






ALM-Tosca Integration Technical Architecture Specification

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DOCUMENT REVIEWED AND APPROVED BY	
SIGNATURE: <small>DocuSigned by:</small>  <small>4DE07D5466F941E...</small>	DATE: 11-Jun-2018
NAME: Henry Farris	
ROLE: Business Manager	
SIGNATURE: <small>DocuSigned by:</small>  <small>46B0779B5A8A47B...</small>	DATE: 12-Jun-2018
NAME: Howard Chase	
ROLE: Technical Manager	
SIGNATURE: <small>DocuSigned by:</small>  <small>25A79B3719D84A9...</small>	DATE: 12-Jun-2018
NAME: Jason Tepfenhardt	
ROLE: Quality Assurance Representative	



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1 INTRODUCTION

1.1 PURPOSE

This document defines the design and architecture of VERA and Tosca integration. VERA, written by Tx3 Services, is software that controls Test Management for regulated environments. Tosca, by Tricentis, is a Testing tool that specializes in automated testing for a wide variety of systems.

The solution is successful when both products integrate without negatively impacting the strengths of each individual product. In other words, have VERA to manage and control the regulatory aspects of testing assets & projects – VERA remains the “system of record” for formal controls and approvals. Simultaneously, allow Tosca engineers to develop tests that execute and store results in the integrated environment, without impediments.

For more information on VERA Technical Specifications and Implementation, refer to the VERA Technical Architecture Specification, “Tx3.1022.SPC.003 (VERA 2.0 Tech Architecture Spec)”.

1.2 SCOPE


This document is narrowly scoped to cover the software design of a VERA – Tosca integration solution. It does not discuss the design or related validation deliverables for HPE/Micro Focus ALM, Tx3’s VERA, Tricentis Tosca or any environment in which they reside. Those artifacts are dealt with separately in the context of validating those components.

This integration solution is a few components that enable communication and control between VERA and Tosca.

1.3 DEFINITIONS

The following terms are used throughout this document:

Term	Definition
ALM	See ‘Application Lifecycle Management’
Application Lifecycle Management	An enterprise application manufactured by Micro Focus that provides test management, requirements management, and defect management capabilities for information technology and software development organizations.
Approval Policy	A collection of business rules establishing approval routes for electronic records.
Execution List	A series of Tosca Test Cases bundled together to achieve a specific result – typically, to test a specific business process. Tosca calls these “Execution Lists”. ALM calls these “Test Sets”.
Policy	A collection of business rules.
Project	A workspace within ALM that is used to access a collection of records related to a single application lifecycle management effort. A project may represent a software application, information system, or business project.
Record	See 'electronic record'

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Term	Definition
Record Owner	A specific person that owns or is responsible for a given electronic record.
Records Management Policy	A collection of business rules establishing workflows for electronic records.
Software Component	A piece of software that is a part of a larger software application.
System Adapter	A software component in the VERA application architecture that specializes in providing a software interface between VERA and an external software application. As it relates to the VERA Records Management Policy, a system adapter is responsible for ensuring the rules of the records management policy are enforced within the associated external system.
Test Case	A series of steps created to be executed in a target system under test. Tosca calls these "Test Cases". ALM calls these "Tests".
Test Set	A series of ALM Tests bundled together to achieve a specific result – typically, to test a specific business process. Tosca calls these "Execution Lists". ALM calls these "Test Sets".
Tosca	Automated Functional Testing tool produced by Tricentis.
Tx3 VERA	An enterprise application manufactured by Tx3 Services, LLC that specializes in enforcing shared business policies pertaining to the control of electronic records across multiple systems.
VERA	See 'Tx3 VERA'.
VERA Action Menu	The context sensitive menu displaying VERA features based on user group membership and the records management policy. The VERA Action Menu is the centralized user interface for all VERA functions.
Windows Client	A locally installed application comprised of a collection of Microsoft .NET library files (.dll) including the VERA user interface and functions.
Workflow	A defined sequence of stages that an electronic record goes through during its lifetime (from creation through deletion).
Workflow Script	A feature of ALM that enables users to programmatically customize the functionality of an ALM project.
Workflow State	A single stage within a workflow.

1.4 OVERVIEW

The overall system is comprised of a few requisite components to enable integration. The solution requires that both Vera 2.3+ and Tosca 11.1+ be installed and operational, supporting a multiuser environment. Additionally, Tosca's REST API service must be up and running.

On top of ALM/Vera, components are installed to register a new ALM Tosca Test Type and provide VERA integration between ALM & Tosca. The Tosca Test Type software knows how to interact with both ALM/Vera and Tosca for basic ALM operations, and VERA is configured to connect ALM & Tosca for defined workflow control operations. Both VERA & the ALM Tosca Test Type connects the two systems via standard API's and mechanisms.



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2 HIGH-LEVEL SOFTWARE ARCHITECTURE

VERA/Tosca integration components provide the following features:

- VERA is the system of record for the purposes of reviewing and approving Tosca Tests, Test Sets, and Execution Results.
- Create ALM Tests & Test Sets that are linked to corresponding Tosca items.
- Control corresponding Tosca Test Cases and Execution Lists for the purposes of Approvals, locking or unlocking Tosca items, preventing or allowing updates, as items move in and out of the approval process.
- Approve Tosca items in VERA, using standard VERA operations and configurable rules functionality.
- Execute Test Sets from ALM, storing results in ALM.
- Approve Tosca Test Results in VERA.
- Prior to Routing a Tosca item for approval, Tosca engineers can update items freely.


The architecture and design provides necessary regulatory controls while not hindering ALM/VERA or Tosca core operations. With this solution, both system can operate independently in ALM/VERA projects that do not use Tosca. VERA/Tosca control only affect ALM items that are created and linked to corresponding Tosca items.

All communication and control is achieved through standard, documented, and supported Tosca and ALM API's. For Tosca communication, REST API's are used for most requests; a Tosca Client executable is used for remote test execution.

Currently, the following ALM/VERA & Tosca items are integrated:

ALM Entity	Tosca Entity
Test	Test Case
Test Set	Execution List
Test Instance	Execution Entry
Run	Actual Log Entries
Results	Execution List Report

Other ALM items are not integrated with Tosca. For example, Requirements, Design Steps, Test Steps, or Defects are not integrated.

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VERA/TOSCA Integration High Level Architecture

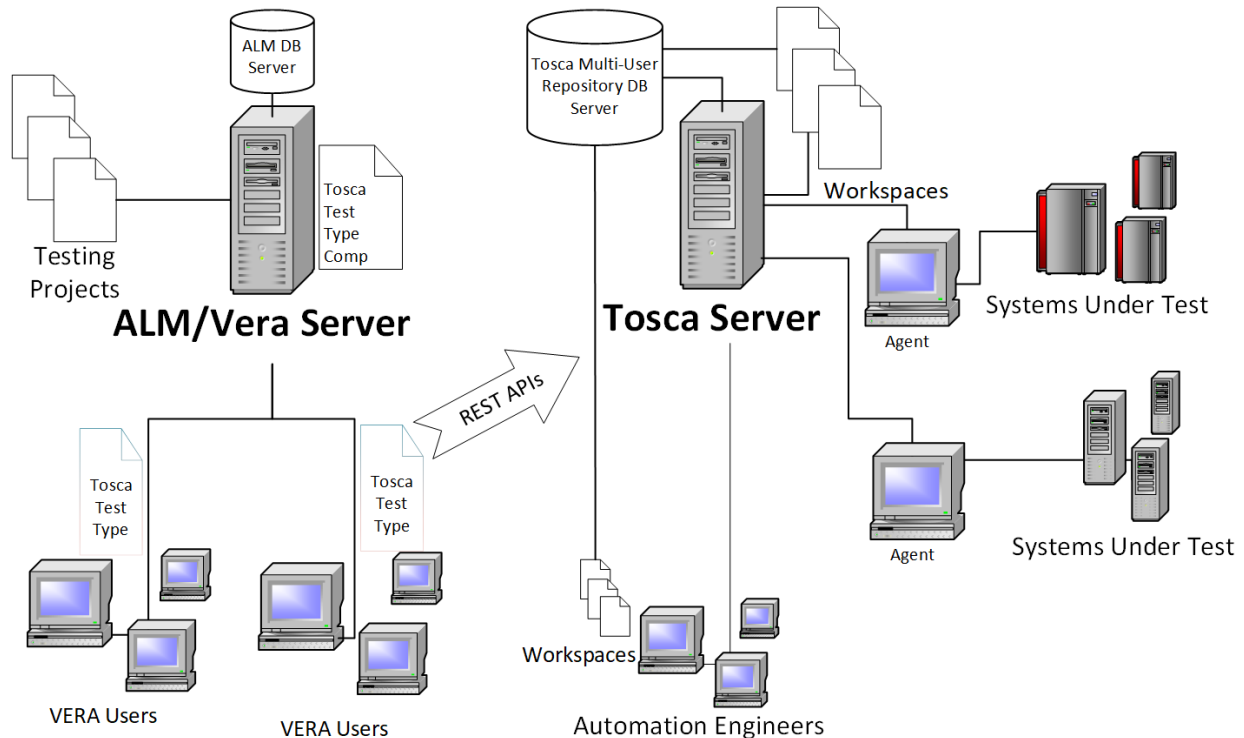


Figure 1. VERA/Tosca Integration

2.1 INTEGRATING WITH THE VERA WINDOWS CLIENT


The VERA ALM Template integrates with the VERA Windows client, which is a locally installed application comprised of a collection of Microsoft .NET library files (.dll).

Each VERA user session downloads additional Tosca-based components to service and control communication between a VERA user and Tosca.

2.2 USE CASES

Primary Use Cases that involve ALM/VERA-Tosca Integration include the following:

- Create Test Case


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- Route for Test Approval
- Create Test Set
- Execute Test Set
- Route Run for Approval

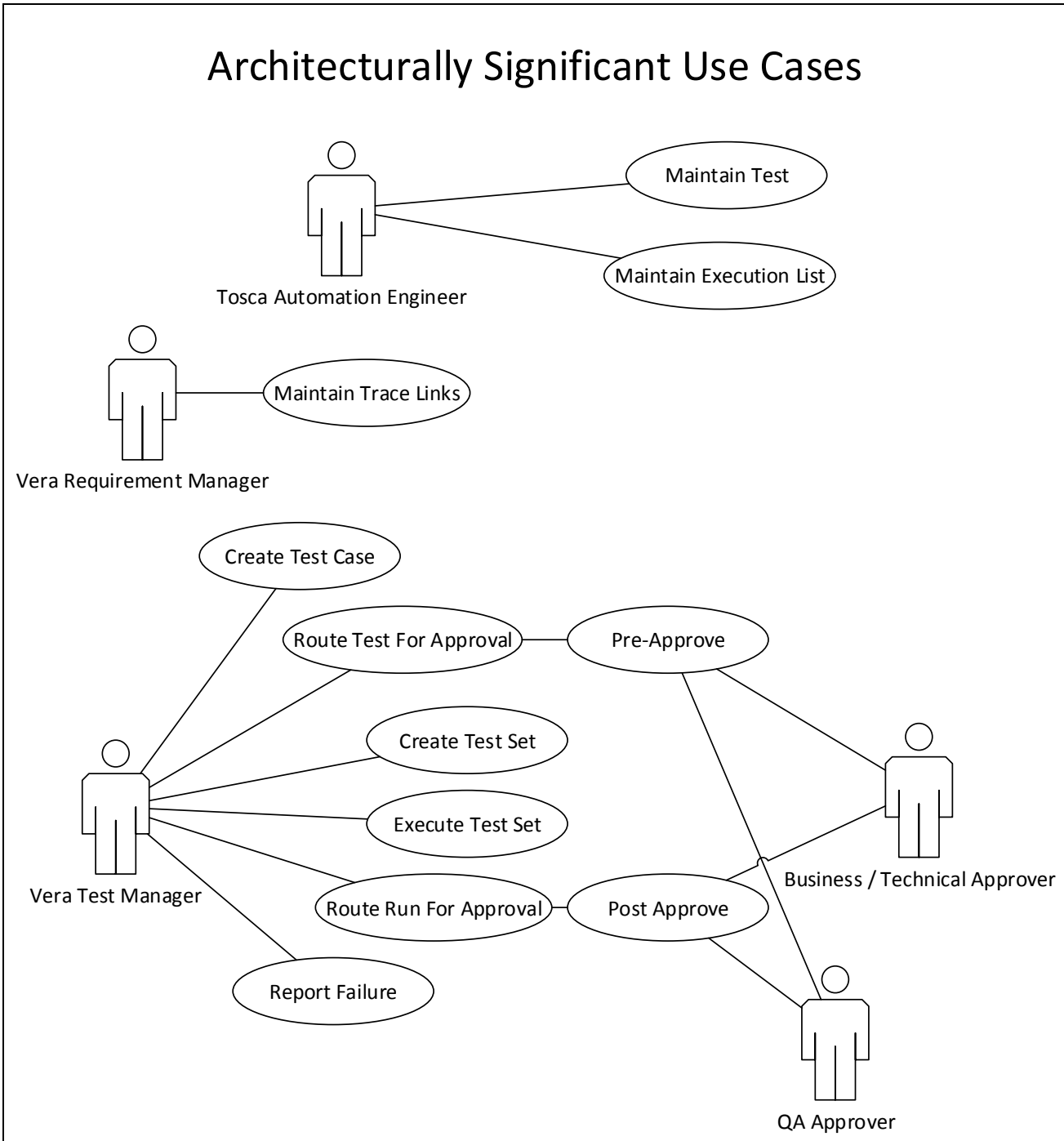
Additional use case such as 'Maintain Automated Test Case' or 'Maintain Traceability' are handled by core functionality within each system.


2.2.1 Actors

Human actors include all typical actors from each system – no new human actors are needed. However, ALM testers and approvers need to know a few new techniques for creating Tosca-based items, as well as approving Run results. ALM Testers must link a target item in Tosca by navigating the Tosca project. Approvers must understand what Tosca tests look like as well as understand a new format for reviewing and approving test results.

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2.2.2 Use Case Diagram

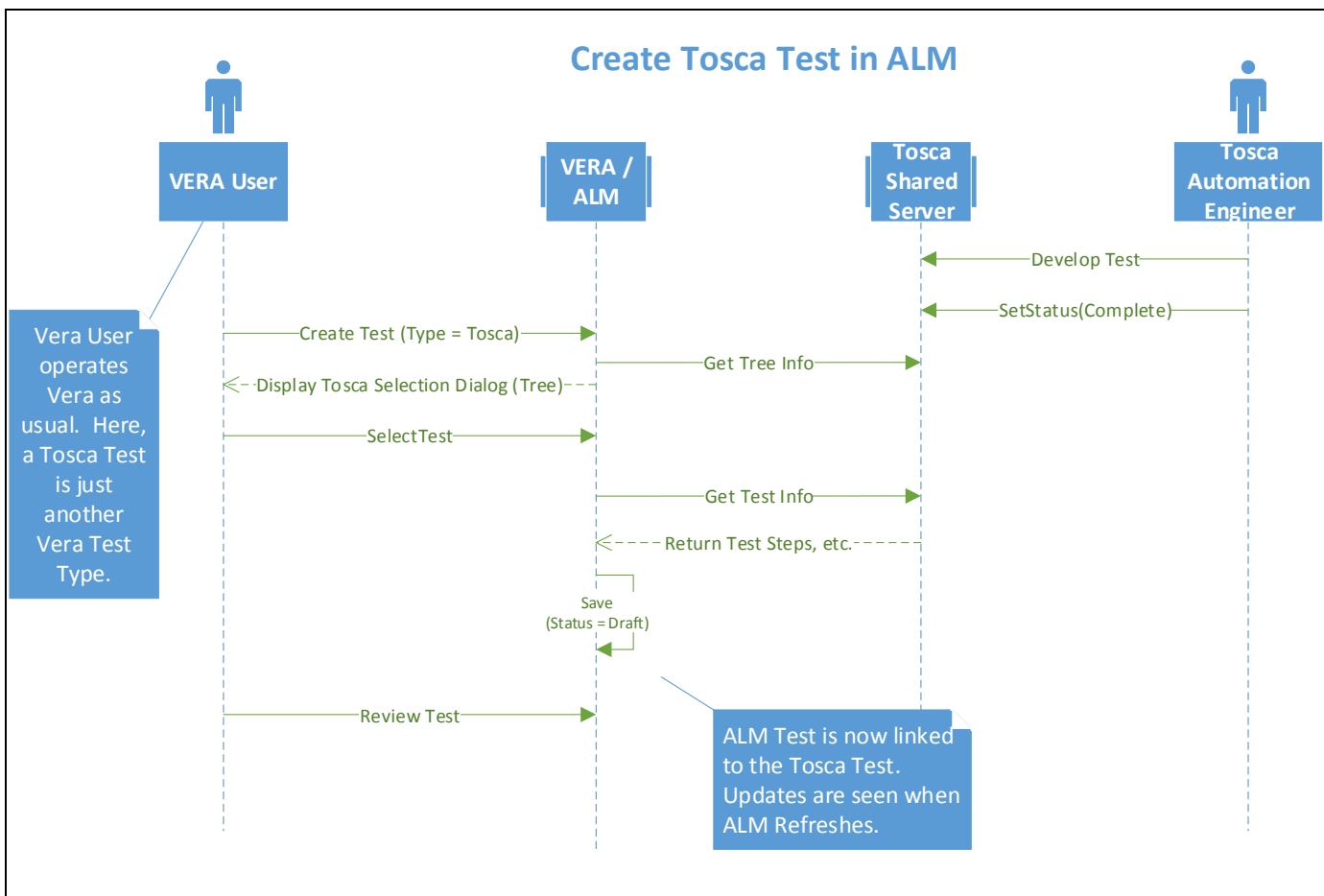


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3 ALM-TOSCA SEQUENCED INTERACTIONS

The sections below illustrate primary interactions between Tosca Engineers and Tosca, ALM Testers and VERA/ALM, and between VERA/ALM and Tosca. Four key operations are illustrated: Create Test, Approve Test, Create & Execute Test Set and Approve Test Execution Results.

3.1.1 Create ALM Tosca Test



Note:

- Once selected, VERA and ALM ID's are saved to the Tosca Item and the Tosca ID is saved to the ALM item. Once this occurs, items are considered "linked" and the Tosca Item can now be controlled by ALM.
- Release 1: Displayed Tosca Tests are representations of what is in Tosca. Step information is not actually stored in ALM.



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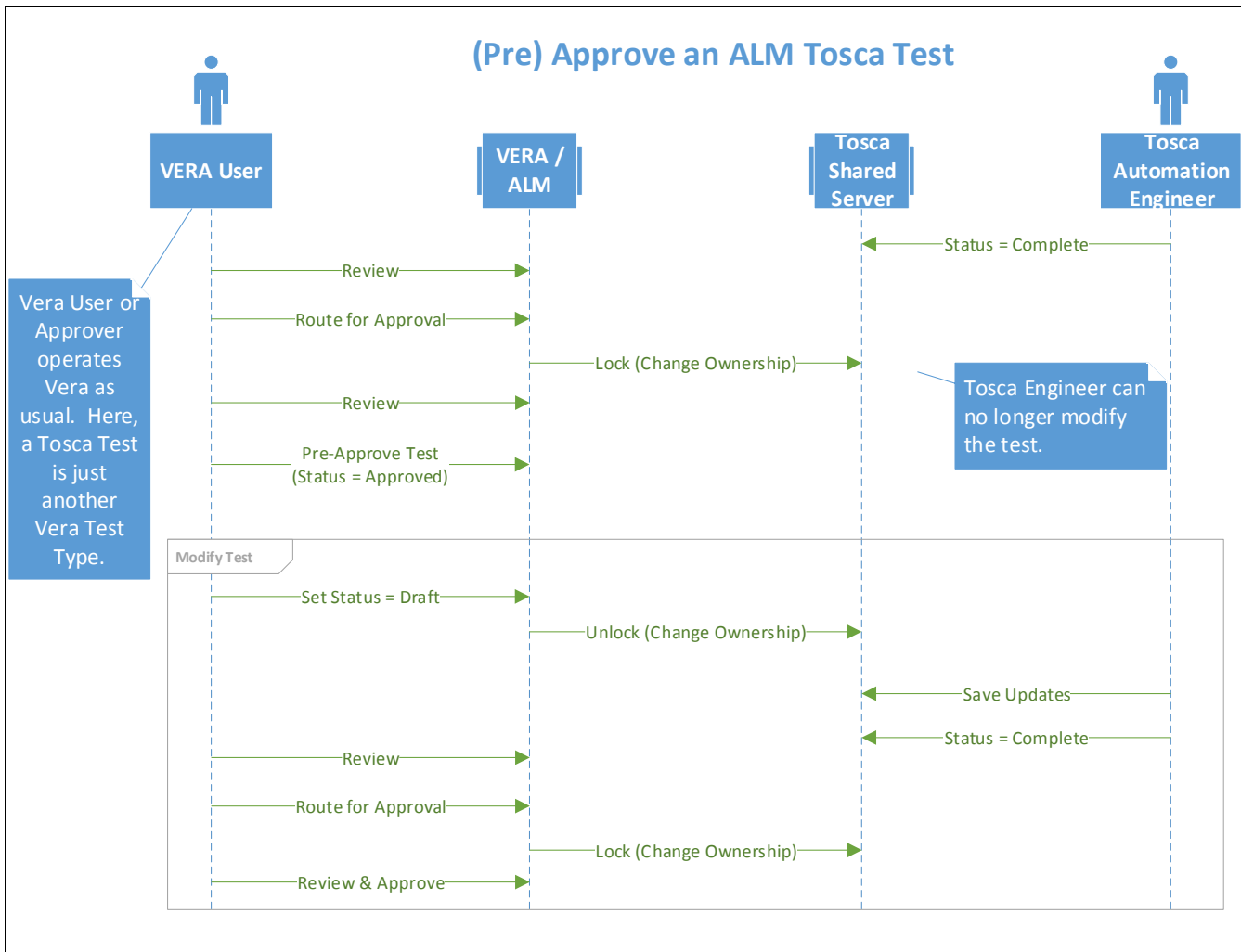
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3.1.2 Pre-Approve ALM Tosca Test



Note:

- Tosca items are “locked” by changing group ownership of the item to an Administrator-level group. Only members of the Administrator level group are able to change the Tosca item.
- Conversely, items are “unlocked” by changing group ownership of a Tosca item to a group where everyone is a member. Under this ownership, all engineers can modify the Tosca Item.



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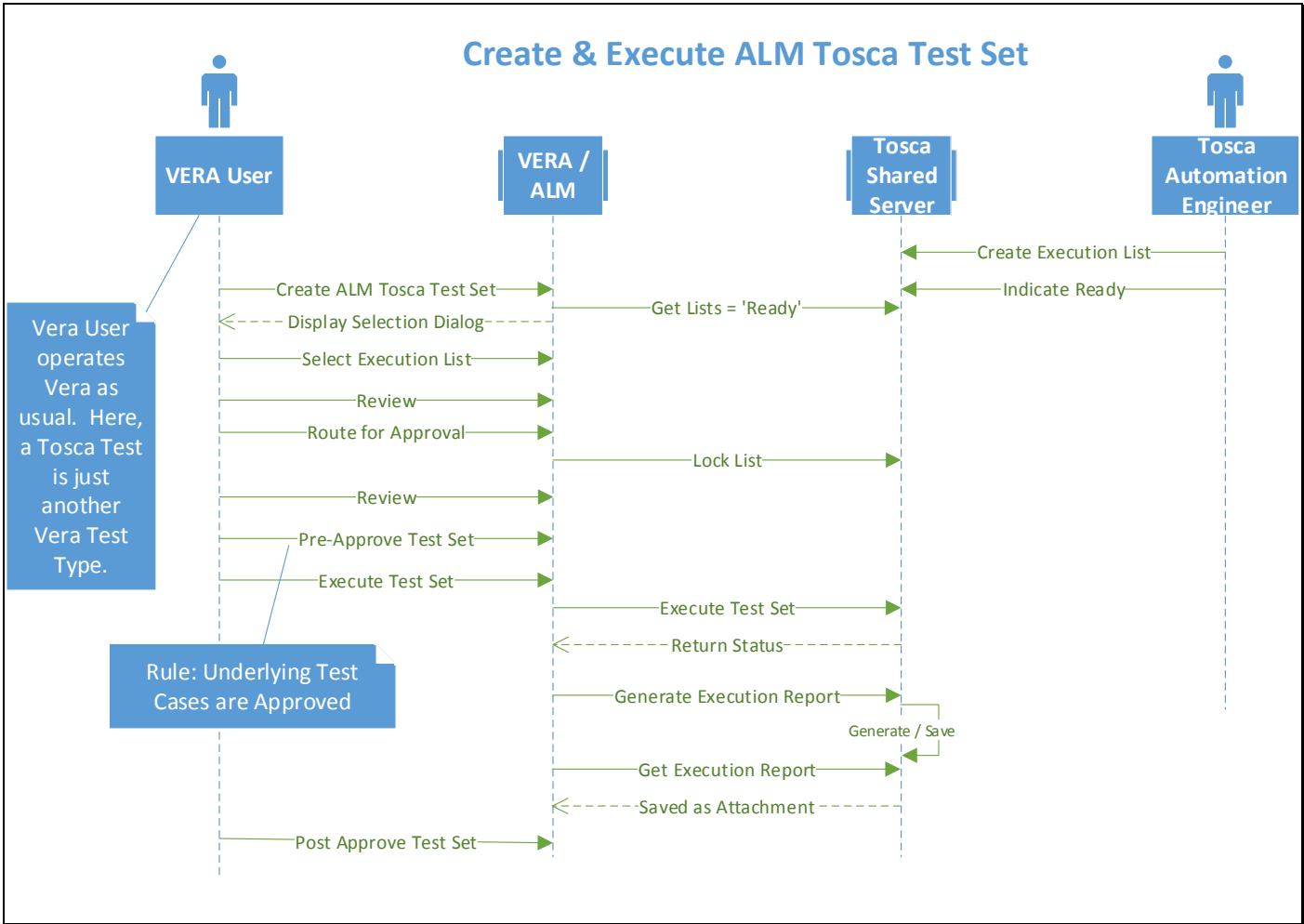
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3.1.3 Create & Execute Test Set

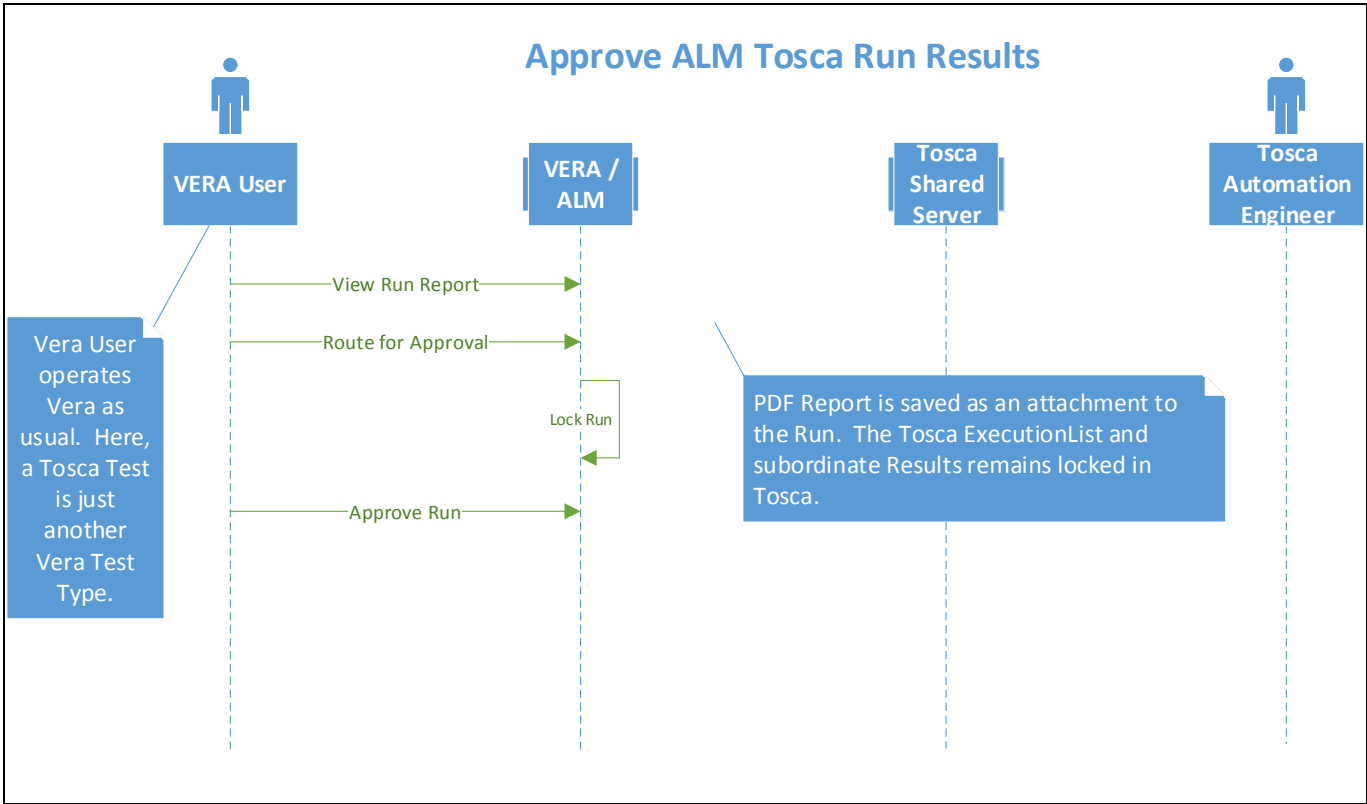



Note:

- Remote execution depends on Tosca Remote Agents being configured and operational.

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3.1.4 Approve Test Set Execution Results



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4 ALM/VERA – TOSCA SERVER & PROJECT INITIALIZATION

4.1 PROJECT CREATION

When creating a new ALM project, it is important to specify correct information about the Tosca environment so that ALM users can link the correct Tosca Test Cases and Execution Lists to corresponding ALM entities. Specifically, each project is setup to point to a specific Tosca Server (configured as a multi-user environment), and a specific Tosca “Workspace” on that server.

The integration allows for various organizational models for connecting ALM to Tosca. The following model is recommended and works well for a large organization with many business units:

4.1.1 Prerequisites

The Integration requires several items to be in place in order to successfully establish communication and control between the two systems:

- Tosca is setup in a multi-user environment
- The Tosca REST API service must be installed & configured
- A Tosca “lock” group and “unlock” group must be defined in order to control access to Tosca items. The “lock” group must be a group containing only Admin users. The “unlock” group is a group that all Tosca engineers are a member of. This enables “locking” and “unlocking” Tosca items from ALM – i.e. when an item is routed for approval, ALM changes the Tosca “owning group” to the “lock” group.
- Tosca Integration property fields are configured.
- One or more Tosca Agent machines are setup with Tosca Commander, Tosca Remote Agent, and the appropriate software required for target testing (i.e. the System/Application under Test).
- A Tosca-enabled ALM template is configured, with a Tosca Test Type and associated add-in components.

4.1.2 Recommended Enterprise Organizational Model

The following model attributes are recommended:

- Each business unit has its own Tosca “Repository” (e.g. if using SQL Server, each business unit has its own database).
- In ALM, each business unit has its own “Domain”. Therefore, each ALM Domain contains all of business unit’s projects.
- Each project in a domain is configured to point to a unique Tosca Workspace on the Tosca Server. That Workspace is configured to store all work in the corresponding Tosca Repository, created for that business unit. In other words, create the Workspace to point to the business unit’s repository.
- There is a one-to-one mapping between an ALM Domain and a Tosca Repository.



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- There is a one-to-one mapping between an ALM Project and a defined Workspace on the Tosca Server.
- Name each Tosca Workspace on the server in the form “<ALMDomain>_<ALMProject>”.

The following illustrates a sample organization of ALM Domains/Projects and how they map to Tosca Repositories, via Workspaces on the Tosca Server.

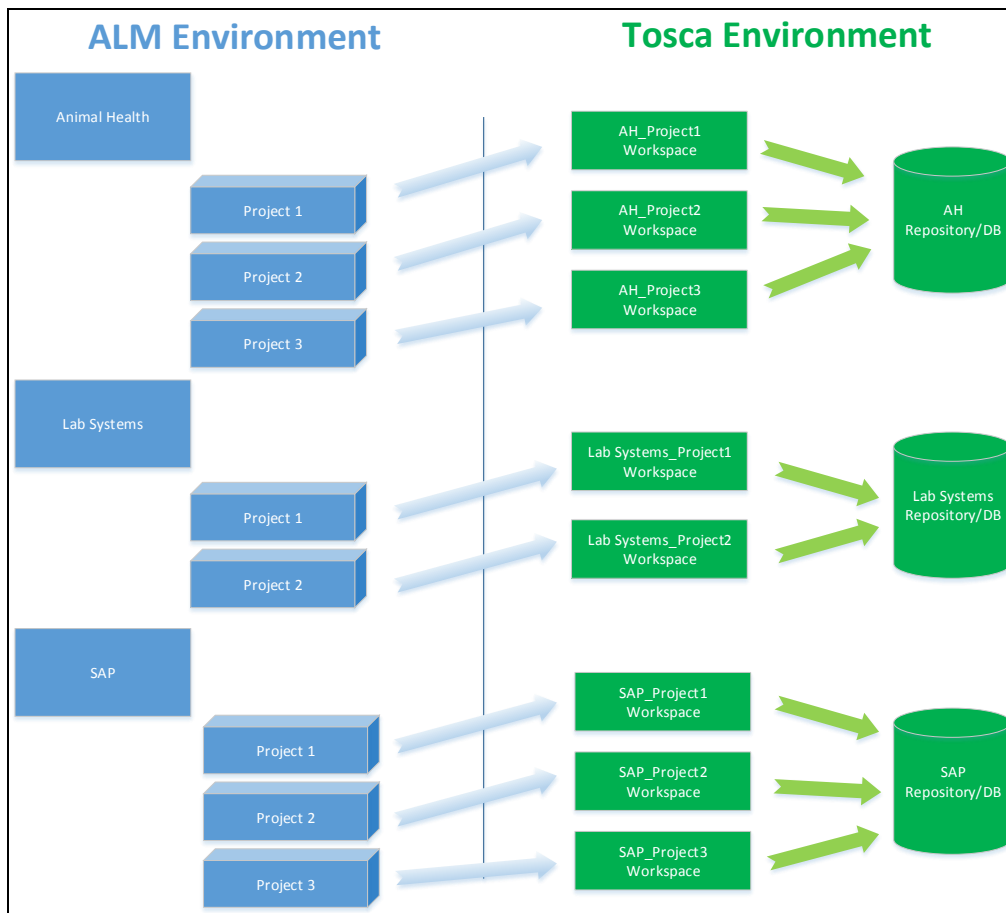



Figure 2. Sample Project / Workspace Organization

In the diagram above, three ALM Domains are defined. Each Domain has a corresponding Tosca Repository in the Tosca environment. Each ALM project is configured (in the Synchronization Policy file) to access Tosca through a corresponding Workspace, defined on the Tosca Server. The implementation uses the project's Tosca Workspace information, in order to communicate to Tosca, via REST.

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4.1.3 High Level Project Creation Steps

1. Create Tosca Repository, if necessary.
2. Create Tosca Workspace on the Tosca Server to point to the correct repository.
3. Create ALM/VERA Project.
4. Identify elevated Admin level Tosca Account for communicating from ALM to Tosca. Make sure to have the encrypted password to put in the project's Synchronization Policy file.
5. Update the ALM/VERA project's Synchronization Policy file to fill in information for Server, Workspace, Service Account credentials, and the Tosca Lock/Unlock group names.

4.1.4 Test Execution

A Tosca Remote Agent must be setup to run a test for a specific application. The Remote Agent software communicates with the primary Tosca Server's Distributed Execution service (aka "Dex"). When a Tosca Test Set is executed in ALM/VERA, VERA requests from Dex that a Tosca Execution List is run and to return results to ALM. This is accomplished using Tosca's "CI Client" software, designed to remotely launch tests on command through Dex.

Once a Test Set completes, ALM/VERA runs a report and saves that report to the Test Set. Approvers view the Report to Approve results.



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5 ALM/VERA CONFIGURATION

5.1 OVERVIEW

The integration updates three areas in VERA:

1. ALM Fields in Test Plan and Test Set
2. VERA Policy files
3. VERA/ALM action “workflow” as an extended ALM .tds file

A few ALM fields are added to support the connection and management of Tosca from ALM. ALM Field controls for items of type “Tosca” are specified in VERA’s Records Management Policy. Tosca connection information is configured in VERA’s Synchronization Policy. And, custom toolbar button/actions are configured in Tosca_Interface.tds.

5.2 ALM FIELDS

In the Test Plan and Test Lab: Test Set modules the following fields are defined as standard string fields:

Tosca ID	Tosca’s Unique ID for the item to which this ALM item is connected. This number varies in format, governed by Tosca.
VERA Sync ID	A Unique ID that is consistent between Vera, ALM, and Tosca. This ID is used for VERA’s ability to Synchronize across multiple systems.

5.3 VERA POLICY FILES

Two VERA Policy files are updated to configure record update controls and Tosca connection information:

1. Records Management Policy
2. Synchronization Policy

For additional information about VERA policy files, see the VERA Technical Architecture Specification, “Tx3.1022.SPC.003 (VERA 2.0 Tech Architecture Spec)”.


5.3.1 Records Management Policy

Additional Rules are configured to control updates in the following areas:

5.3.1.1 Field Editability

These VERA fields are not editable for items of type “Tosca”:

- Tosca ID
- Test Name (comes from Tosca)
- Description (comes from Tosca)
- Test Type

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For example, this entry prevents the Description field from being updated if the item is linked to Tosca (Tosca ID field is empty):

```
{
  "Name": "Description",
  "Is Data": "Yes",
  "Edit Rules": [
    {
      "Is Editable": "No",
      "Roles": ["Everyone"],
      "Constraints": [
        {
          "Name": "Tosca ID"
          "Type": "Field Is Not Empty",
        }
      ]
    }
  ]
},
```

5.3.1.2 Disallowed Actions

The following actions are not allowed on Tosca Test types in ALM:

- Copy/Paste – An ALM Tosca item cannot be copied because it links to one and only one Tosca item.
- Smart Delete – An ALM Tosca item is not currently allowed to be deleted
- “Select Tests” toolbar button/operation in Test Set: Test Instances, within a Tosca Test Set are dictated by the Tosca Execution list and cannot be manually constructed in ALM.
- “Remove Test Instances from Test Set (Del)” toolbar button/operation: Test Instances, within a Tosca Test Set are dictated by the Tosca Execution list and cannot be manually manipulated in ALM.

For example, this entry prevents Smart Copy on an ALM Tosca Test:

```
{
  "Is Allowed": "Yes",
  "Constraints": [
    {
      "Type": "User Is",
      "Role": "Editors"
    },
    {
      "Type": "Record Type Is One Of",
      "Record Types": [
        "Test Case"
      ]
    }
  ],
  {
    "Name": "Type",
    "Type": "Field Is Not Equal",
    "Value": "TOSCA"
  }
]
```



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5.3.2 Synchronization Policy

The Synchronization Policy file contains information to enable synchronizing VERA operations across multiple systems. This policy should be updated **for each** ALM project. The following entry is an example to enable Tosca synchronization; Line items are explained below:

```
{
  "Synchronization Policy":
  {
    "Version": "0.0.0.1",
    "Locations": [
      {
        "System": "Tosca",
        "Name": "Tx3 Tosca",
        "Server": "http://myserver:8088/",
        "Workspace": "AnimalHealth_LIMS",
        "Service Account": "ToscaServiceAdminUser",
        "Service Password": "A3csD0893F98378ACC40",
        "Workflow Lock Group": "ALM Lock",
        "Workflow Unlock Group": "All Users"
      }
    ]
  }
}
```

Variable	Meaning
System	The system with which VERA needs to synchronize. For Tosca, the value must be "Tosca".
Name	Any string that may be more descriptive for this Synchronization Policy entry.
Server	The exact Server and Port that maps to the main Tosca Server's REST API configuration. Refer to the Tosca documentation for installing the REST API service on the Tosca Server.
Workspace	The workspace, configured on the Tosca REST server to point to the correct Tosca Repository. It is recommended to have a naming convention that reflects the ALM Domain and Project. For example, in the above sample, "AnimalHealth" is the ALM domain and "LIMS" is the project name. This will help to avoid potential conflicts on the Tosca server and provide for more effective organization and troubleshooting. Refer to the documentation for installing a multi-user environment and repositories (databases for SQL Server, or Schemas for Oracle).
Service Account	A reserved account name that has Admin-level rights in Tosca to modify object ownership. VERA operations use this account to "lock" and "unlock" Tosca items that are routing for approval, approved, or taken out of the approval process. See section below on "Special Admin Level Integration User" for more details.
Service Password	The password for the Service Account. This is encrypted with a Tx3 utility by the ALM Administrator.
Workflow Lock Group	The Tosca Group designated as the group to own objects that are currently locked for updates, as they in the VERA approval process. This group must be reserved for one or two Admin users and should NOT contain other typical Tosca users.
Workflow Unlock Group	The Tosca Group designated as the owning group for Tosca objects that are free to be updated by the typical Tosca engineer. This group should have most, if not all users, as members.

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5.3.3 ALM Custom Toolbar Button

Test Lab implements a custom toolbar button to support selecting and updating ALM Test Sets with Tosca Execution List information. The ALM template is configured to display the button and a TDS extension file is configured to handle the associated click events. This file, "Tosca_Interface.tds", is stored along with VERA policy files in the ALM Requirements module.

Use this button to create/select a new Tosca Test Set and to 'refresh' a Tosca Test Set with updates from Tosca. When focus is on a folder, implementation logic assumes the user wants to create a Test Set. When focus is on an existing Test Set, the implementation gets an update from Tosca.

Creating a Test Set, links the ALM Test Set with the Tosca Execution List in the same manner as a Test Case, saving all ID's in both systems' entities. Additionally, the implementation creates underlying Test Instances.

6 TOSCA CONFIGURATION

The following properties on Tosca items are required in Tosca to support the integration:

Tosca Item	Property Name: <pick list>
Test Case	ALMTestID
Test Case	VeraSynclId
Execution List	ALMTestSetID
Execution List	ExecListWorkState: PLANNED, IN_WORK, COMPLETED
Execution List	VeraSynclId

6.1 SERVICE ACCOUNT - SPECIAL ADMIN LEVEL INTEGRATION USER

The integration has two categories of operations in terms of permissions:


1. Typical user
2. Admin user

A Typical user operation involves creating and updating entities. An Admin user operation, however, changes group ownership on a Tosca item, and therefore requires Admin level permission in Tosca. Admin operations are operations like routing an item for approval or removing an item from an approval route – these require "locking" and "unlocking" items in Tosca.

Typical user operations use the credentials of the ALM user. (NOTE: the first Tosca operation in an ALM User session requires that the user is prompted for their password, as passwords are not programmatically available in ALM.)

For Admin operations, a special Tosca user must be defined. The implementation refers to this account as the "Service Account" and "Service Password".

These credentials must be specified in each project, in the Synchronization Policy file. The Service Password should be encrypted by the Tx3 VERA encryption utility. See above Synchronization Policy File sample.

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6.2 LOCK / UNLOCK GROUPS

Two Tosca groups must exist – one that has every engineer as a member, and one that only has one or two Admin users as a member. These groups enable locking and unlocking Tosca items, when ALM switches the item's Group Ownership property.

These two group names must be configured in the Synchronization Policy file so VERA knows what values to use when locking/unlocking an item.

See above Synchronization Policy File sample.

6.3 KNOWN ISSUES

Remoting to Tosca Server to run Commander – run Commander “As Administrator”

Tosca Agent – must have a logged in session and that account must have access to a Tosca license. If using Tosca Cloud License, associated user must have logged into and displayed licenses in the “Tosca License Configuration” application, at least once.

Copying linked items in Tosca – must be done by an administrator that clears integration fields

Tosca Properties are currently editable, until an item is routing for approval or approved. Administrative procedures, and training, must be in place to ensure that ALM related properties for managing links are not updated.

Tosca Copy operations also copy ALM link information. Either create a new Tosca entity and copy contents into it or, if the item is locked, have an Admin perform the copy operation to remove the ALM link information.