XOA Core Documentation

Release 1.1.0

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Jul 29, 2025

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XOA Core is a test framework for executing Xena Python RFC test suites and managing Xena's Traffic Generation testers.

The target audience of this document is test specialists who develop and run automated test scripts/programs using Xena traffic generation testers. Users of this document should have the following knowledge and experience:

- Ability to program with Python language.
- Familiarity with the operating system of your development environment.
- Familiarity with Xena test equipment.
- Working knowledge of data communications theory and practice.

Important

To learn *XOA Driver*, go to XOA Driver Documentation.

To learn *XOA CLI* commands, go to XOA CLI Documentation.

CHAPTER

ONE

INTRODUCTION

XOA Core is an open-source test suite framework for network automation and testing. It is designed to host various XOA RFC Test Suites as **plugins**, allowing users to create, manage, and run test cases for different network scenarios. The XOA Core framework serves as the foundation for building and executing test suites in the XOA ecosystem.

Key features include:

1. Modular architecture: The test suite framework employs a modular architecture, enabling users to develop and run different test suites as plugins.
2. Test Suite execution: Supports both local and remote test suite execution. Users can execute test suites on their local machines or on remote testbeds through the XOA CLI or Web GUI.
3. Test Case management: Provides tools for managing test cases, including creating, updating, and deleting them. Users can also organize test cases using tags and execute them in parallel or sequentially.
4. Extensibility: The framework is designed to be extensible, allowing users to develop custom test suites and plugins to address specific testing requirements.
5. Logging and reporting: Offers built-in logging and reporting functionality, generating detailed test reports to help users analyze test results and identify issues.

This document provides a comprehensive guide on how to install, configure, and use XOA Core. It covers topics such as setting up the environment, creating test suites, executing test cases, and analyzing test results. The documentation also includes a reference for XOA Core's API and example test suites to help users get started with their test automation projects.

CHAPTER

TWO

GETTING STARTED

2.1 Installing XOA Core

XOA Core is available to install via the Python Package Index. You can also install from the source file.

2.1.1 Prerequisites

Before installing XOA Core, please make sure your environment has installed:

- *Python*
- *pip*

Python

XOA Core requires that you install Python on your system.

> **Note**
>
> XOA Core requires Python >= 3.8.

`pip`

Make sure `pip` is installed on your system. `pip` is the package installer for Python . You can use it to install packages from the Python Package Index and other indexes.

Usually, `pip` is automatically installed if you are:

- working in a virtual Python environment (virtualenv or venv). It is not necessary to use `sudo pip` inside a virtual Python environment.
- using Python downloaded from python.org

If you don't have `pip` installed, you can:

- Download the script, from https://bootstrap.pypa.io/get-pip.py.
- Open a terminal/command prompt, `cd` to the folder containing the `get-pip.py` file and run:

```
$ python3 get-pip.py
```

See also

Read more details about this script in pypa/get-pip.

Read more about installation of `pip` in pip installation.

2.1.2 Installing From PyPI Using `pip`

`pip` is the recommended installer for XOA Core. The most common usage of `pip` is to install from the Python Package Index using Requirement Specifiers.

Note

When you install XOA Core with the command `pip install tdl-xoa-core`, the Xena Python API (available as the `tdl-xoa-driver` package on PyPI) will be installed automatically.

Install to Global Namespace

```
$ pip install tdl-xoa-core            # latest version
$ pip install tdl-xoa-core==1.0.7     # specific version
$ pip install tdl-xoa-core>=1.0.7     # minimum version
```

Install in Virtual Environment

Install XOA Core in a virtual environment, so it does not pollute your global namespace.

For example, your project folder is called `/my_xoa_project`.

```
[my_xoa_project]$ python3 -m venv ./env
[my_xoa_project]$ source ./env/bin/activate

(env) [my_xoa_project]$ pip install tdl-xoa-core         # latest␣
↪version
(env) [my_xoa_project]$ pip install tdl-xoa-core==1.0.7  # specific␣
↪version
(env) [my_xoa_project]$ pip install tdl-xoa-core>=1.0.7 # minimum␣
↪version
```

Afterwards, your project folder will be:

Listing 1: After creating Python virtual environment

```
/my_xoa_project
    |
    |- env
```

See also

- Virtual Python environment
- virtualenv
- venv

2.1.3 Upgrading From PyPI Using `pip`

To upgrade XOA Core package from PyPI:

```
$ pip install tdl-xoa-core --upgrade
```

Note

If you upgrade XOA Core using `pip install --upgrade tdl-xoa-core`, Xena Python API (PyPI package name tdl-xoa-driver) will be automatically upgraded.

2.1.4 Installing Manually From Source

If for some reason you need to install XOA Core manually from source, the steps are:

Step 1, make sure Python packages wheel and setuptools are installed on your system. Install `wheel` and `setuptools` using `pip`:

```
$ pip install wheel setuptools
```

Step 2, download the XOA Core source distribution from XOA Core Releases. Unzip the archive and run the `setup.py` script to install the package:

```
[xena_rfc_core]$ python3 setup.py install
```

Step 3, if you want to distribute, you can build `.whl` file for distribution from the source:

```
[xena_rfc_core]$ python3 setup.py bdist_wheel
```

Important

If you install XOA Core from the source code, you need to install Xena Python API (PyPI package name tdl-xoa-driver) separately. This is because Xena Python API is treated as a

3rd-party dependency of XOA Core. You can go to XOA Driver repository to learn how to install it.

2.1.5 Uninstall and Remove Unused Dependencies

`pip uninstall tdl-xoa-core` can uninstall the package itself but not its dependencies. Leaving the package's dependencies in your environment can later create conflicting dependencies problem.

We recommend install and use the pip-autoremove utility to remove a package plus unused dependencies.

```
$ pip install pip-autoremove
$ pip-autoremove tdl-xoa-core -y
```

See also

See the pip uninstall reference.

See pip-autoremove usage.

2.2 Step-by-Step Guide

This section provides a step-by-step guide on how to use XOA Core to run XOA test suites.

2.2.1 Create Project Folder

To run XOA test suites, you need a folder to place the test suite plugins, the test configuration files, and yous Python script to control the tests.

Let's create a folder called `/my_xoa_project`

Listing 2: Create the project folder

```
/my_xoa_project
    |
```

2.2.2 Install XOA Core

After creating the folder, you can either choose to *install XOA Core in a Python virtual environment* or *install in your global namespace* .

If you have already installed XOA Core in your system, either to your global namespace or in a virtual environment, you can skip this step.

2.2.3 Place Test Suite Plugins

Depending on what XOA test you want to run, place the corresponding XOA test suite plugins and the test configuration files in `/my_xoa_project`.

Your project folder will look like this afterwards.

Listing 3: Copy test suite plugins into the project folder

```
/my_xoa_project
    |
    |- /test_suites
        |- /plugin2544
        |- /plugin2889
        |- /plugin3918
```

2.2.4 Run Tests from XOA Test Suite Configurations

Important

If you run **Xena GUI test suite configuration files** (`.x2544` for *Xena2544*, `.x2889` for *Xena2889*, `.x3918` for *Xena3918*), go to *Run Tests from Xena Test Suite GUI Configurations*.

Copy your XOA test configuration `.json` files into `/my_xoa_project` for easy access. Then create a `main.py` file inside the folder `/my_xoa_project`.

Listing 4: Copy XOA test configs and create main.py

```
/my_xoa_project
    |
    |- main.py
    |- new_2544_config.json
    |- new_2889_config.json
    |- new_3918_config.json
    |- /test_suites
        |- /plugin2544
        |- /plugin2889
        |- /plugin3918
```

This `main.py` controls the test workflow, i.e. load the configuration files, start tests, receive test results, and stop tests. The example below demonstrates a basic flow for you to run XOA tests.

```
from __future__ import annotations
from xoa_core import (
    controller,
    types,
)
import asyncio
```

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```
import json
from pathlib import Path

PROJECT_PATH = Path(__file__).parent
XOA_CONFIG = PROJECT_PATH / "xoa_2544_config.json"
PLUGINS_PATH = PROJECT_PATH / "test_suites"


async def subscribe(ctrl: "controller.MainController", channel_name:␣
↪str, fltr: set["types.EMsgType"] | None = None) -> None:
    async for msg in ctrl.listen_changes(channel_name, _filter=fltr):
        print(msg)


async def main() -> None:
    # Define your tester login credentials
    my_tester_credential = types.Credentials(
        product=types.EProductType.VALKYRIE,
        host="10.20.30.40"
    )

    # Create a default instance of the controller class.
    ctrl = await controller.MainController()

    # Register the plugins folder.
    ctrl.register_lib(str(PLUGINS_PATH))

    # Add tester credentials into teh controller. If already added, it␣
↪will be ignored.
    # If you want to add a list of testers, you need to iterate␣
↪through the list.
    await ctrl.add_tester(my_tester_credential)

    # Subscribe to test resource notifications.
    asyncio.create_task(subscribe(ctrl, channel_name=types.PIPE_
↪RESOURCES))

    # Load your XOA 2544 config and run.
    with open(XOA_CONFIG, "r") as f:

        # Get rfc2544 test suite information from the core's␣
↪registration
        info = ctrl.get_test_suite_info("RFC-2544")
        if not info:
            print("Test suite RFC-2544 is not recognized.")
            return None
```

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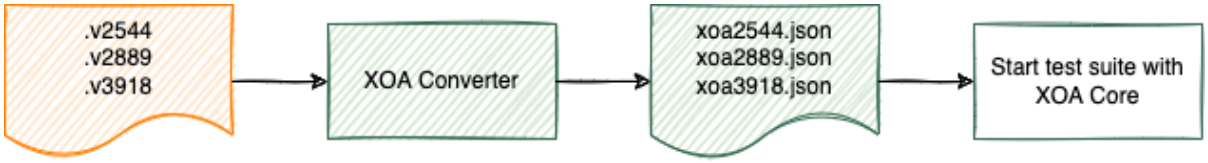
```
        # Test suite name: "RFC-2544" is received from call of c.get_
↪available_test_suites()
        test_exec_id = ctrl.start_test_suite("RFC-2544", json.load(f))

        # The example here only shows a print of test result data.
        asyncio.create_task(
            subscribe(ctrl, channel_name=test_exec_id, fltr={types.
↪EMsgType.STATISTICS})
        )

    # By the next line, we prevent the script from being immediately
    # terminated as the test execution and subscription are non␣
↪blockable, and they ran asynchronously,
    await asyncio.Event().wait()


if __name__ == "__main__":
    asyncio.run(main())
```

Then simply run `main.py`:

```
[my_xoa_project]$ python3 main.py
```

2.2.5 Run Tests from Xena Test Suite GUI Configurations

If you want to run your test suite GUI configuration files, you should install `xena-rfc-converter` to convert Valkyrie test suite configurations into XOA test suite configurations, as illustrated below.



See also

Read more about installing XOA Converter

Copy your GUI test configurations into `/my_xoa_project` for easy access. Then create a `main.py` file inside the folder `/my_xoa_project`.

Listing 5: Copy TUI test configs and create main.py

```
/my_xoa_project
    |
```

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```
    |- main.py
    |- old_2544_config.v2544
    |- old_2889_config.v2889
    |- old_3918_config.v3918
    |- /test_suites
        |- /plugin2544
        |- /plugin2889
        |- /plugin3918
```

This `main.py` controls the test workflow, i.e. convert the GUI configs into XOA configs, load the configuration files, start tests, receive test results, and stop tests. The example below demonstrates a basic flow for you to run the GUI tests.

```
from __future__ import annotations
import sys
from xoa_core import (
    controller,
    types,
)
import asyncio
import json
from pathlib import Path
# XOA Converter is an independent module and it needs to be installed␣
↪via `pip install xoa-converter`
try:
    from xoa_converter.entry import converter
    from xoa_converter.types import TestSuiteType
except ImportError:
    print("XOA Converter is an independent module and it needs to be␣
↪installed via `pip install xoa-converter`")
    sys.exit()

PROJECT_PATH = Path(__file__).parent
OLD_2544_CONFIG = PROJECT_PATH / "old_2544_config.v2544"
OLD_2889_CONFIG = PROJECT_PATH / "old_2889_config.v2889"
PLUGINS_PATH = PROJECT_PATH / "test_suites"


async def subscribe(ctrl: "controller.MainController", channel_name:␣
↪str, fltr: set["types.EMsgType"] | None = None) -> None:
    async for msg in ctrl.listen_changes(channel_name, _filter=fltr):
        print(msg)



async def main() -> None:
```

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```
    # Define your tester login credentials
    my_tester_credential = types.Credentials(
        product=types.EProductType.VALKYRIE,
        host="10.20.30.40"
    )

    # Create a default instance of the controller class.
    ctrl = await controller.MainController()

    # Register the plugins folder.
    ctrl.register_lib(str(PLUGINS_PATH))

    # Add tester credentials into teh controller. If already added, it␣
↪will be ignored.
    # If you want to add a list of testers, you need to iterate␣
↪through the list.
    await ctrl.add_tester(my_tester_credential)

    # Subscribe to test resource notifications.
    asyncio.create_task(subscribe(ctrl, channel_name=types.PIPE_
↪RESOURCES))

    # Convert Valkyrie 2544 config into XOA 2544 config and run.
    with open(OLD_2544_CONFIG, "r") as f:
        # get rfc2544 test suite information from the core's␣
↪registration
        info = ctrl.get_test_suite_info("RFC-2544")
        if not info:
            print("Test suite is not recognized.")
            return None

        # convert the old config file into new config file
        new_data = converter(TestSuiteType.RFC2544, f.read())

        # you can use the config file below to start the test
        new_config = json.loads(new_data)

        # Test suite name: "RFC-2544" is received from call of c.get_
↪available_test_suites()
        execution_id = ctrl.start_test_suite("RFC-2544", new_config)


        # The example here only shows a print of test result data.
        asyncio.create_task(
            subscribe(ctrl, channel_name=execution_id, fltr={types.
↪EMsgType.STATISTICS})
```

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```
        )

    # By the next line, we prevent the script from being immediately
    # terminated as the test execution and subscription are non␣
↪blockable, and they ran asynchronously,
    await asyncio.Event().wait()


if __name__ == "__main__":
    asyncio.run(main())
```

2.2.6 Receive Test Result Data

XOA Core sends test result data (in JSON format) to your code as shown in the example below. It is up to you to decide how to process it, either parse it and display in your console, or store them into a file.

Listing 6: Receive test result data

```
async for stats_data in ctrl.listen_changes(execution_id, _filter=
↪{types.EMsgType.STATISTICS}):
    print(stats_data)
```

See also

Read about *Test Result Types*

CHAPTER

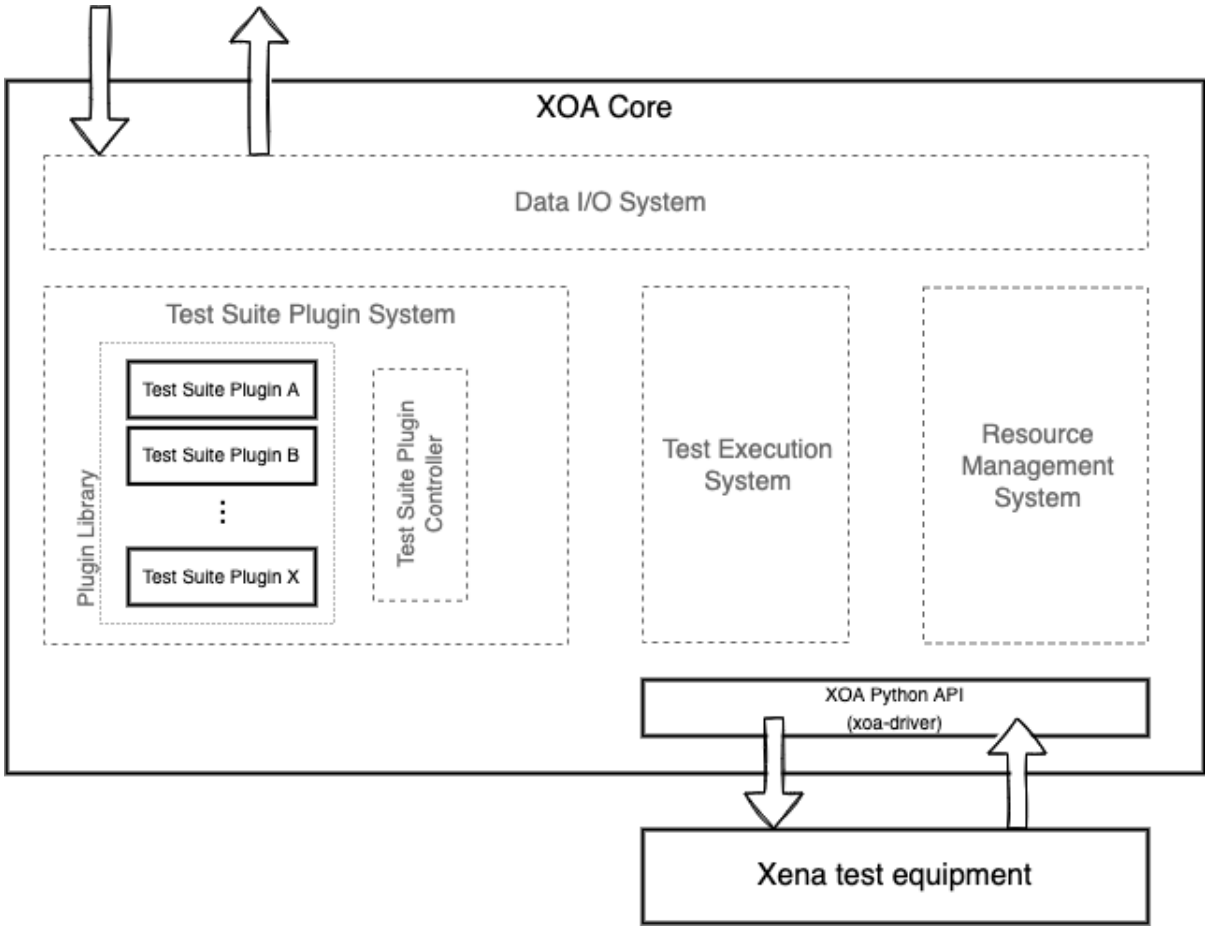
THREE

UNDERSTANDING XENA PYTHON RFC CORE

3.1 Introduction

The XOA Core is an asynchronous Python framework that can be represented by four subsystems:

1. *Resources Management System* lets you manage testers, i.e. add, remove, connect, disconnect, and view a list of available testers.
2. *Test Suite Plugin System* dynamically loads the test suites that are organized in a common structure, and exposes information of those test suites to you.
3. *Test Execution System* provides methods that let you control the test execution.
4. *Data IO System* let you subscribe to different messages generated by different test suites and subsystems so you can get test statistics/results, monitor test progress, receiver errors and warnings, etc.



3.2 Resources Management System

The key functionality is represented in managing and monitoring the state of known testers.

Available operations for users:

- Add testers
- Remove testers
- Connect to testers
- Disconnect from testers
- Get the list of available testers

Under the hood, XOA Core uses the instance of tdl-xoa-driver library as a representation of the resource.

3.3 Test Suite Plugin System

All test suites are considered plug-ins by the XOA Core. You can freely choose which test suites to use. XOA Core dynamically loads test suites that are organized in a common structure, and exposes information of those test suites to you.

Available operations for users:

- Register a test suite into the plug-in library
- Get the name list of available test suites
- Get test suite information by its name

Users can register one or multiple test suite lookup folders in a test script by calling the method `register_lib(<lookup_path: str>)`.

3.3.1 Plugin Folder Structure

A test suite plug-in must have the structure below:

```
./my_test_suite
    |
    |- meta.yml
    |- __init__.py
    |- <any other modules defined by user>
```

`meta.yml` has a fixed structure as shown below, and is used as the entry point for the plug-in loading system. If the test suite folder doesn't contain this file, it will not be loaded by XOA Core.

Listing 1: `meta.yml` example

```yaml
name: "RFC-2544[Frame Loss]" # Plugin name
version: "1.0" # Plugin current version
core_version: ">=1.0.0" # compatible to xoa-core version
author: # Optional list of authors
    - "ACO"
entry_object: "FrameLossTest" # class name of script entry point
data_model: "FrameLossModel"  # class name of test suite data model
```

- `entry_object` must be inherited from an abstract class: `types.PluginAbstract`
- `data_model` must be a class of Pydantic model inherited from `pydantic.BaseModel`

Note

Be aware of imports during implementation of your plug-in. It is recommended to use relative import in your plug-in because the library paths in different user environments can be different, which makes it impossible for the plug-in code to run.

Important

Test suites are treated as an asyncio.Task . It means all heavy computational operations must be implemented with subprocess workers or threadings.

3.4 Test Execution System

XOA Core provides the following controlling methods of test suite execution:

- Start test
- Pause/continue test
- Stop test

3.4.1 Start Test

Use `execution_id = my_core_controller.start_test_suite(<plugin_name>, <suite_config_dict>)` to start a test and get the test ID as a returned value. With the test ID, you will be able to stop or pause the test.

`<plugin_name>` - must match the name from plugin's `meta.yml`.

`<suite_config_dict>` - must be a dictionary matching to the following structure:

Listing 2: Dictionary structure for `<suite_config_dict>`

```
{
    "username": "XOA",
    "port_identities": {
        "p0": {
            "tester_id": "2906f8d041e9fd07191d6a37ef5785b2",
            "tester_index": 0,
            "module_index": 1,
            "port_index": 4
        },
        ...
    },
    "config": TestSuiteModel<as dict>
}
```

If the test suite is successfully started, the function `start_test_suite` will return an `execution_id`, which can be used to control the test suite executions, or to subscribe to the outgoing messages from the test suite.

> **Note**
>
> A test suite will not start if its test resources are not registered in *Resource Manager*, or if one of its test resources is unavailable/disconnected.

3.4.2 Pause/Continue Test

Use `await my_core_controller.running_test_toggle_pause(<execution_id>)` to pause/continue a test.

User should use `await self.state_conditions.wait_if_paused()`, where the test suite should be paused/continued.

> **Note**
>
> To apply pause/continue action, a valid `execution_id` must be passed into the method.

3.4.3 Stop Test

Use `await my_core_controller.running_test_stop(<execution_id>)` to stop a test.

User should use `await self.state_conditions.stop_if_stopped()`, where the test suite should be stopped.

If the execution of `execution_id` exists, the test suite will be terminated.

3.5 Data IO System

XOA Core allows users to subscribe to different messages generated by different test suites and subsystems (ResourcesManager, ExecutorManager), so you can get test statistics/results, monitor test progress, receiver errors and warnings, etc.

3.5.1 Message Subscription

XOA Core provides two types of messages for you to subscribe to:

- `Subsystem Type`
- `Test Execution Type`

Subsystem Type Message

Subscribe to subsystem-type messages to receive messages exchanged between your code and the testers.

Listing 3: Subscribe to the messages from tester resource management subsystem.

```
async for msg in my_controller.listen_changes(<subsystem-type>}:
    # do whatever you want to the message
```

There are two types of subsystems that you can subscribe to:

Listing 4: Subsystem types

```
types.PIPE_EXECUTOR
types.PIPE_RESOURCES
```

- `types.PIPE_EXECUTOR` messages tells information about the test executor.

- `types.PIPE_RESOURCES` messages tells information about the test resources, such as port reservation status, link sync status, tester connection status and so on.

Test Execution Type

A test execution can generate different types of messages, such as **test statistics**, **test progress**, **test state**, **errors**, and **warnings**. To subscribe to a specific type, you can use the `_filter` argument.

Listing 5: Subscribe to statistics of test execution

```
async for msg in my_controller.listen_changes(execution_id, _filter={
↪<filter_type>}):
    # do whatever you want to the message
```

The `_filter` argument is an set of filter types. The first parameter of `_filter` argument is a mandatory identifier of the subsystem or the test suite execution. Available filters types are as shown below:

Listing 6: Available filters types

```
class EMsgType(Enum):
    STATE = "STATE"
    DATA = "DATA"
    STATISTICS = "STATISTICS"
    PROGRESS = "PROGRESS"
    WARNING = "WARNING"
    ERROR = "ERROR"
```

Note

`_filter` argument is optional. If it is not provided, all message types will be returned from this test suite execution.

The example below demonstrates how to subscribe to test resource notifications and test results.

```
from __future__ import annotations
from xoa_core import (
    controller,
    types,
)
import asyncio
import json
from pathlib import Path

PROJECT_PATH = Path(__file__).parent
XOA_CONFIG = PROJECT_PATH / "xoa_2544_config.json"
PLUGINS_PATH = PROJECT_PATH / "test_suites"
```

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```
async def subscribe(ctrl: "controller.MainController", channel_name:␣
↪str, fltr: set["types.EMsgType"] | None = None) -> None:
    async for msg in ctrl.listen_changes(channel_name, _filter=fltr):
        print(msg)


async def main() -> None:
    # Define your tester login credentials
    my_tester_credential = types.Credentials(
        product=types.EProductType.VALKYRIE,
        host="10.20.30.40"
    )

    # Create a default instance of the controller class.
    ctrl = await controller.MainController()

    # Register the plugins folder.
    ctrl.register_lib(str(PLUGINS_PATH))

    # Add tester credentials into teh controller. If already added, it␣
↪will be ignored.
    # If you want to add a list of testers, you need to iterate␣
↪through the list.
    await ctrl.add_tester(my_tester_credential)

    # Subscribe to test resource notifications.
    asyncio.create_task(subscribe(ctrl, channel_name=types.PIPE_
↪RESOURCES))

    # Load your XOA 2544 config and run.
    with open(XOA_CONFIG, "r") as f:

        # Get rfc2544 test suite information from the core's␣
↪registration
        info = ctrl.get_test_suite_info("RFC-2544")
        if not info:
            print("Test suite RFC-2544 is not recognized.")
            return None

        # Test suite name: "RFC-2544" is received from call of c.get_
↪available_test_suites()
        test_exec_id = ctrl.start_test_suite("RFC-2544", json.load(f))

        # The example here only shows a print of test result data.
```

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```
        asyncio.create_task(
            subscribe(ctrl, channel_name=test_exec_id, fltr={types.
↪EMsgType.STATISTICS})
        )

    # By the next line, we prevent the script from being immediately
    # terminated as the test execution and subscription are non␣
↪blockable, and they ran asynchronously,
    await asyncio.Event().wait()


if __name__ == "__main__":
    asyncio.run(main())
```

3.6 Test Result Types

XOA Core sends test result data (in json format) to your code as shown in the example below. It is up to you to decide how to process them, either parse JSON into Python dictionary, display in your console, or store them into a file.

Listing 7: Receive test result data

```
async for stats_data in ctrl.listen_changes(execution_id, _filter=
↪{types.EMsgType.STATISTICS}):
    print(stats_data)
```

There are three types of test result data (JSON format) that you receive from XOA Core.

- Live test result data

Every second, XOA queries statistics such as port TX and RX counters and sends them to you. The amount of this type of test result data can be large when your test duration is long.

- Intermediate test result data

If the test uses an iterative searching algorithm, such binary search in RFC 2544 Throughput Test and Back-to-Back Test, the result data after each searching step is called intermediate result because the searching is not yet complete. Intermediate results let you keep track of the searching steps.

- Final test result data

Final result date are the conclusion of a certain test iteration. For example, the throughput value for a certain frame size, the traffic latency value for a certain traffic rate with a certain frame size. This type of test result lets you analyze and verify the performance, conformance, and functionalities of your DUT/SUT.

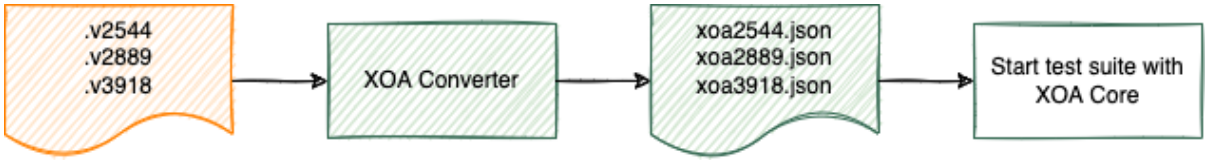
To check the type of the test result data:

Listing 8: Check the type of the test result data

```
# The example here only shows a print of test result data.
async for stats_data in ctrl.listen_changes(execution_id, _filter=
↪{types.EMsgType.STATISTICS}):
    if stats_data.is_final == True:
        # This is final result
    else:
        ...
```

3.7 Migrate from Xena Windows Desktop Test Suites

We have developed a test configuration converter, XOA Converter, to help users easily migrate their existing Windows test suite configurations (*.x2544* for *Xena2544*, *.x2889* for *Xena2889*, *.x3918* for *Xena3918*) into XOA. The illustration below may help you understand the use flow.



This converter is meant for those who want to integrate Xena Python RCC test suites into their own Python environment.

CHAPTER

FOUR

GLOSSARY OF TERMS

API
Application Programming Interface.

IDE
An integrated development environment (IDE) is a software application that provides comprehensive facilities to computer programmers for software development.

Index Manager
An Index Manager manages the subport-level resource indices such as stream indices, filter indices, connection group indices, match term indices, length term indices, etc. It automatically ensures correct and conflict-free index assignment.

Module Manager
A Module Manager helps you access test modules. There is one Module Manager per tester.

Port Manager
A Port Managers helps you access test ports. There is one Port Manager per test module.

Resource Manager
XOA Python API HL-API provides an easy way to manage subtester test resources, including obtaining test resources and managing indices.

Test Resource
Test chassis, test module, and test port, both hardware and virtual are referred to as test resources. A user must have the ownership of a test resource before be able to perform testing.

TGA
Traffic Generation and Analysis.

Xena1564
Xena1564 provides full support for both the configuration and performance test types described in Y.1564. It is installed together with ValkyrieManager and uses the same terminology. The simple intuitive GUI makes it easy to connect one or more ValkyrieCompact and/or ValkyrieBay chassis for testing Layer 2 and Layer 3.

Xena2544
Xena2544 offers full support for the 4 test-types specified in RFC2544, and also lets you

partially enable one or more test types. Xena2544 supports different network topologies and traffic flow directions on both Layer 2 and Layer 3, as well as both IPv4 and IPv6.

Xena2889
: Xena2889 is a free application for benchmarking the performance of Layer 2 LAN switches.

Xena3918
: Xena3918 provides an easy-to-use port configuration panel that lets you add and remove ports, and assign IP addresses and port roles. Ports from multiple ValkyrieBay and ValkyrieCompact chassis can be freely mixed.

XOA CLI
: Xena Command-Line Interface. Xena provides a rich set of CLI commands for users to administer test chassis for test automation.

XOA Core
: XOA Core is an open test suite framework to execute XOA RFC Test Suites as its plugins.

XOA Driver
: The foundation of Xena OpenAutomation is XOA Driver that provides Python interfaces for engineers to manage Xena test equipment.

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