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Terms of Reference for the ITU-T Focus Group on “Testbeds Federations for IMT-2020 and beyond” (FG-TBFxG)

1. Rationale and Scope

Over the years, ICT Research Communities (including publicly funded R&D Projects in US, Europe, China, Japan, South Korea, and in many other parts of the world), together with the Industry, have been working on various topics on building and implementing Testbeds for various purposes, including ICT Testbeds and Testbeds for industrial sectors (such as certain applications in the areas of transportation, finance & banking, healthcare, automotive, manufacturing, production plants, retail, entertainment & broadcasting, etc., that leverage ICT technologies and infrastructures).

Today, there are many Testbeds available for Research purposes and many Testbeds continue to be built by the Research Communities and by the Industry as well. The Industry continues to build its own Testbeds that are used internally within organizations such as Network Operators (or Communications Service Providers) or Vendors, and in some cases some industrial Testbeds are useable to multiple organizations based on certain collaboration agreements that are closed only to the partners.

Over the years it has increasingly been experienced that singly isolated standalone Testbeds are not sufficient to test and trial out certain technology use cases because the use cases rather require the use of components and resources located in various Testbeds (due to the varying capabilities of the different Testbeds that need to be used, and due to the fact that it is more sustainable when the burden of investing in Testbed facilities is shared among various potential Testbed suppliers/providers). New ICT Technologies, Networks and Industry-oriented Applications are becoming increasingly complex to test using Standalone Testbeds. Hence, Federated Testbeds bring sustainability in fostering environments for quick innovations and testing of complex technologies and use cases, and for enabling quicker time to market for products and services.

In this regard, federated testbeds may bring a lot of value to “research use-cases” and “industry real technology deployment use cases”. In general, there is an urgent need to build an Ecosystem for enabling Sustainable Testbeds Development, Evolutions, and Federations. This becomes important for the whole ICT Industry and different domains, especially in this era of automation and consideration of emerging impacts of pandemics like COVID-19 on products developments and lifecycle management.

ITU-T SG11 in close collaboration with ETSI TC INT developed draft Recommendation ITU-T Q.4068 “Open APIs for interoperable testbed federations” which defines a generic Reference Model for Testbeds Federations and describes the main elements of this Reference Model.

In addition, ITU-T SG11, ETSI TC INT and IEEE co-organized Joint SDOs Brainstorming Workshop on Testbeds Federations for 5G and Beyond: Interoperability, Standardization, Reference Model and APIs which was held fully virtual on 15-16 March 2021 (www.itu.int/go/BTF4-5G). It was noted that Research Communities and the Industry (Solutions vendors/suppliers, CSPs, Enterprises, and Standards Development Organizations (SDOs)/Fora) all have roles to play in this desired Ecosystem that should be built around the Testbeds Federations Reference Model now and into the future, in this era of “*Software’rization*” and *Disaggregation* of ICT Networks, IMT-2020 and beyond.

Taking into account the importance of the desired Ecosystem, including APIs for the Testbed Federations that affect various stakeholders, this Focus Group on “Testbeds Federations for

IMT-2020 and beyond” (FG-TBFxG) would play a role in providing a platform to share views, to develop a series of deliverables, and showcasing initiatives, projects, and standards activities linked to Testbed Federations.

The FG-TBFxG will serve as a platform to help bring about Harmonization of Testbeds specifications across SDOs/Fora. The FG-TBFxG will leverage and align with the Testbeds Federations Reference Model being standardized jointly by ETSI TC INT and ITU-T SG11 in researching, developing and specifying the required APIs, and defining a set of use cases for Federated Testbeds and use of the APIs. FG-TBFxG encourages all Stakeholders, SDOs/Fora, to:

1. Contribute to the development of the APIs being prescribed by the Testbeds Federations Reference Model;
2. Share the burden on APIs Specifications and Standardization and on Roadmaps in a harmonized and collaborative way;
3. Develop New use cases and services for Testbeds Suppliers that derive from the Testbeds Federations Reference Model and associated APIs, such as “Testbed-as-a Service” (TaaS).

NOTE: Among the expected Stakeholders are: SDOs/Fora, Research Communities, Researchers on IMT-2020 and beyond, Industry Users of Testbeds, Testbeds Suppliers for IMT-2020 Testbeds and other Testbeds, CSPs (Communications Service Providers), Network Operators, Infrastructure Vendors/Suppliers for ICT and Verticals, Open Source & Open Hardware Projects, Regulators.

The Focus Group will also seek to elucidate the roles that can be played by the various Stakeholders in the Ecosystem for Testbeds Federations Standards and Use Cases. For that the FG-TBFxG will play a role in providing a platform to share views, to develop a series of deliverables associated with the topics above, and it will also offer a platform to players that may like to showcase initiatives and projects that align with the outlined vision and the desired Ecosystem on Testbeds Federations. The Focus Group will develop Specifications that may become a basis for further Standardization in the area of Testbeds Federations. It will invite non ITU-T members to participate in this work.

2. Objectives of the FG-TBFxG

FG-TBFxG will have the following objectives:

- To define a set of APIs definitions that complement the ongoing ITU-T SG11 study activities related to Testbed Federations and APIs of the Testbeds Federations Reference Model;
- To collect Use Cases for Testbeds Federations of relevance to IMT-2020 and beyond;
- To identify use cases and services based on Testbed Federations reference model that should be considered for various types of Stakeholders on the benefits of them joining the ecosystem around Testbeds Federations for IMT-2020 and beyond;
- To study the various Topics/Points compiled in the Key Takeaways from the ITU-T, ETSI, IEEE Joint SDOs Brainstorming Workshop on Testbeds Federations for 5G & Beyond (www.itu.int/go/BTF4-5G) in order to take them into consideration in the work of the Focus Group;
- To identify Metrics/Key Performance Indicators (KPIs) of relevance to Use Cases for Testbed Federations per and across ICT industry sectors in different domains (verticals); and propose methods/mappings by which E2E relationships among various metrics (e.g. KPIs) across Testbeds can be defined (see NOTE below):

NOTE: Among KPIs for Testbed Federations are:

(1) KPIs of relevance to a Technology or combined Technologies that are being Tested using Federated Testbeds such that the measured KPIs help in the Test Cases verdicts setting;

(2) KPIs of relevance to utilization, availability, capabilities, customer-experience (satisfaction) of the Testbeds and their resources being consumed or can be consumed in Testbed usage in a Test Scenario;

(3) Non-technical KPIs that relate to Testbed Service Offerings and Consumption

- To develop guidance to Research and Industry communities working on IMT-2020 and beyond on how to use the Testbeds Reference Model to contribute to the development of the APIs being prescribed by the Testbeds Reference Model, and also contribute to various instantiations cases of the Reference Model
- To facilitate discussions by which various SDOs/Fora can share ideas on how they can potentially share the burden on APIs Specifications and Standardization and on Roadmaps in a harmonized and collaborative way, based on the Testbeds Federations Reference Model, and produce a matrix that maps SDOs/Fora and other Stakeholders to APIs types they will be addressing or have interest to address;
- To define Potential New use cases and services for Testbeds Suppliers that derive from the Testbeds Federations Reference Model and associated APIs, such as “Testbed-as-a Service” (TaaS);
- To develop guidelines to Owners of Existing Testbeds and Platforms for IMT-2020 and beyond on how they could embark on Transformation or Evolution of existing Testbeds (Industry-grade, and potential Research Testbeds as well) and their Federation APIs to meet the requirements of the Testbeds Federation reference model (ITU-T Q.4068);
- To develop guidelines to the Industry on how to address the Challenges that need to be addressed as guided by the Reference Model and APIs for Testbeds Federations for IMT-2020 and beyond;
- To identify any Regulatory requirements and other aspects of relevance to Testbeds Federations and engage the relevant Stakeholders on how such aspects can be addressed;
- To define steps that can be pursued by the Industry towards Developing and Maintaining ONPs (Open Networking Platforms) for IMT-2020 and beyond, and the Use of the Testbeds Federations Reference Model and APIs to build ONPs;
- To develop reports of the FG activities on reference model and APIs for testbeds federation after the FG finished its work;
- To encourage participation from various projects and fora in the activities of the FG-TBFxG.

3. Structure

The FG-TBFxG may establish sub-groups as needed. To coordinate operations and provide guidance to subgroups, there will be a chair and vice-chairs.

4. Specific Tasks and Deliverables

Tasks and deliverables developed by FG-TBFxG may include the following:

- Gathering information about ongoing standardization initiatives on Testbed Federations and related APIs being standardized by SDOs/Fora (e.g. ITU-T SG11, IEEE INGR,

ETSI TC INT, TM Forum, BroadBand Forum (BBF)). The aim of this task is to amend the ongoing SG11 standardization work on this subject matter;

- Developing an APIs Invocations Framework as part of the Testbeds Federations Reference Model being standardized by ITU-T SG11, by which Generic APIs invoke Testbed-specific specialized APIs in specific Testbeds Types during execution of Use Cases for Testbeds and Testbeds Federations;
- Defining use cases for Testbeds Federations of relevance to IMT-2020 and beyond for different ICT industrial sectors based on the Testbeds Federations Reference Model and solicitations of inputs from relevant players in different domains (verticals) (e.g. IoT, Autonomic/Autonomous Networks (ANs));
- Studying existing and ongoing Initiatives in Research and Industry on IMT-2020 and beyond, on APIs of relevance to the Testbeds Federations Reference Model (ITU-T Q.4068), and provide guidelines on how the stakeholders can implement the standardized Testbeds Federations Reference Model or its Instantiations for various types of Testbeds;
- Providing a Framework on how transformations or enhancements/evolutions may be pursued by the community to make existing IMT-2020 related Testbeds APIs fit to the Reference Model and its APIs Invocations Framework;
- Defining Potential New use cases and services for Testbeds Suppliers or Owners that derive from the Testbeds Federations Reference Model and associated APIs, such as “Testbed-as-a Service” (TaaS);
- Organising thematic workshops and forums on Testbeds Federations for IMT-2020 and beyond. These workshops and forums are expected to bring together all stakeholders including policy makers, ICT sector members, national telecommunication authorities, academia, SDOs/Fora, UN agencies to discuss various aspects related to Testbeds Federations for IMT-2020 and beyond;
- Identifying and selecting relevant projects and fora that can be used in Testbed Federations for IMT-2020 and beyond that conform to the SG11’s Reference Model for Testbeds Federations and its APIs; and promote the vision to the relevant Open Source/Hardware Projects/Forums;
- Developing Technical Reports and Specifications which address the outlined items such as APIs and Frameworks, while also identifying future standardization work for ITU-T study groups in the area of Federated Testbeds for IMT-2020 and beyond (as described in the objectives);
- Communicating the final list of deliverables to SG11, at least four calendar weeks before the parent group’s next meeting.

5. Relationships

This Focus Group will work closely with SG11 through collocated meetings where and when possible and will work in close coordination with all ITU-T Study Groups as appropriate.

This FG–TBF5G will also collaborate (as required) with other relevant entities, in accordance with Recommendation ITU-T A.7.

It will establish close collaboration with other SDOs/Fora (e.g. IEEE, ETSI, TMForum, BroadBand Forum (BBF), TIP, ORAN, NGMN, 3GPP, etc.), municipalities, non-governmental organizations (NGOs), policy makers, companies, academic institutions, research institutions and other relevant organizations.

6. Parent group

The parent group of the FG-TBFxG is ITU-T Study Group 11 “Signalling requirements, protocols, test specifications and combating counterfeit products”.

Among others, SG11 leads ITU activities on establishing test specifications, conformance and interoperability testing for all types of networks, technologies and services that are the subject of study and standardization by all ITU-T study groups.

7. Leadership

The stipulations in clause 2.3 of Recommendation ITU-T A.7 apply.

8. Participation

See clause 3.1 of Recommendation ITU-T A.7.

Any individual from a country that is a member of ITU and who is willing to contribute actively to the work may participate in the focus group. This includes individuals who are also members of international, regional and national organizations.

A list of participants will be maintained for reference purposes and reported to the parent group.

All participants are strongly encouraged to contribute to the FG’s activities.

9. Administrative support

The stipulations in clause 5 of Recommendation ITU-T A.7 apply.

10. General financing

FG-TBFxG will follow the guidance in clause 4 of Recommendation ITU-T A.7 with regard to financing of focus groups and their meetings and clause 10.2 of Recommendation ITU-T A.7 with regard to printing and distribution of deliverables.

11. Meetings

The frequency and locations of meetings will be determined by the Focus Group management. The overall meetings plan will be announced after the approval of the terms of reference. The Focus Group will use remote collaboration tools to the maximum extent, and collocation with ITU-T SG11 meetings is encouraged.

The meeting dates will be announced by electronic means (e.g., e-mail and website, etc.) at least six weeks in advance.

12. Technical contributions

See clause 8 of Recommendation ITU-T A.7.

Any participant may submit a technical contribution directly to FG-TBFxG, in accordance with the time schedule adopted. A template for contributions can be found on the ITU-T website. Electronic document transfer methods should be used whenever possible.

Deadline for contributions will be announced by FG Chairman for each particular meeting.

13. Working language

The working language is English.

14. Approval of deliverables

Approval of deliverables shall be taken by consensus.

15. Working guidelines

Working procedures shall follow the procedures of Rapporteur group meetings.

FG-TBFxG will exchange draft deliverables and other outcomes on a regular basis with its parent group, to ensure efficient transfer of deliverables to streamline future activities (see ITU-T A.7 Appendix I).

No additional working guidelines are defined.

16. Progress reports

Regular progress reports will be provided at each meeting of the parent group, as per the guidance in clause 11 of Recommendation ITU-T A.7.

17. Announcement of Focus Group formation

The creation of the FG-TBFxG will be announced via TSB Circular to all ITU membership. ITU-T Newslog, press releases and other means, including communication with other involved organizations could be utilized.

18. Milestones and duration of the Focus Group

The Focus Group lifetime is set for one year from the first meeting (see ITU-T A.7, clause 2.2), with the possibility for a further year subject to the agreement of the parent study group.

19. Patent policy

See clause 9 of Recommendation ITU-T A.7.
