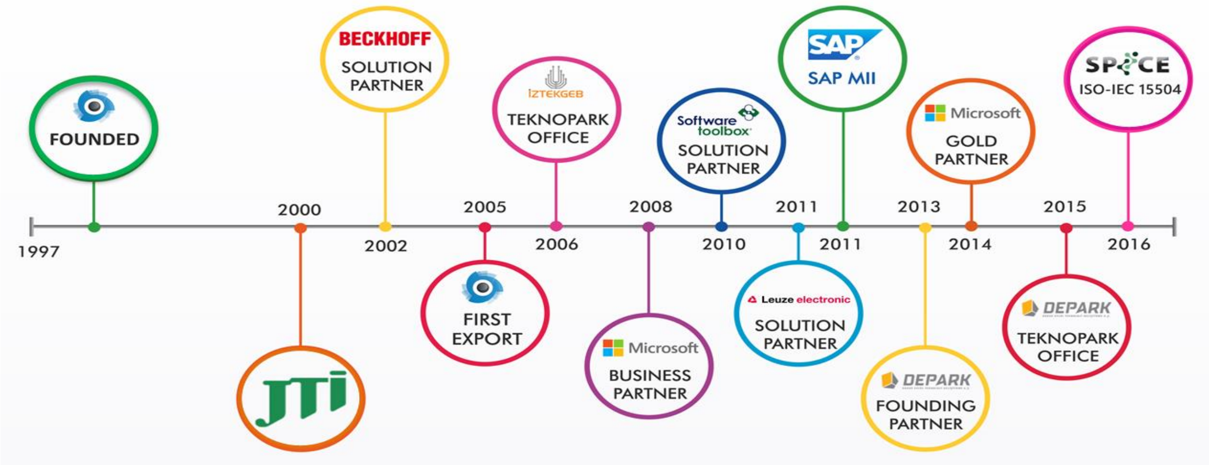
Automated Functional Testing with tSQLt in VSTS

Team : Bihter Günüşen / Çağatay Yıldırım / Damla Şimşek / Gizem Çelik / Tülay Altuntaş
Mentor : Assist. Prof. Tuğkan Tuğlular
Presenter : Zeynep Çağdaş- Quality & Test Specialist
Date : 21.05.2018

About Siskon

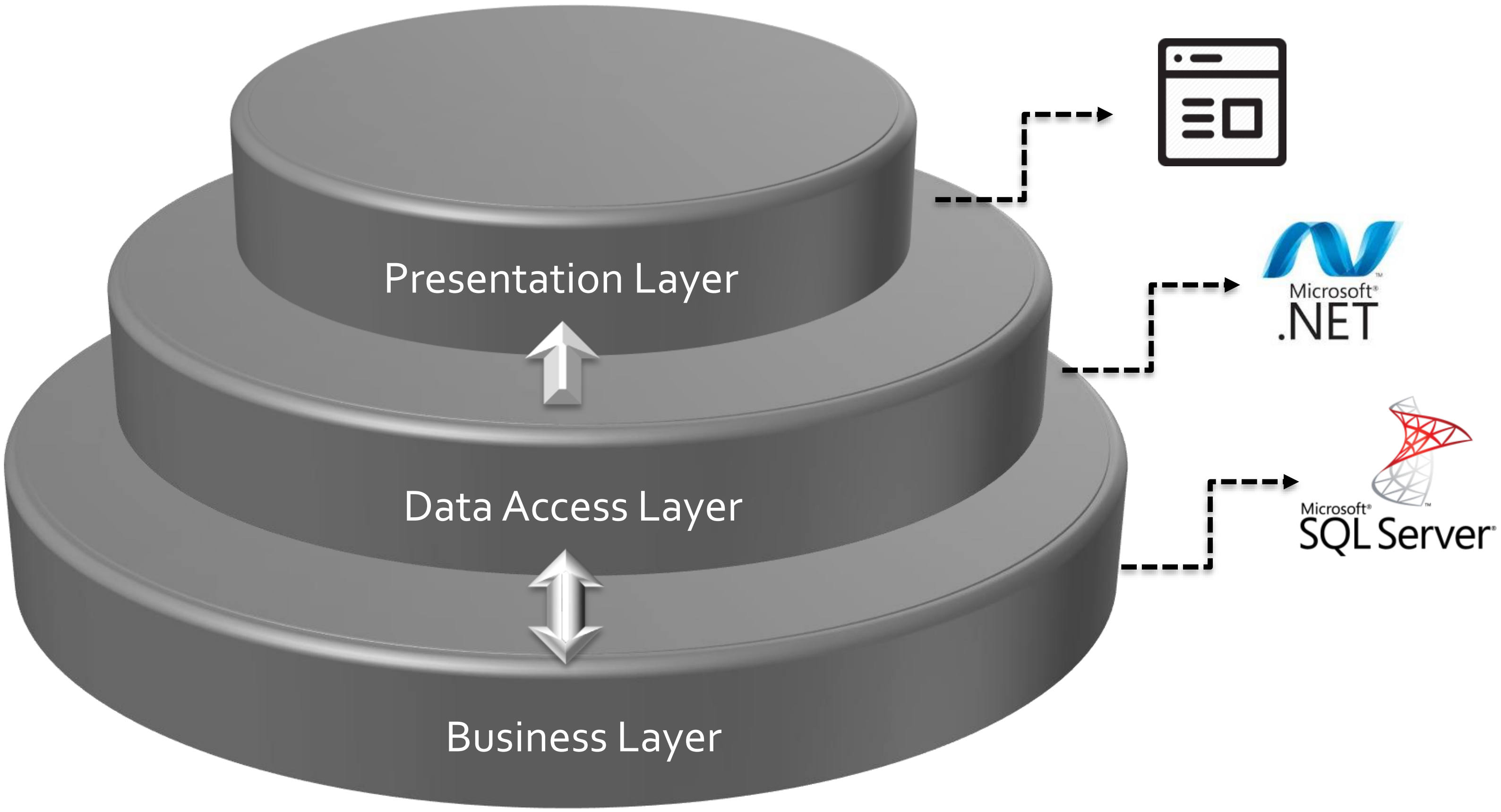
- Founded in 1997
- Leading technology and consultancy company specialized in customized software and automation solutions
- Turn-key projects covering all related mechanical, electrical, cabling, automation and software services
- Major specialties
  - Software Services and Projects
  - Machine & Process Automation
- One of the first ISO/IEC 15504 certificated companies in Turkey.
- 240 + customers worldwide.



Overview of Presentation

- ✓ Test Process Workflow in Siskon
- ✓ Automated Functional Testing with tSQLt in VSTS
  - ✓ Why tSQLt?
  - ✓ Generate Test Cases in MS Project
  - ✓ Why VSTS?
  - ✓ Test Repository in VSTS
  - ✓ Test case build in VSTS
  - ✓ Test case execution in VSTS
  - ✓ Dashboard & Reporting
- ✓ Statistics
- ✓ Key Benefits
- ✓ Next Steps

Architecture of our project

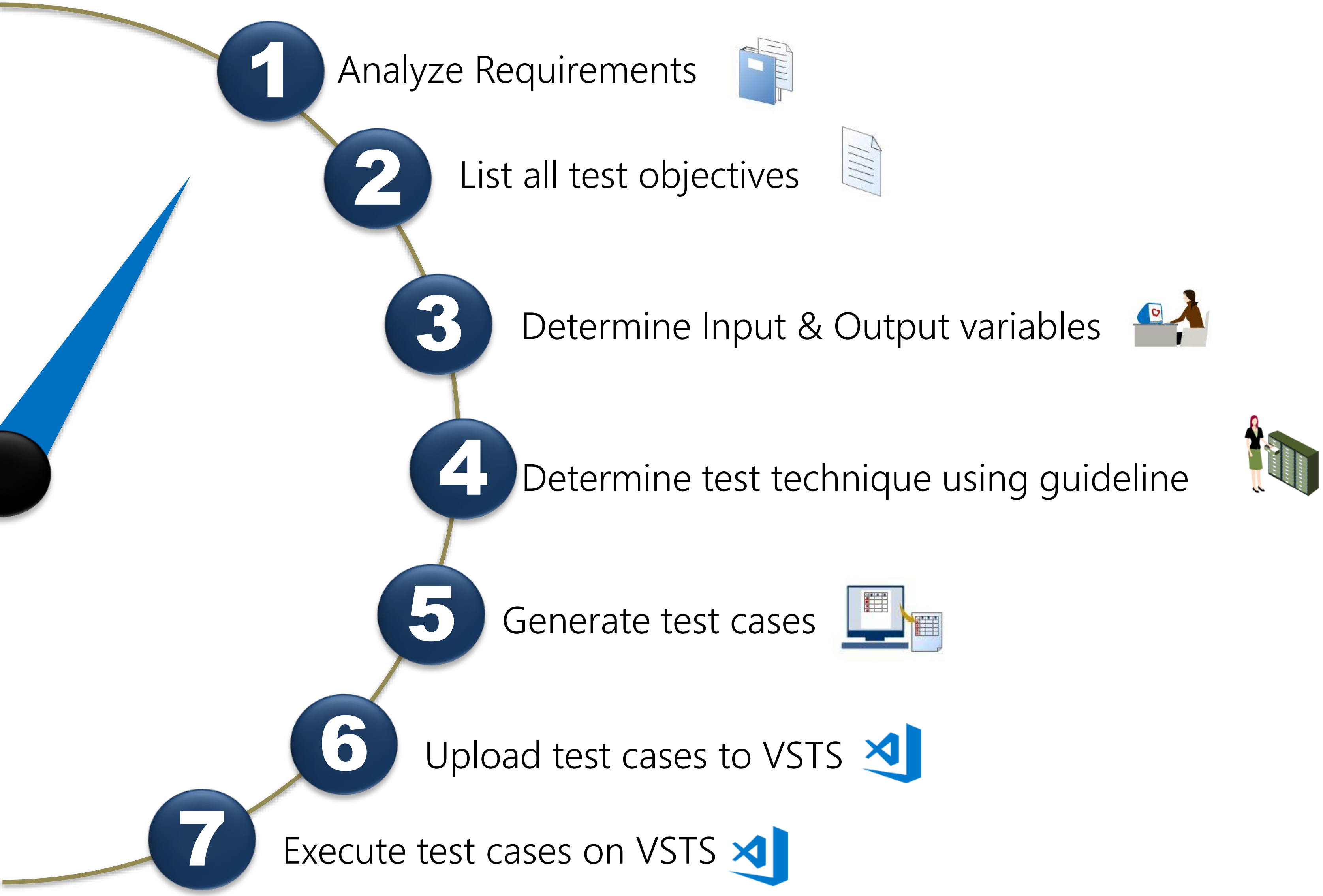


Presentation Layer

Data Access Layer

Business Layer

Test Process Workflow in Siskon



1. Analyze Requirements
2. List all test objectives
3. Determine Input & Output variables
4. Determine test technique using guideline
5. Generate test cases
6. Upload test cases to VSTS
7. Execute test cases on VSTS

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Why tSQLt?

tSQLt allows you to implement unit tests in T-SQL. This is important as you do not have to switch between various tools to create your code and your unit tests.

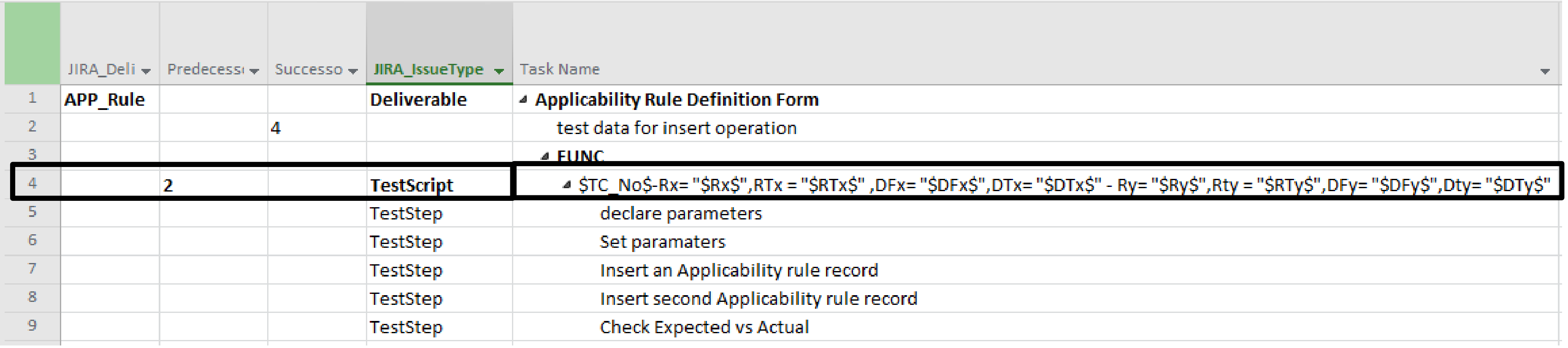
tSQLt also provides the following features to make it easier to create and manage unit tests:

- ❖ Tests are automatically run within transactions – this keeps tests independent and reduces any clean-up work you need
- ❖ Tests can be grouped together within a schema – allowing you to organize your tests and use common setup methods
- ❖ Output can be generated in plain text or XML – making it easier to integrate with a continuous integration tool
- ❖ Provides the ability to fake tables and views, and to create stored procedure spies – allowing you to isolate the code which you are testing

* *Reference: http://www.tsqlt.org*

Generate Test Cases in MS Project

- Each Test Case corresponds to a Test Script that contains test steps
- Benefits:
    - Test script generation using test data (Test data variables as $<VariableName>$ are populated with each test data set)
    - Reusability of test steps (Predecessor & Successor)



	JIRA_Deli	Predecess	Successo	JIRA_IssueType	Task Name
1	**APP_Rule**			**Deliverable**	**Applicability Rule Definition Form**
2			4		test data for insert operation
3					**FUNC**
4		**2**		**TestScript**	TC_No-Rx= "Rx",RTx = "RTx" ,DFx= "DFx",DTx= "DTx" - Ry= "Ry",Rty = "RTy",DFy= "DFy",Dty= "DTy"
5				TestStep	declare parameters
6				TestStep	Set paramaters
7				TestStep	Insert an Applicability rule record
8				TestStep	Insert second Applicability rule record
9				TestStep	Check Expected vs Actual

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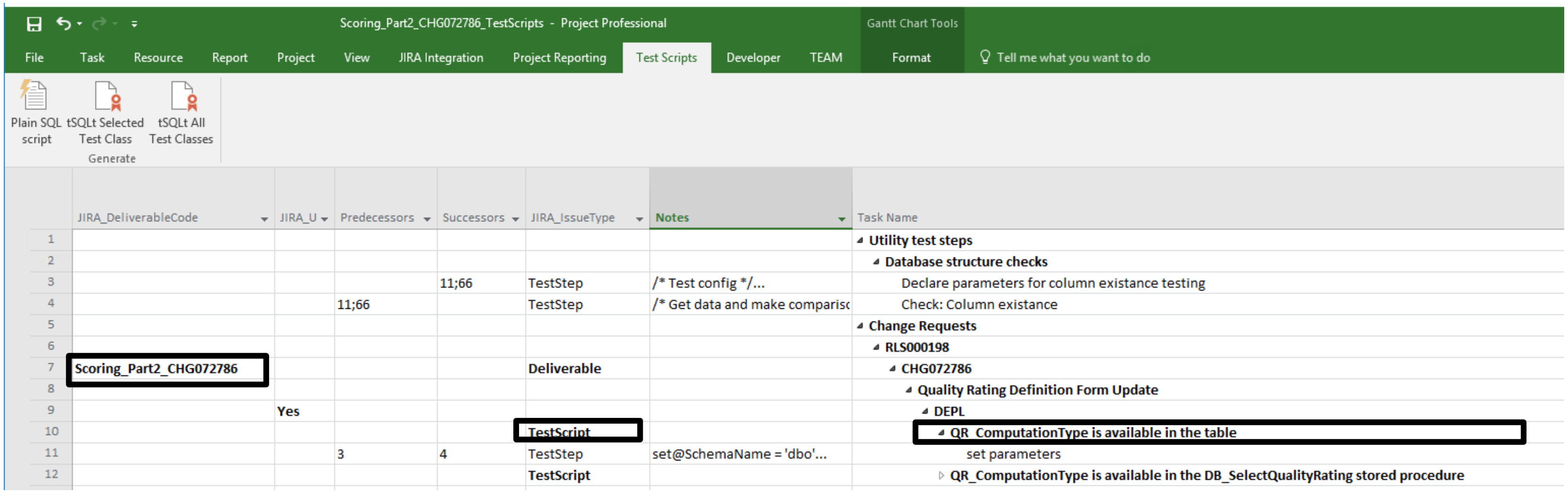
Generate Test Cases in MS Project

Each Test Case corresponds to a Test Script that contains test steps

IssueType

- Test Script: test script procedure is created using test step
- Test Step: each line that contains script is called as test step



	JIRA_DeliverableCode	JIRA_U	Predecessors	Successors	JIRA_IssueType	Notes	Task Name
1							**Utility test steps**
2							**Database structure checks**
3				11;66	TestStep	/* Test config */...	Declare parameters for column existance testing
4			11;66		TestStep	/* Get data and make comparisc	Check: Column existance
5							**Change Requests**
6							**RLS000198**
7	**Scoring_Part2_CHG072786**				**Deliverable**		**CHG072786**
8							**Quality Rating Definition Form Update**
9		**Yes**					**DEPL**
10					**TestScript**		**QR_ComputationType is available in the table**
11			3	4	TestStep	set@SchemaName = 'dbo'...	set parameters
12					**TestScript**		**QR_ComputationType is available in the DB_SelectQualityRating stored procedure**

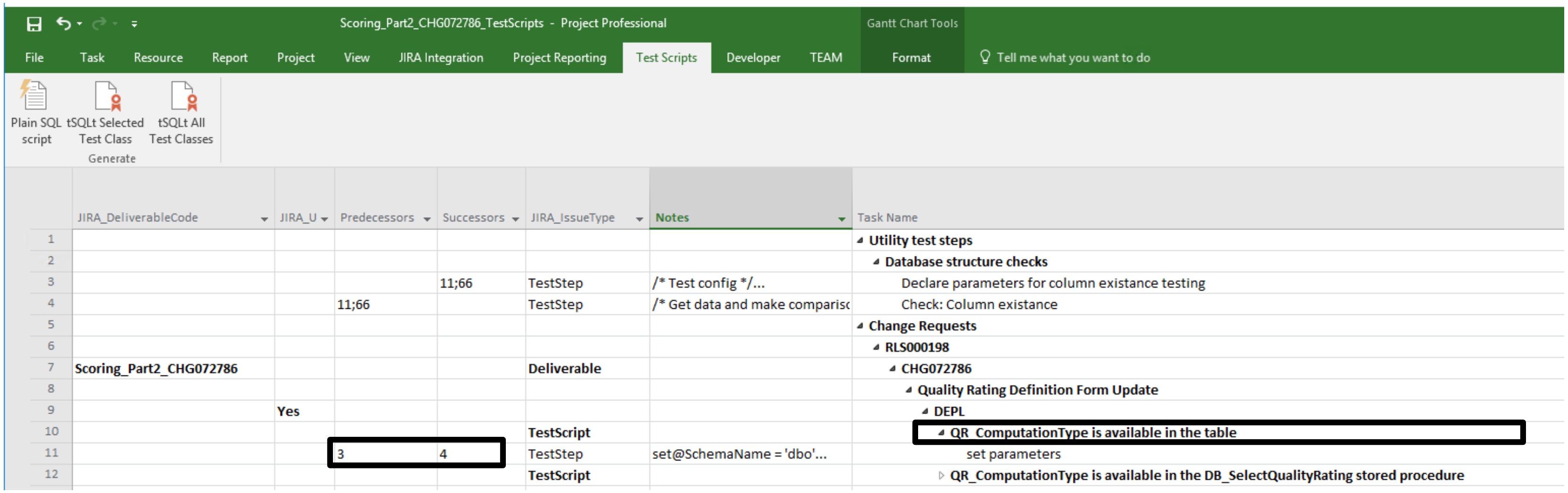
Deliverable

Test Script Title

```
CREATE PROCEDURE [Scoring_Part2_CHG072786].[test DEPL QR_ComputationType is available in the table]
```

Generate Test Cases in MS Project

Reusability of test steps (Predecessor & Successor)



	JIRA_DeliverableCode	JIRA_U	Predecessors	Successors	JIRA_IssueType	Notes	Task Name
1							◢ **Utility test steps**
2							◢ **Database structure checks**
3				11;66	TestStep	/* Test config */...	Declare parameters for column existance testing
4			11;66		TestStep	/* Get data and make comparisc	Check: Column existance
5							◢ **Change Requests**
6							◢ **RLS000198**
7	**Scoring_Part2_CHG072786**				**Deliverable**		◢ **CHG072786**
8							◢ **Quality Rating Definition Form Update**
9		**Yes**					◢ **DEPL**
10					**TestScript**		◢ **QR_ComputationType is available in the table**
11			3	4	TestStep	set@SchemaName = 'dbo'...	set parameters
12					**TestScript**		▷ **QR_ComputationType is available in the DB_SelectQualityRating stored procedure**

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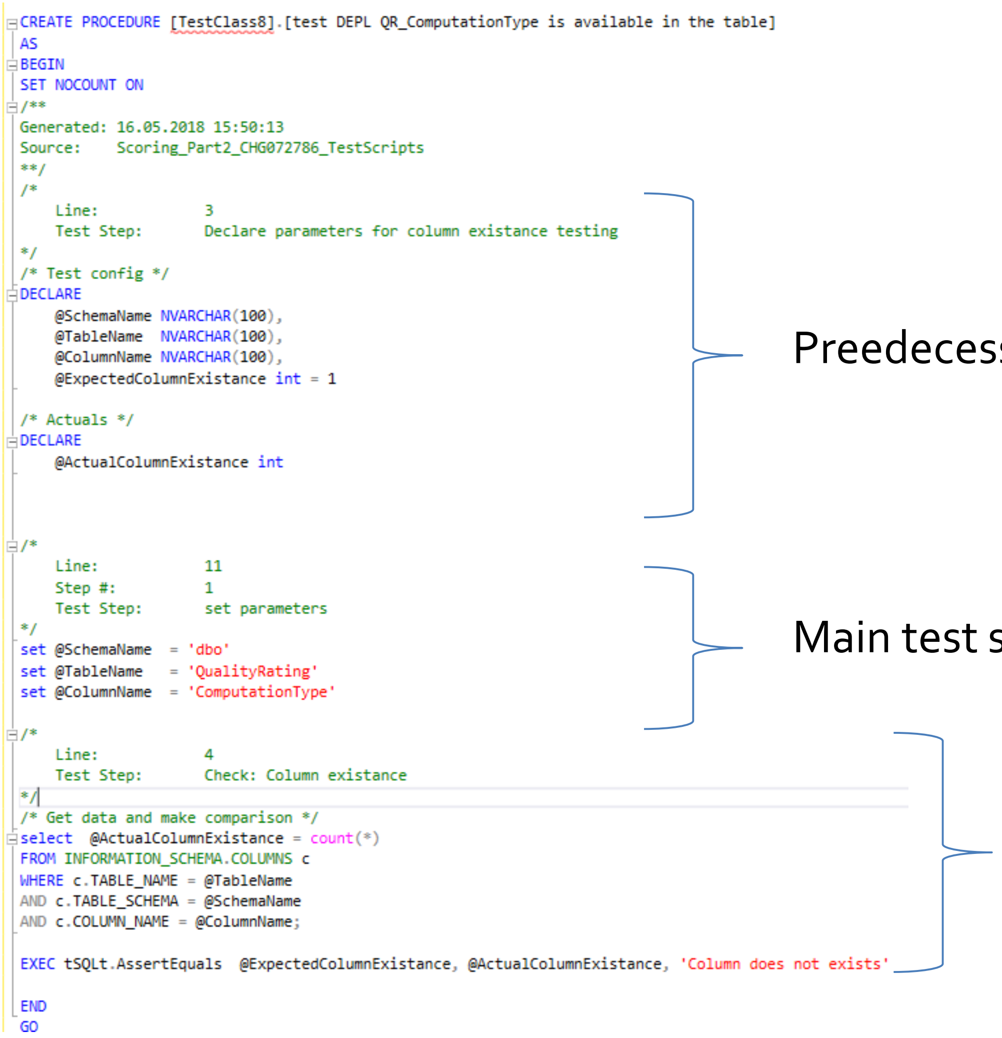
Generate Test Cases in MS Project



```sql
CREATE PROCEDURE [TestClass8].[test DEPL QR_ComputationType is available in the table]
AS
BEGIN
SET NOCOUNT ON
/**
Generated: 16.05.2018 15:50:13
Source:     Scoring_Part2_CHG072786_TestScripts
**/
/*
    Line:            3
    Test Step:       Declare parameters for column existance testing
*/
/* Test config */
DECLARE
    @SchemaName NVARCHAR(100),
    @TableName  NVARCHAR(100),
    @ColumnName NVARCHAR(100),
    @ExpectedColumnExistance int = 1

/* Actuals */
DECLARE
    @ActualColumnExistance int



/*
    Line:            11
    Step #:          1
    Test Step:       set parameters
*/
set @SchemaName  = 'dbo'
set @TableName   = 'QualityRating'
set @ColumnName  = 'ComputationType'

/*
    Line:            4
    Test Step:       Check: Column existance
*/
/* Get data and make comparison */
select  @ActualColumnExistance = count(*)
FROM INFORMATION_SCHEMA.COLUMNS c
WHERE c.TABLE_NAME = @TableName
AND c.TABLE_SCHEMA = @SchemaName
AND c.COLUMN_NAME = @ColumnName;

EXEC tSQLt.AssertEquals  @ExpectedColumnExistance, @ActualColumnExistance, 'Column does not exists'

END
GO
```

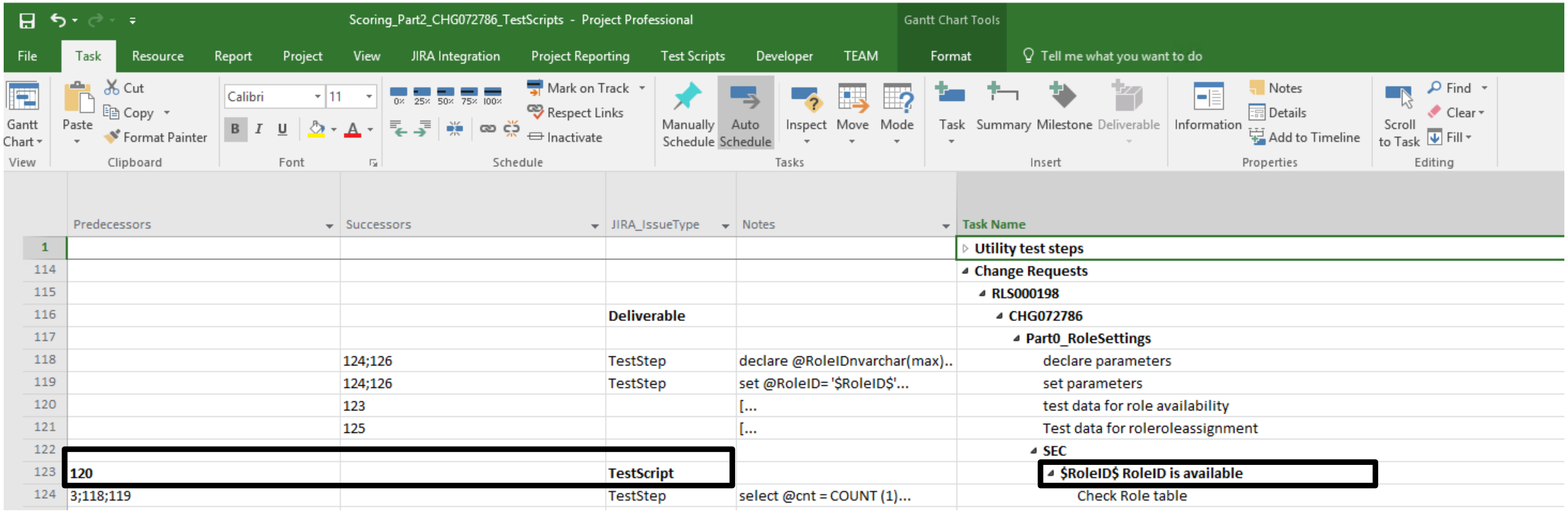
Preedecessors test step

Main test step

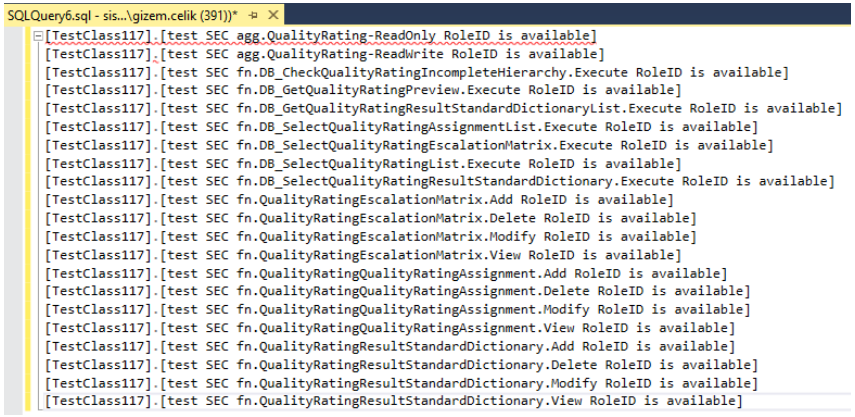
Successors test step

Generate Test Cases in MS Project

- Test script generation using test data (Test data variables as $<VariableName>$ are populated with each test data set)



	Predecessors	Successors	JIRA_IssueType	Notes	Task Name
1					Utility test steps
114					Change Requests
115					RLS000198
116			Deliverable		CHG072786
117					Part0_RoleSettings
118		124;126	TestStep	declare @RoleIDnvarchar(max)..	declare parameters
119		124;126	TestStep	set @RoleID= '$RoleID$'...	set parameters
120		123		[...	test data for role availability
121		125		[...	Test data for roleroleassignment
122					SEC
123	120		TestScript		$RoleID$ RoleID is available
124	3;118;119		TestStep	select @cnt = COUNT (1)...	Check Role table



```
[TestClass117].[test SEC agg.QualityRating-ReadOnly RoleID is available]
[TestClass117].[test SEC agg.QualityRating-ReadWrite RoleID is available]
[TestClass117].[test SEC fn.DB_CheckQualityRatingIncompleteHierarchy.Execute RoleID is available]
[TestClass117].[test SEC fn.DB_GetQualityRatingPreview.Execute RoleID is available]
[TestClass117].[test SEC fn.DB_GetQualityRatingResultStandardDictionaryList.Execute RoleID is available]
[TestClass117].[test SEC fn.DB_SelectQualityRatingAssignmentList.Execute RoleID is available]
[TestClass117].[test SEC fn.DB_SelectQualityRatingEscalationMatrix.Execute RoleID is available]
[TestClass117].[test SEC fn.DB_SelectQualityRatingList.Execute RoleID is available]
[TestClass117].[test SEC fn.DB_SelectQualityRatingResultStandardDictionary.Execute RoleID is available]
[TestClass117].[test SEC fn.QualityRatingEscalationMatrix.Add RoleID is available]
[TestClass117].[test SEC fn.QualityRatingEscalationMatrix.Delete RoleID is available]
[TestClass117].[test SEC fn.QualityRatingEscalationMatrix.Modify RoleID is available]
[TestClass117].[test SEC fn.QualityRatingEscalationMatrix.View RoleID is available]
[TestClass117].[test SEC fn.QualityRatingQualityRatingAssignment.Add RoleID is available]
[TestClass117].[test SEC fn.QualityRatingQualityRatingAssignment.Delete RoleID is available]
[TestClass117].[test SEC fn.QualityRatingQualityRatingAssignment.Modify RoleID is available]
[TestClass117].[test SEC fn.QualityRatingQualityRatingAssignment.View RoleID is available]
[TestClass117].[test SEC fn.QualityRatingResultStandardDictionary.Add RoleID is available]
[TestClass117].[test SEC fn.QualityRatingResultStandardDictionary.Delete RoleID is available]
[TestClass117].[test SEC fn.QualityRatingResultStandardDictionary.Modify RoleID is available]
[TestClass117].[test SEC fn.QualityRatingResultStandardDictionary.View RoleID is available]
```

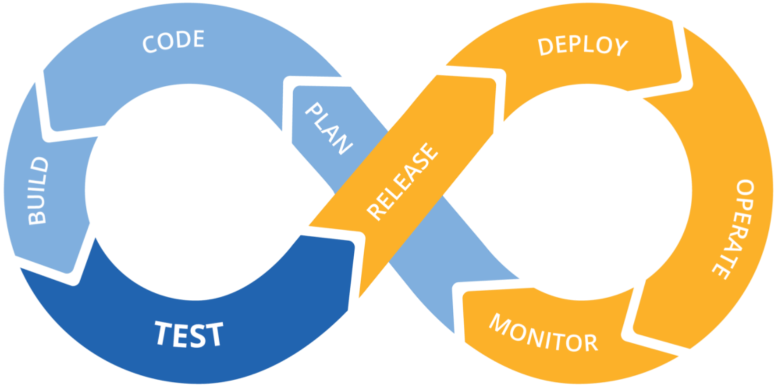
Why VSTS?

MS Visual Studio Team Services (VSTS) is a cloud-based application which offers number of services for development teams:

1. Source control (GIT / TFS based)
2. Comprehensive Build and Release scenario definition and execution
3. Test process support (test repository, test result storage and reporting)
4. Development process support (CMMI, Agile/Scrum; Work Item management)

All services are well integrated between each other.

For software product delivery we're using all mentioned above services of VSTS.



Integrating

AUTOMATED BUILD

Testing

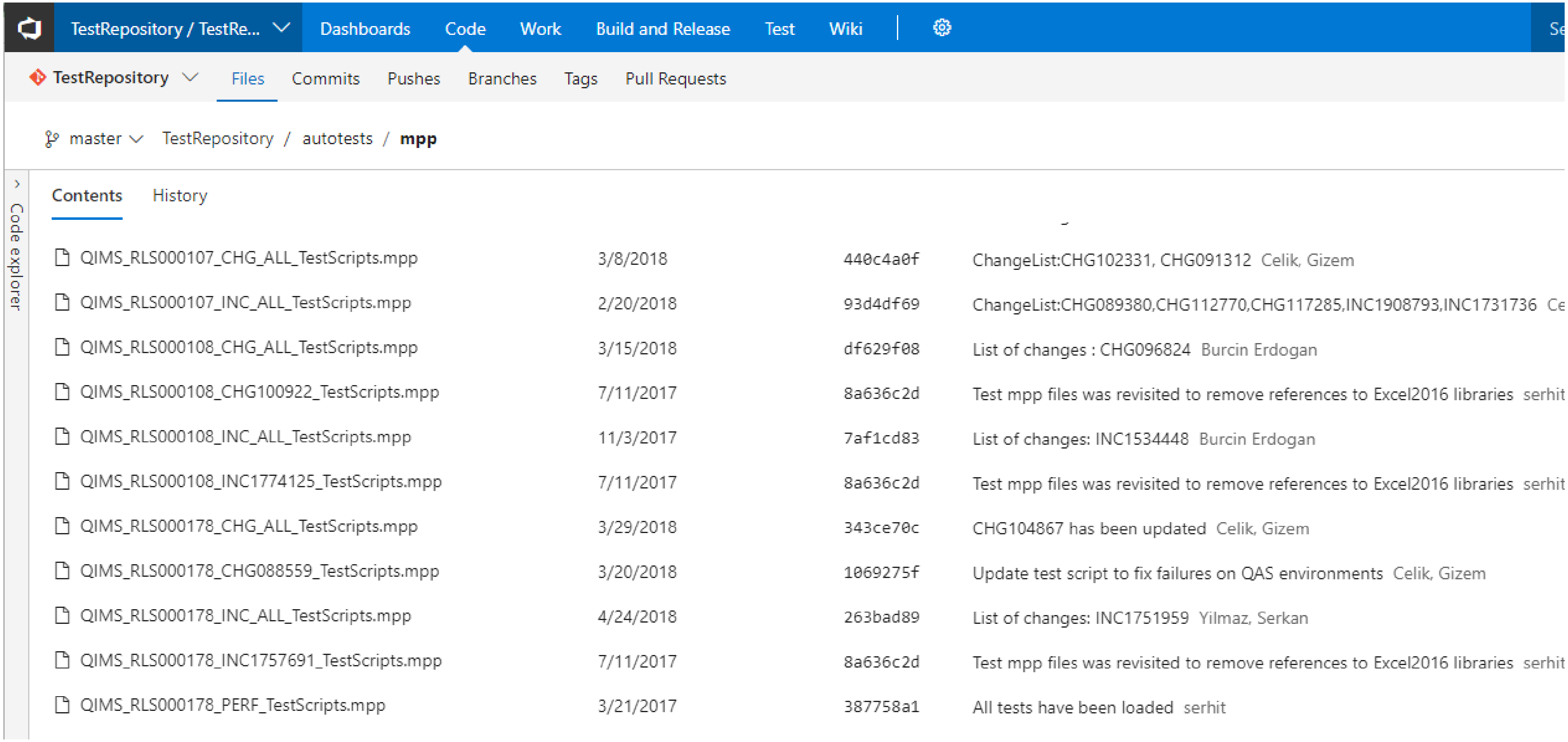
AUTOMATED TEST

Deploying

AUTOMATED DEPLOY

Test Repository in VSTS

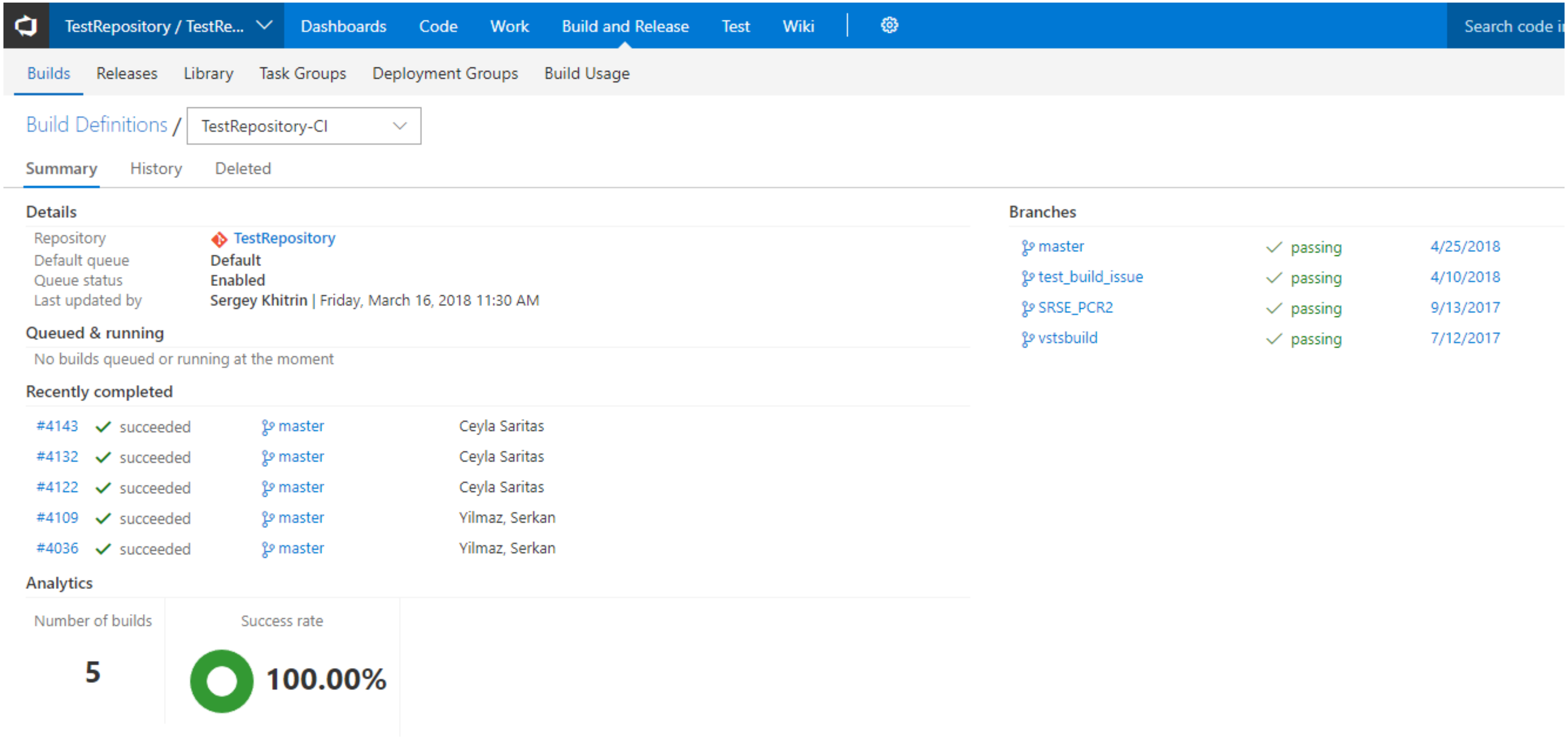
✓ MS Project files per Release or Project are located on Test Repository



QIMS_RLS000107_CHG_ALL_TestScripts.mpp	3/8/2018	440c4a0f	ChangeList:CHG102331, CHG091312 Celik, Gizem
QIMS_RLS000107_INC_ALL_TestScripts.mpp	2/20/2018	93d4df69	ChangeList:CHG089380,CHG112770,CHG117285,INC1908793,INC1731736 Ce
QIMS_RLS000108_CHG_ALL_TestScripts.mpp	3/15/2018	df629f08	List of changes : CHG096824 Burcin Erdogan
QIMS_RLS000108_CHG100922_TestScripts.mpp	7/11/2017	8a636c2d	Test mpp files was revisited to remove references to Excel2016 libraries serhit
QIMS_RLS000108_INC_ALL_TestScripts.mpp	11/3/2017	7af1cd83	List of changes: INC1534448 Burcin Erdogan
QIMS_RLS000108_INC1774125_TestScripts.mpp	7/11/2017	8a636c2d	Test mpp files was revisited to remove references to Excel2016 libraries serhit
QIMS_RLS000178_CHG_ALL_TestScripts.mpp	3/29/2018	343ce70c	CHG104867 has been updated Celik, Gizem
QIMS_RLS000178_CHG088559_TestScripts.mpp	3/20/2018	1069275f	Update test script to fix failures on QAS environments Celik, Gizem
QIMS_RLS000178_INC_ALL_TestScripts.mpp	4/24/2018	263bad89	List of changes: INC1751959 Yilmaz, Serkan
QIMS_RLS000178_INC1757691_TestScripts.mpp	7/11/2017	8a636c2d	Test mpp files was revisited to remove references to Excel2016 libraries serhit
QIMS_RLS000178_PERF_TestScripts.mpp	3/21/2017	387758a1	All tests have been loaded serhit

Test Case Build in VSTS

- ✓ Executable Test Script files are generated via VSTS Test Build definitions.
- ✓ Build is triggerred by each mpp file upload into Test Repository.



Build Definitions / TestRepository-CI

Details

Repository	TestRepository
Default queue	**Default**
Queue status	**Enabled**
Last updated by	**Sergey Khitrin** | Friday, March 16, 2018 11:30 AM

Queued & running

No builds queued or running at the moment

Recently completed

#4143	✓ succeeded	master	Ceyla Saritas
#4132	✓ succeeded	master	Ceyla Saritas
#4122	✓ succeeded	master	Ceyla Saritas
#4109	✓ succeeded	master	Yilmaz, Serkan
#4036	✓ succeeded	master	Yilmaz, Serkan

Analytics

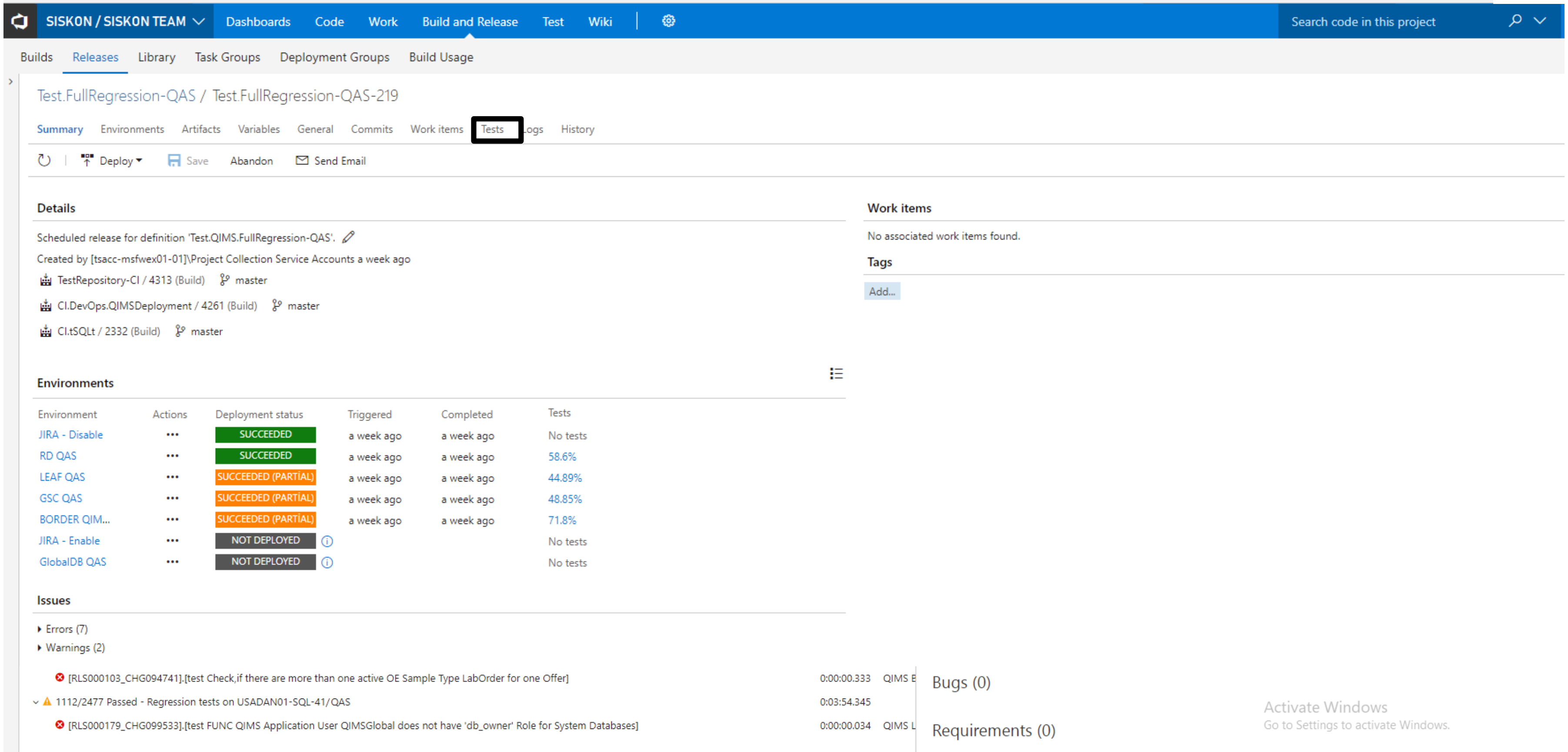
Number of builds	Success rate
5	100.00%

Branches

master	✓ passing	4/25/2018
test_build_issue	✓ passing	4/10/2018
SRSE_PCR2	✓ passing	9/13/2017
vstsbuild	✓ passing	7/12/2017

Test Case Execution in VSTS

- ✓ Executable Test Script files are loaded and executed on test environments nightly.
- ✓ Test execution results are listed in detail.
- ✓ Test execution results can be subscribed in order to receive results as email notificiation.



Test.FullRegression-QAS / Test.FullRegression-QAS-219

Details

Scheduled release for definition 'Test.QIMS.FullRegression-QAS'.

Created by [tsacc-msfwex01-01]\Project Collection Service Accounts a week ago

TestRepository-CI / 4313 (Build) master

CI.DevOps.QIMSDeployment / 4261 (Build) master

CI.tSQLt / 2332 (Build) master

Work items

No associated work items found.

Tags

Environments

Environment	Actions	Deployment status	Triggered	Completed	Tests
JIRA - Disable	•••	SUCCEEDED	a week ago	a week ago	No tests
RD QAS	•••	SUCCEEDED	a week ago	a week ago	58.6%
LEAF QAS	•••	SUCCEEDED (PARTIAL)	a week ago	a week ago	44.89%
GSC QAS	•••	SUCCEEDED (PARTIAL)	a week ago	a week ago	48.85%
BORDER QIM...	•••	SUCCEEDED (PARTIAL)	a week ago	a week ago	71.8%
JIRA - Enable	•••	NOT DEPLOYED ⓘ			No tests
GlobalDB QAS	•••	NOT DEPLOYED ⓘ			No tests

Issues

- Errors (7)
- Warnings (2)

```
    ✖ [RLS000103_CHG094741].[test Check,if there are more than one active OE Sample Type LabOrder for one Offer]      0:00:00.333   QIMS E
  ⚠ 1112/2477 Passed - Regression tests on USADAN01-SQL-41/QAS                                                      0:03:54.345
    ✖ [RLS000179_CHG099533].[test FUNC QIMS Application User QIMSGlobal does not have 'db_owner' Role for System Databases]   0:00:00.034   QIMS L
```

Bugs (0)

Requirements (0)

Activate Windows
Go to Settings to activate Windows.

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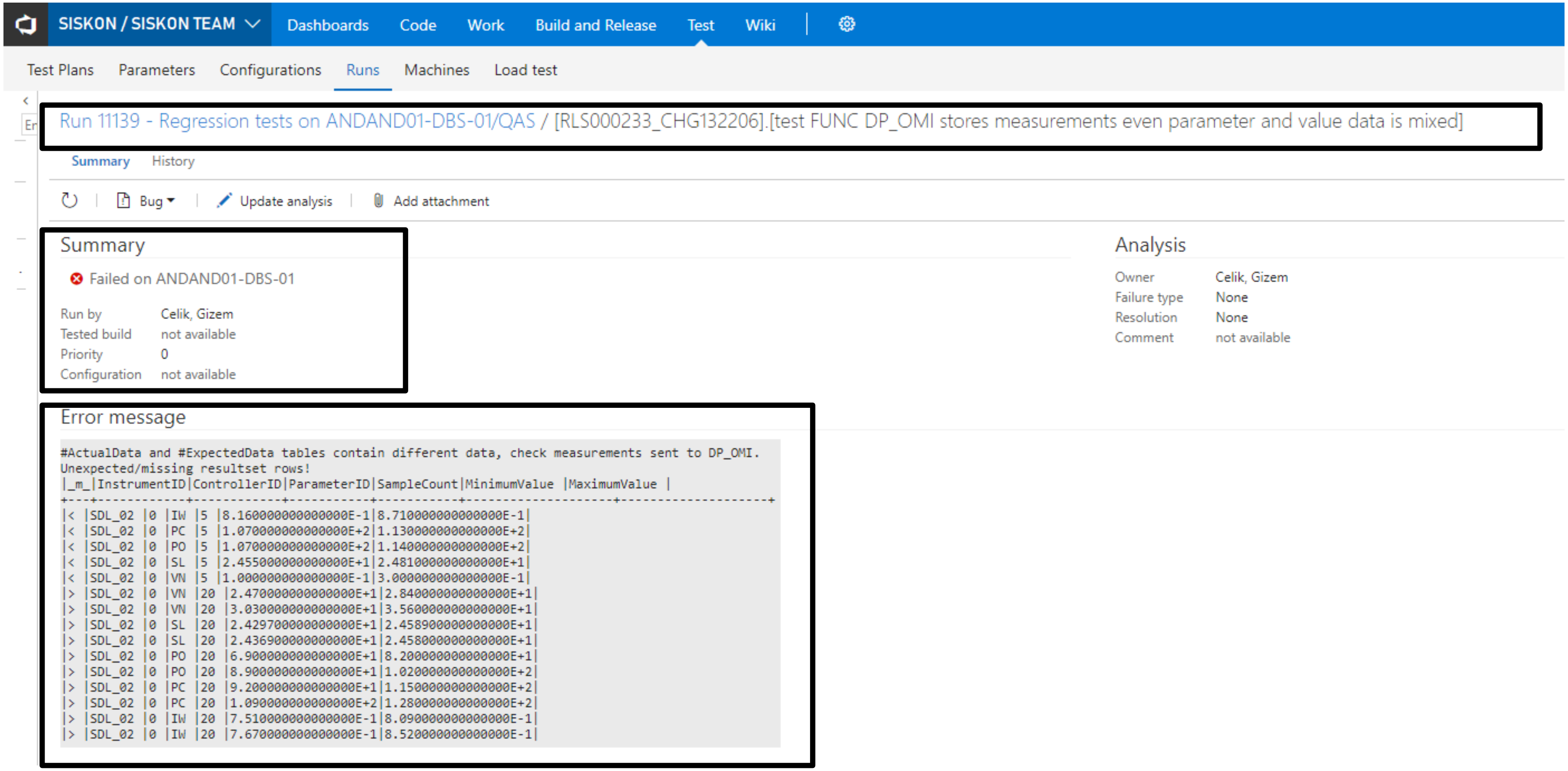
Test Execution Result Details

- ✓ Test execution result details are displayed as follows:



Run 11139 - Regression tests on ANDAND01-DBS-01/QAS / [RLS000233_CHG132206].[test FUNC DP_OMI stores measurements even parameter and value data is mixed]

Summary

Failed on ANDAND01-DBS-01

Run by	Celik, Gizem
Tested build	not available
Priority	0
Configuration	not available

Analysis

Owner	Celik, Gizem
Failure type	None
Resolution	None
Comment	not available

Error message

```
#ActualData and #ExpectedData tables contain different data, check measurements sent to DP_OMI.
Unexpected/missing resultset rows!
|_m_|InstrumentID|ControllerID|ParameterID|SampleCount|MinimumValue |MaximumValue |
+---+------------+------------+-----------+-----------+---------------------+--------------------+
|< |SDL_02 |0 |IW |5 |8.160000000000000E-1|8.710000000000000E-1|
|< |SDL_02 |0 |PC |5 |1.070000000000000E+2|1.130000000000000E+2|
|< |SDL_02 |0 |PO |5 |1.070000000000000E+2|1.140000000000000E+2|
|< |SDL_02 |0 |SL |5 |2.455000000000000E+1|2.481000000000000E+1|
|< |SDL_02 |0 |VN |5 |1.000000000000000E-1|3.000000000000000E-1|
|> |SDL_02 |0 |VN |20 |2.470000000000000E+1|2.840000000000000E+1|
|> |SDL_02 |0 |VN |20 |3.030000000000000E+1|3.560000000000000E+1|
|> |SDL_02 |0 |SL |20 |2.429700000000000E+1|2.458900000000000E+1|
|> |SDL_02 |0 |SL |20 |2.436900000000000E+1|2.458000000000000E+1|
|> |SDL_02 |0 |PO |20 |6.900000000000000E+1|8.200000000000000E+1|
|> |SDL_02 |0 |PO |20 |8.900000000000000E+1|1.020000000000000E+2|
|> |SDL_02 |0 |PC |20 |9.200000000000000E+1|1.150000000000000E+2|
|> |SDL_02 |0 |PC |20 |1.090000000000000E+2|1.280000000000000E+2|
|> |SDL_02 |0 |IW |20 |7.510000000000000E-1|8.090000000000000E-1|
|> |SDL_02 |0 |IW |20 |7.670000000000000E-1|8.520000000000000E-1|
```

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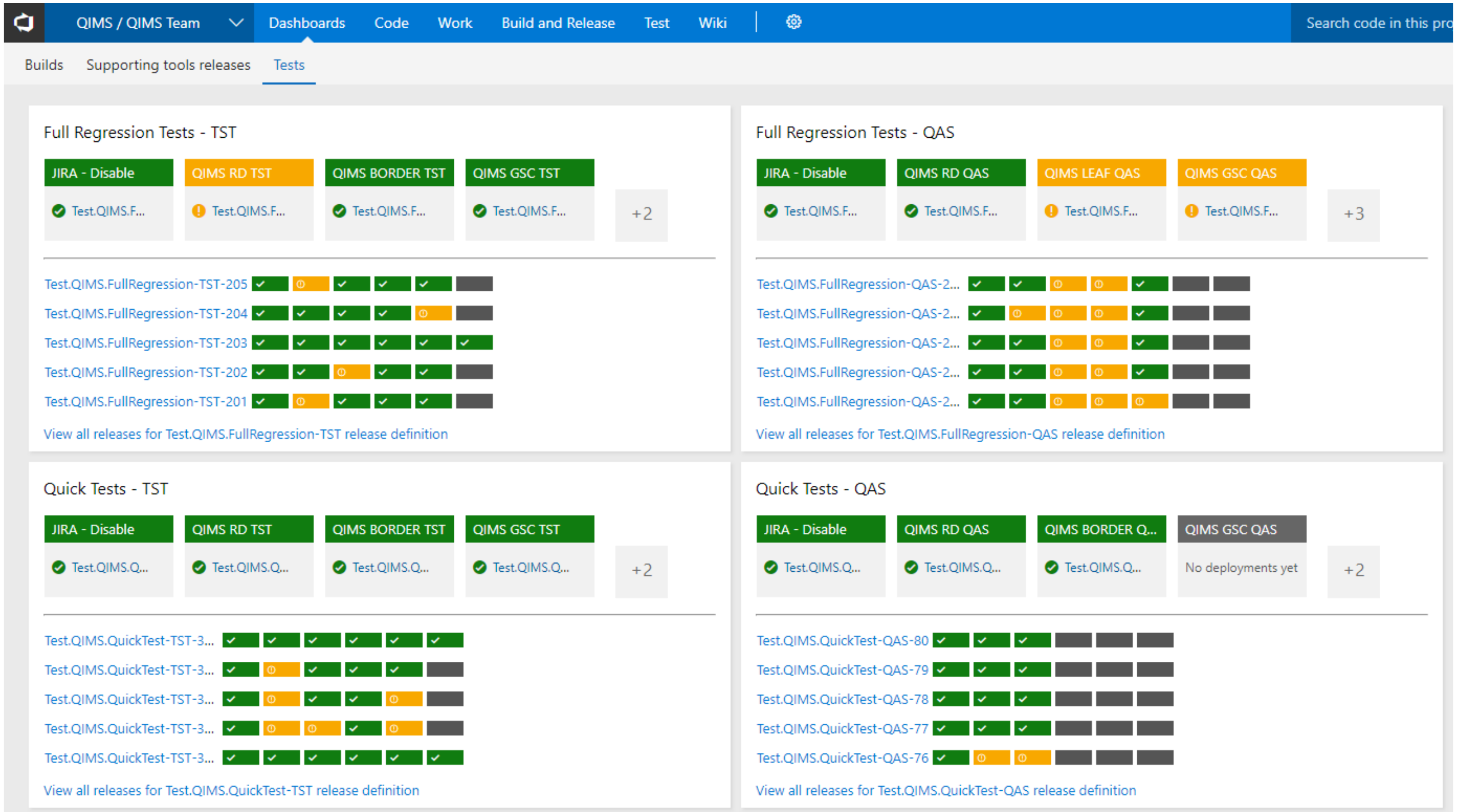
Dashboard & Reporting

- ✓ Test execution results on different environments are presented on dashboards for quick and detailed view.
- ✓ After fixing failed test cases (object fix, data fix, test fix, etc.) Quick Tests are executed.



Full Regression Tests - TST

JIRA - Disable: ✓ Test.QIMS.F...
QIMS RD TST: ! Test.QIMS.F...
QIMS BORDER TST: ✓ Test.QIMS.F...
QIMS GSC TST: ✓ Test.QIMS.F...
+2

Test.QIMS.FullRegression-TST-205 ✓ ! ✓ ✓ ✓ ■
Test.QIMS.FullRegression-TST-204 ✓ ✓ ✓ ✓ ! ■
Test.QIMS.FullRegression-TST-203 ✓ ✓ ✓ ✓ ✓ ✓
Test.QIMS.FullRegression-TST-202 ✓ ✓ ! ✓ ✓ ■
Test.QIMS.FullRegression-TST-201 ✓ ! ✓ ✓ ✓ ■

View all releases for Test.QIMS.FullRegression-TST release definition

Full Regression Tests - QAS

JIRA - Disable: ✓ Test.QIMS.F...
QIMS RD QAS: ✓ Test.QIMS.F...
QIMS LEAF QAS: ! Test.QIMS.F...
QIMS GSC QAS: ! Test.QIMS.F...
+3

Test.QIMS.FullRegression-QAS-2... ✓ ✓ ! ! ✓ ■ ■
Test.QIMS.FullRegression-QAS-2... ✓ ! ! ! ✓ ■ ■
Test.QIMS.FullRegression-QAS-2... ✓ ✓ ! ! ✓ ■ ■
Test.QIMS.FullRegression-QAS-2... ✓ ✓ ! ! ✓ ■ ■
Test.QIMS.FullRegression-QAS-2... ✓ ✓ ! ! ! ■ ■

View all releases for Test.QIMS.FullRegression-QAS release definition

Quick Tests - TST

JIRA - Disable: ✓ Test.QIMS.Q...
QIMS RD TST: ✓ Test.QIMS.Q...
QIMS BORDER TST: ✓ Test.QIMS.Q...
QIMS GSC TST: ✓ Test.QIMS.Q...
+2

Test.QIMS.QuickTest-TST-3... ✓ ✓ ✓ ✓ ✓ ✓
Test.QIMS.QuickTest-TST-3... ✓ ! ✓ ✓ ✓ ■
Test.QIMS.QuickTest-TST-3... ✓ ! ✓ ✓ ! ■
Test.QIMS.QuickTest-TST-3... ✓ ! ! ✓ ! ■
Test.QIMS.QuickTest-TST-3... ✓ ✓ ✓ ✓ ✓ ✓

View all releases for Test.QIMS.QuickTest-TST release definition

Quick Tests - QAS

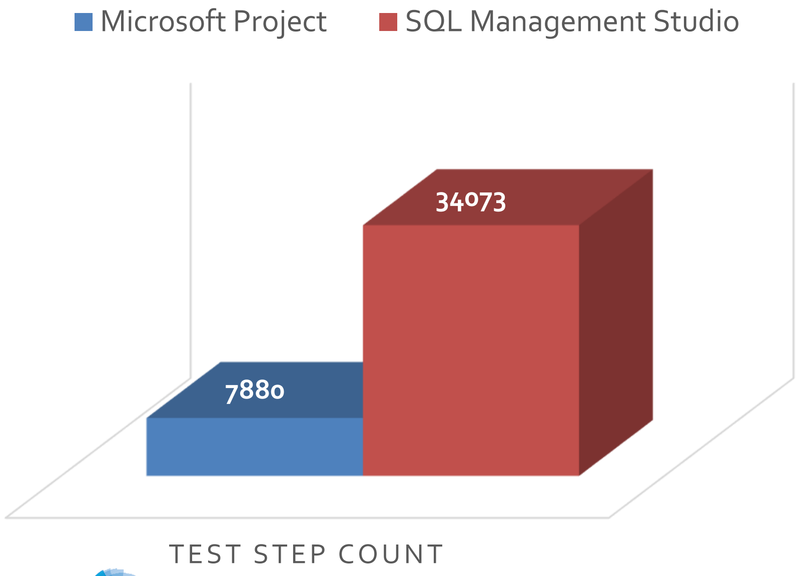
JIRA - Disable: ✓ Test.QIMS.Q...
QIMS RD QAS: ✓ Test.QIMS.Q...
QIMS BORDER Q...: ✓ Test.QIMS.Q...
QIMS GSC QAS: No deployments yet
+2

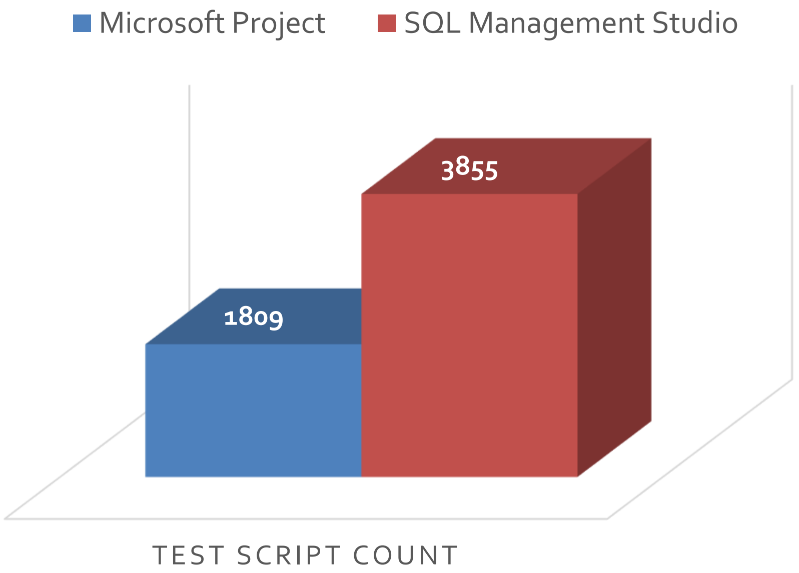
Test.QIMS.QuickTest-QAS-80 ✓ ✓ ✓ ■ ■ ■
Test.QIMS.QuickTest-QAS-79 ✓ ✓ ✓ ■ ■ ■
Test.QIMS.QuickTest-QAS-78 ✓ ✓ ✓ ■ ■ ■
Test.QIMS.QuickTest-QAS-77 ✓ ✓ ✓ ■ ■ ■
Test.QIMS.QuickTest-QAS-76 ✓ ! ! ■ ■ ■

View all releases for Test.QIMS.QuickTest-QAS release definition

Statistics

- Start to use this process on 24 March 2016
- Now we have 3835 executable test scripts
- Test step reusability
    - Test step count in Microsoft Project: 7880
    - Test step count in SQL Management Studio: 34073
- Test data usage for test script reusability
    - Test script count in Microsoft Project: 1809
    - Test script count in SQL Management Studio: 3835





Key Benefits

- Reusability of test steps
- Test script generation using test data
- Tests are automatically run within transactions, this keeps tests independent and reduces any clean-up work you need
- Automatic test script deployment and execution via VSTS on several environments for regression testing
- Test results reporting and monitoring on VSTS (Including historical execution results)
- Subscribed email notification of test execution results via VSTS

Next Steps

- Categorization of test cases based on Modules & Components in order to have a Test Catalogue
  - Ease impact analysis
  - Provides reusability
  - Ease maintenance
- Work items (change requests & bug fixes) based mpp
  - Traceability of test cases and work items

Thank You!