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SERIES O: SPECIFICATIONS OF MEASURING
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Equipment to perform measurements on IP networks

Test and measurement equipment to perform tests at the IP layer

ITU-T Recommendation O.211

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ITU-T Recommendation O.211

Test and measurement equipment to perform tests at the IP layer

Summary

This Recommendation specifies an IP performance measurement signature (IPPMS) and test packets which may be used to measure the performance and the availability of IP network services across administrative areas, composite networks and among heterogeneous devices. The IPPMS may be used to support provisioning and maintenance of IPv4 as well as IPv6 networks.

Source

ITU-T Recommendation O.211 was approved on 13 January 2006 by ITU-T Study Group 4 (2005-2008) under the ITU-T Recommendation A.8 procedure.

Keywords

Active measurement, network performance.

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.

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Test and measurement equipment to perform tests at the IP layer

1 Scope

In order to support provisioning and maintenance of IP-based networks, a common standard IP test packet format is desirable such that *interoperability* between test equipment and comparison of measurement results can be achieved. In order to measure the performance of IPv4 and IPv6 networks and services for different Type-P, there is a need for interoperability among heterogeneous manufacturer equipment in order to perform measurements of ITU-T Recs Y.1540 [4] and M.2301 [1] parameters (IPER, IPLR, IPTD, IPDV, IPSLB, IPRR) across administrative domains or composite networks. The packet format should facilitate not only the achievement of measurements between operator domains, but also the identification of the test manager who is in control of the measurement.

This is analogous to previous requirements at the PDH/SDH (layer 1) and ATM (layer 2) network layers specified in ITU-T Recs O.181 [2] and O.191 [3]. The test packet must contain appropriate information needed to measure the main network performance parameters specified in ITU-T Recs Y.1540 [4] and M.2301 [1].

This Recommendation deals with the performance measurement of IP network services.

Measurement techniques should also support the metrics specified by ITU-T Study Groups 2, 4, 9, 12, 13, 15 and 16, ATIS T1A1, ETSI TIPHON, EURESCOM, 3GPP and the IETF.

The aim of this Recommendation is to standardize a common IP performance signature named IPPMS and test packets in order to measure the performance and the availability of IP network services across administrative areas, composite networks and among heterogeneous devices. The IP-layer supports many different IP-based services which may have different performance requirements, therefore the test packets must be, as far as possible, *representative of the services* being carried by the IPv4 and/or IPv6 layer for service turn-up tests, maintenance, troubleshooting and SLA monitoring.

It is not in the scope of this Recommendation to specify the way in which the measures are activated or torn down, nor to define how measurements' results are managed. Nevertheless, the measurement signature should give room to identify a measure and its initiator.

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.

- [1] ITU-T Recommendation M.2301 (2002), *Performance objectives and procedures for provisioning and maintenance of IP-based networks*.
- [2] ITU-T Recommendation O.181 (2002), *Equipment to assess error performance on STM-N interfaces*.
- [3] ITU-T Recommendation O.191 (2000), *Equipment to measure the cell transfer performance of ATM connections*.

- [4] ITU-T Recommendation Y.1540 (2002), *Internet protocol data communication service – IP packet transfer and availability performance parameters*.
- [5] ITU-T Recommendation Y.1541 (2006), *Network performance objectives for IP-based services*.
- [6] ITU-T Recommendation Y.1241 (2001), *Support of IP-based services using IP transfer capabilities*.
- [7] ITU-T Recommendation I.353 (1996), *Reference events for defining ISDN and B-ISDN performance parameters*.
- [8] ITU-T Recommendation G.7041/Y.1303 (2005), *Generic framing procedure (GFP)*.
- [9] ITU-T Recommendation M.1400 (2004), *Designations for interconnections among operators' networks*.
- [10] IETF RFC 4148 (2005), *IP Performance Metrics (IPPM) Metrics Registry*.
- [11] ISO 3166-1:1997, *Codes for the representation of names of countries and their subdivisions – Part 1: Country codes*.

3 Definitions

The following definitions are taken from ITU-T Rec. Y.1241 [6]:

3.1 IP-based service: 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.

3.2 IP network service: 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 IP (Internet protocol) packets (sometimes called datagrams). IP network service includes the service provided by using the IP transfer capabilities.

3.3 IP transfer capability: IP transfer capability is defined as the set of network capabilities provided by the IP layer. It may be characterized by the traffic contract as well as performance attributes supported by control and management functions of the underlying protocol layers.

ITU-T Rec. Y.1540 [4] defines end-to-end IP-service and measurement point (MP) as follows:

3.4 end-to-end IP service: For the purpose of this Recommendation, end-to-end IP service refers to the transfer of user-generated IP datagrams (referred to in this Recommendation as IP packets) between two end hosts as specified by their complete IP addresses.

3.5 measurement point (MP): The boundary between a host and an adjacent link at which performance reference events can be observed and measured. Consistent with ITU-T Rec. I.353 [7], the standard Internet protocols can be observed at IP measurement points. ITU-T Rec. I.353 provides more information about MPs for digital services.

3.6 Type-P: RFC 2330 defines a performance measurement framework. It introduces the notion of type of packet, the Type-P. It corresponds to the suite of protocols present in the IP and SUB-IP headers of the packet. A Type-P is represented as a list of protocol identifier names. Protocol identifiers' names for IP are defined in RFC 2896. Specific protocol identifiers' names for IPv6 are defined in RFC 3919. As an example, the Type-P ip.udp.snmp differs from the Type-P ip.ip6.udp.snmp because the latter is not only an SNMP packet over IPv6 but is also an IPv6 packet encapsulated over IP. This definition is only used in this Recommendation to give clear encapsulation examples.

3.7 IP performance measurement signature (IPPMS): An IP test packet is a regular IP packet that contains a standardized block of fields needed to perform the measurement. This block of fields is named IP performance measurement signature (IPPMS).

4 Abbreviations

This Recommendation uses the following abbreviations:

3GPP	Third Generation Partnership Project
ATIS	Alliance for Telecommunications Industry Solutions
ATM	Asynchronous Transfer Mode
BGP	Border Gateway Protocol
CAC	Connection Admission Control
CIF	Controller Identifier Format
CRC	Cyclic Redundancy Check
CRC32	32-bit Cyclic Redundancy Check
DiffServ	Differentiated Service
DoS	Denial of Service
DSCP	Differentiated Service Code Point
DST	Destination
ETSI	European Telecommunications Standards Institute
EURESCOM	European Institute for Research and Strategic Studies in Telecommunications
FR	Frame Relay
FTP	File Transfer Protocol
HTTP	Hyper Text Transfer Protocol
ICMP	Internet Control Message Protocol
ID	Identifier
IETF	Internet Engineering Task Force
IntServ	Integrated Service
IP	Internet Protocol
IPDR	IP Packet Discard Rate
IPDV	IP Packet Delay Variation
IPER	IP Packet Error Ratio
IPLR	IP Packet Loss Ratio
IPOD	IP Operator Domain
IPPM	IP Performance Metrics
IPPMS	IP Performance Measurement Signature
IPRR	IP Packet Reordering Ratio
IPRTD	IP Packet Round Trip Delay
IPSLBR	IP Packet Severe Loss Block Ratio