z/TPF Automated Test Framework

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Problem

- The cost of testing z/TPF application code can be expensive.
  - Test resources are required to manually run and validate test cases
  - Manual testing takes time, increasing time to market for new application function
  - Perception of z/TPF and the mainframe suffers making it harder to get new function on the platform

- The quality of code can suffer
  - In some cases tests are lost over time as skills and priorities change
  - Testing is done with throw away code to get the application tested more quickly

- **There is no z/TPF testing framework in place that allows for repeatable, automated testing**

z/TPF Automated Test Framework

- Allows you to create new (or convert old), self-validating programmatic test cases similar to other testing frameworks, like Google Test.
  - Set of TPF unique APIs to create z/TPF automated tests.

- Provides the ability to organize tests by a namespace
  - For example, airco.res.overbook

- Framework automatically detects new test cases when they are loaded to the z/TPF system
  - Allows for tests to be included with the modules being tested.

- Ability to query / run testcases defined in the z/TPF automated test framework
  - Using the new ZDEVO operator command
  - Using a Java application (ie. jUnit) on a remote platform

Creating Automated Test Cases

qovb.c

```
TPF_TESTSUITE ("airline.overbook", "TOV*, TOB1");

TPF_TESTCASE (overbook_firstClass, "overbooking in first class") {

     // Test case logic

}

TPF_TESTCASE (overbook_economy, "Test overbooking in economy")  {

     // Test case logic

}

.
.   Additional overbook tests
.
```

TPF_TESTSUITE

- defines the namespace of tests in this shared object
- Code coverage mask – reserved for future enhancements

One or more individual test cases that will be contained in the namespace defined

Automatic Detection of Test Cases

qovb.c -> QOVB.so

```
TPF_TESTSUITE ("airline.overbook", "TOV*, TOB1");


TPF_TESTCASE (overbook_firstClass, "overbooking in first
class") {

     // Test case logic

}


TPF_TESTCASE (overbook_economy, "Test overbooking in
economy")  {

     // Test case logic

}
```

OLD/TLD load driver program

z/TPF

Automated Test Table

airline.overbook
  overbook_firstClass
  overbook_economy

Upon loading, the testsuite/testcases in the shared object are runnable using command or from a remote platform.

z/TPF Framework Architecture

z/TPF

Invoked from a remote platform through a REST request.

Test Framework Process

For each test case being run
- Create new process and invoke
- Wait for test case completion

Operator issues ZDEVO command to run one or more tests

New Process

Testcase Process

TPF_TESTCASE(apptest,...) {

- **Perform Test Case Setup**
  - ECB fields
  - Database Setup
  - Data levels
- **Calls to application code**
- **Verify results**
  - Return values
  - ECB fields
  - Read database
  - Etc.
- **Perform any clean-up**
- Return

}

Application must Return

Application Code

Invoking z/TPF Application Code

```
TPF_TESTCASE (overbook_firstClass, "Test overbooking in first class") {
     struct overbook_input overbook_parms;

     …  Setup environment for call

     TPF_TC_INFO ("Calling overbook routine");

     TPF_TC_TIMEOUT(3);

     int rc = process_overbook (&overbook_parms);

     if (rc == RETURN_ERROR)
         TPF_TC_ERROR ("overbook failure-%d", overbook_parms.errCode);
         return;

     …  Validate results
}
```

TPF_TC_INFO to log the flow through the test case

Ability to change timeouts at runtime
Default – 10 seconds

Call to application function

TPF_TC_ERROR to log error messages

- **During the execution of a testcase if a TPF_TC_ERROR at any time during the test case logic results in a test case failure**

Test Case Message Logging

Successful Test Case

```
zdevo run airline.overbook overbook_firstClass
CSMP0097I 13.55.13 CPU-B SS-BSS  SSU-HPN  IS-01
DEVO0004I 13.55.13 PROCESSING FOR THE SELECTED TEST
                   CASES IS STARTED.
-- overbooking in first class --
TEST CASE STARTED
  Calling overbook routine
    … Additional information / error messages
TEST CASE COMPLETED IN 10ms - PASSED - overbook_firstClass
CSMP0097I 13.55.13 CPU-B SS-BSS  SSU-HPN  IS-01
DEVO0005I 13.55.13 RESULTS FOR TEST 1 -
overbook_firstClass
CSMP0097I 13.55.13 CPU-B SS-BSS  SSU-HPN  IS-01
DEVO0018I 13.55.13 1 TEST WERE COMPLETED.
                   1 PASSED, 0 FAILED, 0 SKIPPED+
END OF DISPLAY
```

Failed Test Case

```
zdevo run airline.overbook overbook_firstClass
CSMP0097I 14.30.18 CPU-B SS-BSS  SSU-HPN  IS-01
DEVO0004I 14.30.18 PROCESSING FOR THE SELECTED TEST
                   CASES IS STARTED.
-- overbooking in first class --
TEST CASE STARTED
   Calling overbook routine
     … Additional information / error messages
   ERROR IN QOVB,qovb.c:1813 overbook failure-19
TEST CASE COMPLETED IN 14ms - FAILED - overbook_firstClass

CSMP0097I 14.30.18 CPU-B SS-BSS  SSU-HPN  IS-01
DEVO0007E 14.30.18 AN ERROR OCCURRED WHILE RUNNING TEST CASE
overbook_firstClass.
PGM: QOVB SOURCE: qovb.c LINE: 1813 - overbook failure-19
CSMP0097I 14.30.18 CPU-B SS-BSS  SSU-HPN  IS-01
DEVO0005I 14.30.18 RESULTS FOR TEST 1 - overbook_firstClass
CSMP0097I 14.30.18 CPU-B SS-BSS  SSU-HPN  IS-01
DEVO0020E 14.30.18 1 TEST WERE COMPLETED.
                   0 PASSED, 1 FAILED, 0 SKIPPED
END OF DISPLAY
```

Setting Up Testcase and Validating Results

How do you setup the environment for a test case? How do you validate results?

```
TPF_TESTCASE (overbook_firstClass, "Test overbooking in first class") {
     struct overbook_input overbook_parms;

     …  Setup environment for call

     TPF_TC_INFO ("Calling overbook routine");
     int rc = process_overbook (&overbook_parms);
     if (rc == RETURN_ERROR)
         TPF_TC_ERROR ("overbook failure-%d", overbook_parms.errCode);
         return;


     …  Validate results
        and restore environment

}
```

- Setting up input structures
- Setting up ECB fields
- Setting up data level
- Setting up database

- Validating output
- Validating ECB fields
- Validating data levels
- Validating database
- Validate for memory leaks
- Validate performance (I/O, etc)

May need to restore things to ensure subsequent tests are consistent and repeatable.

Multi-ECB Test Cases

Use TPF_TC_NEW_ECB/TPF_TC_DONE_ECB to include created ECBs in the test case

```
TPF_TESTSUITE ("airline.overbook", "TOV*, TOB1");


TPF_TESTCASE (overbook_multiECB, "overbook multi-ECB") {
     for (int i = 0; i < 10; i++) {
          swisc_create(…)

          TPF_TC_NEW_ECB();     ← Indicates another ECB is
                                  participating in the test
     }
}
```

```
void main() {
   struct overbook_input overbook_parms;

   TPF_TC_INFO ("Calling overbook routine");
   int rc = process_overbook (&overbook_parms);
   if (rc == RETURN_ERROR)
      TPF_TC_ERROR ("overbook failure");
      return;
   TPF_TC_ECB_DONE();
}
```

ECB 1

ECBs created via SWISC

```
void main() {
   struct overbook_input overbook_parms;

   TPF_TC_INFO ("Calling overbook routine");
   int rc = process_overbook (&overbook_parms);
   if (rc == RETURN_ERROR)
      TPF_TC_ERROR ("overbook failure");
      return;
   TPF_TC_ECB_DONE();
}
```

ECB *n*

- Testcase ECB waits for all ECBs to issue TPF_TC_ECB_DONE before completion
  - If any ECB issues TPF_TC_ERROR the testcase fails

Passing Parameters

Can use TPF_TC_SET_PROPERTY/TPF_TC_GET_PROPERTY to pass parameters between ECBs and functions

```
TPF_TESTSUITE ("airline.overbook", "TOV*");


TPF_TESTCASE (overbook_multiECB, "overbooking multiECB")
{
   int option = 1;
   TPF_TC_SET_PARAMETER("option",
       (void*) option, sizeof(option));

   swisc_create(…)

   TPF_TC_NEW_ECB();
}
```

New ECB

```
void main() {
   int length = 0;
   int option =
     *(int *) TPF_TC_GET_PROPERTY("option",length);

   switch (option) {
      …

   }

}
```

- **Parameters saved in shared memory**
- **Parameters can be set or obtained from any ECB participating in test case.**
- **Can be used for…**
  - **Test case specific processing in common routines.**
  - **Serialization of multi-ECB testing**

Invoking Test Cases Using Command

- The ZDEVO command allows you to query and run automated tests that have been loaded to the z/TPF system.
  - Command has two primary parameters – namespace(s) and test case(s)
    - ZDEVO RUN airline.overbook overbook_firstClass

- Support for wildcards in namespace and test cases providing a better user experience
  - ZDEVO RUN airline* overbook* ←All namespaces starting with airline and all testcases starting with overbook
  - ZDEVO RUN airline.overbook over*economy ←All tests starting with “over” and ending in “economy”

- Testcase output is displayed on console and optionally written to file
  - All TPF_TC_INFO and TPF_TC_ERROR messages
    - “Quiet” option to only display testcase output on error

ZDEVO Examples

Querying Tests

```
zdevo info airline.overbook *
CSMP0097I 08.34.24 CPU-B SS-BSS  SSU-HPN  IS-01
DEVO0010I 08.34.24 TEST CASE INFORMATION DISPLAY
PGM   NAME                 DESCRIPTION
----- ------------------- ----------------
**********************************************
QOVB  airline.overbook
**********************************************
QOVB overbook_firstClass  overbooking in first class
QOVB overbook_economy     overbooking in economy
**********************************************
2 TEST CASES TOTAL
```

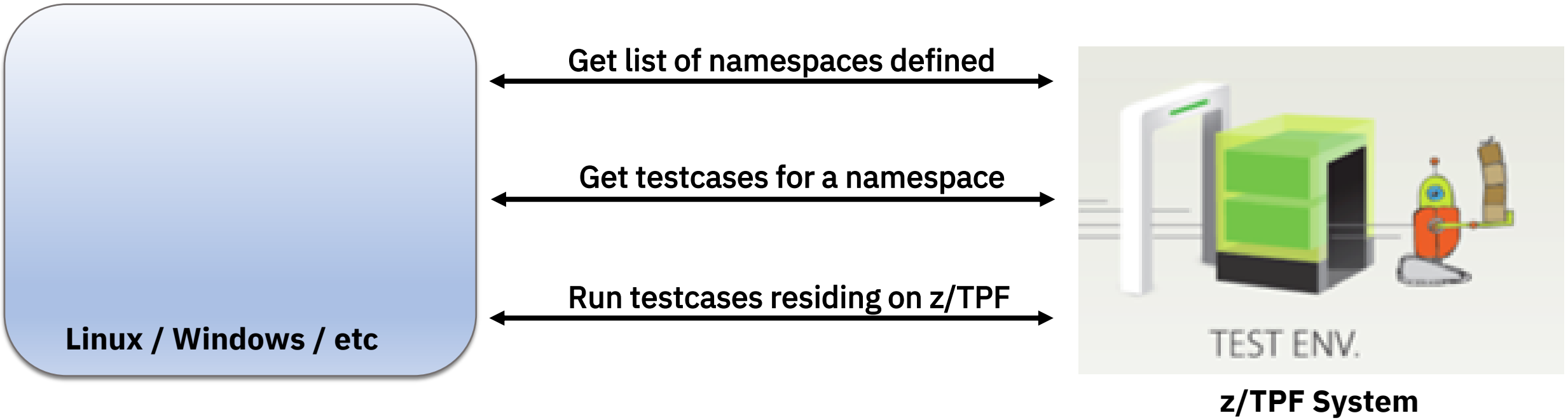
Running Tests

```
zdevo run airline.overbook overbook_economy quiet
CSMP0097I 08.32.22 CPU-B SS-BSS  SSU-HPN  IS-01
DEVO0004I 08.32.22 PROCESSING FOR THE SELECTED
TEST CASES IS STARTED.
CSMP0097I 08.32.41 CPU-B SS-BSS  SSU-HPN  IS-01
DEVO0018I 08.32.41 1 TESTS WERE COMPLETED.
                   1 PASSED, 0 FAILED, 0 SKIPPED+
```

```
zdevo run airline.overbook * quiet
CSMP0097I 08.32.22 CPU-B SS-BSS  SSU-HPN  IS-01
DEVO0004I 08.32.22 PROCESSING FOR THE SELECTED
TEST CASES IS STARTED.
CSMP0097I 08.32.41 CPU-B SS-BSS  SSU-HPN  IS-01
DEVO0018I 08.32.41 2 TESTS WERE COMPLETED.
                   2 PASSED, 0 FAILED, 0 SKIPPED+
```

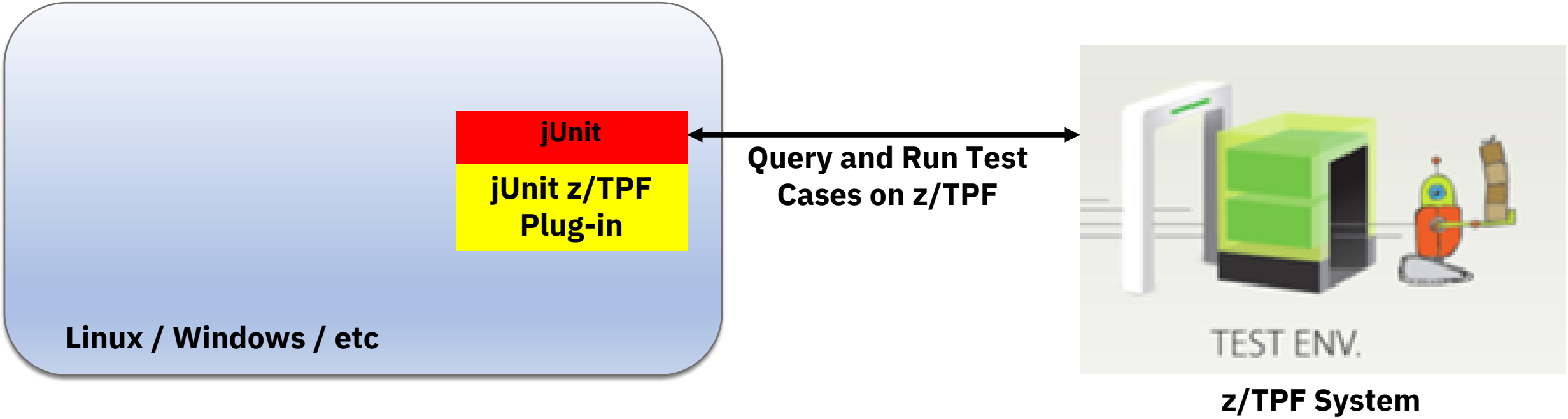
Invoking Test Cases Remotely

REST services have been created to query and run tests from a remote platform



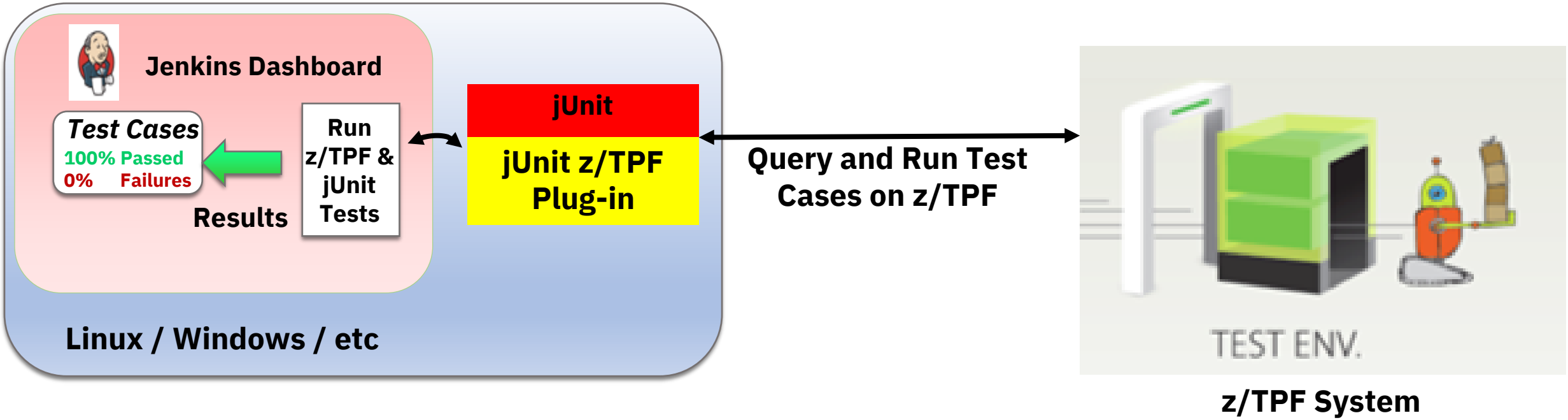
The jUnit Plugin for z/TPF

Provides the ability to run z/TPF automated tests from a Java application (ie. jUnit) on a remote platform

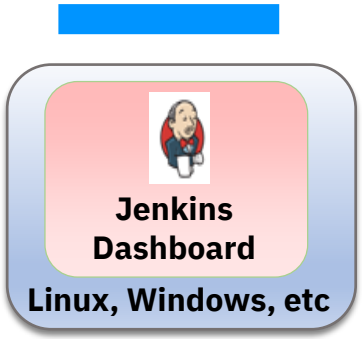


Integrating Into Automated Testing Platforms

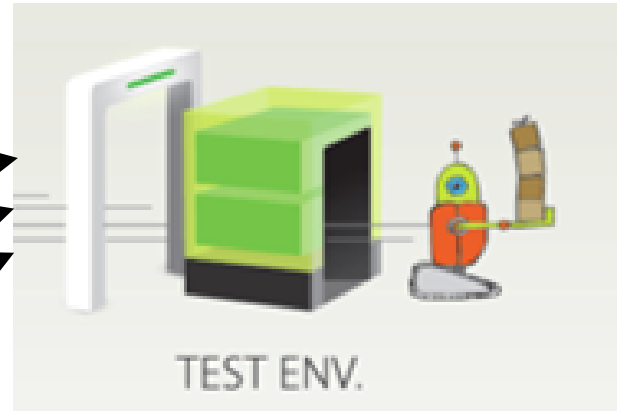
Can integrate into Open Tooling packages like Jenkins to facilitate automated testing

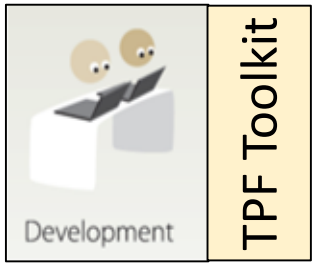


Expanding Test Coverage

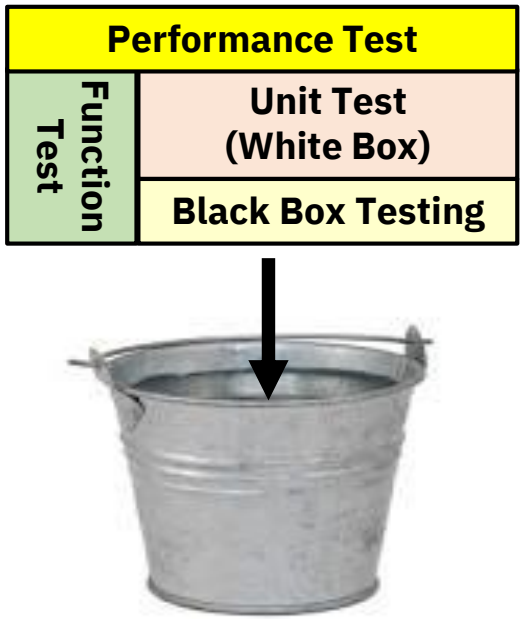


Query and Run Test Cases on z/TPF





- Tests can be invoked on z/TPF from anywhere!
- Tests residing on z/TPF can be combined with external block box tests
  - Testing end-to-end application messages



Automated Regression Test

Value Statement

- The z/TPF automated testing framework allows you to create automated tests on the z/TPF system
  - The test framework can be integrated into automated test platforms.

- A z/TPF automated testing environment…
  - Leads to more efficient and effective testing
    - Test organizations can focus on more complex testing
  - Shifts testing left to find problems earlier
    - Reduces costs when problems are found
  - Results in a faster time to market
  - Improved code quality.

Recap

- The z/TPF Automated Test Framework requires the following
  - **PJ45217, 1Q 2018** -- Infrastructure APAR
  - **PJ43782, 3Q 2018** -- Initial support (invocations from ZDEVO)
  - **PJ45488, 4Q 2018** -- Remote invocation support
    - Includes delivery and support of the z/TPF jUnit plugin.

Thank You!

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