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TESTVECTOR PERTINENCE FOR SCA CONFORMANCE EVALUATION

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AGENDA

- MBT for Conformance Testing
- SCA Conformance Testing
- Logical Architecture of a Certification Testbench

AGENDA

- MBT for Conformance Testing
  - Introduction to Model-Based Testing
  - Example
- SCA conformance testing
- Logical architecture of a certification testbench

Introduction to Model-Based Testing

- Model-Based Testing (MBT) is part of MDE
- MBT is a systematic method of generation of test cases from models based on system requirements.
- Models (for ex UML) can be used to represent :
  - Behavior of System Under Test (SUT) and Component Under Test (CUT)
  - Represent testing strategies
  - SUT or CUT environment

Introduction to Model-Based Testing

- MBT process steps:
  - Modeling functional requirements on SUT
  - Generate test scripts
- Test execution can be automatically developed
  - Generation and analysis of tests report
  - Automatic traceability between requirements and tests

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Example

- MBT modeling from a standard (e.g. SCA 2.2.2 specifications)
- Test selection criteria are used to generate the adequate conformance test suite
  - Typically, 2 to 5 abstract test cases for each functional requirement
- Automated publication of abstract generated conformance tests:
  - To create a documented test repository (using a test management tool), including traceability between requirements and tests
  - To generate executable test scripts for test execution automation

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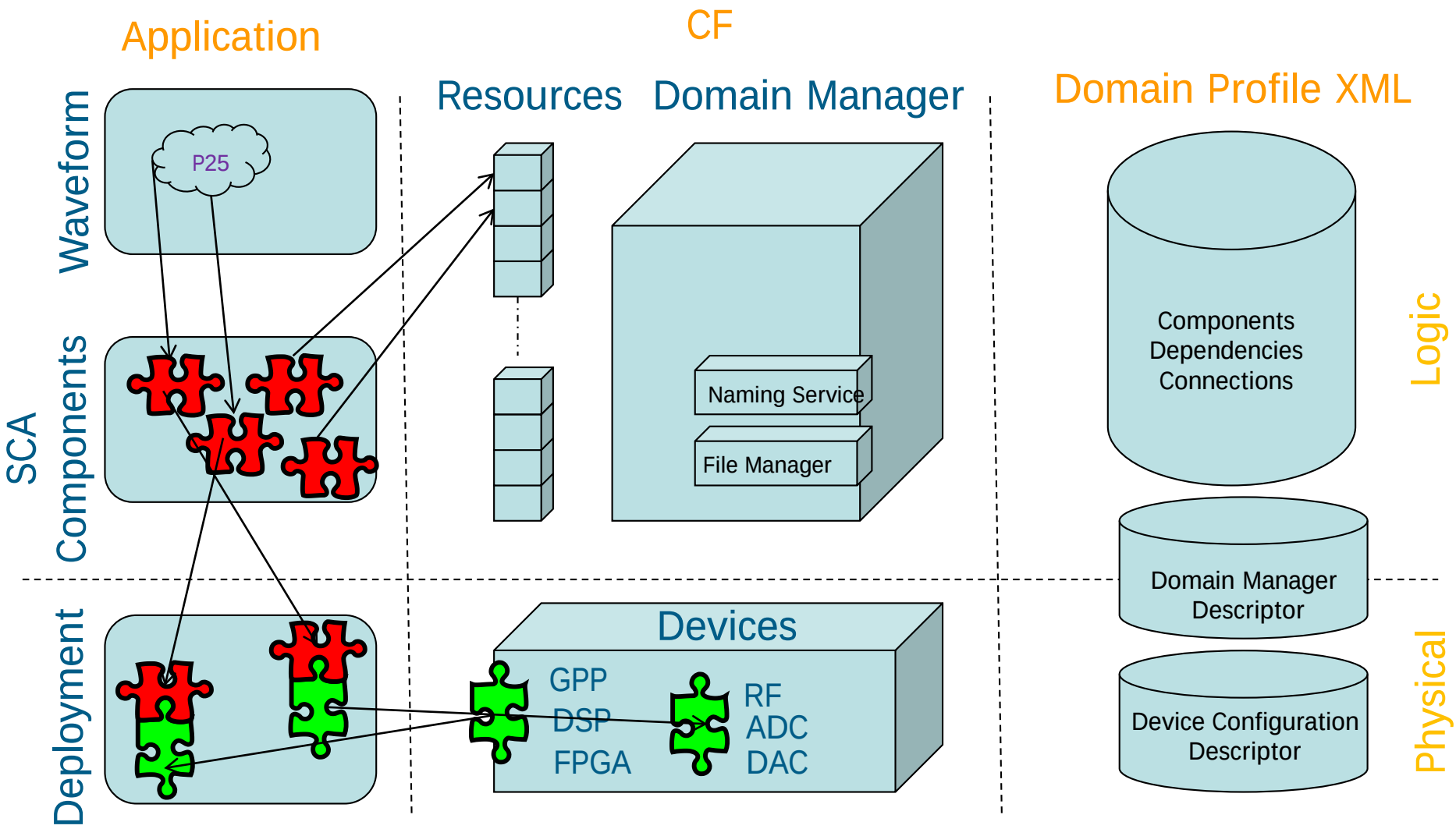
- Model-Based Testing
- SCA conformance testing
  - SCA context
  - MBT positioning
  - Static vs. dynamic analysis
- Logical architecture of a certification testbench

SCA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Domain Profile XML
Waveform
P25
SCA
Components
Naming Service
File Manager
Components
Dependencies
Connections
Logic
Domain Manager
Descriptor
Deployment
Devices
GPP
DSP
FPGA
RF
ADC
DAC
Device Configuration
Descriptor
Physical

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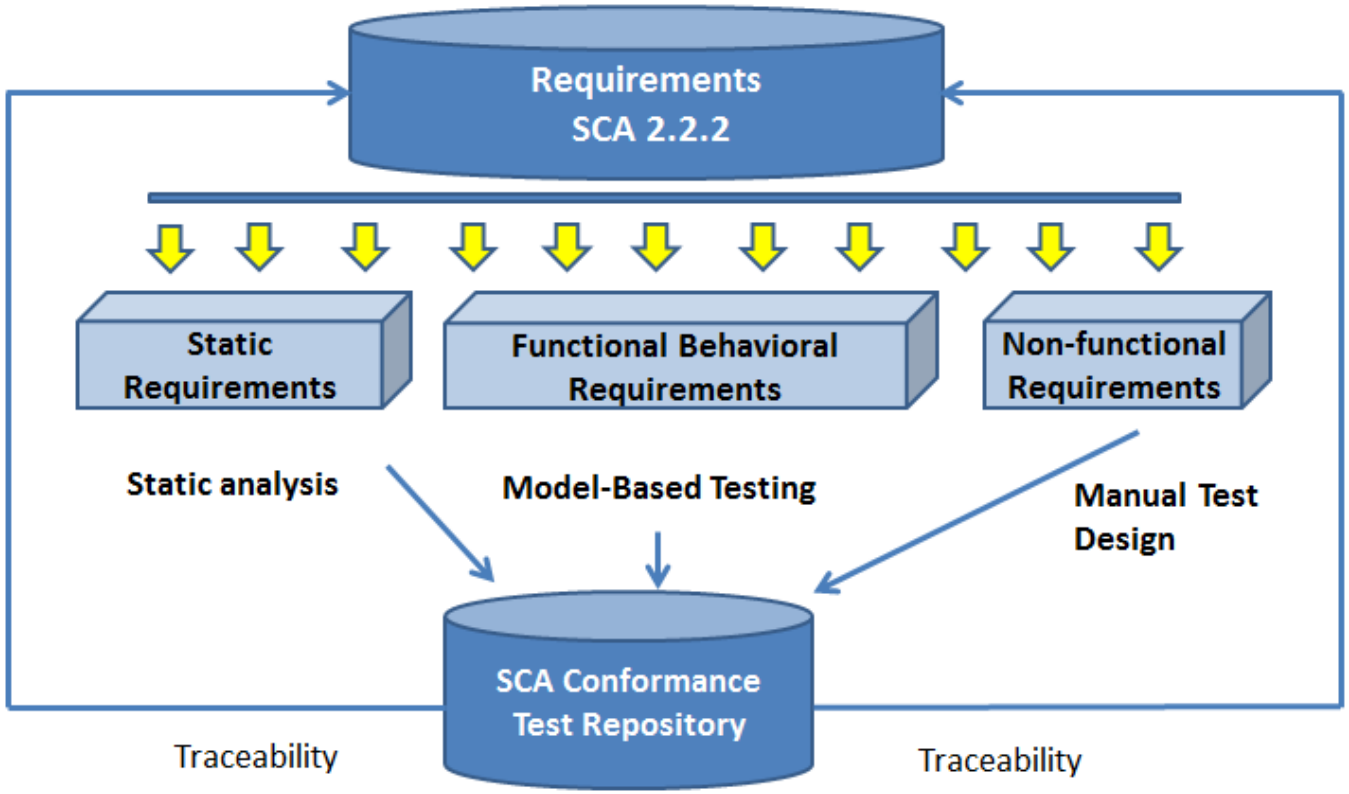
MBT positioning



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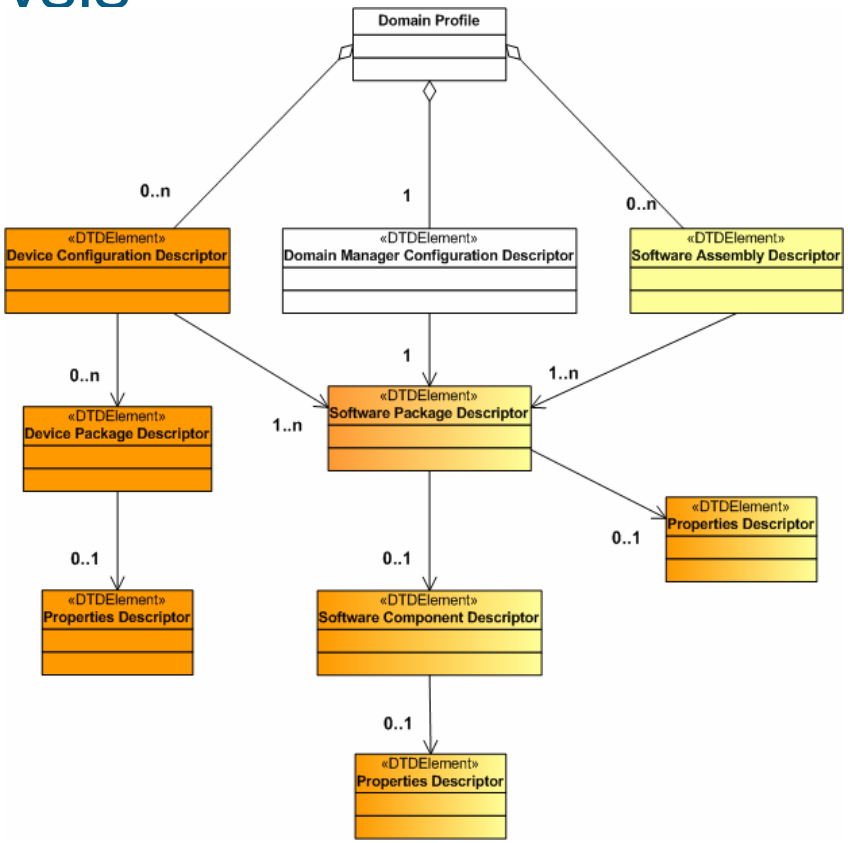
Static vs. dynamic analysis

- SCA 2.2.2 requirements

Requirement Tag	Criterion Tag	Requirement/Criterion Text	Section Number	Test Method	JTAP Test Case Name	Manual Test Case Number
SCA 2.2.2 Specification - Main Body						
AP0011		A log producer shall only output log records that contain an enabled CosLwLog::LogLevel value.	3.1.2.2.1	Manual		APP_TC_001
AP0012		Log producers shall use their component identifier attribute in the producerId field of the CosLwLog::ProducerLogRecord.	3.1.2.2.1	Manual		APP_TC_001
AP0013		Log producers and CF components that are required by this specification to write log records shall operate normally in the absence of a log service or in the case where the connections to a log are nil or an invalid reference.	3.1.2.2.1	Manual		APP_TC_001
AP0063		A component (e.g., Resource, DomainManager, etc.) that consumes events shall implement the CosEventComm PushConsumer interface.	3.1.2.3.1	Manual		APP_TC_029
AP0064		A component (e.g., Resource, Device, DomainManager, etc.) that produces events shall implement the CosEventComm PushSupplier interface and use the CosEventComm PushConsumer interface for generating the events.	3.1.2.3.1	Manual		APP_TC_029
AP0065		A producer component shall not forward or raise any exceptions when the connection to a CosEventComm PushConsumer is a nil or invalid reference.	3.1.2.3.1	Manual		APP_TC_029
AP0069		The connectPort operation shall make a connection to the component identified by its input parameters.	3.1.3.1.1.5.1.3	Automated	ConnectPort	APP_TC_015
AP0069	C002	A port may support several connections. The input connectionId is a unique identifier to be used by the disconnectPort operation when breaking a specific connection.	3.1.3.1.1.5.1.3	Manual		APP_TC_015
AP0070[2]		The connectPort operation shall raise the InvalidPort exception when the input connection parameter is an invalid connection for this port.	3.1.3.1.1.5.1.5	Automated	ConnectPort InvalidPort Exception	APP_TC_014
AP0070	C004[2]	The InvalidPort exception indicates one of the following errors has occurred in the specification of a Port association: 1. errorCode 1 means the Port component is invalid (unable to narrow object reference) or illegal object reference.	3.1.3.1.1.3.1	Automated	ConnectPort InvalidPort Exception	APP_TC_014
AP0071		The connectPort operation shall raise the OccupiedPort exception when unable to accept the connections because the port is already fully occupied.	3.1.3.1.1.5.1.5	Automated	ConnectPort Occupied Port Exception	APP_TC_015
AP0072		The disconnectPort operation shall break the connection to the component identified by the input connectionId parameter.	3.1.3.1.1.5.2.3	Automated	DisconnectPort Test	APP_TC_012
AP0073[2]		The disconnectPort operation shall raise the InvalidPort exception when the input connectionId parameter is not a known connection to the Port component.	3.1.3.1.1.5.2.5	Automated	DisconnectPort Test	APP_TC_012

Static vs. dynamic analysis

- Static analysis



Static vs. dynamic analysis

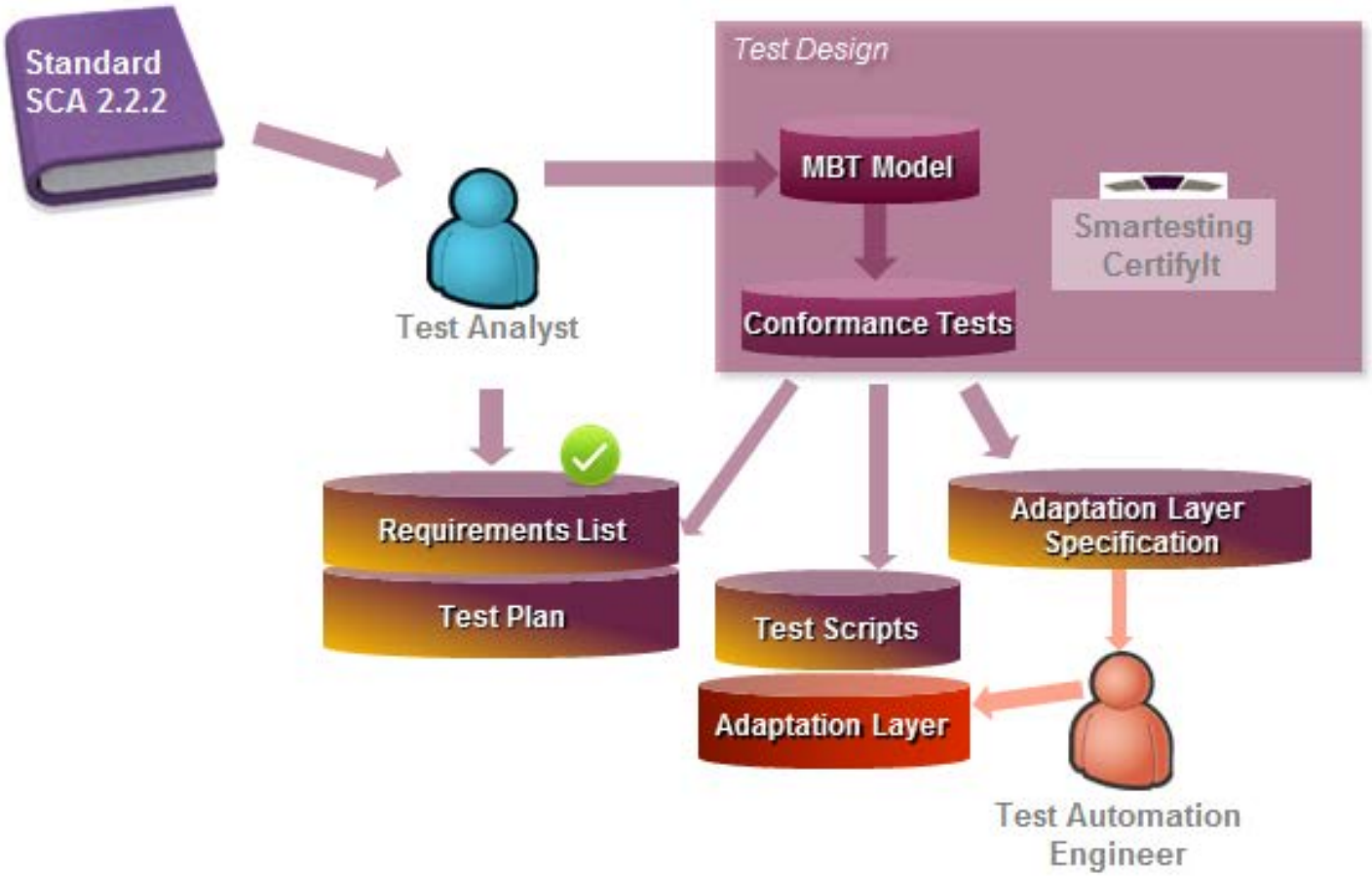
- Static analysis
  - Extract a model from IDL
  - Configure source code model
  - Analysis conformance requirements
  - Consolidate resulting model with IDL model
  - Report results

Static vs. dynamic analysis

- Dynamic analysis
  - Test executed at runtime
  - Test harness
    - “Test driver” :
      - Client of the component under test (CUT) exercising the functions of the provided interface.
      - Initializes test cases, interacts with the CUT by sending it test inputs and collecting the outcomes.
    - “Stub”
      - Replaces components that are required by the CUT.

SCA conformance testing

- Test generation



SCA conformance testing

- Test configuration
  - Three informations for each configuration parameter
    - Generic part
      - Name, description
    - Specific part
      - Default value
      - Set of values applied

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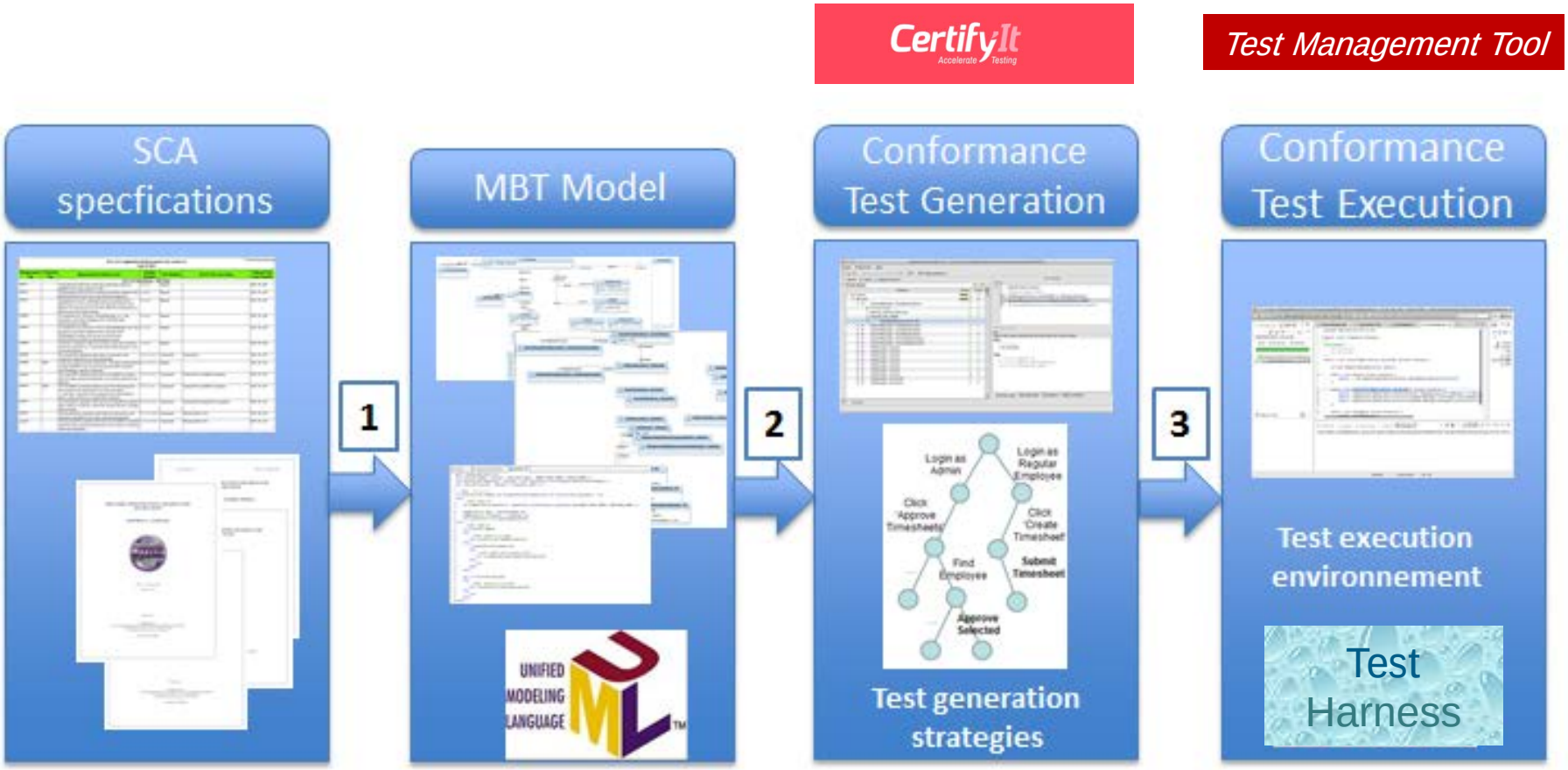
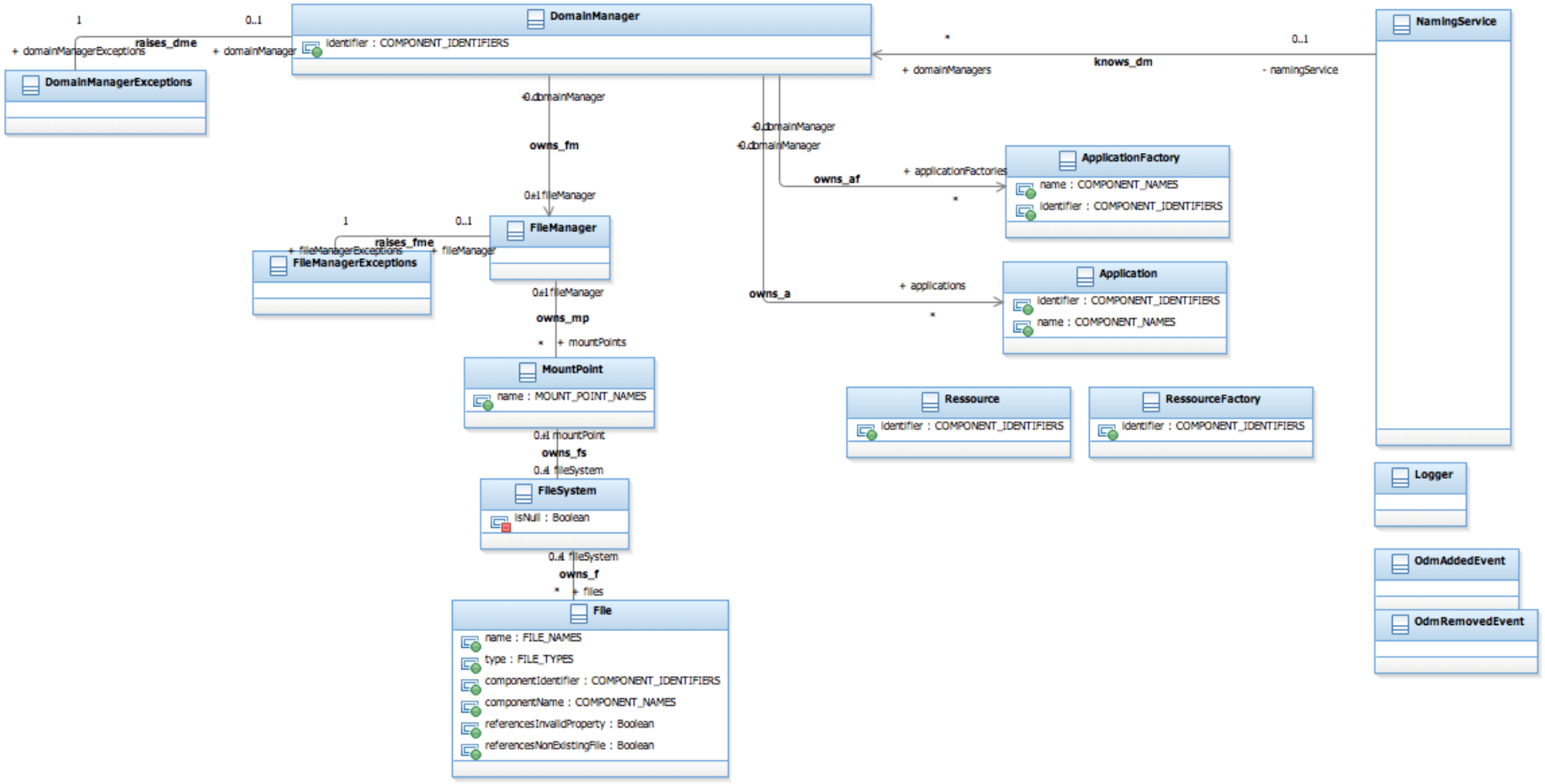
  - MBT tool chain
  - Test bench architecture

MBT tool chain



MBT tool chain

- MBT model



MBT tool chain

- MBT Model - OCL Constraints

*Main *DiagrammeObjet1 mount

```
self.resetExceptions() and
let invalidFileName : Boolean = (mountPointName = MOUNT_POINT_NAMES::INVALID_NAME) in
let mountPointAlreadyExists : Boolean = (self.mountPoints->exists(mp|mp.name=mountPointName)) in
let invalidFileSystem : Boolean = fileSystem.isNull in

---@REQ: 3.1.3.4.3.5.1
if (not(invalidFileName) and not(mountPointAlreadyExists) and not(invalidFileSystem)) = true
then
    ---@AIM: MOUNT_OK
    let newMountPoint:MountPoint = MountPoint.allInstances()->any(mp|mp.name=MOUNT_POINT_NAMES::UNDEFINED_NAME) in

    newMountPoint.name = mountPointName and
    newMountPoint.fileSystem = fileSystem and
    self.mountPoints->includes(newMountPoint)
else
    ---@AIM: MOUNT_KO
    if (invalidFileName)
    then
        ---@AIM: INVALID_FILE_NAME
        self.raiseInvalidFileNameException()
    else
        if (mountPointAlreadyExists)
        then
            ---@AIM: MOUNT_POINT_ALREADY_EXISTS
            self.raiseMountPointAlreadyExistsException()
        else
            true
        endif
    endif

    and if (invalidFileSystem)
    then
        ---@AIM: INVALID_FILE_SYSTEM
        self.raiseInvalidFileSystemException()
    else
        true
    endif
endif
```

MBT tool chain

- Generated Scripts

```
package Smartesting.SCA.suite;

import junit.framework.TestCase;
/*
REQUIREMENTS:
    3.1.3.2.3.6.3
    3.1.3.4.3.5.1
*/
public class InstallApplication__c6_a4_38_ extends TestCase {

    private AdapterImplementation adapter;

    public void setUp() throws Exception {
        adapter = new AdapterImplementation(new TypesAdapterImplementation());
    }

    public void testInstallApplication__c6_a4_38_() throws Exception {
        adapter.componentsFrameworkServicesInterfacesFileManagermount(FileManager.FileManagerInstance, MOUNT_POINT_NAMES.NAME_0, FileSystem.FileSystemInstance);
        adapter.componentsFrameworkControlInterfacesDomainManagerinstallApplication(DomainManager.DomainManagerInstance, FILE_NAMES.INVALID_NAME);
        adapter.componentsFrameworkControlInterfacesDomainManagercheckApplicationFactoriesIsEmpty(DomainManager.DomainManagerInstance);
    }

    public void tearDown() throws Exception {
        adapter.closeAdapter();
    }
}
```

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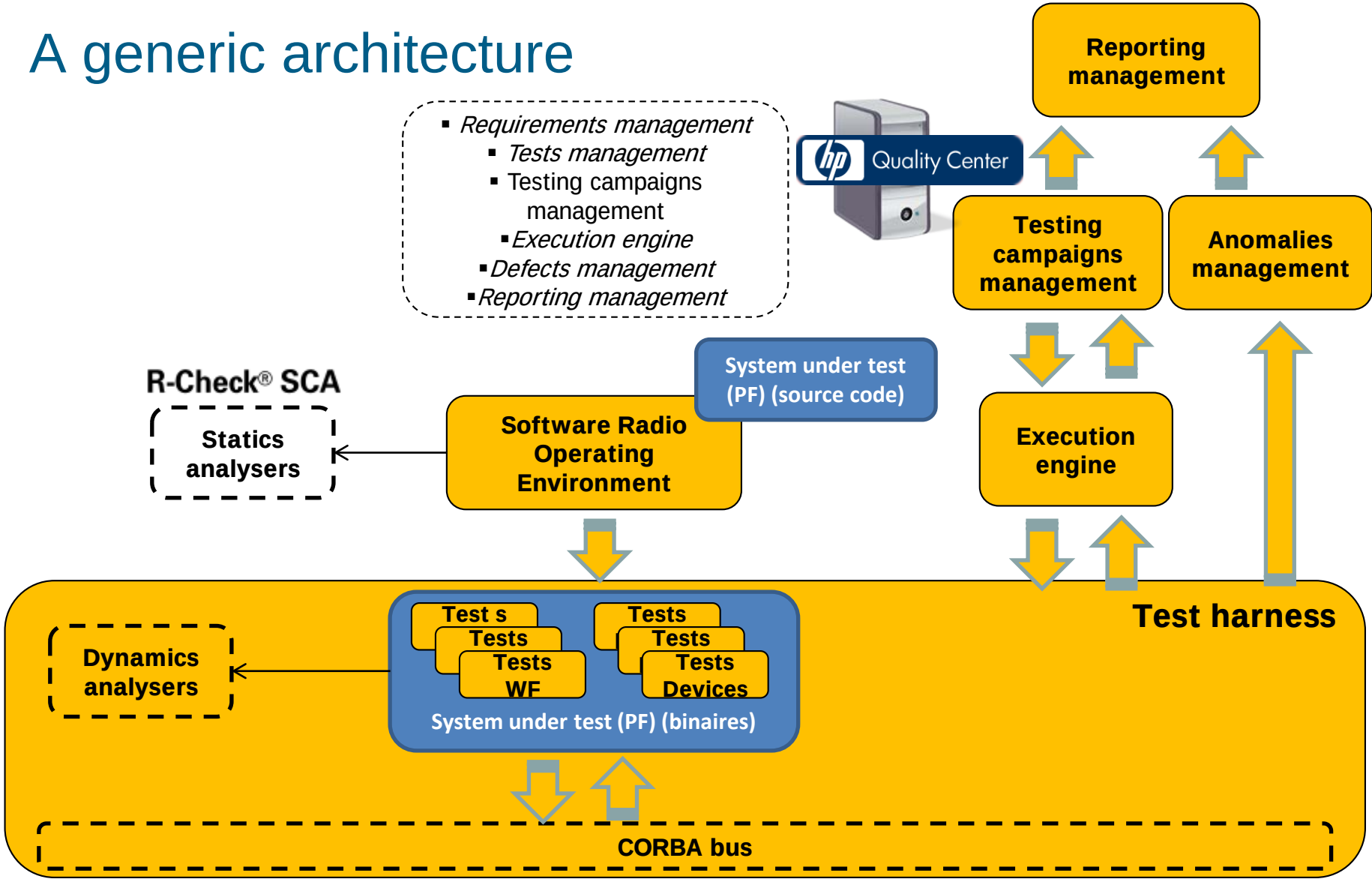
  - Test bench architecture

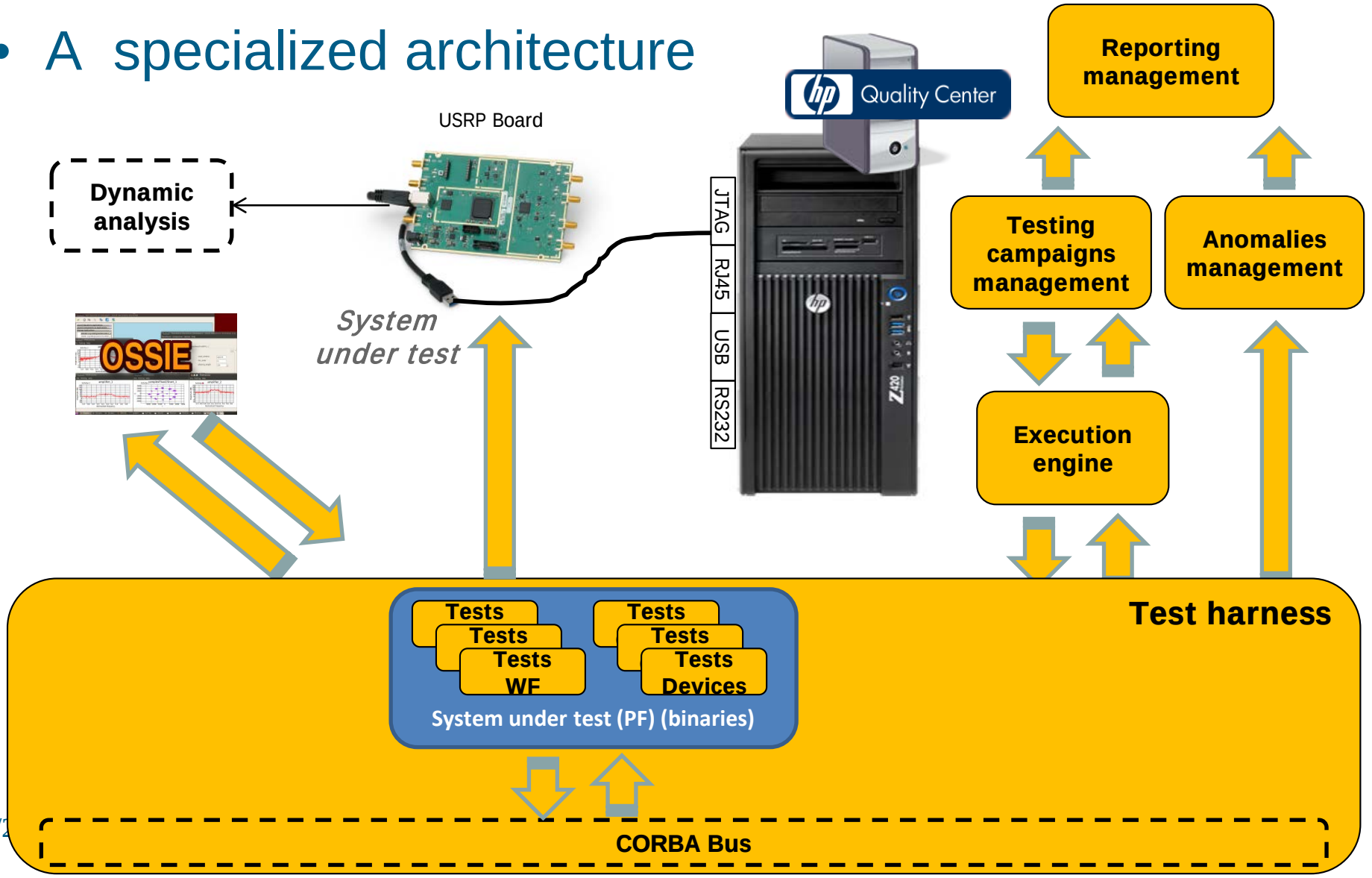
Test bench architecture

- A generic architecture



Test bench architecture

- A specialized architecture



CONCLUSION

- Model-Based Testing is adequate for SCA conformance testing
- This process targets functional behavioral of SCA requirements
- The modeling notation used (UML / OCL) was suitable to model targeted SCA requirements
- The MBT tool-chain helps to automate test generation (documented test repository, traceability and executable test scripts)
    - Increased productivity for the development of the conformance test suite
    - Better control about what is really tested and how in the conformance test suite

THANK YOU !

Any question ?