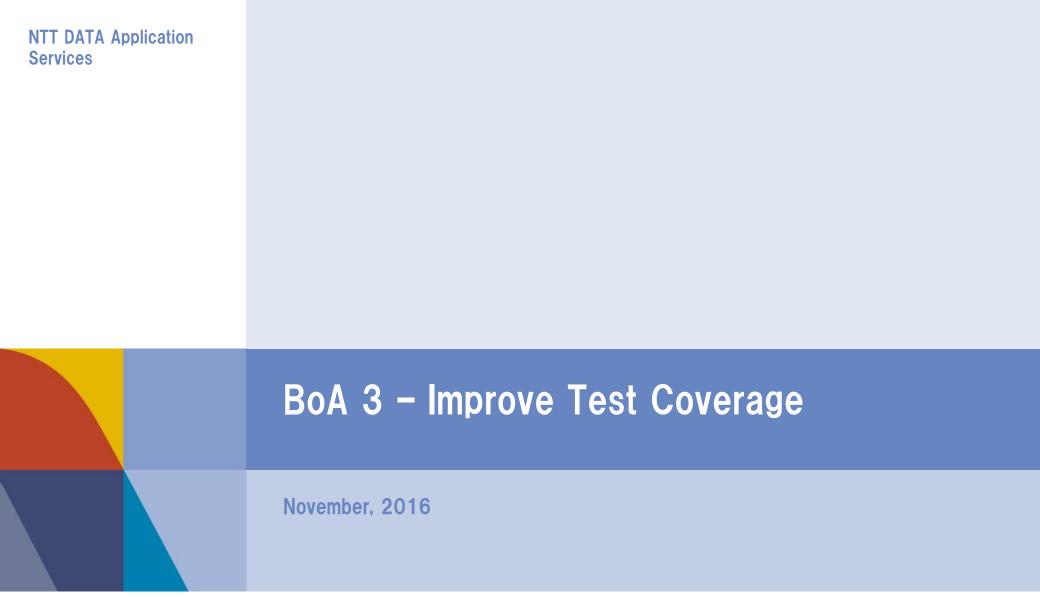
▼ Module 1	▼ Module 3
TC0012	TC0045
TC0111	TC0123
TC0188	TC0356
TC0656	TC04412

Export

Duplicate test cases

▼ Module 1	▼ Module 3
TC0312	TC0041
TC0411	TC0143
TC0184	TC0326
TC0676	TC0422

Export





CRESTA - Questionnaire?

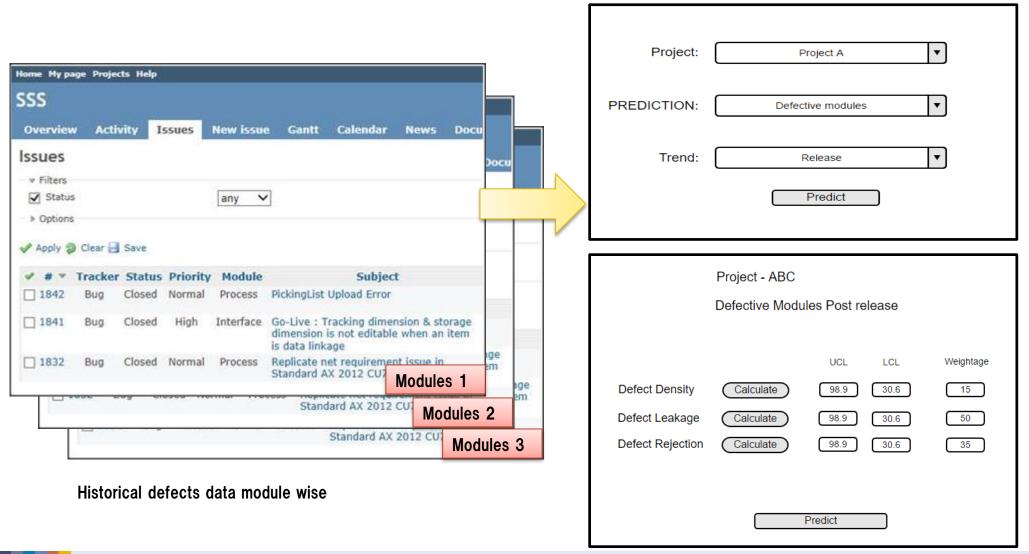


Use Case No.	Role	Question	Use Case Name
MVP	Test Manager	Which application areas require more attention?	Predict Defective Modules
3	Test Manager	Which requirements should be covered more adequately?	Identify scope for adequate test coverage of defective modules
3A	Test Manager	Are these test cases effective in terms of identifying defects?	Measure adequacy & efficiency of test cases
3B	Test Manager	Which application modules require more test cases?	Measure adequacy & efficiency of test cases for high risk modules

MVP - Predict Defective Modules



Which modules will have difficulties during and after release?

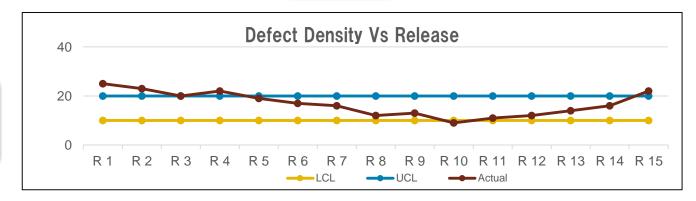


MVP - Predict Defective Modules



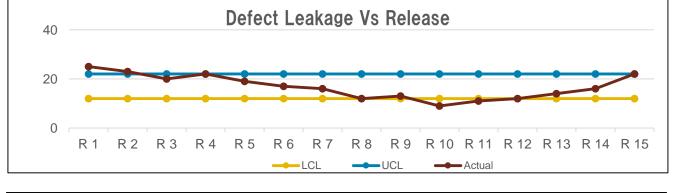
Modules 2

Module2
Weighted average prediction Score =
[(DD * Weight) + (DL * Weight) +
(DR * Weight)] /No of metrics

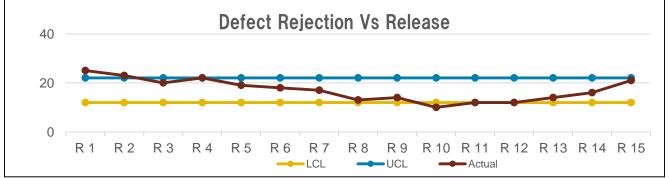


High Risk	Risk	Normal
Module 3	Module 2	Module 1
Module 5		Module 4
	^	

Project manager selects a module to see details



Note - R15 data is predicted data



3 - Identify scope for adequate test coverage of defective modules



Requirements doc

7.6.1. Only one user should be assigned to CRESTA Admin role

CRESTA admin should have permissions to create new project

7.6. CRESTA Admin

Test Cases

7.1. CRESTA should provide interface to setup users & roles. Precondition Test Case Description Test Step Test Case **Expected Results** 7.2. CRESTA should provide four static roles(refer section 3.4 for actors list): 7.2.1. Project Manager(PM) 1.User has logged This is to verify that TL user goes to "Home" page On load of the Home page, system loads following into the system the TL user can to input prediction 7.2.2. Test Lead(TL) with TL/PM Role predict using CRESTA conditions. 1. Project dropdown with project list from the 7.2.3. CRESTA Admin(CA) as per the Prediction database applicable (accessible) to logged in User and is on the home 7.2.4. Guest User(GU) "Defect Density" and 2. Prediction Questions dropdown with prediction page. 7.3. These 4 roles should be 'READ ONLY'. The Permissions of those CANNOT be modified 2.CRESTA is Trend "Release" questions. (Edit/Remove) even by CRESTA Admin connected to selected 3. Trend Parameters dropdown is populated with 7.4. Project Manager external defect either or both of the values "Release wise" and repository Red "Module wise" depending upon the prediction 7.4.1. Project manager should have permissions to define metrics for a project lmine auestion selected. 7.4.2. Project manager should have permissions to configure UCL & LCL for various metrics 7.4.3. Project manager should have permissions to monitor metrics & predictions given by 2 TL User selects project Single project gets selected CRESTA 7.5. Test Lead 3 TL User selects "Defect The prediction question "Defect Density" should get 7.5.1. Test lead should have permissions to configure UCL & LCL for various metrics Density" as prediction displayed question 7.5.2. Test lead should have permissions to monitor metrics & predictions given by CRESTA

4

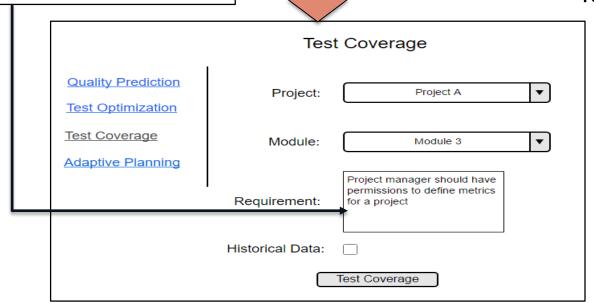
TL User selects "Release" as

trend parameter

Test case Database

displayed.

The trend parameter "Release" should get



3 - Identify scope for adequate test coverage of defective modules



Back Home Logout

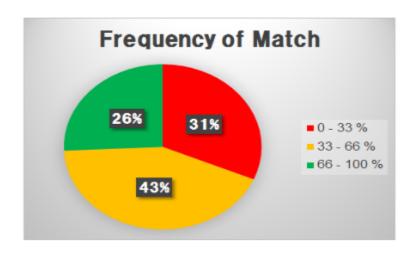
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Project - ABC Module - 3

Identify Test Coverage

Requirement	Bag of words	Frequency of Match %	Test Coverage
Project manager should have permissions to define metrics for a project	Define, metrics	0 - 33	Coverage is poor.
	Permissions	33 - 66	Coverage is average.
	Project, manager	66 - 100	Coverage is good.

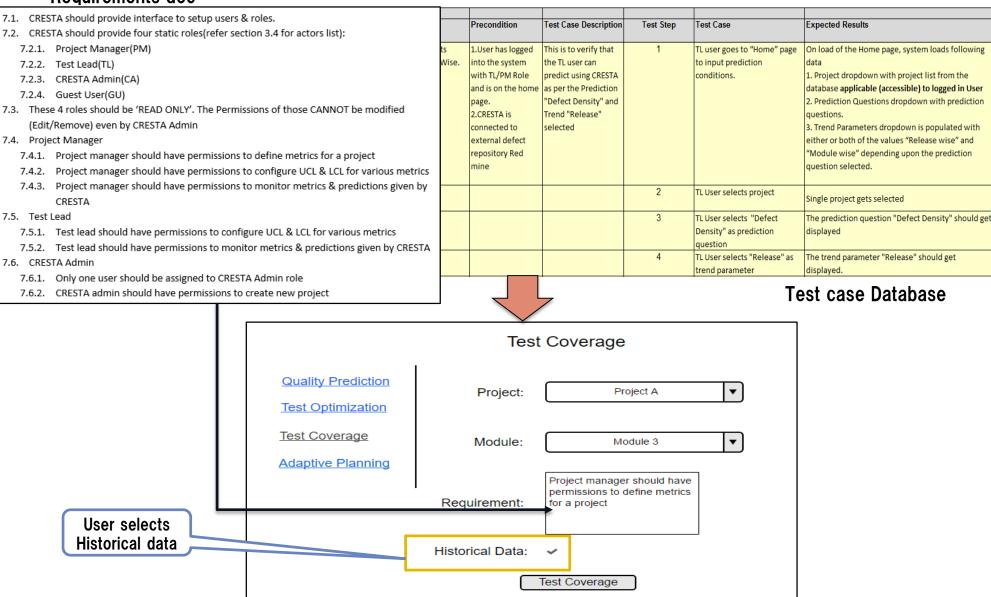


3A,B - Measure adequacy & efficiency of test cases



Requirements doc

Test Cases



3A,B - Measure adequacy & efficiency of test cases



Back Home Logout

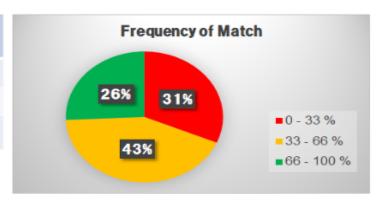
CRESTA

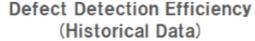
Comprehensive Robotic Engine for Software Test Acceleration

Project - ABC Module - 3

Identify Test Coverage

Requirement	Bag of words	Frequency of Match %	Test Coverage
Project manager should have permissions to define metrics for a project	Define, metrics	0 - 33	Coverage is poor.
	Permissions	33 - 66	Coverage is average.
	Project, manager	66 - 100	Coverage is good.







Analyse efficiency of test cases from historical data



Test Case ID	Test Scenario	Defect Detection score
TC0012	User successfully predicts Defect Density Release Wise.	31
TC0032	User ends up in error message when mandatory validation checks are not performed in home page	37

Historical Test execution data

Severity	Weight age
Minor	1
Major	2
Severe	3
Critical	4

Defect detection score

Count of defects

×

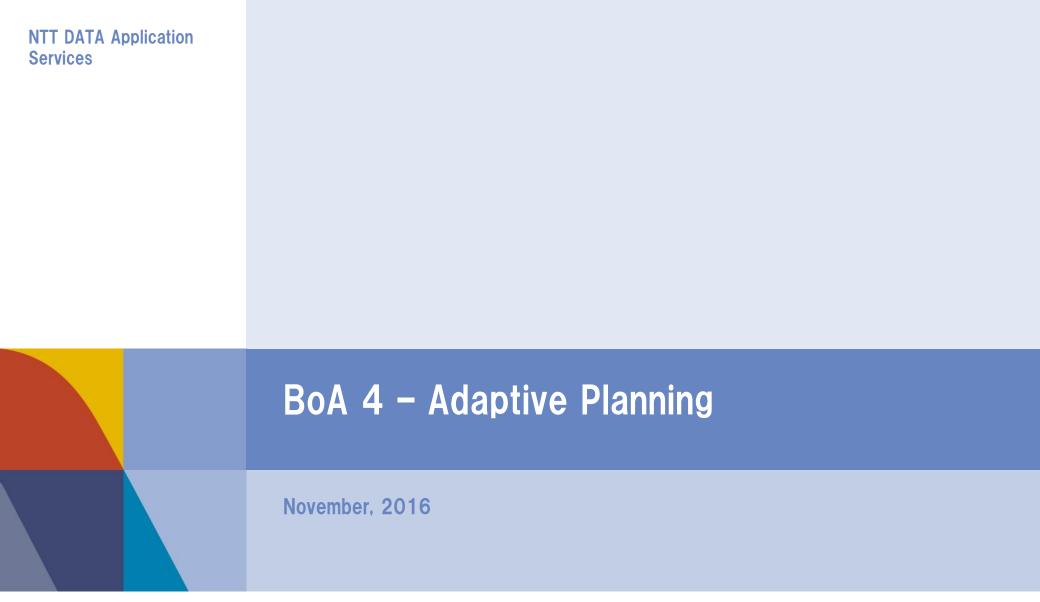
Severity of defects

Test effectiveness (Module 3)

Defect detection score (Module 3)



Defect detection score (All Modules)





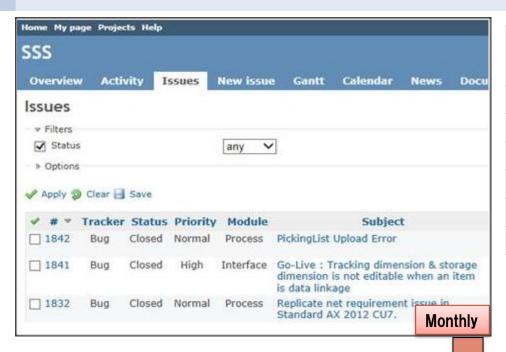
CRESTA - Questionnaire?



Use Case No.	Role	Question	Use Case Name
4	Test Manager	How project quality & efficiency to be improved?	Adjust Test Planning
4A	Test Manager	Scheduled reports?	Centralized reporting to disseminate the analysis to leadership team.

4 - Adaptive Planning





Month	Total efforts (Hours)	Total cost	Schedule varience (Days)	Project ABC Efficiency
Jan	440	\$500	2	
Feb	520	\$600	1	
Mar	480	\$560	0	
Apr	528	\$700	0	
May	400	\$450	1	
Jun	488	\$460	1	

Quality Prediction
Program:
xyz
▼

Test Optimization
Project:
ABC
▼

Adaptive Planning
Trend:
Month
▼

Adaptive Planning

4 - Adaptive Planning



Back Home Logout

CRESTA

Comprehensive Robotic Engine for Software Test Acceleration

Program - xyz

Project - ABC

Adaptive Planning

Month	Quality	Efficiency
Jan		
Feb		
Mar		
Apr		
May		
Jun		
Prediction		

Recommendation: Reduce cost by \$100

4A - Centralized reporting to disseminate the analysis to leadership team



Back Home Logout

CRESTA

Comprehensive Robotic Engine for Software Test Acceleration

Program - xyz

Project - ABC

Adaptive Planning

Month	Quality	Efficiency
Jan		
Feb		
Mar		
Apr		
May		
Jun		
Prediction		

Recommendation: Reduce cost by \$100

Report