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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

Framework for monitoring the quality of service of IP network services

Recommendation ITU-T Y.1545.1

ITU-T

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Recommendation ITU-T Y.1545.1

Framework for monitoring the quality of service of IP network services

Summary

Recommendation ITU-T Y.1545.1 is a diagnostic reference for IP network quality of service (QoS) monitoring, and is primarily a guide used to assist regulators in monitoring the QoS of Internet provided by service providers (although subscribers and network service providers may also benefit).

The Internet, known as the information superhighway, has established a worldwide borderless cyber society. Nowadays, the Internet is acknowledged worldwide as an essential component for electronic communication services. The rapid increase in the use of the Internet has changed the way people live, and has become an important factor in daily life.

As reliance on Internet networks, in promoting socioeconomic development, increases the QoS of Internet networks also becomes very critical and important. However, occasionally the scenarios under which Internet is sold to customers is not fair and unfortunately Internet subscribers are not well informed on the Internet QoS provided to them by Internet service providers (ISPs).

Therefore, this Recommendation highlights the necessity of testing the QoS of network services offered by ISPs, from a diagnostic and regulatory point of view. This Recommendation also addresses QoS evaluation scenarios, sampling methodology and testing tools for regulators. This Recommendation gives guidance to regulators about minimum QoS parameters for evaluating the quality of Internet services.

History

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Data rate, IP network service, QoS.

* 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>.

FOREWORD

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The World Telecommunication Standardization Assembly (WTSA), which meets every four years, establishes the topics for study by the ITU-T study groups which, in turn, produce Recommendations on these topics.

The approval of ITU-T Recommendations is covered by the procedure laid down in WTSA Resolution 1.

In some areas of information technology which fall within ITU-T's purview, the necessary standards are prepared on a collaborative basis with ISO and IEC.

NOTE

In this Recommendation, the expression "Administration" is used for conciseness to indicate both a telecommunication administration and a recognized operating agency.

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As of the date of approval of this Recommendation, ITU had not received notice of intellectual property, protected by patents, which may be required to implement this Recommendation. However, implementers are cautioned that this may not represent the latest information and are therefore strongly urged to consult the TSB patent database at <http://www.itu.int/ITU-T/ipr/>.

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Recommendation ITU-T Y.1545.1

Framework for monitoring the quality of service of IP network services

1 Scope

This Recommendation highlights the need for testing the quality of service (QoS) of IP network service offered by Internet service providers (ISPs), from a regulatory and diagnostic point of view. This Recommendation describes QoS evaluation scenarios and sampling methodology for both measuring and monitoring QoS. This Recommendation also gives guidance to regulators about the minimum set of QoS parameters necessary for evaluating the quality of IP network services.

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 E.802 Amd.1] Recommendation ITU-T E.802 (2007) Amd.1 (2017), *Framework and methodologies for the determination and application of QoS parameters*.
- [ITU-T E.804] Recommendation ITU-T E.804 (2014), *Quality of service aspects for popular services in mobile networks*.
- [ITU-T G.1000] Recommendation ITU-T G.1000 (2001), *Communications Quality of Service: A framework and definitions*.
- [ITU-T Y.1540] Recommendation ITU-T Y.1540 (2016), *Internet protocol data communication service – IP packet transfer and availability performance parameters*.
- [ITU-T Y.1546] Recommendation ITU-T Y.1546 (2014), *Hand-over performance among multiple access networks*.
- [ITU-T Y.1731] Recommendation ITU-T Y.1731 (2011), *OAM functions and mechanisms for Ethernet based networks*.
- [IETF RFC 2681] IETF RFC 2681 (1999), *A Round-trip Delay Metric for IPPM*.
- [IETF RFC 7398] IETF RFC 7398 (2015), *A Reference Path and Measurement Points for Large-Scale Measurement of Broadband Performance*.
- [IETF RFC 7799] IETF RFC 7799 (2016), *Active and Passive Metrics and Methods (with Hybrid Types In-Between)*.
- [ETSI EG 202 057] ETSI EG 202 057-04 V1.2.1 (2008), *Speech Processing, Transmission and Quality Aspects (STQ); User related QoS parameter definitions and measurements; Part 4: Internet access*.

3 Definitions

3.1 Terms defined elsewhere

This Recommendation uses the following terms defined elsewhere:

3.1.1 active methods of measurement [IETF RFC 7799]: Active methods of measurement have the following attributes: Active methods generate packet streams. Commonly, the packet stream of interest is generated as the basis of measurement. Sometimes, the adjective "synthetic" is used to categorize active measurement streams [ITU-T Y.1731]. An accompanying packet stream or streams may be generated to increase overall traffic load, though the loading stream(s) may not be measured. The packets in the stream of interest have fields or field values (or are augmented or modified to include fields or field values) that are dedicated to measurement. Since measurement usually requires determining the corresponding packets at multiple measurement points, a sequence number is the most common information dedicated to measurement, and it is often combined with a timestamp. The source and destination of the packet stream of interest are usually known a priori. The characteristics of the packet stream of interest are known at the source (at least), and may be communicated to the destination as part of the method. Note that some packet characteristics will normally change during packet forwarding. Other changes along the path are possible, see [STDFORM]. When adding traffic to the network for measurement, active methods influence the quantities measured to some degree, and those performing tests should take steps to quantify the effect(s) and/or minimize such effects.

3.1.2 dedicated component (links or nodes) [IETF RFC 7398]: All resources of a dedicated component (typically a link or node on the reference path) are allocated to serving the traffic of an individual subscriber. Resources include transmission time-slots, queue space, processing for encapsulation and address/port translation, and others. A dedicated component can affect the performance of the reference path or the performance of any sub-path where the component is involved.

3.1.3 IP network service [b-ITU-T Y.1241]: An IP network service is defined as a data transmission service in which the data passed across the interface between the user and provider is transferred in the form of Internet protocol (IP) packets (sometimes called datagrams). IP network service includes the service provided by using the IP transfer capabilities.

3.1.4 IP-based service [b-ITU-T Y.1241]: An IP-based service is defined as a service provided by the service plane to an end user (e.g., a host (end system) or a network element) and which utilizes the IP transfer capabilities and associated control and management functions, for delivery of the user information specified by the service level agreements.

3.1.5 managed and unmanaged sub-paths [IETF RFC 7398]: Service providers are responsible for the portion of the path they manage. However, most paths involve a sub-path that is beyond the management of the subscriber's service provider. This means that private networks, wireless networks using unlicensed frequencies, and the networks of other service providers are designated as unmanaged sub-paths. The service demarcation point always divides managed and unmanaged sub-paths.

3.1.6 measurement point [ITU-T Y.1540]: The boundary between a host and an adjacent link at which performance reference events can be observed and measured. Consistent with [b-ITU-T I.353], the standard Internet protocols can be observed at IP measurement points (MPs). [b-ITU-T I.353] provides more information about MPs, for digital services.

3.1.7 parameter [b-ITU-T Y.1545]: A quantifiable characteristic of a service with specified scope and boundaries.

3.1.8 passive methods of measurement [IETF RFC 7799]: Passive methods of measurement are based solely on observations of an undisturbed and unmodified packet stream of interest (in other words, the method of measurement MUST NOT add, change, or remove packets or fields or change field values anywhere along the path). Dependent on the existence of one or more packet streams to