

Recommendation

ITU-T Q.4077 (04/2025)

SERIES Q: Switching and signalling, and associated measurements and tests

Testing specifications – Testing specifications for IMT-2020 and IoT

**Testbed as a service application program
interfaces descriptions and interoperability
requirements**

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For further details, please refer to the list of ITU-T Recommendations.

Recommendation ITU-T Q.4077

Testbed as a service application program interfaces descriptions and interoperability requirements

Summary

Recommendation ITU-T Q.4077 reports on the elaboration of testbed as a service (TaaS) application program interfaces (APIs) based on the requirements and reference model with properties of relevance for delivering testbed as a service (TaaS), to complement and extend Recommendation ITU-T Q.4068. Recommendation ITU-T Q.4077 is more particularly focused on the user interface, services, and requirements to address end-user needs when remotely accessing testbeds through APIs in order to deliver adequate user experience. From this perspective, the Recommendation elaborates the related terms and definitions, requirements, and reference model with properties of relevance for TaaS. Recommendation ITU-T Q.4077 also presents interoperability requirements for virtualizing and delivering modular and scalable TaaS on top of existing and future testbed infrastructures, including federated testbeds. TaaS is able to list the assets provided by the different testbeds and expose them through dedicated APIs based on Recommendation ITU-T Q.4068.

History*

Edition	Recommendation	Approval	Study Group	Unique ID
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API, federated testbeds, interoperability, testbed as a service.

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Recommendation ITU-T Q.4077

Testbed as a service application program interfaces descriptions and interoperability requirements

1 Scope

This Recommendation describes the testbed as a service application program interfaces (APIs) and interoperability requirements. The APIs specified in this Recommendation are dedicated exclusively to testbed as a service (TaaS). The integration, interoperability and extensibility of the TaaS are also studied in this Recommendation.

2 References

The following ITU-T Recommendations and other references contain provisions which, through reference in this text, constitute provisions of this Recommendation. At the time of publication, the editions indicated were valid. All Recommendations and other references are subject to revision; users of this Recommendation are therefore encouraged to investigate the possibility of applying the most recent edition of the Recommendations and other references listed below. A list of the currently valid ITU-T Recommendations is regularly published. The reference to a document within this Recommendation does not give it, as a stand-alone document, the status of a Recommendation.

- [ITU-T Q.4068] Recommendation ITU-T Q.4068 (2021), *Open application program interfaces (APIs) for interoperable testbed federations*.
- [ITU-T Q.4078] Recommendation ITU-T Q.4078 (2025), *User requirements and reference model for testbed as a service*.
- [IEEE 2302] IEEE 2302-2021, *IEEE Standard for Intercloud Interoperability and Federation (SIIF)*.

3 Definitions

3.1 Terms defined elsewhere

This Recommendation uses the following terms defined elsewhere:

- 3.1.1 experiment** [b-ISO 3534-3]: Purposive investigation of a system through selective adjustment of controllable conditions and allocation of resources.
- 3.1.2 resource** [b-ETSI TS 102 812]: A well-defined capability or asset of a system entity, which can be used to contribute to the realization of a service. Examples: MPEG decoder, graphics system.
- 3.1.3 testbed** [ITU-T Q.4068]: Platform to realise scientific tests with new technologies on an environment fully controlled by experimenters.
- 3.1.4 testbed as a service (TaaS)** [b-ITU-T QSTR.FTT]: Refers to the offering of a testbed by its owner to users based on a defined policy framework. This framework may include service level agreements (SLAs), pricing models, usage time frames, and testbed availability. Users can access the testbed to run tests, analyse results, and utilize the findings while adhering to the established policies.

3.2 Terms defined in this Recommendation

None.

4 Abbreviations and acronyms

This Recommendation uses the following abbreviations and acronyms:

API	Application Program Interface
BSS	Business Support Systems
CUT	Component Under Test
E2E	End-to-End
FHS	Fed Hosting Server
GUI	Graphical User Interface
HTTPS	Hypertext Transfer Protocol Secure
IEEE	Institute of Electrical and Electronics Engineers
MPEG	Moving Picture Experts Group
OSS	Operations Support Systems
SIIF	Standard for Intercloud Interoperability and Federation
SLA	Service Level Agreement
SUT	System Under Test
TaaS	Testbed as a Service

5 Conventions

None.

6 TaaS API and interoperability requirements

This Recommendation is dedicated to all the TaaS APIs which are based on the generic reference model defined in [ITU-T Q.4068] and [ITU-T Q.4078]. These APIs cover all aspects of the monetization of TaaS. Through the APIs specified in this Recommendation, it is possible for users, for example, to reserve a testbed slice, or to reuse an experiment based on a template of a testbed slice. Furthermore, if the user does not find a service through the TaaS APIs, a request to a specific endpoint of the TaaS APIs can be made by the user to execute the service on demand.

With reference to Figure 1 and Table 1 of [ITU-T Q.4068], the APIs needed for the TaaS are listed in Table 1.

Table 1 – Testbed as a service APIs

#	API name (identification tags)	API description
1	APIa	The API is used for providing descriptive information about the resource, its state and usage in real-time upon the invocation of the API by the testbed management system.
2	APIb	The API is used for enabling a test manager to interact with the resource, in cases where the resource is either a component under test (CUT) or system under test (SUT), or provides an interface that can be used by a test system to configure it, such that the test manager may configure the resource as may be required for some test scenario, and/or pull test results from the resource after a completion of a test.

Table 1 – Testbed as a service APIs

#	API name (identification tags)	API description
3	APIc	The API is used by Level-0 resources to dynamically provide information in real-time about their state in terms of usage and other information such as performance data and workload being sustained on the resource.
4	APId	The API is used by Level-1 resources to dynamically provide information in real-time about their state in terms of usage and other information such as performance data and workload being sustained on the resource.
5	APIe	The API is used by testbed management system to enable testbed admin to pull and view (visualize) information about the state of resources (Level-0 and Level-1) from the real-time state repository, especially when the testbed admin intends to view the state of certain resources before deciding to cause connectivity to be established among resources in the testbed and/or establishing connectivity to resources in other testbeds.
6	APIf	The API is used by test manager to pull information about Level-0 and Level-1 resources that may be required to participate in a certain test scenario a testbed user may want to execute. The API is also meant for use by a test manager to pull information about the state of resources (Level-0 and Level-1) from the real-time state repository, especially when state of a resource plays a role during the execution of certain test cases or when the test manager may require to use the state of certain resources in deciding to cause connectivity to be established among resources in the testbed and/or establishing connectivity to resources in other testbeds.
7	APIg	The API is used by a test manager to execute certain test cases that are meant to test the resource during a scenario in which the resource is a system under test (SUT) or a component under test (CUT). The API is also meant for use by a test manager to request the resource to execute a certain behaviour that is required by a test case(s) being executed by the test manager, including configuring some Level-0 resource(s) that can only be configured via the Level-1 resource.
8	APIh	The API is used by the testbed resource broker to gather information about the capabilities of the resource, its state and its availability to serve testbed services request(s) received from prospective testbed user(s). In case the resource is an orchestrator of resources (Level-1 and/or Level-0), then the same API is also used by the testbed resource broker to request the resource for orchestration of instance(s) of certain Level-1 resource(s) and/or Level-0 resource(s) as slices that are required to fulfil requirements of a testbed service request received from a prospective testbed user, when there is no existing instance (slice) of the required type of resource(s) that is already available to fulfil the requirements of the newly received request for a prospective testbed user. The same API is also used by testbed broker to obtain information about capabilities and state of resources