

Test Automation DevOps and CI/CD

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Part 1: VNF end-to-end testing with ONAP and OVP

- **Participants** : EUAG Group
- **Response** : 5 participants, anonymous
- **Design of survey** : 34 Questions

1. Testing process and content

- Before the introduction of NFV, investigate the test types and test contents of new equipment, equipment patches, resource pools and other network access tests.

2. Testing Participants and Collaboration

- Investigate the personnel and division of labor involved in the network access test, including the development of test specifications, test environment provision, test execution, and test result summary.

3. Test Restrictions

- Investigate network access tests factors, including network access times, test costs, test stability, and others.

4. Changes of NFV Network Element Access Test

- Investigate test changes such as test organization, test cycle, and test frequency after the introduction of NFV.

5. Status and Requirements of Test Automation

- After the introduction of NFV, investigate the automation requirements and the application of automation tools for various test phrase.

6. Community Work Requirements

- Research on the requirements and value as well as co-construction ideas of community open source certification platform.

• Changes of NFV network element access test

➤ Increased test types and frequency

- Resource pool tests and network element tests are usually conducted separately.
- Pairing tests are needed between resource pools and network elements.

➤ Shorter upgrade cycle:

Upgrade cycle is shortened **from half-year to 2 ~ 3 weeks (1 ~ 2 months)** compared to traditional physical network elements

• Limiting factors for NFV access test

test environment in short supply

Long approval process for access test

Insufficient stability of the production environment

• Optimization of NFV access test

The functional testing and performance testing of Testbed/lab test are usually necessary before the new device or patch obtains the network access license.

Specific optimization measures can include:

- Establish common test resource pool, reuse hardware and virtual resources between different rounds of test; Introduce test management system to optimize the resource use approval process.
- Introduce automated tools and DevOps technology in different test stages.
- Provide integrated standards for third-party test tools and test scripts.

- **Status and requirements of test automation**

- The life cycle test and the traditional business test are performed separately
- Automation requirements priority
 - Test environment setup(highest)
 - Test execution(high)
 - Test design, test analysis, test scoring(medium)
- Problems to be solved in life cycle test and business function test
 - Automatic configuration of network element (most urgent)
 - Automatic deployment, test scripts integration from different vendors, automatic control of the test process(urgent)
 - Test tools/test instruments integration from different vendors, traceability of test results(medium)
- DevOps application status and cooperation mode
 - Some operators have introduced DevOps tools, and all operators hope to achieve full-automatic closed loop, including
 - a) Network element codes are automatically built and automatically integrated
 - b) Network element life cycle and service test is performed automatically
 - c) Network elements are automatically deployed and brought online to a test or production environment
 - The DevOps cooperation model between operators and VNF suppliers is VNF vendors provide VNF software packages and operators implement CI/CD in their own DevOps environment.
There is a requirements about how to load the VNF software package into the operator's DevOps environment automatically

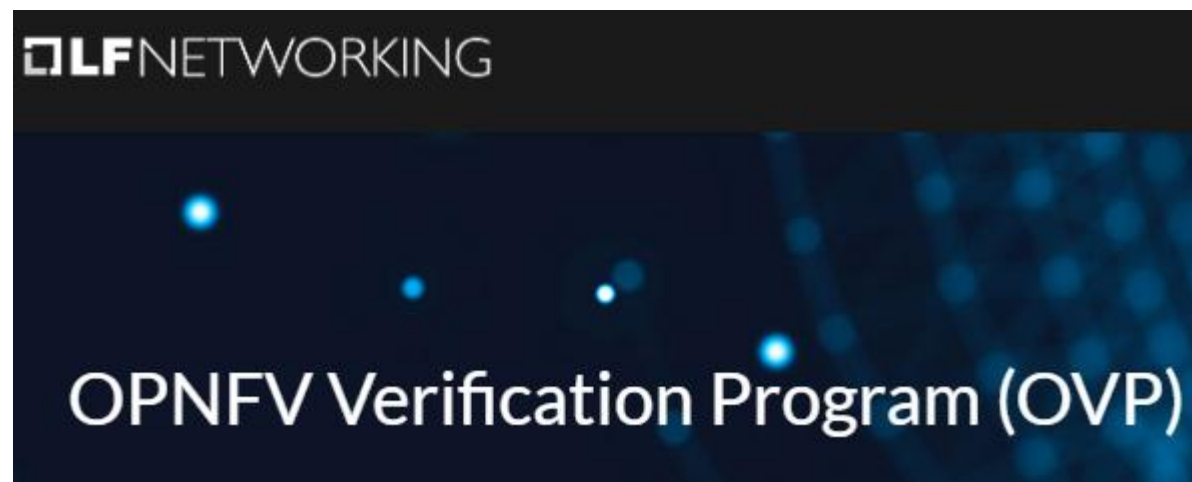
•Significance of LFN OVP certification project for operators

The value of the LFN OVP certification program to operators is mainly reflected in:

- Build the automated test framework together, operators can reference the open source implementation of OVP test framework to support their network access test.
- Build test case executors together, operators can integrate existing test scripts and test tools with reference to test framework requirements, and leverage the capabilities of third-party tools to improve test efficiency.

For the enhancement of OVP automated test functions, the top priorities are :

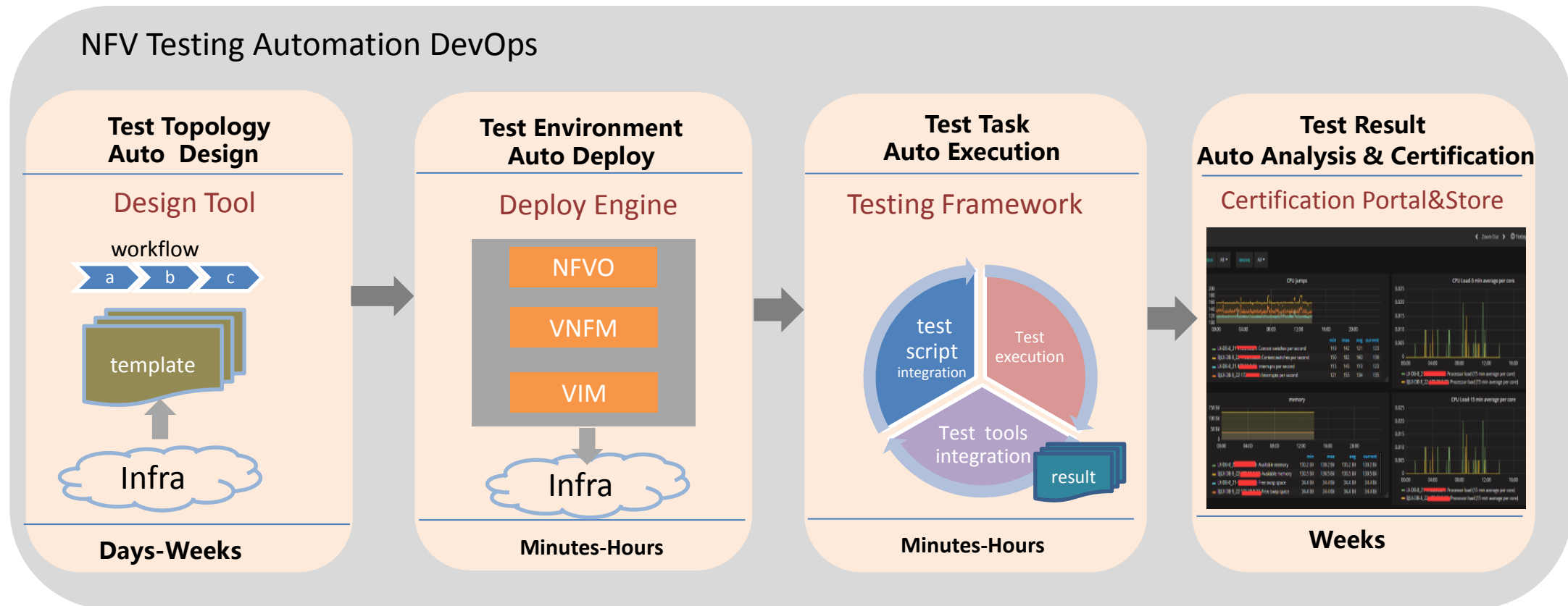
- Topology design
- test environment setup
- test execution
- Test analysis



NE Testing: Vision - Testing Automation DevOps

Objectives :

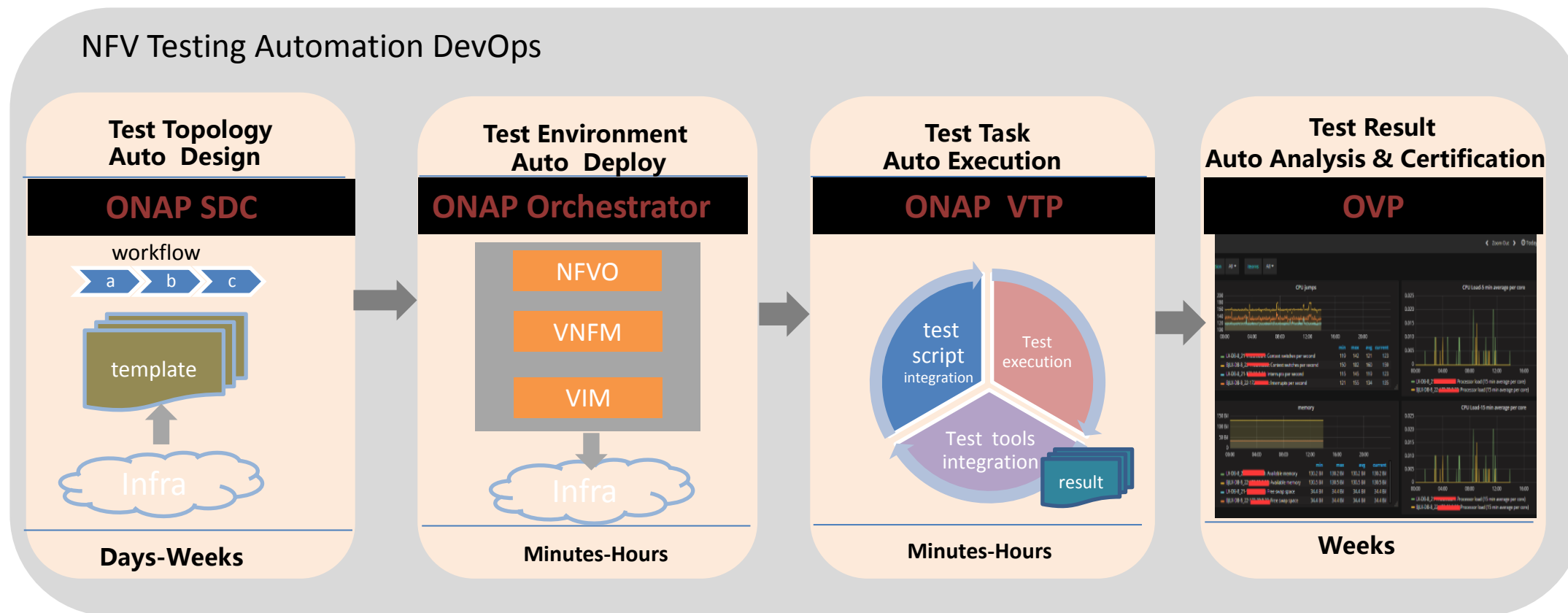
1. Common NFV automated test platform
2. Self-service certification NFV stores
3. Open ecosystem of 5G + AI and 5G + edge



NFV Testing Automation with OVP+ONAP

Function mapping with ONAP components

- Test Topology Design - ONAP SDC
- Test Environment Deploy - ONAP Orchestrator(SO、VF-C、APPC)
- Test Task Execution - ONAP VTP(VNFSDK, VVP)
- Test Result Certificate - OVP

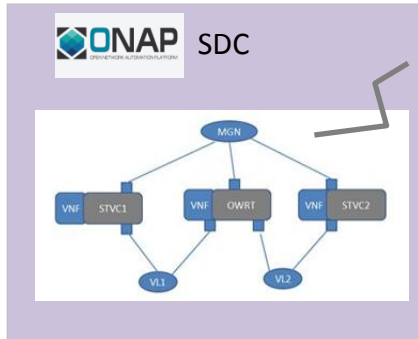


Step1 Test topology design



Test Designer

Test designer either uses the existing test case models from VTP or create new test cases model and uses them for creating test flow, finally upload them to VTP with NS ID tag



SDC Sync NS
Topology with VFC
(onboard to VF-C
catalog)

Step2 Test Case Model Definition and Development



Test Case Developer

Test developer implements the required test cases based model designed by test designer. And maintain it with VTP

```

class SampleNetworkFactory(object):
    def __init__(self, labserver_ip,
                dut_left_ip, dut_right_ip):
        self.labserver_ip = labserver_ip
        self.west_stcv = {
            "mgmt_ip": stcv_west_mgmt_ip,
            "test_port_ip": stcv_west_test_port_ip,
            "gw_ip": dut_left_ip,
            "port_location": "/" + stcv_west_mgmt_ip + "/1/1",
            "result": None
        }
        self.east_stcv = {
            "mgmt_ip": stcv_east_mgmt_ip,
            "test_port_ip": stcv_east_test_port_ip,
            "gw_ip": dut_right_ip,
            "port_location": "/" + stcv_east_mgmt_ip + "/1/1",
            "result": None
        }
    
```

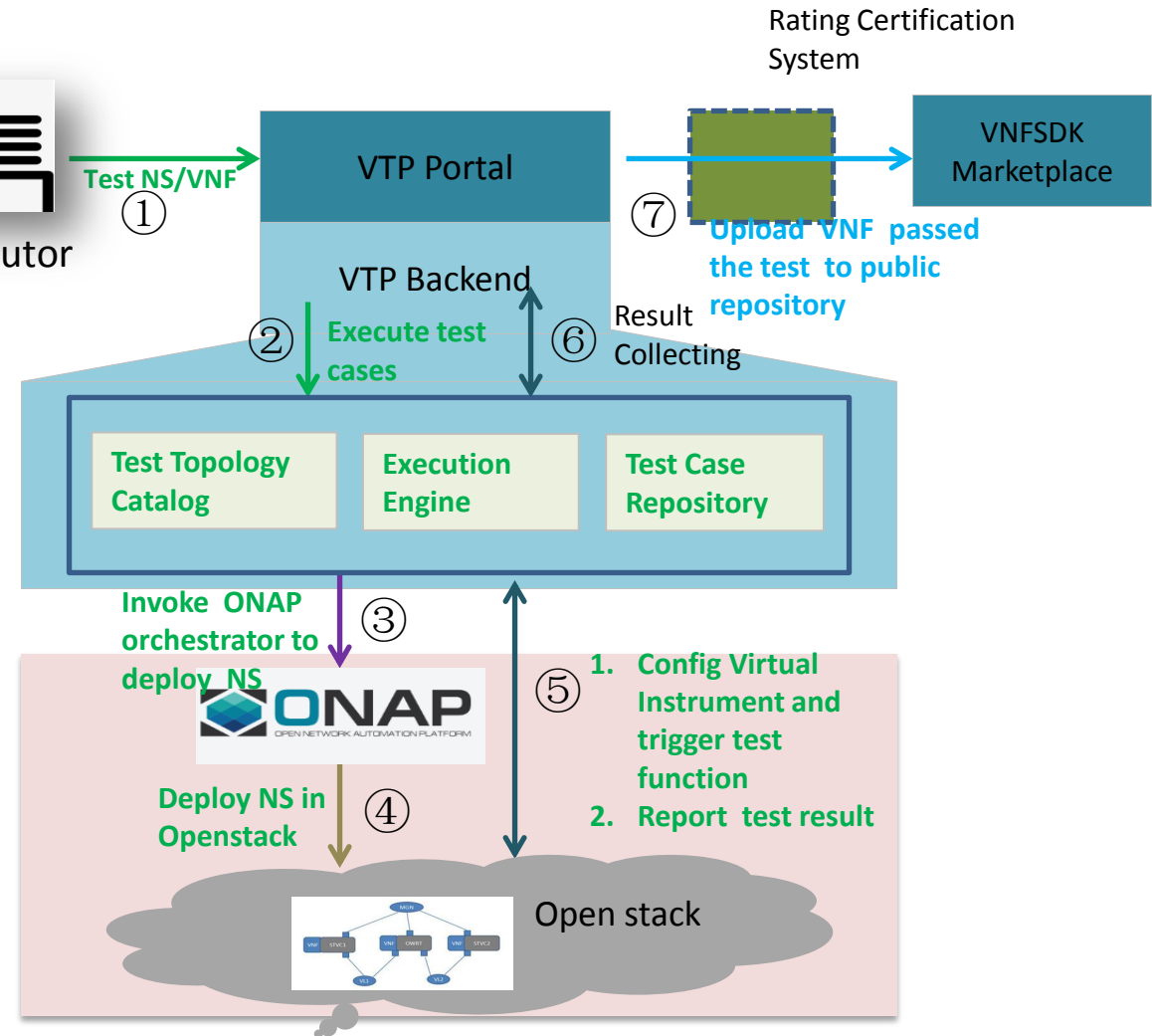
Upload NS test flow to VTP

Import Test Case to VTP

Step3 Test Case Execution



Test Executor



Demo Scenario – Bidirectional Traffic Forwarding Test

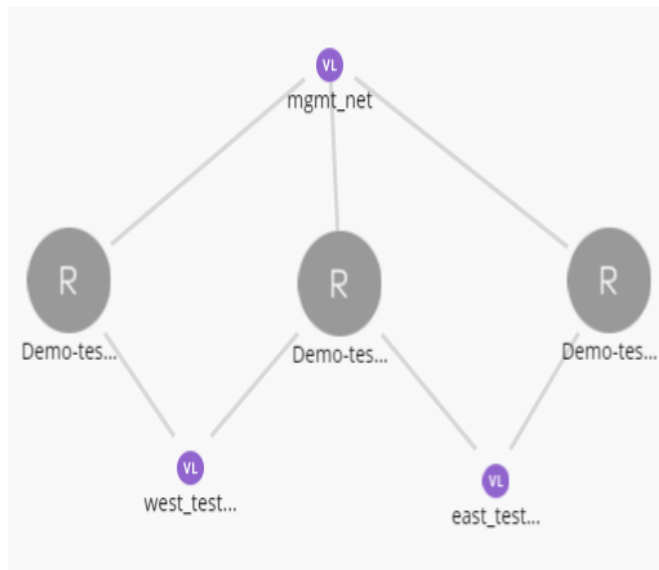
SUT : Openwrt

Test Instrument : Spirent virtual STCv

Step1



Test Designer



Step2



Test Case Developer

```
try:
onap.setup_cloud_and_subscription()
job_id = onap.create_vnf() # onboard vnf,onboard ns,create ns, instantiate ns
ns = onap_api(conf, onap.ns_instance_id, job_id,onap.tenant_id)
ns.get_vnfs_info()
testresult = onap.traffic_test(labserver=conf['instrument']['instrument_mgs']['mnt_address'],
username = conf['instrument']['instrument_mgs']['username'],
stcv1_mgmtip=ns_stcv_west_ip,
stcv1_testip=ns_stcv_west_test_port_ip,
stcv2_mgmtip=ns_stcv_east_ip,
stcv2_testip=ns_stcv_east_test_port_ip,
dut_leftip=ns_dut_left_ip,
dut_rightip=ns_dut_right_ip)
except Exception as e:
logger.debug('----- Exception Happened! -----')
print(e)
print(traceback.print_exc():)
traceback.print_exc()
finally:
#puase = input('stop here before cleanup: ')
onap.cleanup()
print ('Done')
```

Step3



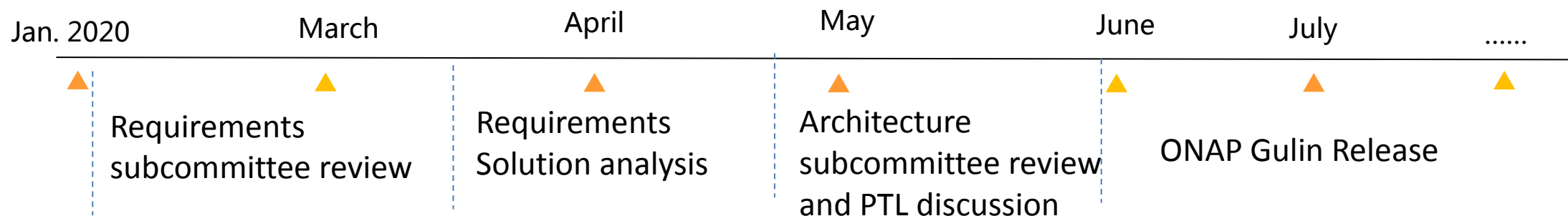
Test Executor

ID	Job Name	SUT Name	Job Description	Action
440968276093579264	Test-compliance-027	VNF1-Compliance	Test-compliance-027	Start Edit Delete Download More
4406683838905267712	test-func-03	OpenWRT	test functional 03	Start Edit Delete Download More
440667302781468672	DNS compliance test	Ebuot-DNS	DNS compliance test	Start Edit Delete Download More
440655280305307136	validation-test001	VNF1-Compliance	validation-test001	Start Edit Delete Download More
440114963365150720	test-func-02	OpenWRT	functional test 02	Start Edit Delete Download More

Goal : Provide common test platform through the augment of ONAP components to support VNF/CNF/Service automated testing

Progress : Has proposed the NFV Testing Automatic Requirements in ONAP Gulin Release
<https://wiki.onap.org/display/DW/Guilin+release+-+functional+requirements+proposed+list>

TimeLine:



Welcome to join above requirements discussion.

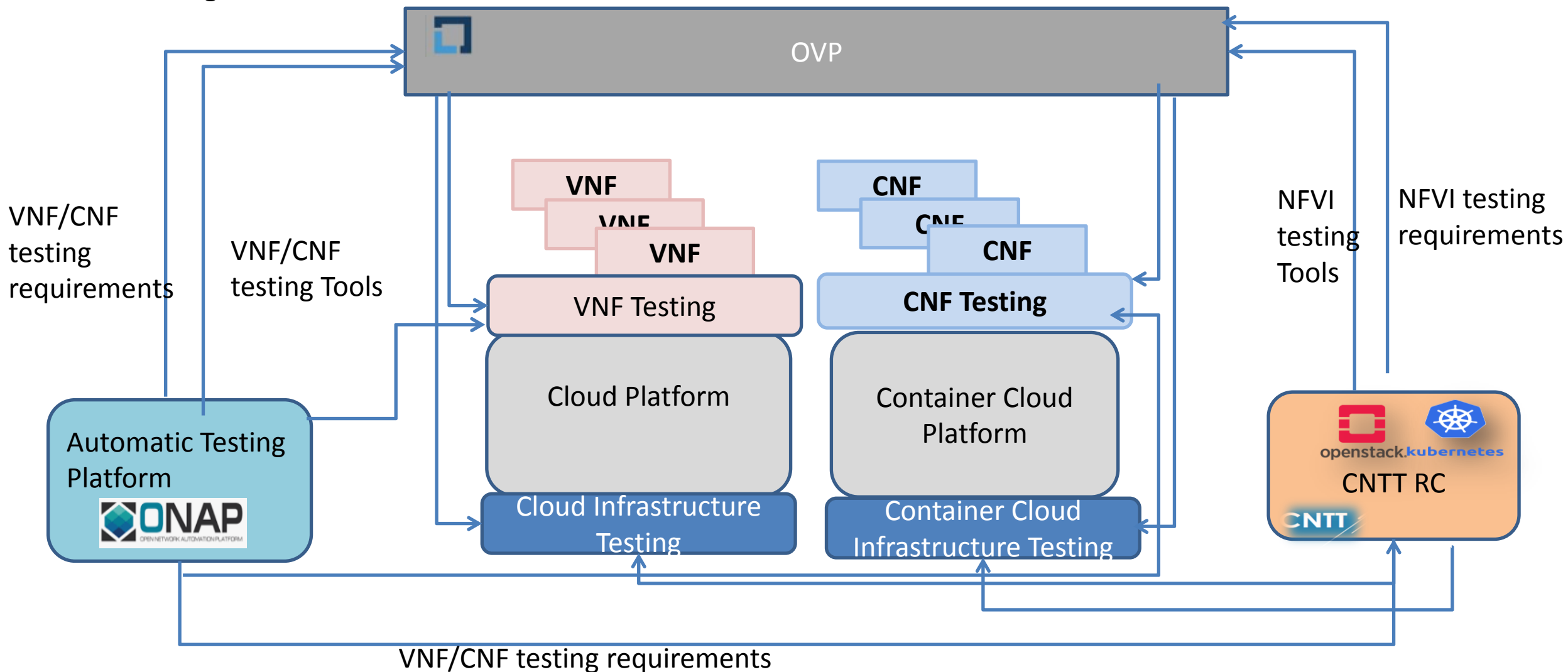
More expertise for NE and test instrument integration (esp. LCM and configuration) is welcome

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Relationship with CNTT and OVP

VNF/CNF testing requirements —» CNTT and OVP

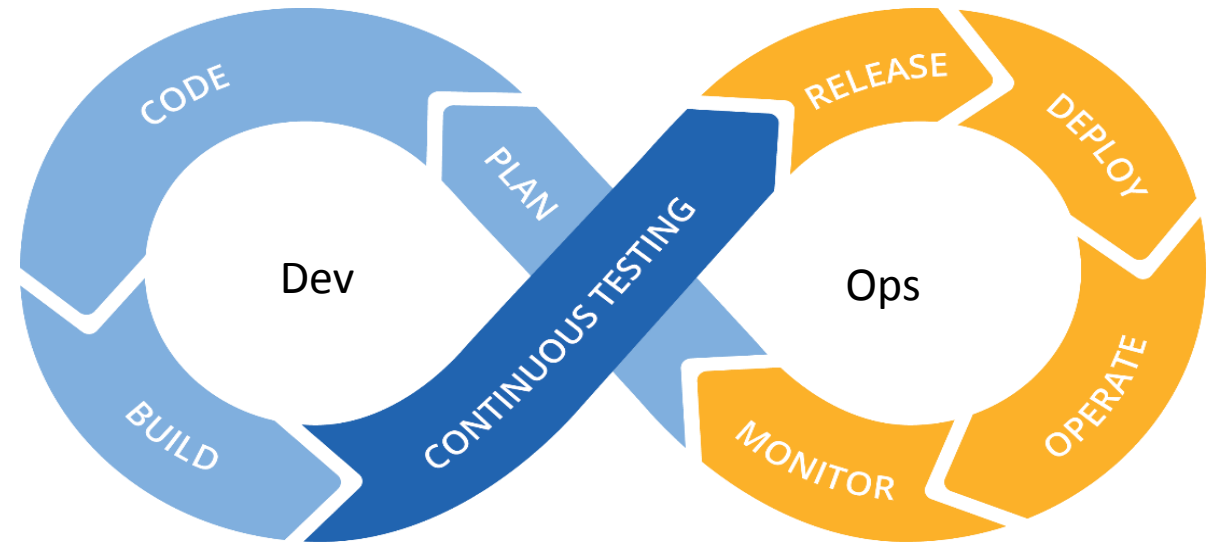
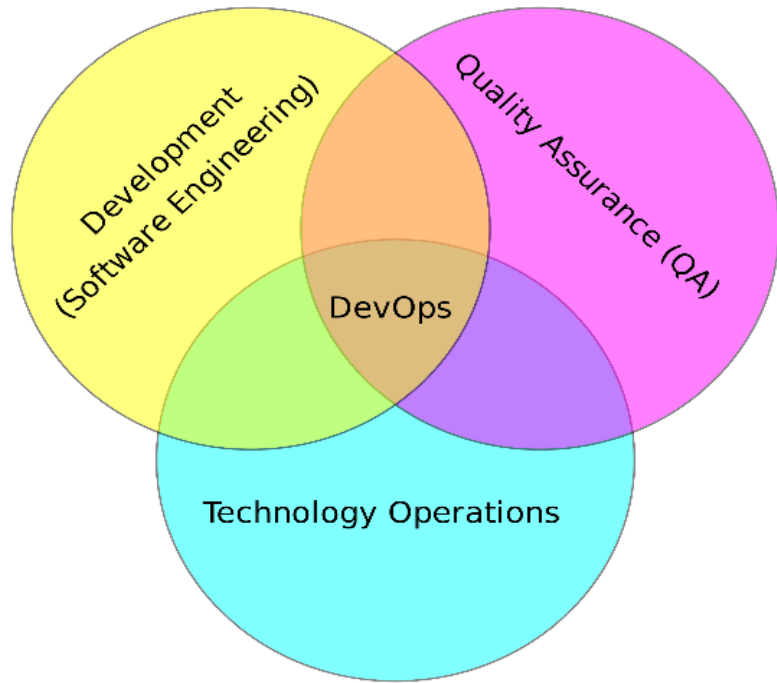
VNF/CNF testing tools —» OVP



Part 2: Open Discussion

Test Automation DevOps and CI/CD

DevOps represents a cultural shift that stresses collaboration between the business, developers, and IT professionals. Software test automation can enhance these connections and help organizations achieve desired SDLC acceleration.

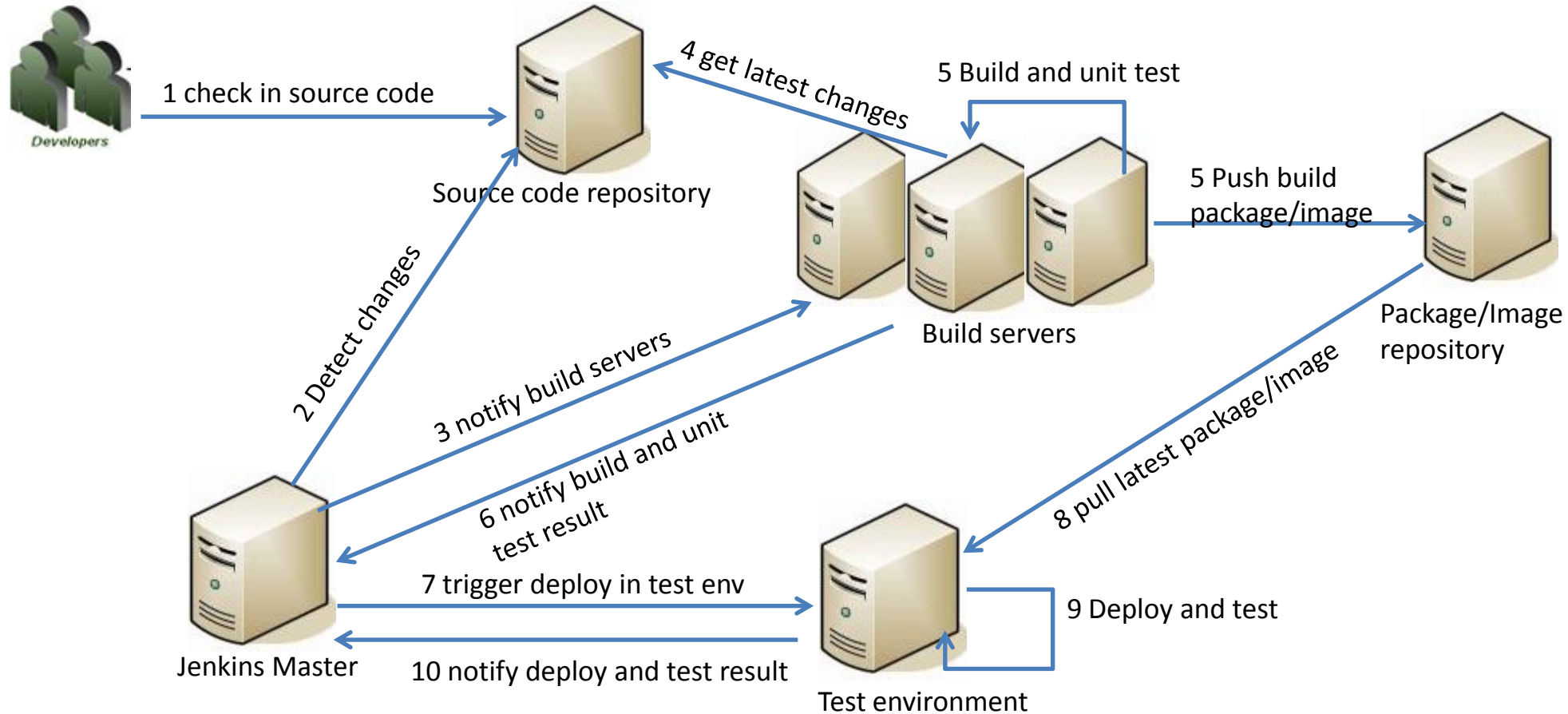


Continuous testing is the most important phases of the DevOps toolchain
Automated testing is a prerequisite for Continuous testing

Typical CI/CD Scenario

This scenario is mainly applicable to development and testing of specific products within a single company.

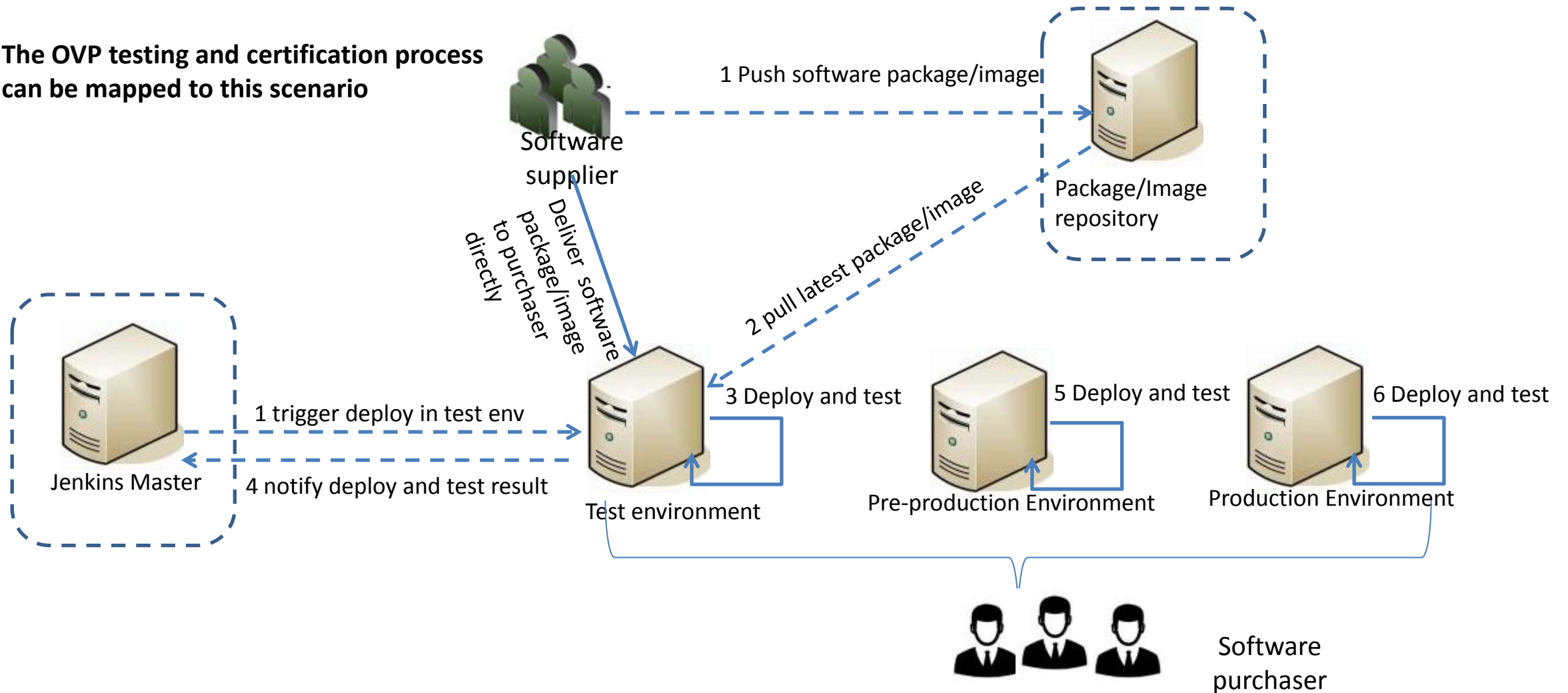
- R & D and testing completely closed loop
- Testing more refers to the **company's internal product testing**



Procurement CI/CD Scenario

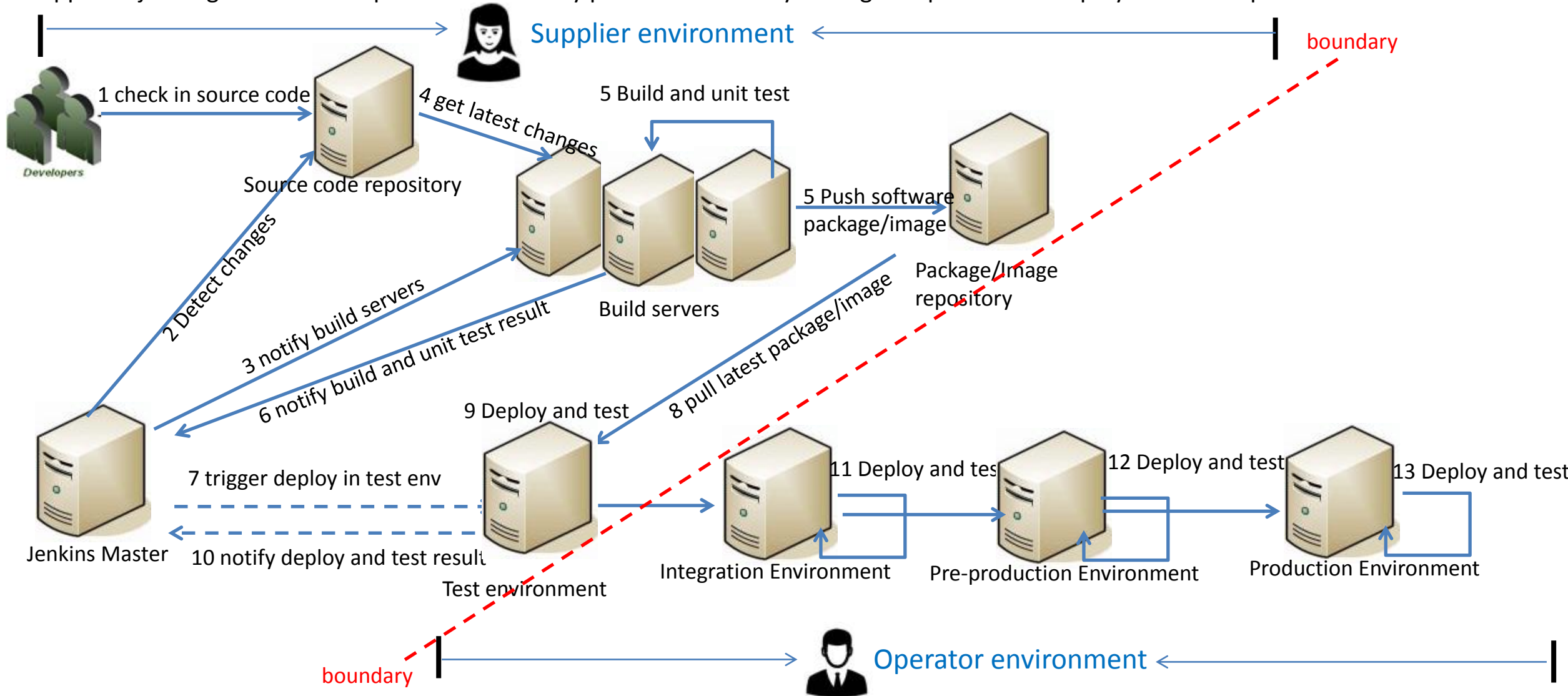
- This scenario generally has two roles: software supplier and purchaser
- Testing more means that the purchaser conducts procurement tests and other tests for the products provided by the supplier

The OVP testing and certification process can be mapped to this scenario



Joint CI/CD Pipeline Scenario

- In NFV context, this scenario allows development, operations, security, and other teams in both the supplier and operator organizations to build confidence in the release through testing.
- Support a joint agile VNF development and delivery process all the way through to production deployment and operation.

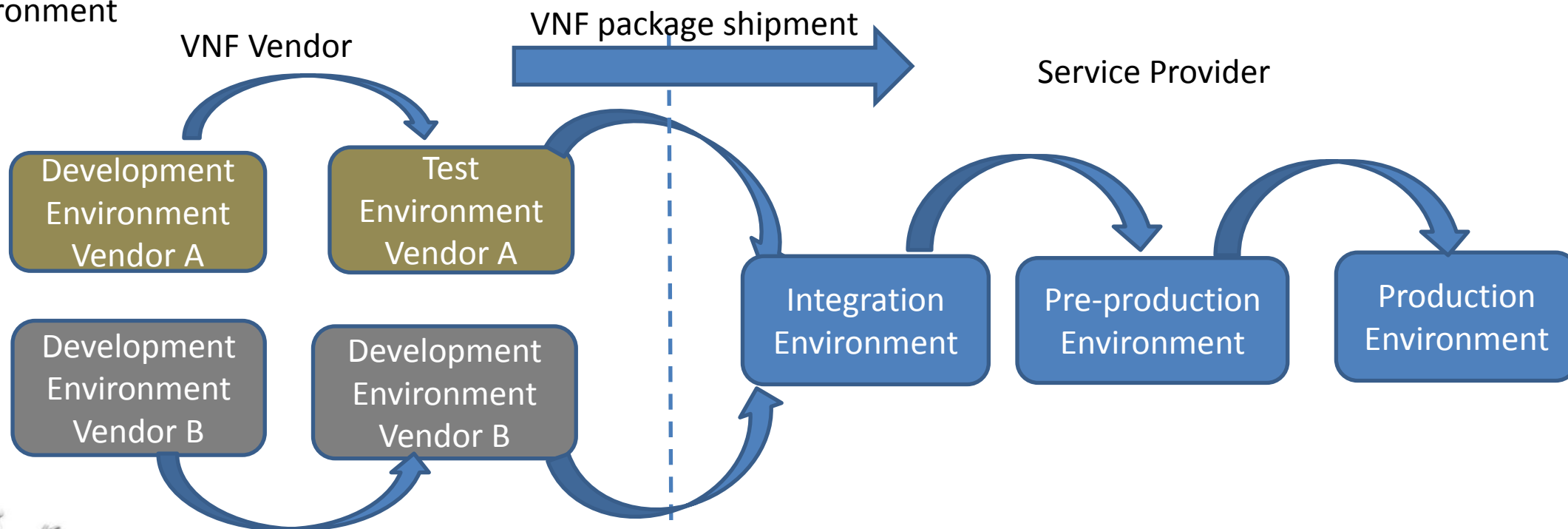


Joint CI/CD Pipeline in NFV Context

DevOps cooperation model between operators and VNF suppliers may have two options:

Option A: VNF vendors provide VNF software packages, and operators implement CI/CD in their own DevOps environment

Option B: Operators open DevOps environment to VNF vendors, and VNF vendors implement CI/CD directly in the open DevOps environment



Which option do you prefer?

If chose option A, How VNF is shipped to Operator?

- Operator-triggered
- Supplier-triggered
- Does the test function need to be shipped from suppliers to operators?

➤ How to apply test frameworks in CI / CD? the integrated options and requirements for test framework?

Test framework can be used in continuous testing in different test environment

Integration Options and requirements for test framework in CI/CD:

- Test framework should provide flexible interface to support test execution, such as test case query, test case execution(single use case execution, batch execution of test suit), test result collection, etc.
 - a) CLI/RestAPI can be invoked directly by CI/CD toll chains, such as Jenkins
 - b) For test framework which provides GUI, can be deployed by CI/CD tool chains, which can be used to monitor the test execution and download the customized test report
- Test framework should effectively cooperate with the test planning system to flexibly execute incremental, smoke or full-scale tests between different test iteration tests
- Other requirements?

➤ What else is needed for continuous testing other than automated test execution?

- Requirements Traceability
- Test Data
- Change Impact Analysis
- Other?



If you have more expertise for automated testing , continuous testing , DevOps&CI/CD, or you are interested in any of the above aspects, welcome to discuss with us.

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Thank You!