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SERIES Y: GLOBAL INFORMATION
INFRASTRUCTURE, INTERNET PROTOCOL ASPECTS,
NEXT-GENERATION NETWORKS, INTERNET OF
THINGS AND SMART CITIES

Internet protocol aspects – Quality of service and network
performance

Quality of service metrics for continuity of performance of packet data-based services

Recommendation ITU-T Y.1545.2

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Recommendation ITU-T Y.1545.2

Quality of service metrics for continuity of performance of packet data-based services

Summary

Recommendation ITU-T Y.1545.2 specifies spatially resolved metrics for packet data-based services and a methodology for their computation, using the same conceptual framework as Recommendation ITU-T G.1034. The metrics cover the quality of service (QoS) and quality of experience (QoE) aspects of a wide range of applications used in motion, i.e., during travel. A taxonomy of application categories is provided, taking into account their absolute data rate (DR) requirements and, in particular, their sensitivity against temporary drops in available DRs, which are caused by motion through an environment that is characterized by spatial variation of network performance, i.e., available DR or latency. The methodology establishes ways to create a description of such spatial distributions of performance, termed route profiles and use route profiles to create predictions of QoS and QoE of application usage. It also establishes a new entity to describe local network performance that provides an abstraction and thereby a versatile way to express performance requirements.

History

Edition	Recommendation	Approval	Study Group	Unique ID*
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End-to-end, mobile communication, packet data services, QoE, QoS, spatially resolved information.

* To access the Recommendation, type the URL <http://handle.itu.int/> in the address field of your web browser, followed by the Recommendation's unique ID. For example, <http://handle.itu.int/11.1002/1000/11830-en>.

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Introduction

[ITU-T G.1034] specifies metrics for mobile telephony communication during rail travel, based on actual measurement data from telephony tests on trains.

[ITU-T G.1034] introduces two metrics: local drop probability (LDP) describes local call stability; and call completion probability (CCP) predicts expected call stability for telephone calls of selected length.

In many services using packet-data connectivity, continuity of performance is also key to perceived quality. The range of services that suffer from insufficient data rate (DR) – the DR zero in case of complete loss of connectivity being just an extreme case – starts with real-time services such as video conferencing or gaming where even short dips of DRs cause drastic degradations in quality of service (QoS). The case of video streaming is a bit more complex than for adaptive streaming, no direct relation between bit rate changes and QoS change may exist, and in any case, buffering can conceal insufficient DRs for a few seconds. Even then, however, perceived quality will suffer during longer periods of poor packet data performance.

The categorization of application builds upon, and extends, the terminology and categories established in [ITU-T G.1010], and uses the definition framework for hand-over processes provided by [ITU-T Y.1546].

NOTE –The term 'service' is used as the subject of a QoS-related view. However, be aware that the subject of user experience is actually an application that uses primary wireless packet data services. For completeness, mobile networks are not the only means to provide such primary services. Connectivity can also be provided by, for example, a network of wireless fidelity (Wi-Fi) hotspots with respective hand-over functionality, or a Wi-Fi hotspot in a vehicle that is connected via single or multiple modems to either public mobile networks or trackside infrastructure.

Fifth generation is expected to be an enabler for higher bitrate packet data-based service offerings. Correspondingly, continuity of performance will increase in importance wherever use cases include mobility. In particular, autonomous driving may lead to a large boost in usage of such services, as passengers on board of autonomous vehicles will significantly add to demand. The proposed open-model framework allows ease of addition of QoS and quality of experience predictions for new services and is also open to the integration of multi-level quality rating scales, as well as to the addition of more dimensions of performance indicators, e.g., round-trip times or packet loss.

As in the case of telephony on-board vehicles moving along a predefined track, user experience can vary widely depending on the actual distribution of DRs along the route. Conventional key performance indicators, such as the mean DR, aggregated over a longer period of time or a larger area, can only give a very rough estimate of the actual QoS. In analogy to telephony, exploiting the special conditions in the case of movement along predefined routes allows the derivation of enhanced metrics, again with a solid foundation in actually measured data. To also support this view, the concept of a local expected data rate is introduced, computed from an abstraction of the various methods of sample pre-selection and aggregation used.

This Recommendation builds on the concepts and definitions given in [ITU-T G.1034] and establishes a set of respective metrics for QoS of services depending on continuity of packet data performance. It also builds upon [ITU-T G.1010] and evolves the taxonomy further to reflect ongoing developments in popular use cases.