Trends in IP network performance measurement technology

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I. Introduction

On the IETF website, I use the terms "network performance measurement", "performance measurement", and "performance metrics" and other keywords, the search results are not many but the relationship is complex, here is a timeline of RFC documents, such as Fig. 1. The following is an overview of some of the most important RFC documents and an analysis of the trends in IP network performance measurement technology through the mapping of these documents.

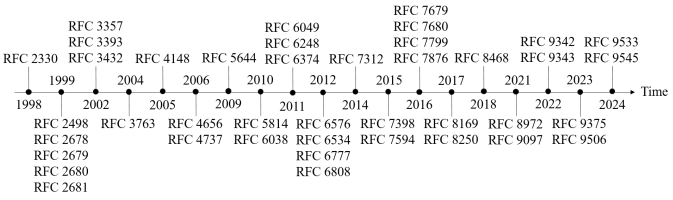

Fig. 1. Timeline of RFC documents

II. RFC 2330

RFC 2330, the document is called "Framework for IP Performance Metrics", which means IP Performance Metrics Framework. This document was established in May 1998 and is the basis for almost all subsequent documents, the purpose of which is to define a general framework for the IETF's IP performance metrics, starting from: BMWG covers all areas of transmission from the operational requirements to the IPPM.

This document lists several standard indicators adopted by the IETF, defines some Internet vocabularies, identifies the basic concepts of measurement metrics and methods, and elaborates on issues related to measurement metrics and methods. For example, terms such as links, paths, subpaths, and clouds, as well as rules for selecting measurement indicators and methods. Equation 1 is an exponential distribution with rate lambda.

$$G(t) = 1 - exp(-lambda * t) \tag{1}$$

III. RFC 4148

RFC 4148, the document is called "IP Performance Metrics (IPPM) Metrics Registry", which means IPPM Metrics Registry. This document was finalized in August 2005 and the previous documents were supplemented by measurement methods and indicators, and are summarized and registered for the first time.

This document defines a registry of current metrics and frameworks for the following reasons:

1. Ensure that MIB or other data models can accurately refer to this indicator;
2. Provide measurement interoperability for each indicator identifier;
3. Provide integrated services for future standard indicators;
4. Provide operational space for other standard systems;
5. Provide space for enterprise registration standards.

This document clearly identifies the basic RFC documents for seven network metrics, i.e., Fig. 1 and seven from 1999 and 2002. As of 2005, 33 indicators of the IPPM WG are based on these seven RFC documents.

IV. RFC 6248

RFC 6248, document name "RFC 4148 and the IP Performance Metrics (IPPM) Registry of Metrics Are Obsolete," means that the RFC 4148 and its IPPM indicator registry is outdated. This document was finalized in April 2011, and the update to RFC 4148 was due to the lack of detailed indicators due to technological changes over the years, and there was almost no response to RFC 4148 in the second half of 2010.

This document clearly points out that the P-type nodes and related indicator variables in RFC 2679 have not been fully determined. Previous documents before RFC 3432 were based on Poisson flow, while this document is based on periodic flow. The dependency issues of RFC 4148 make it urgent to make corrections

V. RFC 6576

RFC 6575, the document is called "IP Performance Metrics (IPPM) Standard Advancement Testing", which means IPPM Standard Advanced Testing. This document was established in March 2012 to update the previous relevant measurement documents and to evaluate the existing RFC documents and their indicators for better unified management.

This document points out that even the widespread deployment of different measurement systems does not justify the implementation of measurement metrics. Therefore, this article provides a flexible definition of measurement, and by comparing the results of independent tests, it can be seen that this method is correct and feasible.

VI. Inference of the development of network measurement technology

After analyzing the above important RFC documents, and then comparing them according to the time and document

relationship, we can find the development trend of some network performance measurement technologies. Table I shows the update of these RFCs.

TABLE I
OLD RFCS AND THERE UPDATES

Old RFC	New RFCs
2330	7312 8468 9198
2498	2678
2679	7679
2680	7680
4148	4737 5644 6049 6248

1. First of all, as a foundational document, RFC 2330 was expanded and supplemented in the following years, including the addition of flow parameters and sampling frameworks in 2014, IPV4 and IPV6 updates in 2018, and Single Route Assessment (AURA) in 2022. These supplements to foundational documents indicate the shift of research hotspots in network measurement over the years from data flow to IPV6 to path analysis.

2. The 1999 RFC document has been updated with a clear definition of active and passive measurements.

3. From 1998 and 1999, the concept of network measurement and some basic indicators such as latency and packet loss were proposed, to the follow-up more specific indicators and measurement methods, and then to the solutions proposed for some application scenarios, such as large-scale measurementIPV6 technology, Link member link path, etc.

At present, network performance measurement technology is no longer a simple concept and method that can be described, and it needs to be combined with other new technologies, the old methods are extended, and the fuzzy concepts are updated and supplemented.