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Abstract: This document is the initial output of draft Recommendation Q.RI_PISRM "Requirements and reference model of resource integration and protocol independent methods for source routing measurements". It is the result of the discussions at the Q13/11 meeting held in Geneva on 6-15 July 2022.

The following table shows discussion results for contributions.

Document Number	Source	Title	Meeting results
[C 47-r1]	China Telecommunications Corporation,China Unicom,CAICT	A new work item on Requirements and Reference Model of endogenous generation of the minimum set of monitoring parameters in Multi-modality communication services	Accept with modification

Draft new Recommendation ITU-T Q.RI_PISRM

Requirements and reference model of resource integration and protocol independent methods for source routing measurements

Summary

Keywords

Introduction

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Draft new Recommendation ITU-T Q.RI_PISRM

Requirements and reference model of resource integration and protocol independent methods for source routing measurements

1 Scope

The scope of this Recommendation consists of:

(1) Requirements of resource integration and protocol independent methods for source routing measurements;

(2) Resource integration and protocol independent methods for source routing measurement;

(3) Reference Model for resource integration and protocol independent methods for source routing measurement;

2 References

3 Definitions

3.1 Terms defined elsewhere

3.2 Terms defined in this Recommendation

4 Abbreviations and acronyms

5 Convention

6 Background

6.1 Current types of SR OAM measurement methods and their drawbacks

Currently, there is a large quantity of network measurement methods/tools according to diverse source routing applications. These tools could be roughly classified by the mechanisms and applications.

6.1.1 Measurement tools classified by mechanism

The existed source routing OAM measurement methods which are classified by mechanism could be divided into two categories: active methods and passive methods.

(1) Active Method (Bi-direction measurement)

The active methods have two phases of echo-request and echo-response, and both of those two phases are using dedicated OAM packets to detect and measure the performance of the network. The typical tools using active methods are ping,traceroute and etc.This type of method is called active measurement methods because it is actively triggered by the administrator based on certain purposes.One of the purpose is trouble shooting and another purpose is routing inspection to predict the network failure in advance.

The drawbacks of the active methods are listed as below but not limited to:

Firstly, when this kind of tools are aiming at trouble shootingThe time opportunities to use dedicated OAM packets to collect the path performance information are after the trouble arises. So, OAM packets have no chance to experience the real traffic congestion at the time failure occured. The information it collected apparently cannot reconstruct the scene.Consequently it may be helpful to find out the trouble point and alleviate symptoms temporarily,but it has limited help to find the root causes.

Secondly, when congestion occurs, a large number of dedicated OAM packets are sent to locate faults and they even worse the congestion. The intermediate routers need to deal with extra OAM packets from two directions. Consequently, the large quantity of the extra dedicated OAM packet will fight for the queuing and switching resource of the router with the customers packets. It speeds the congestion and consequently the information collected from nodes and paths is inaccurate.

Thirdly, when this kind of tools targets to network routing inspection,the frequency of sending the dedicated OAM packets is extreamly low,for example,one time check per 24 hour, that the path status experienced by OAM packets also cannot truly reflect the path status when congestion or failure occurs in real time. Even though nodes with problems can be identified, the occurrence of congestion is difficult to predict, thus losing the opportunity to deploy preventive measures.

Finally, it is costly to detect network status in only one direction by using two directional echo-request and echo-response packets.Additionly, the current network performance value(such as RTT) is not very accurate when it is calculated by averaging the taken time of departure journey and taken time of the return journey. It is because that the departure path and return path are always not the same path. The information of end-to-end delay is more accurate when the departure time and return time are measured and collected seperately. However, the current tools of active measurement types are not properly design to satisfy this requirements.

(2)Passive Method (Uni-direction measurement)

When it comes to the passive methods, e.g. telemetry, the system uses data packets in real traffic to carry the path and node information. No extra dedicated OAM packets are needed to measure the path. Because the measurements are simultaneously fulfilled during the packet transferring, it has only one direction to complete the measurements. It not only eliminates the extra dedicated test packets from the source, but also catch the accurate information of the network in real time.

However, most of the data packets carry repetitive and redundant OAM information. It introduces significant additional overhead to packets, which wastes a large amount of bandwidth.

6.1.2 Measurement tools classified by source routing protocols

There are different types of network protocol using source routing mechanism. For example, SR, SRv6 and service function chaining. SR and SRv6 is different in carrier protocol, for instance, SR could be based on IP and MPLS. SRv6 could be based on IPv6. Service function chaining is totally different from SR and SRv6 not only in carrier protocol but also in application mechanism. But service function chaining is a typical application of source routing since it satisfies each step of the workflow of source routing.

Each protocol of source routing scenario has its own set of OAM tools. The tool sets are subdivided into small pieces according to different carrier protocol or applications and consequently large number of tools are generated.

The drawbacks of the protocol dependent measurement methods are listed as below but not limited to:

(1) The fine sorted and trifling measurement methods have partly overlapped and redundant functions. The large number of the tools brought remarkable workload for administrators.For example, the tools classified by the SR applications could be further more differentiated by the mechnisms.

(2) The protocol dependent measurement tools will inevitably be carried by the dedicated protocol header. The protocol headers of source routing are extremely heavy carrying the intermediate node information hop-by-hop. Meanwhile, the major part of the protocol header involves the parameters and information to establish the network service but not necessary for the measurement. So, the heavily unnecessary header information wastes the network bandwidth.

6.1.3 Resource integration and protocol independent measurement methods are required

To solve the problems introduced by active and passive measurement methods, it is required to integrate the resources of the active and passive methods. To solve the problems brought by large number of measurement tools depends on the unnecessary and heavy burden protocols, a normalized and protocol independent measurement mechanism is required.By meet both of these two requirements, the number of functionality overlapped and trifling OAM tools could be largely shrinked.

For example, currently, the SR tools are divided into N types for MPLS,IPv6 and SFC. The current OAM tools divided by mechanism are about M kinds, for examle ping, traceroute, IPPM and so on. The total number of the OAM tools is the combination of these two categories, and that is N*M. However, if we can abstract and integrate the number of OAM tools of each class to 1, the combination number of the OAM tools which can satisfy the requirement not only from the mechanism but also from the application could be 1, which is far less than N*M.

7 Requirements of resource integration and protocol independent methods for source routing measurements

R01: It is required to integrate the resources of the active and passive tools.

R02: It is required to normalize the source routing and service function chaining to form a protocol independent data plane for carrying the measurement tools.

8 Methods of resource integration and protocol independent methods for source routing measurements

8.1 Resource integration measurement methods

To solve the problems methods mentioned above, a method which integrates active and passive OAM detection mechanisms is required. By coordinating two different types of measurement instances, the passive method packets are required to carry the echo packets of the active method.

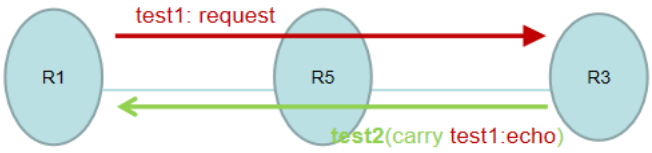

Fig-1 SRv6 OAM active and passive cooperation measurement method

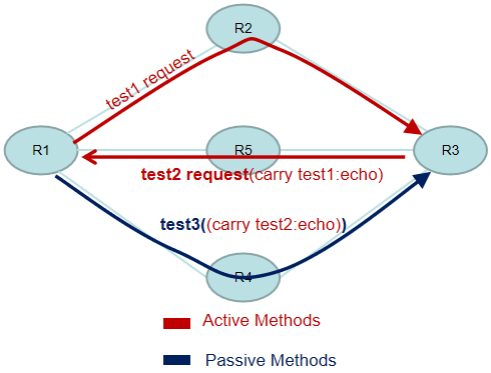

Fig-2 Variant Integrated monitoring method

By combining active and passive methods, in the two directions of SRv6 path, the active method is used to forward sending echo-request packets, while the passive method is used in reverse direction carrying echo-response packets for the active requests. As echo-response packets are carried in passive method packets in reverse direction, the number of dedicated OAM echo packets detecting the forward direction OAM performance is reduced by 50% compared to those using only active methods. Additionally, without using passive method to detect forward direction performance, it means that part of the data packets only carry the echo-response information of R1-R3, but not detect the performance information from R3-R1, so the extra bandwidth carrying repeating OAM information in user data packets in forward direction are reduced compared to those using only passive methods in forward direction.

Consequently, this integrated measurement method reduces the number of dedicated OAM messages required by the active method, and greatly reduces the repeated OAM information in the passive message. While effectively avoiding the disadvantages of the existing TWO SRv6 OAM detection mechanisms, the advantages of both are taken. At the same time, the advantages of locating faults, predicting congestion, not worsening congestion when failure occurs, and saving bandwidth by reducing redundant OAM information are to be realized.

Consequently, the integrated monitoring method eliminates the drawbacks when they are used separately and it is required for large-scale network fault management and performance measurements.

8.2 Normalized and Protocol independent data plane for measurement methods

[Contributer's Note]: This clause will introduce a normalized and protocol independent data plane to carry the measurement packets. TBC

9 Reference Model of resource integration and protocol independent methods for source routing measurements

[Contributer's Note]: TBC

Bibliography