

Increased Code Quality With DevOps

David Votaw
NGC

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Who is David Votaw?

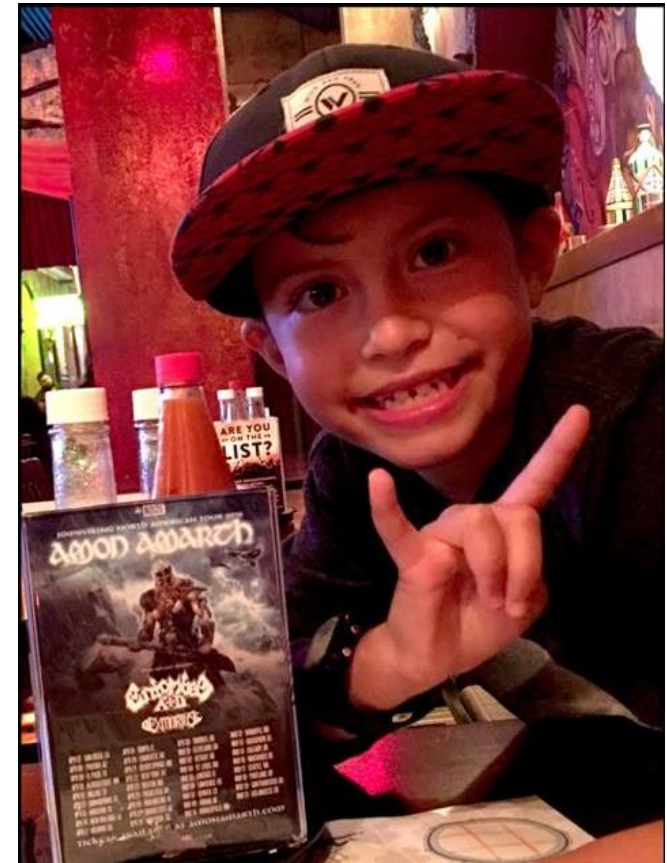
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- **Background**
 - Software Developer - 13 years
 - 86% complete with a Doctorate of Computer Science (DCS) in Information Assurance
- **Current Assignments**
 - Taking teams to the next level of DevOps
 - Research and innovation
- **Fun**
 - Family
 - Video games
 - Road trips
 - Heavy metal \m/



Who is David Votaw? Cont.

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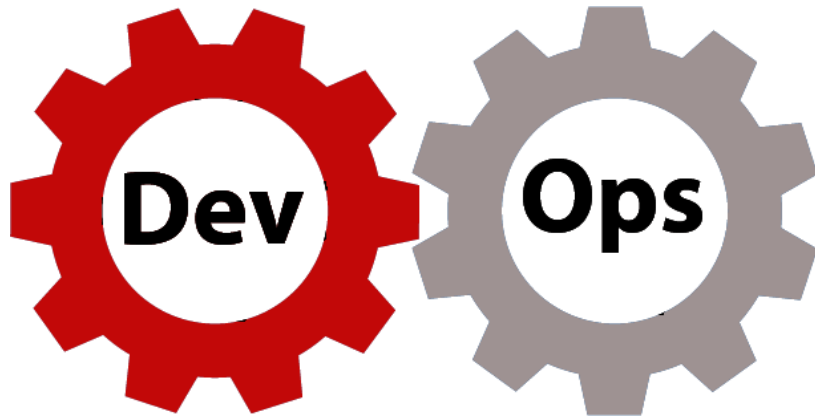
Agenda

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- **This presentation will give on overview of DevOps practices including:**
 - **Test Driven Development (TDD)**
 - **Continuous Integration (CI)**
 - **Static Code Analysis (SCA)**
 - **Functional Testing**
 - **Continuous Deployment (CD)**
 - **Infrastructure as Code (IaC)**
 - **Virtualization and Parallelization**
 - **Monitoring and Metrics**

DevOps

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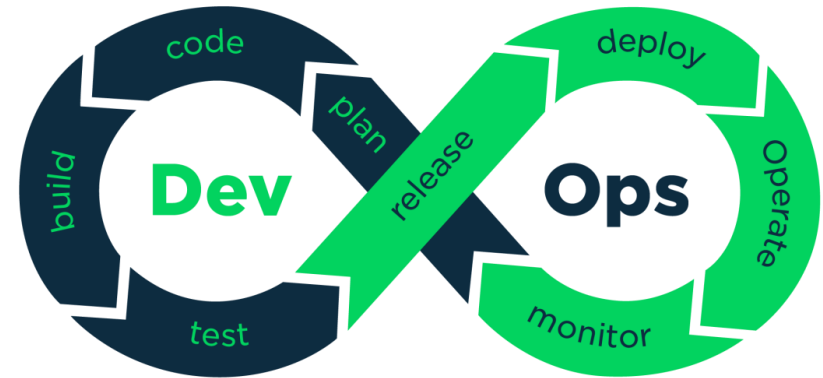


Developer and Operations (DevOps)

What is DevOps?

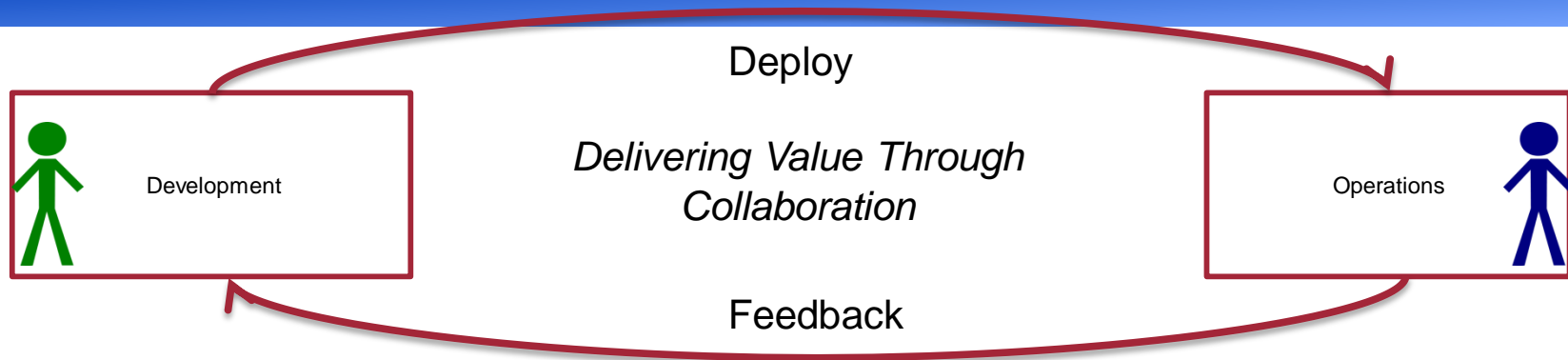
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According to DevoPedia, “DevOps is the coming together of both development and operations teams into a coordinated workflow such that collaboration and productivity are improved to meet shared business goals. Building on Agile and Lean, DevOps enables the business to respond to changes and meet customer needs faster. Tools and automation are necessary enablers. Practices such as Continuous Integration and Continuous Delivery are often followed.”

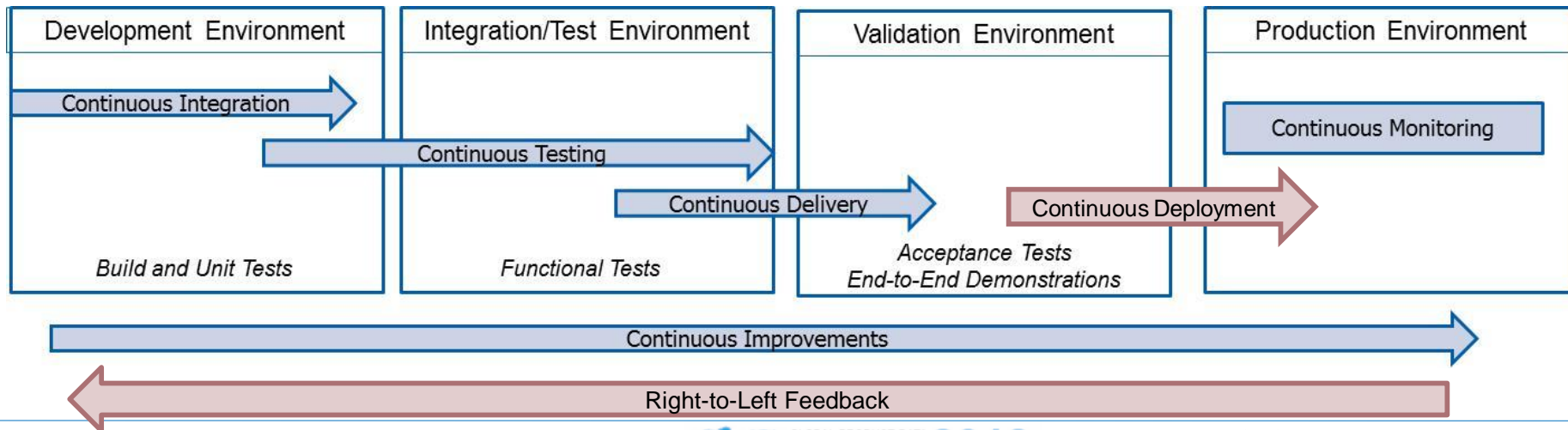


DevOps Process

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Example Environment Setup



TDD

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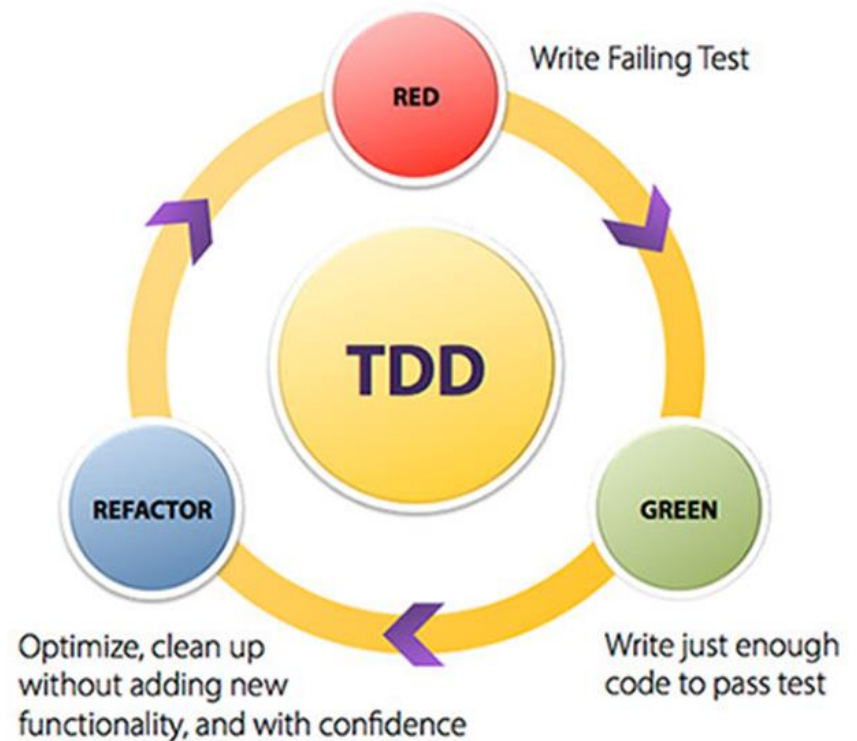


Test Driven Development (TDD)

TDD Cont.

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- Works well with Agile teams and short development cycles
- Keep the unit or module small
- Steps
 - Write the test first
 - Write only the code that is needed to pass the test
 - Refactor to organize and eliminate duplication
 - Repeat
- Focus on software quality
- Avoid building dependencies between test cases



TDD using NUnit

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```
namespace DataProvidersTests
{
    /// <summary>
    /// Data Provider Test Class
    /// </summary>
    [TestFixture]
    public class AuthenticationDataProviderTests : BaseTestClass
    {
        /// <summary>
        /// Tests that a Logoff operation is performed successfully.
        /// </summary>
        [Test]
        public void LoginLogout()
        {
            string dbid = ConfigurationManager.AppSettings["dbid"];
            string username = ConfigurationManager.AppSettings["username"];
            string password = ConfigurationManager.AppSettings["password"];

            LoginResult result = authenticationDataProvider.AttemptLogOn(username, password, dbid, true, "DataProvidersTests", "unittest", false);

            bool success = (result.SuccessLevel == LoginSuccessLevel.Success ||
                           result.SuccessLevel == LoginSuccessLevel.SuccessPasswordExpired ||
                           result.SuccessLevel == LoginSuccessLevel.SuccessPasswordPinExpired ||
                           result.SuccessLevel == LoginSuccessLevel.SuccessPinExpired);

            Assert.IsTrue(success, "Testing logon success");
            Assert.IsNotNull(result.Ticket, "Checking that login succeeded");
            authenticationDataProvider.LogOff(result.Ticket);
        }
    }
}
```

TestFixture -- Causes NUnit to recognize this as a test class.

Test -- Causes NUnit to recognize this as a test method

Actual API call we are trying to test

Assertions are used to check values and conditions.

Arrange
Act
Assert
Cleanup

Benefits and Limitations of TDD

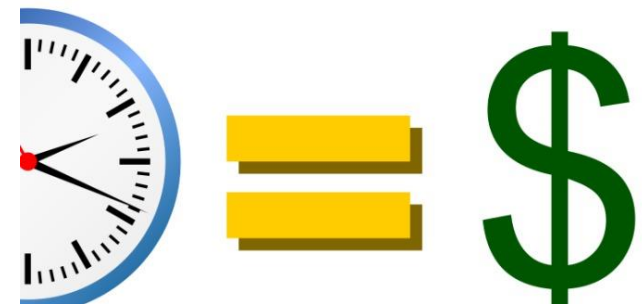
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- **Benefits**

- Develop code that reflects new business requirements
- Higher productivity by focusing on one test at a time
- Tidier and higher quality code
- Helps keep unused code out of the system
- Built-in regression testing as part of a Continuous Integration process
- Fewer bugs
- Living documentation

- **Limitations**

- Requires time and effort up front
- Difficult to write good test cases
- Takes time maintain test suites

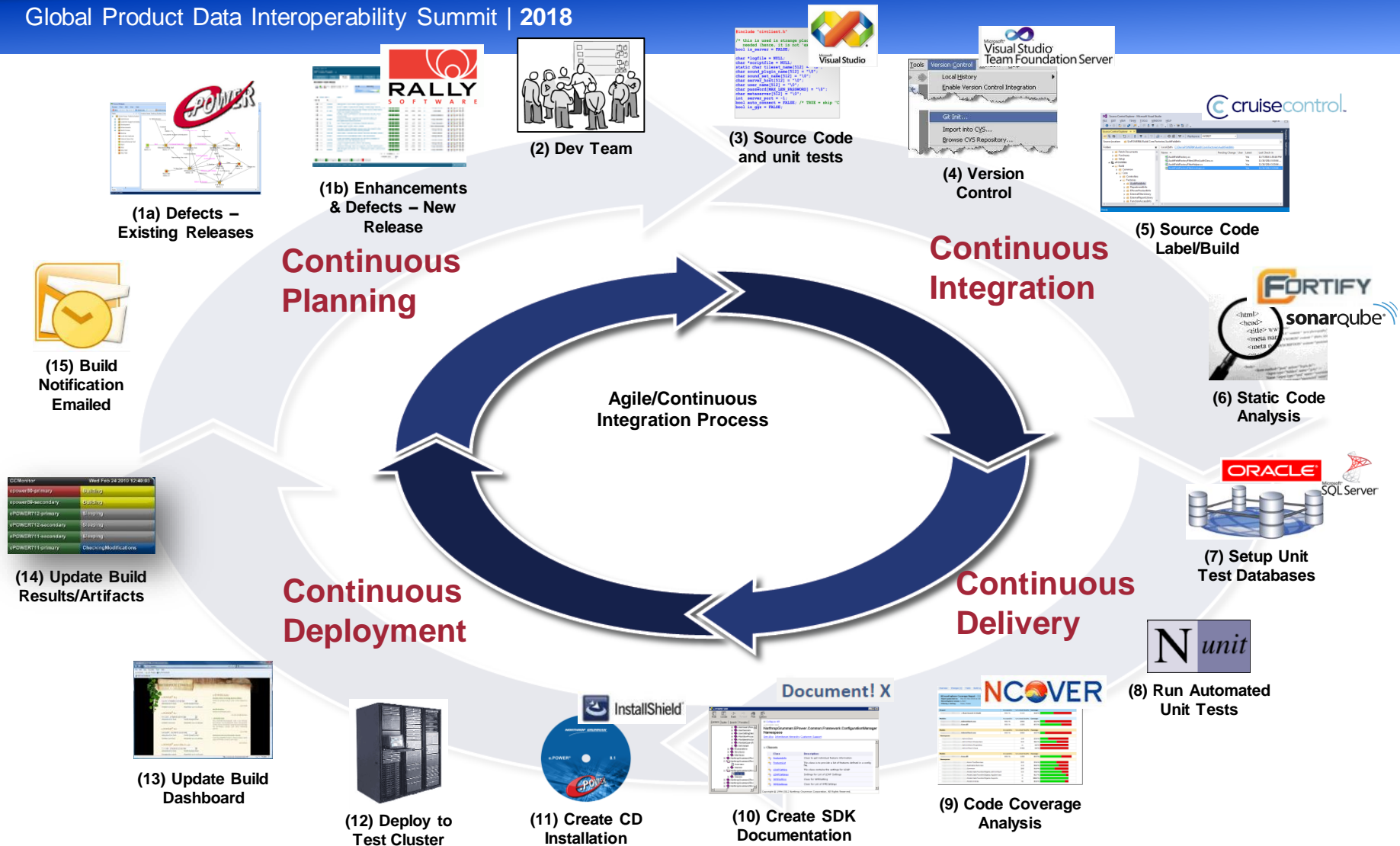




Continuous Integration (CI)

CI Process

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CI – Source Control

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The screenshot shows the Source Control Explorer in Microsoft Visual Studio. The interface includes a menu bar (FILE, EDIT, VIEW, TEAM, TOOLS, WINDOW, HELP) and a toolbar. The 'Team Explorer - Pending Changes' pane on the left shows 'Pending Changes | ePOWER84' with options like 'Check In', 'Shelve', and 'Actions'. Below this are sections for 'Comment', 'Related Work Items', 'Included Changes', and 'Excluded Changes (2)'. The 'Source Control Explorer' pane in the center shows the 'Source location: \$/ePOWER91/Build' and a tree view of folders including 'Administrative', 'ePOWER84', 'ePOWER90', and 'ePOWER91'. The 'ePOWER91' folder is expanded, showing subfolders like 'Build', 'Client.Tests', 'Common', 'Core', 'Database', 'Inetpub', 'Install', 'Lib', 'packages', 'Plugins', 'Research', 'RESTServices', 'Services', 'TempFiles', 'TestHelper', 'ThirdParty', 'Toolkit', 'Tools', 'UI', and 'WebServiceLoadTest'. A callout box points to the 'Build' folder with the text: 'Source code is structured so each release is branched and maintains it's own history.' The 'Local Path' is shown as 'c:\dev\ePOWER91\...'. On the right, a partial view of a table is visible, showing columns for 'Check-in' and dates.

Source code is structured so each release is branched and maintains it's own history.

CI – Cruise Control

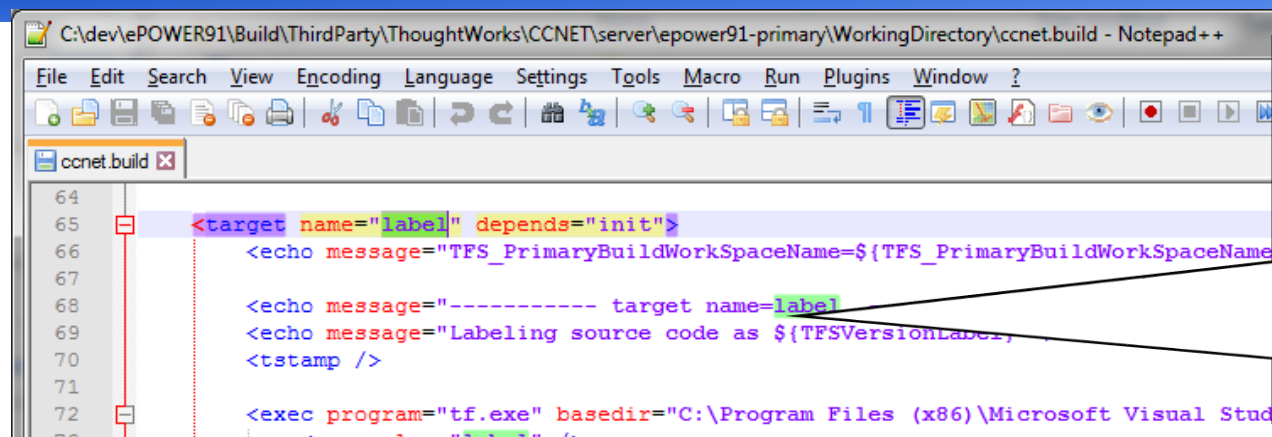
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```
<?xml version="1.0" encoding="utf-8"?>
<cruisecontrol xmlns:cb="urn:ccnet.config.builder" xmlns="http://thoughtworks.com/ccnet" >
  <!-- ePOWER version number prefix -->
  <cb:define ePOWERVersionPrefix="9.0.0."/>
  <project name="epower91-primary">
    <askForForceBuildReason>Required</askForForceBuildReason>
    <webURL>http://PSDBuild91/builds/server/PSDBuild91/primary/epower91-primary</webURL>
    <triggers>
      <intervalTrigger name="continuous" seconds="300" buildCondition="IfModificationExists" initialSeconds="30" />
      <!-- intervalTrigger name="continuous" seconds="60" buildCondition="ForceBuild" initialSeconds="30" -->
    </triggers>
    <modificationDelaySeconds>300</modificationDelaySeconds>
    <sourcecontrol type="filtered">
      <sourceControlProvider type="vsts" autoGetSource="false" applyLabel="false">
        <executable>C:\Program Files (x86)\Microsoft Visual Studio 14.0\Common7\IDE\tf.exe</executable>
        <server>http://[redacted]:8081/tfs/ePOWER</server>
        <project>$/epower91/Build</project>
        <workspace>ws_epower91_primary_build</workspace>
        <workingDirectory>C:\CCNET\server\epower91-primary\WorkingDirectory\build</workingDirectory>
        <domain>USI-DOMAIN</domain>
        <username>[redacted]</username>
        <password>[redacted]</password>
      </sourceControlProvider>
    </sourcecontrol>
  </project>
</cruisecontrol>
```

CCNet polls for changes every 5 minutes. If a change is found it will wait an additional 5 minutes of inactivity before starting a build.

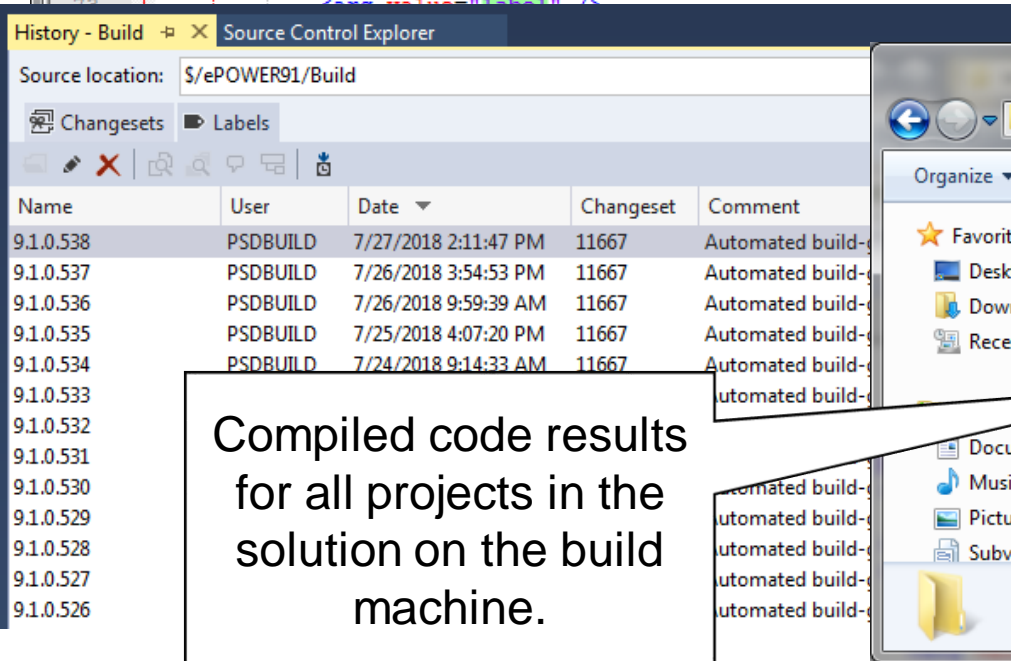
CI – Label, Get, and Compile Code

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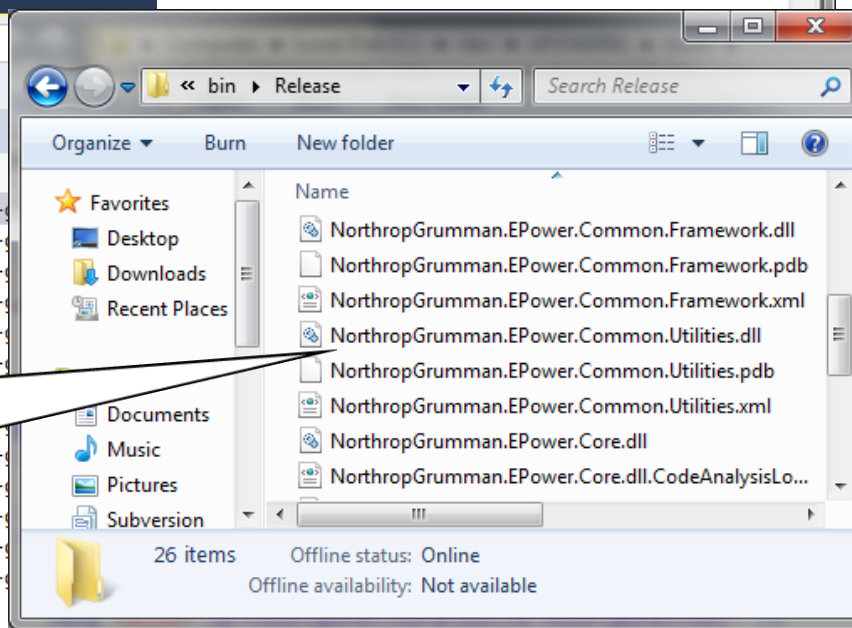
```
64
65 <target name="label" depends="init">
66   <echo message="TFS_PrimaryBuildWorkSpaceName=${TFS_PrimaryBuildWorkSpaceName}" />
67
68   <echo message="----- target name=label" />
69   <echo message="Labeling source code as ${TFSVersionLabel}" />
70   <tstamp />
71
72   <exec program="tf.exe" basedir="C:\Program Files (x86)\Microsoft Visual Studio\2010\Team Tools\Build Tools\MSBuild\Binaries\amd64" />
73 </target>
```

NAnt script is run to label the “build” directory in source control with the build number (e.g. 9.1.0.538)



Name	User	Date	Changeset	Comment
9.1.0.538	PSDBUILD	7/27/2018 2:11:47 PM	11667	Automated build-
9.1.0.537	PSDBUILD	7/26/2018 3:54:53 PM	11667	Automated build-
9.1.0.536	PSDBUILD	7/26/2018 9:59:39 AM	11667	Automated build-
9.1.0.535	PSDBUILD	7/25/2018 4:07:20 PM	11667	Automated build-
9.1.0.534	PSDBUILD	7/24/2018 9:14:33 AM	11667	Automated build-
9.1.0.533				Automated build-
9.1.0.532				Automated build-
9.1.0.531				Automated build-
9.1.0.530				Automated build-
9.1.0.529				Automated build-
9.1.0.528				Automated build-
9.1.0.527				Automated build-
9.1.0.526				Automated build-

Compiled code results for all projects in the solution on the build machine.



SCA

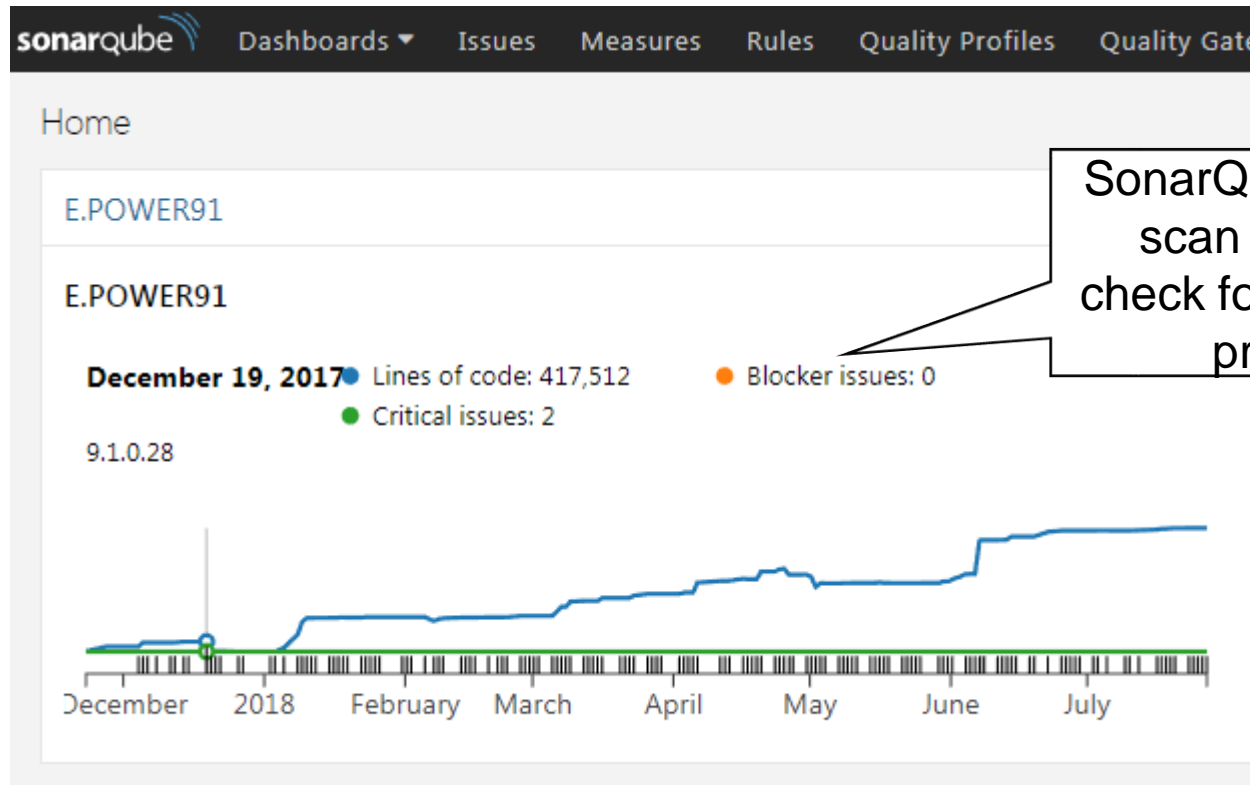
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Static Code Analysis (SCA)

SCA - SonarQube

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SonarQube is used to scan the code to check for good coding practices.

SCA - Fortify

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e.POWER 9.1 Code Scan Report

Hewlett Packard
Enterprise

Executive Summary

Issues Overview

On Jul 20, 2018, a source code review was performed over the Client code base. 527 files, 36,761 LOC (Executable) were scanned and reviewed for defects that could lead to potential security vulnerabilities. A total of 293 reviewed findings were uncovered during the analysis.

Fortify is used to check code for good security practices.

Issues by Folder

Critical	0
High	27
Medium	5
Low	254
False Positive - Access Control	0
False Positive - Cross Site Scripting	0
False Positive - Misc	0
False Positive - Null Dereference	0
False Positive - Path Manipulation	0
False Positive - Privacy	3
False Positive - Random	1
False Positive - Resources	0
False Positive - SQL Injection	0
False Positive - Third Party	3
False Positive - UI	0
False Positive - XML Validation	0
Defect Created	0

Functional Testing

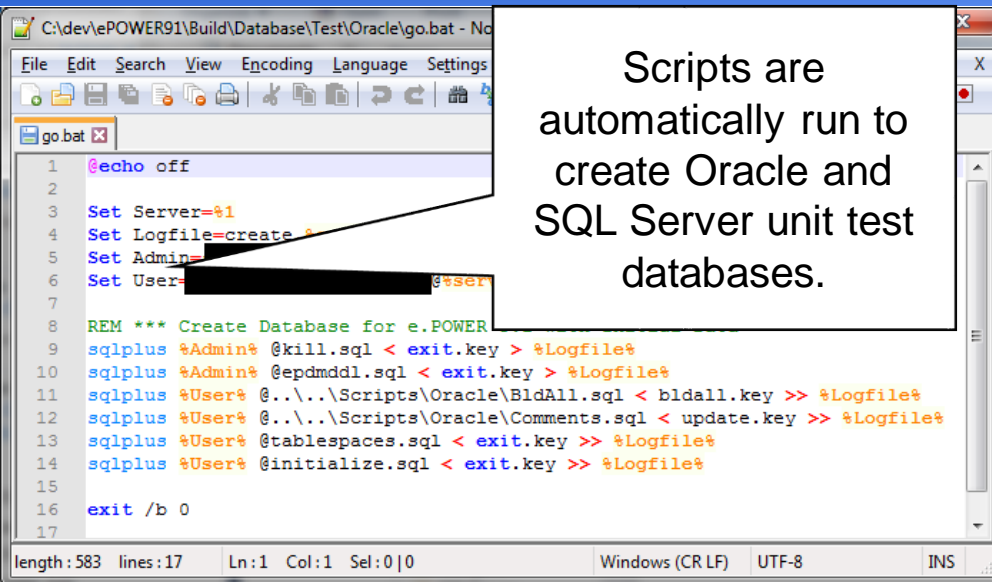
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Functional Testing

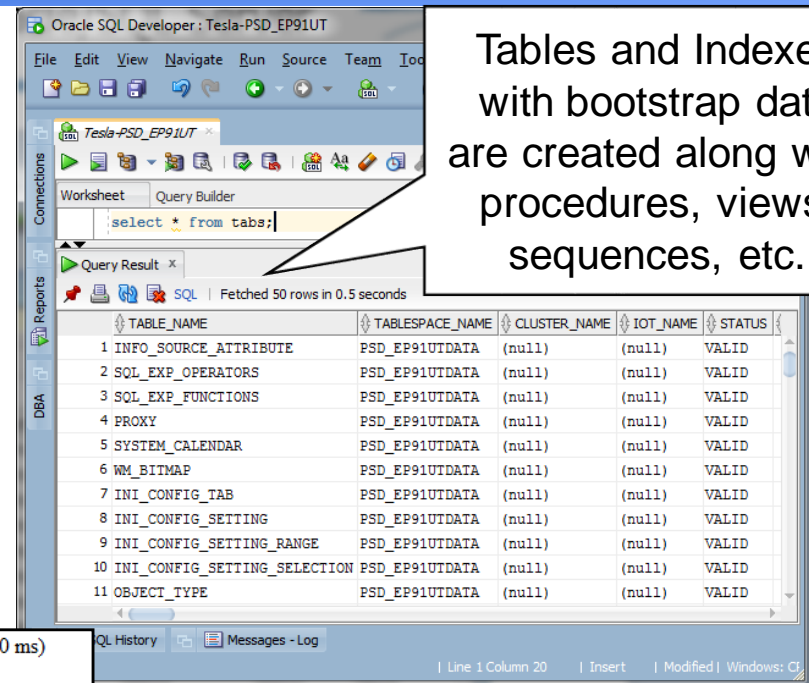
Functional Testing Cont.

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```
C:\dev\POWER91\Build\Database\Test\Oracle\go.bat - No
File Edit Search View Encoding Language Settings
go.bat
1 @echo off
2
3 Set Server=%1
4 Set Logfile=create %
5 Set Admin=
6 Set User= %ser
7
8 REM *** Create Database for e.POWER
9 sqlplus %Admin% @kill.sql < exit.key > %Logfile%
10 sqlplus %Admin% @epdmdl.sql < exit.key > %Logfile%
11 sqlplus %User% @...\Scripts\Oracle\BldAll.sql < bldall.key > %Logfile%
12 sqlplus %User% @...\Scripts\Oracle\Comments.sql < update.key > %Logfile%
13 sqlplus %User% @tablespaces.sql < exit.key > %Logfile%
14 sqlplus %User% @initialize.sql < exit.key > %Logfile%
15
16 exit /b 0
17
length: 583 lines: 17 Ln: 1 Col: 1 Sel: 0 | 0 Windows (CR LF) UTF-8 INS
```

Scripts are automatically run to create Oracle and SQL Server unit test databases.



TABLE_NAME	TABLESPACE_NAME	CLUSTER_NAME	IOT_NAME	STATUS
1 INFO_SOURCE_ATTRIBUTE	PSD_EP91UTDATA	(null)	(null)	VALID
2 SQL_EXP_OPERATORS	PSD_EP91UTDATA	(null)	(null)	VALID
3 SQL_EXP_FUNCTIONS	PSD_EP91UTDATA	(null)	(null)	VALID
4 PROXY	PSD_EP91UTDATA	(null)	(null)	VALID
5 SYSTEM_CALENDAR	PSD_EP91UTDATA	(null)	(null)	VALID
6 WM_BITMAP	PSD_EP91UTDATA	(null)	(null)	VALID
7 INI_CONFIG_TAB	PSD_EP91UTDATA	(null)	(null)	VALID
8 INI_CONFIG_SETTING	PSD_EP91UTDATA	(null)	(null)	VALID
9 INI_CONFIG_SETTING_RANGE	PSD_EP91UTDATA	(null)	(null)	VALID
10 INI_CONFIG_SETTING_SELECTION	PSD_EP91UTDATA	(null)	(null)	VALID
11 OBJECT_TYPE	PSD_EP91UTDATA	(null)	(null)	VALID

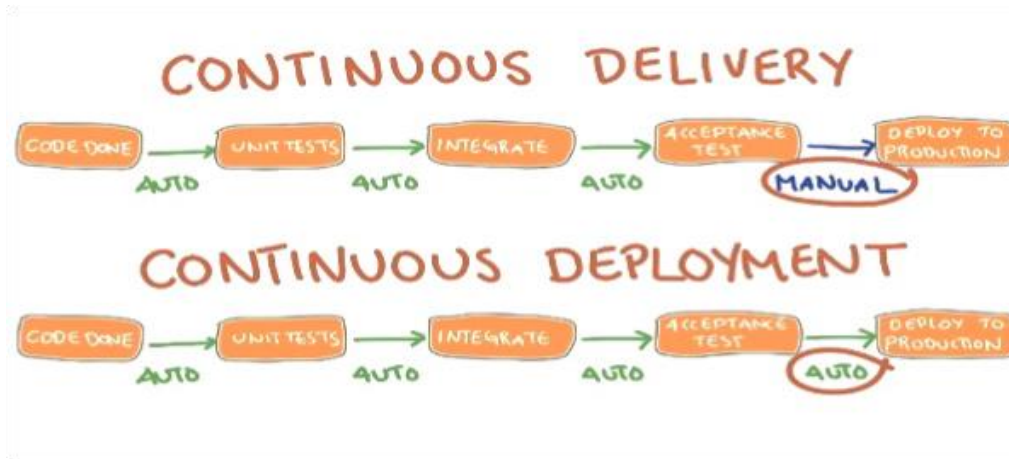
Tables and Indexes with bootstrap data are created along with procedures, views, sequences, etc.

```
[exec] 3:03:36 PM Unit Test > SampleSupportDataProviderTests_PID692< (TearDown done) Elapsed: 0.00 sec ( 578.00 ms)
[exec] 3:03:36 PM Unit Test > SecurityObjectReferencesTests_PID692< (SetUp started)
[exec] .....
[exec] 3:03:44 PM Unit Test > SecurityObjectReferencesTests_PID692< (TearDown done) Elapsed: 8.00 sec ( 8,436.00 ms)
[exec] 3:03:44 PM Unit Test > WorklistRelated_PID692< (SetUp started)
[exec] ...
[exec] 3:03:46 PM Unit Test > WorklistRelated_PID692< (TearDown done) Elapsed: 1.00 sec ( 1,140.00 ms)
[exec] 3:03:46 PM Unit Test > XmlVariantRelated_PID692< (SetUp started)
[exec] ..
[exec] 3:03:46 PM Unit Test > XmlVariantRelated_PID692< (TearDown done) Elapsed: 0.00 sec ( 828.00 ms)
[exec] 3:03:46 PM Unit Test > ServerConfigurationInfoTests_PID692< (SetUp started)
[exec] .....
[exec] 3:03:47 PM Unit Test > ServerConfigurationInfoTests_PID692< (TearDown done) Elapsed: 0.00 sec ( 703.00 ms)
[exec] 3:03:47 PM Unit Test > EventProcessDataProviderTests_PID692< (SetUp started)
[exec] .....
[exec] 3:03:49 PM Unit Test > EventProcessDataProviderTests_PID692< (TearDown done) Elapsed: 1.00 sec ( 1,421.00 ms)
[exec] 3:03:49 PM Unit Test > EventSubscriptionDataProviderTests_PID692< (SetUp started)
```

Unit test startup, execute, and teardown is recorded in the build log.

CD

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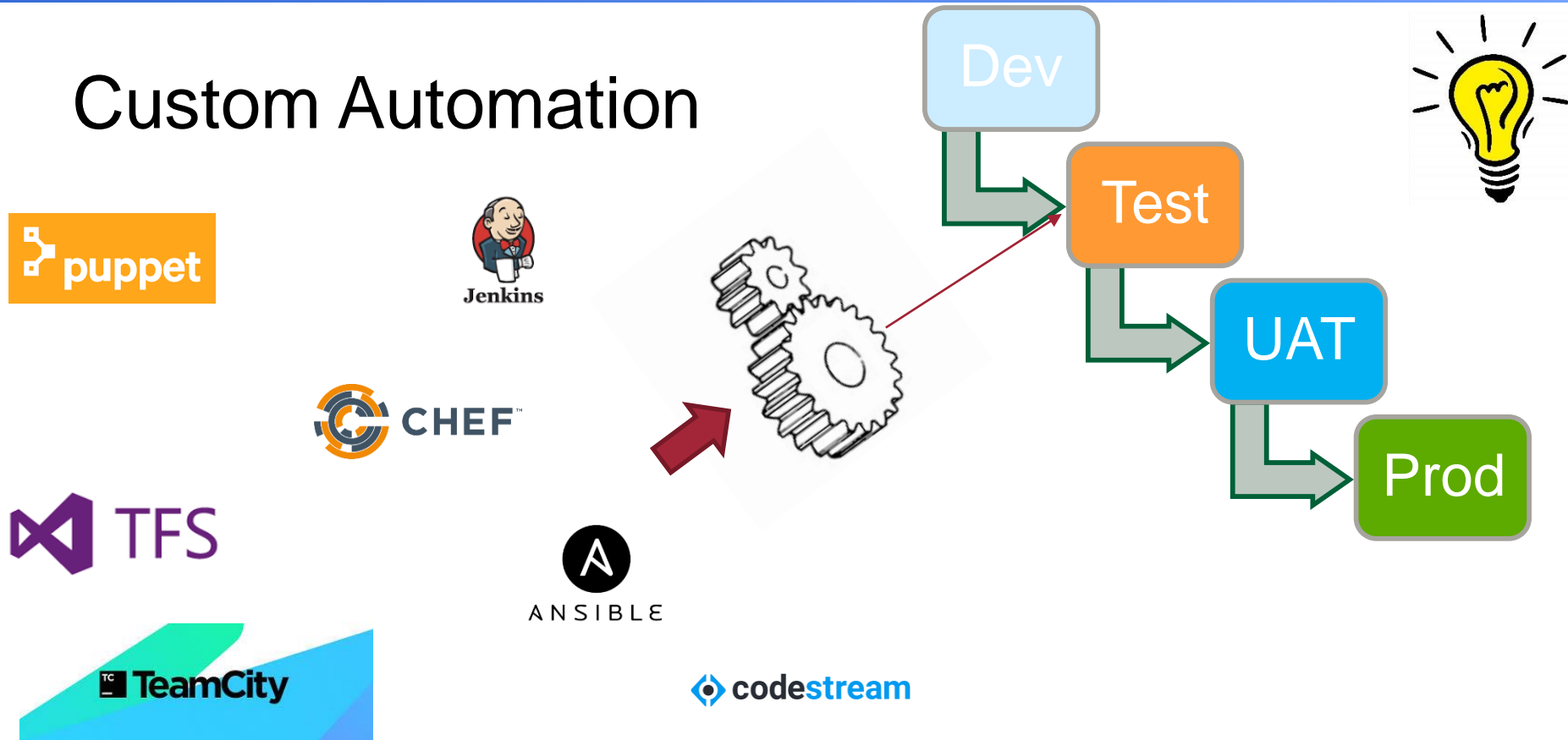


Continuous Deployment/Delivery (CD)

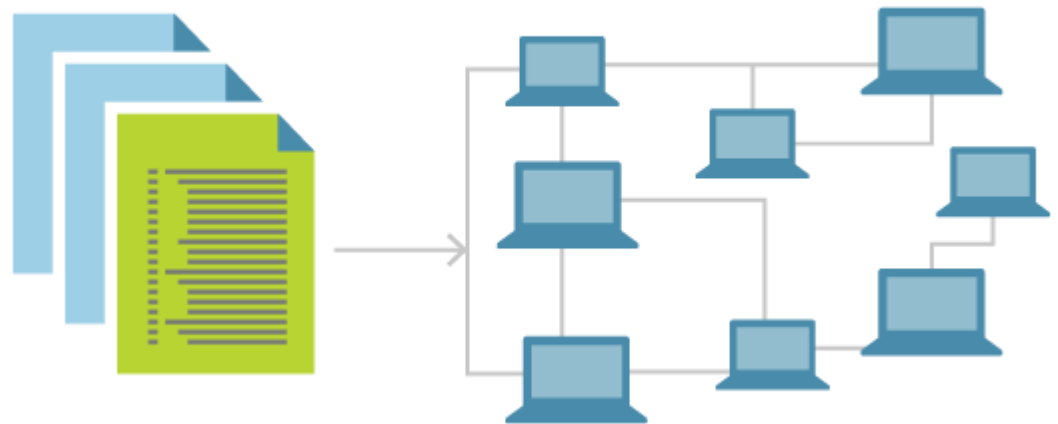
CD – Actionable Data

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Custom Automation



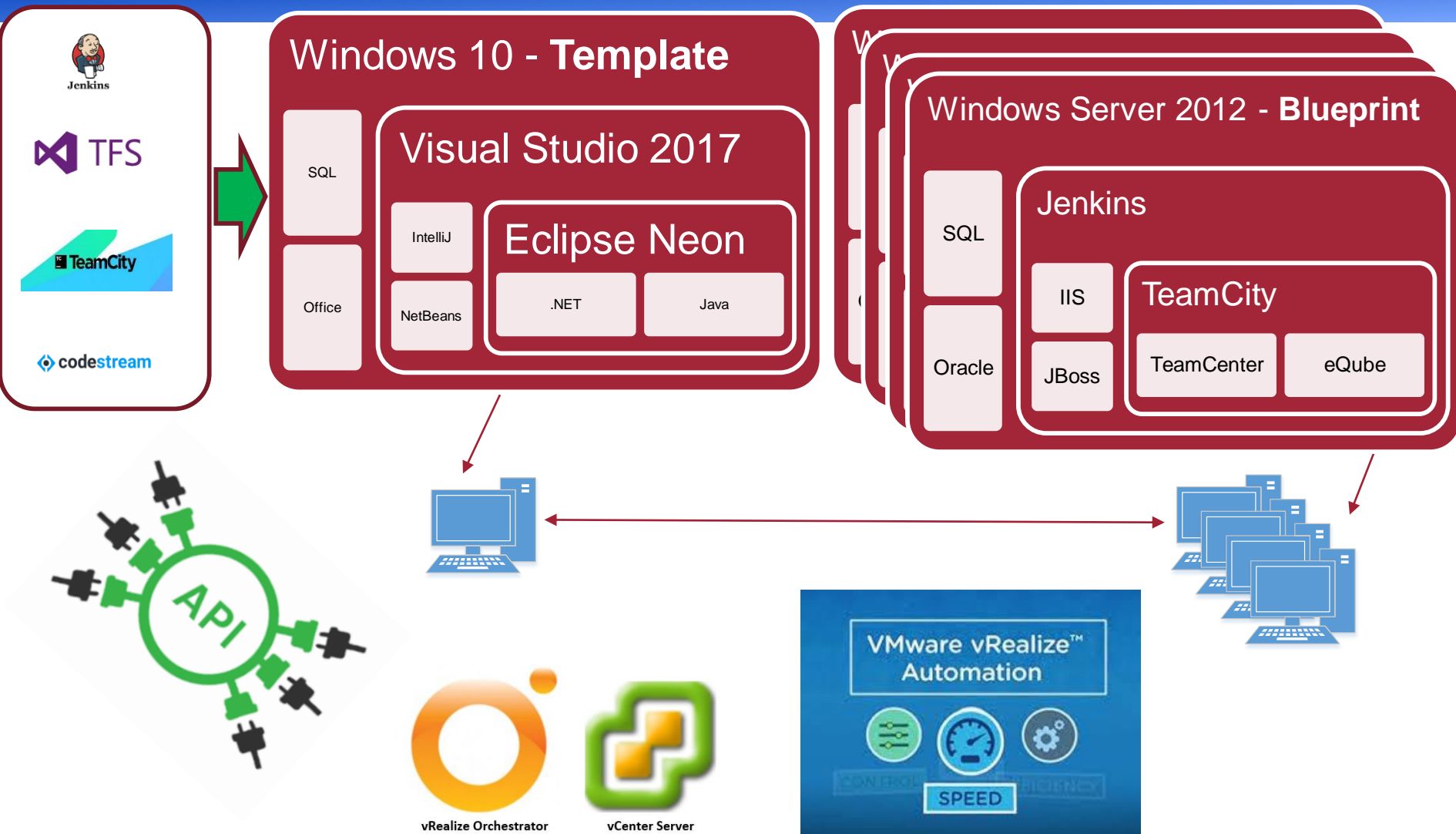
Intelligently transferring and deploying a solution to the desired environments



Infrastructure as Code (laC)

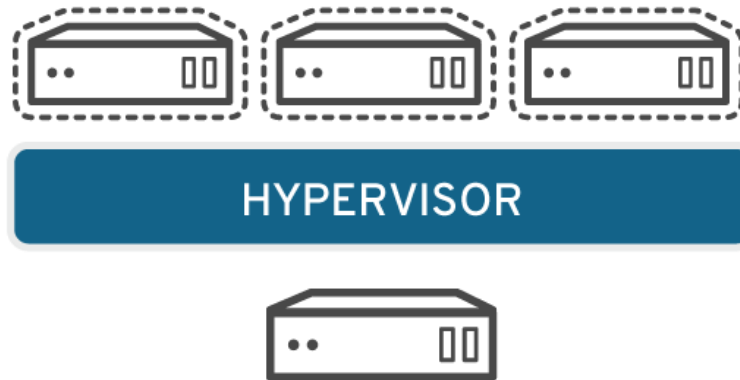
IaC – Gold Disk Management

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Virtualization and Parallelization

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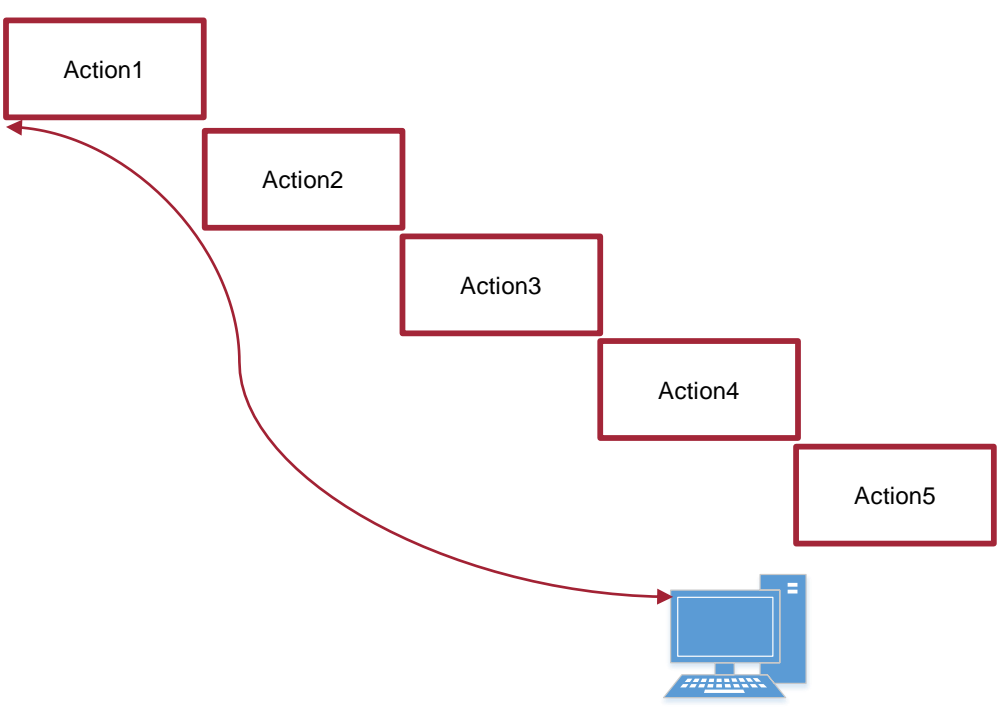
1:1

Virtualization and Parallelization

Virtualization and Parallelization Cont.

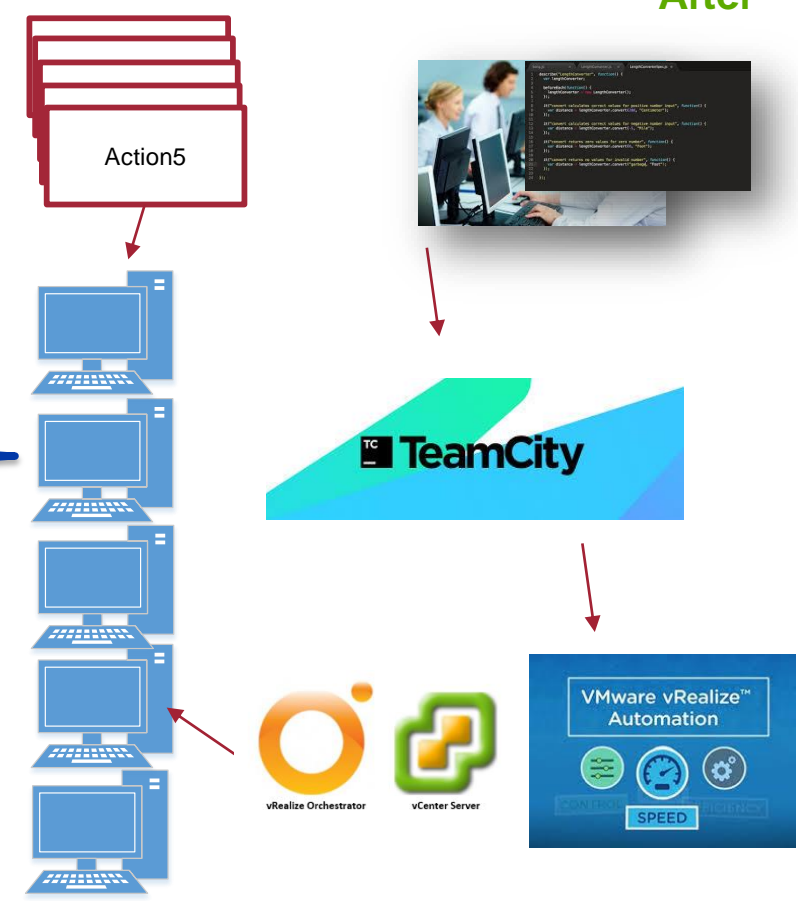
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Before



5 hours in total (1 hour for each task)

After



1 hour in total

Automated regression test tend to take hours to complete, parallelization can decrease that time.

Metrics

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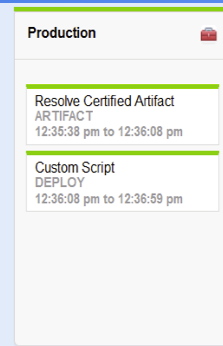
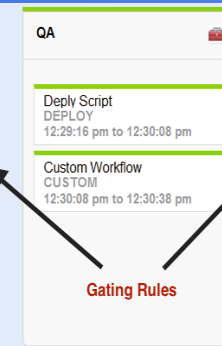
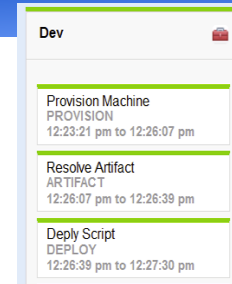
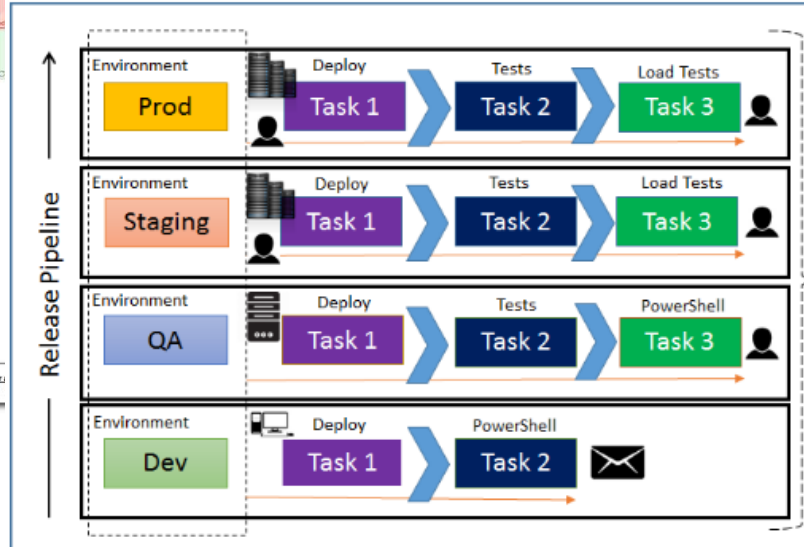
Metrics

Metrics Cont.

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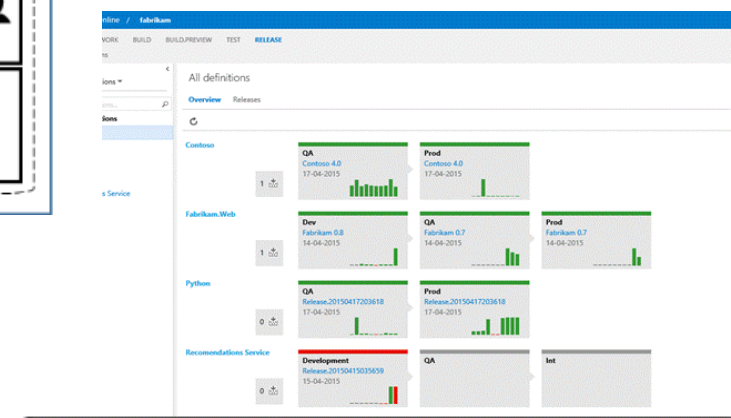


Release Definition

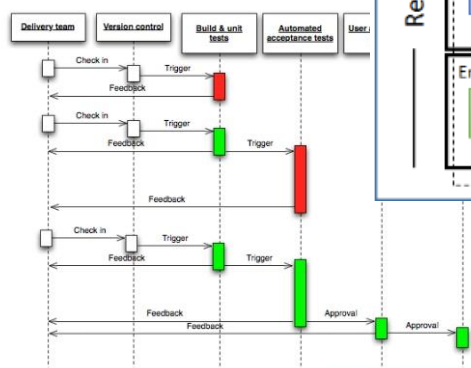


Gating Rules

Release



Deployment Pipeline



TeamCity - Continuous Delivery Server

Metrics - Code

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NCover drills down all the way to individual lines of code to show what was tested.

```
172 #region IAssignmentListTemplateDataProvider Members
173
174 /// <summary>
175 /// Returns all defined <see cref="AssignmentListTemplate"/>s owned by the given
176 /// node (user or group).
177 /// </summary>
178 /// <param name="nodeId">Node Id for the user or group to retrieve templates for.</param>
179 public List<AssignmentListTemplate> GetAll(int nodeId)
180 {
181     IWorkflowAdministrationService proxy = GetIClientWorkflowAdministrationService(); IChannel channel = proxy as IChannel;
182
183     try
184     {
185         List<AssignmentListTemplate> result = proxy.GetAllAssignmentListTemplates(AuthenticationTicket, nodeId);
186         CloseChannel(channel);
187         return result;
188     }
189     catch (Exception exception)
190     {
191         DetermineException(channel, exception);
192     }
193
194     return null;
195 }
```

The screenshot displays the NCover Coverage Report for a project named 'New Project'. The report is viewed in a web browser at the URL 'psdbuild91/builds/epower91-secondary/log/coverage-9.1.0.537/FullCoverageReport.html'. The left sidebar shows a tree view of the project structure, including Modules, Namespaces, and Classes. The main content area shows the 'New Project Coverage Summary' with the following metrics:

- Symbol Coverage: **71.98%** (57339 of 79660)
- Branch Coverage: **72.32%** (25460 of 35207)
- Method Coverage: **74.86%** (9108 of 12166)
- Cyclomatic Complexity Avg: **1.99** Max: **145**
- Modules: **5**
- Namespaces: **113**
- Classes: **1279**
- Methods: **12166**
- Documents: **898**

Below the summary, the 'Top 5 Uncovered Assemblies' are listed with their respective coverage metrics:

Assembly	Symbol Coverage	Branch Coverage	Method Coverage	Cycl. Complexity
NorthropGrumman.EPower.Common.Utilities	55.88% : 1312 of 2348	56.97% : 601 of 1055	60.25% : 344 of 571	Avg: 1.51 Max: 16
NorthropGrumman.EPower.UI.Common.DataProviders	56.10% : 5475 of 9759	65.49% : 702 of 1072	83.76% : 815 of 973	Avg: 1.80 Max: 10
NorthropGrumman.EPower.Database.DataAccessLayer	57.66% : 790 of 1370	55.93% : 377 of 674	60.45% : 133 of 220	Avg: 2.07 Max: 14

Questions???

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References and Images

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- CodeStream - <https://blogs.vmware.com/management/2015/03/gating-rules-vrealize-code-stream.html>
- Continuous Delivery - <http://electric-cloud.com/resources/continuous-delivery-101/continuous-deployment/>
- Continuous Integration - <https://visualstudio.microsoft.com/team-services/continuous-integration/>
- DevOps Cog - <https://gptpartners.com/industry-trends/devops-why-now/>
- DevoPedia - <https://devopedia.org/devops>
- IaC - <https://docs.microsoft.com/en-us/azure/devops/what-is-infrastructure-as-code>
- Functional Testing - <http://appknights.com/functional.html>
- Jenkins - <https://www.cloudbees.com/blog/top-10-best-practices-jenkins-pipeline-plugin>
- Metrics - <https://www.monsterinsights.com/google-analytics-vanity-metrics-that-are-wasting-your-time/>
- Questions - <https://nosweatpublicspeaking.com/your-questions-my/>
- SCA - <https://crmbusiness.wordpress.com/2016/07/27/why-developers-should-use-code-analysis-to-keep-code-quality-high/>
- TeamCity - <https://www.slideshare.net/vomel/continuous-delivery-with-teamcity>
- TDD - <https://www.vectorcast.com/blog/2011/03/test-driven-development-vectorcast-part-1>
- TDD2 - <https://centricconsulting.com/case-studies/agile-test-driven-development/>
- TFS - <https://blogs.msdn.microsoft.com/bharry/2015/04/29/visual-studio-and-team-foundation-server-at-build-2015/>
- Time Is Money - <https://yourstory.com/mystory/f39bea5268-do-you-know-the-phrase>