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MANAGING THE INCREASING COMPLEXITY WITH THE EVALUATION OF IMT-2030 TECHNOLOGIES

Proposal on the expectations by IEG's in evaluating candidate IMT-2030 technologies

Introduction

The advent of IMT-2030 technologies marks a significant evolution in the realm of telecommunications, promising unprecedented capabilities and performance. However, with this progress comes a notable increase in the complexity of evaluating these technologies compared to previous generations. In this paper we highlight these challenges, especially to the independent evaluation groups participating and recommend considerations for ITU-R with the evaluation in the evolving technological landscape.

The IMT-2030 Framework

The IMT-2030 framework in ITU-R M.2160 outlines a comprehensive approach to the design, development and evolution of the next-generation IMT systems. It emphasizes on the key usages evolved from those of IMT-2020; enhanced mobile broadband, ultra-reliable and low-latency communications, and massive machine-type communications into Immersive communications, hyper reliable & low-latency communications and massive communications respectively. In addition to these evolved usage scenarios, there are new usage scenarios identified including – ubiquitous connectivity, integrated sensing and communications and AI and communication. These elements introduce new dimensions to the evaluation process, necessitating more sophisticated methodologies, tools and resources.

Comparison with Previous Generations

Previous generations, including IMT-2000 (3G), IMT-Advanced (4G) and IMT-2020 (5G), focused primarily on technological advancements targeting the enhancing of data transmission speeds and improving network capacity. Evaluating these technologies for the metrics such as throughput, latency, and coverage involved straightforward simulation approaches. In contrast, IMT-2030 encompasses a broader scope of applications and performance criteria, making the evaluation process inherently more complex. For e.g., evaluation of performance requirements for readiness towards AI in the radio interface, impact on sustainability as an overarching design principle in IMT-2030, ability of security and resilience, ability for ubiquitous connectivity, etc.

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Proposals towards development of New Evaluation Methodologies

Focusing solely on the mandate of ITU-R and evaluating the radio aspects of IMT-2030 technologies could alleviate some of these challenges.

- ITU-R WP5D evaluation activities must be limited to the evaluation of the radio aspects of the candidate IMT-2030 technologies,
- The evaluation configurations and test environments should be targeting the most typical deployments of the IMT-2030 system,
- Minimize the number of test environments; and limit to only those that are most relevant for the IMT applications under the usage scenario,
- Enablers for applications for usage scenarios that depend on higher layer functionalities that are outside the scope of WP5D evaluation may be made as part of candidate technology submission in the description template as supported capabilities to deliver such applications which can then be verified as part of the evaluation,
- Anticipated evaluation scenarios if any (e.g., mesh technology needed for IMT-2020 technology evaluation) need to be made part of the Evaluation Configuration from the very beginning.
- Evaluation should be strictly based on general purpose models that are reproducible with benchmarking.
- AI models: The need to develop AI models to independently evaluate the possible gains due to AI in radio and non-radio environments should be avoided (at network end, edge and devices). ITU-R WP5D can instead request proponents to voluntarily share relevant technical study done that demonstrates possible gains by exposure of metrics and interfaces from the radio functionalities which assist in developing AI inferencing. Provisions may be added in the *submission templates* to disclose such information as appropriate.

- Security and Resilience: Though the physical layer provides necessary mechanisms to secure the various physical/logical channels between a base-station and user-terminal, evaluation of overall security of the system/network should be out of the scope of the evaluation activity of WP5D. Since security and resilience of a network is an important aspect expected in an IMT-2030 network and must be an expected aspect of the overall design principle of IMT-2030 technologies. ITU-R WP5D should expect the proponents to report such details of the capabilities *supported by radio access network to higher layers functions in their submission templates as informative material.*

We further propose, that WP5D agree on the scope of the independent evaluation groups involvement with IMT-2030 evaluation and device the evaluation activity to serve that purpose. The evaluation exercise should focus on validating the functional behaviour of the radio and the interface. Expectations on the candidate technology development should solely remain a matter with the proponents and WP5D should instead focus on the proponents of technology providing such additional appropriate material in a voluntary manner. This is very essential for proponents and evaluation groups to participate in the IMT-2030 technology development in an inclusive manner. Such voluntary information relevant to the IMT-2030 framework need to be included in *description templates,* that can be verified by the independent evaluation groups as well as administrations considering the deployment of IMT-2030 network/systems.