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Title:	Progress and further discussion on hitless path segment monitoring		

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1. Abstract

This contribution reports the progress of temporal and hitless segment monitoring in IETF which seems close to completion. In addition, we make some proposals to promote the discussion.

2. Introduction

The necessity of temporal and hitless path segment monitoring (HPSM) was discussed in June 2010 [1]. An ITU-T liaison [2], which describes a request and problem statements for temporal and hitless path segment monitoring, was sent to IETF based on the approval in ITU-T SG15 meeting in June 2010. In IETF, Internet-draft "Temporal and hitless path segment monitoring"[3] is now being discussed. After some discussion, support for a more sophisticated segment monitoring mechanism (temporal and hitless segment monitoring) was suggested in the OAM framework draft [4]. The draft for requirement and problem statement is now being developed in IETF.

A joint contribution was submitted to the ITU-T SG15 meeting in February 2011, but there was no substantial discussion due to other prioritized discussion items. Therefore, this contribution describes the progress of the discussion so far on HPSM in IETF.

In IETF, the Internet-draft [3] is a joint work among Telecom Italia, Deutsche Telecom, NTT communications and NTT.

3. Reports of the progress on hitless path segment monitoring

3.1 Necessity of on-demand hitless path segment monitoring

In MPLS-TP, the one path segment monitoring function, which is called the sub-path maintenance element (SPME) has already been specified [4]. The SPME instantiates a hierarchical transport path (introducing MPLS label stacking) through which OAM packets can be sent. The SPME constructs a monitoring function used mainly for protecting bundles of transport paths and carriers' carrier solutions, which are pre-configured before making a path in-service. From this perspective, a monitoring function related to SPME can be considered for "pre-configured multi-layer monitoring", which has already been determined by consensus to be mandatory in the OAM framework draft [4].

In contrast, the proposed new segment monitoring function is applied only for temporal/on-demand diagnostic purposes. The most serious problem at the moment in SPME is that there is no way to

localize the degradation point on a path without changing the conditions of the original path. This means, when loss measurement (LM) or delay measurement (DM) detects degradation, operators cannot localize or diagnose a degraded point without service disruption. Strictly speaking, the hitless non-disruptive make before break (MBB) technique might be applied. However, the inner label value and length of the OAM packet must be changed. In this case, it no longer monitor the original path segment, but monitors a different path.

A new monitoring mechanism is therefore required that supports temporal and hitless path segment monitoring. Hereafter, it is called on-demand hitless path segment monitoring (HPSM). More details are explained in the IETF internet draft [3].

3.2 Applicable OAM functions in on-demand HPSM

OAM functions in which on-demand HPSM is required are basically limited to on-demand monitoring. They are defined in the OAM framework document [4] because those segment monitoring functions are used to locate the fault/degraded point or to diagnose the status for detailed analyses, especially when a problem occurs. In other words, the characteristic of "on-demand" is generally temporal for maintenance operation. Conversely, this could be a good reason that operations should not be based on pre-configuration and pre-design.

Packet loss and packet delay measurements are OAM functions in which hitless and temporal segment monitoring are strongly required because these functions are supported only between end points of a transport path. If a fault or defect occurs, there is no way to locate the defect or degradation point without using the segment monitoring function. If an operator cannot locate or narrow the cause of the fault, it is quite difficult to take prompt action to solve the problem. Therefore, on-demand HPSM for packet loss and packet delay measurements is indispensable for transport network operation.

Regarding other on-demand monitoring functions path segment monitoring is desirable, but not as urgent as for packet loss and packet delay measurements.

Regarding out-of-service on-demand monitoring functions, such as diagnostic tests, there seems no need for HPSM. However, specific segment monitoring should be applied to the OAM function of a diagnostic test.

Table 1 lists the requirements concerning which on-demand functions should be or may be supported in the new HPSM.

Table 1: Functional requirements of new HPSM and existing OAM

		Pro-actively						On-demand						**New HPSM**	
		MEP-MEP			MEP-MIP			MEP-MEP			MEP-MIP			**segment MEP-segment MEP**	
		PW	LSP	SEC	PW	LSP	SEC	PW	LSP	SEC	PW	LSP	SEC	**PW**	**LSP**
1	Continuity Checks	*	*	*											
2	Connectivity Verifications	*	*	*				*	*	*	*	*		**May**	**May**
3	Diagnostic Tests							*	*	*	*	*		**May**	**May**
4	Route Tracing							*	*	*	*	*		**May**	**May**
5	Lock Instruct							*	*	*					

6	Lock Reporting				*	*								
7	Alarm Reporting				*	*								
8	Remote Defect Indication	*	*	*										
9	Client Failure Indication	*	*											
10	Packet Loss Measurement	May	May	May				May	May	May				* *
11	Packet Delay Measurement	May	May	May				*	*	*				* *

* should

3.3 Detailed requirements of on-demand HPSM

3.3.1 Necessity of single-level monitoring

In contrast to the "proactive multi-layer monitoring" so called "SPME", the new segment monitoring function is supposed to be applied mainly for diagnostic purposes on-demand. We can differentiate this monitoring from proactive segment monitoring as on-demand multi-level monitoring. The most serious problem at the moment is that there is no way to localize the degradation point on a path without changing the conditions of the original path. Therefore, as a first step, single layer segment monitoring that does not affect the monitored path is required for a new on-demand and hitless segment monitoring function.

A combination of multi-level and simultaneous monitoring is the most powerful tool for accurately diagnosing the performance of a transport path. However, considering the substantial benefits to operators, a strict monitoring function, which is required in such a test environment as a laboratory, does not seem to be necessary in the field. To summarize, on-demand and in-service (hitless) single-level segment monitoring is required, and on-demand and in-service multi-level segment monitoring is desirable. Figure 1 shows an example of multi-level on-demand segment monitoring.

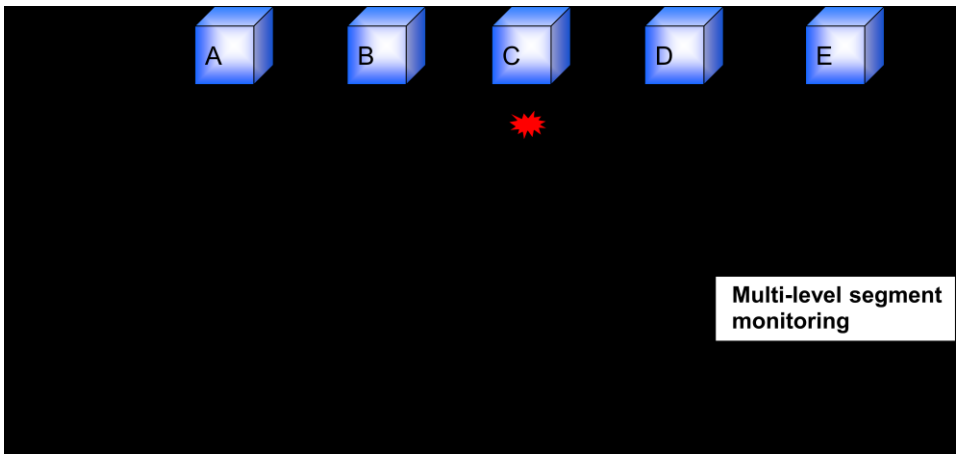

Figure 1: Example of multi-level on-demand hitless segment monitoring

3.3.2 Necessity of on-demand path segment monitoring independent from end-to-end proactive monitoring

Next, we consider the necessity of simultaneous monitoring of end-to-end current proactive monitoring and new on-demand path segment monitoring. Normally, on-demand path segment

monitoring is configured in a segment of a maintenance entity of a transport path. In this environment, on-demand single-level monitoring should be done without disrupting pro-active monitoring of the targeted end-to-end transport path.

If operators have to disable pro-active monitoring during “on-demand and in-service” segment monitoring, the network operation system might miss any performance degradation of user traffic. This inconvenience should be avoided in network operations. From this perspective, the ability for on-demand single level path segment monitoring is required without changing or interfering with the proactive monitoring of the original end-to-end transport path.

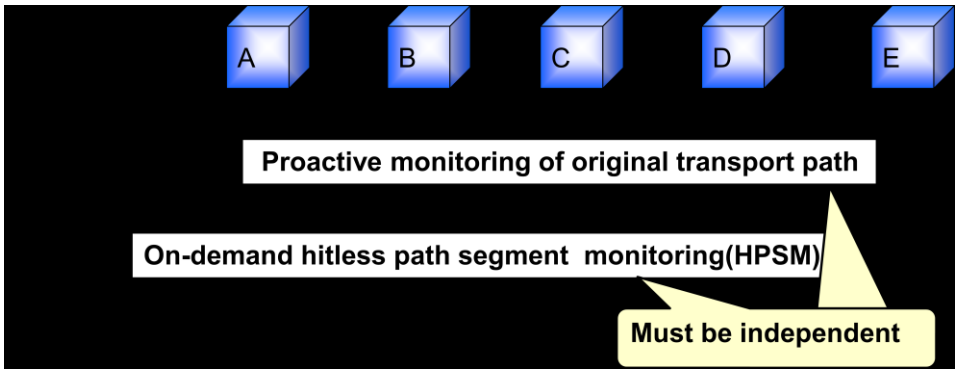

Figure 2: Indecency between proactive end-to-end monitoring and on-demand segment monitoring

3.3.3 Necessity of arbitrary segment monitoring

The main objective of on-demand segment monitoring is to diagnose the fault points. One possible diagnostic procedure is to fix one end point of a segment at the MEP of a transport path and progressively change the length of the segment in the order of levels shown in Fig. 3. This example is shown in Fig. 3_case 2. This approach is considered as a common and realistic diagnostic procedure. In this case, one end point of a segment can be anchored at the MEP at any time.

Other scenarios are also considered, one is shown in Fig. 3_case 1. In this case, the operators want to diagnose a transport path from a transit node B that is located in the middle of the path because the end nodes (A and E) are located at customer sites and consist of a cost-effective small box in which a subset of OAM functions are supported. In this case, if one end point and an originator of the diagnostic packet are limited to the MEP position, on-demand segment monitoring will be ineffective because all the segments cannot be diagnosed.

Accordingly, on-demand monitoring of arbitrary segments is mandatory in in Fig. 3 case 1. As a result, on-demand HPSM should be set in an arbitrary segment of a transport path and diagnostic packets should be inserted from at least any of the intermediate maintenance points of the original ME.

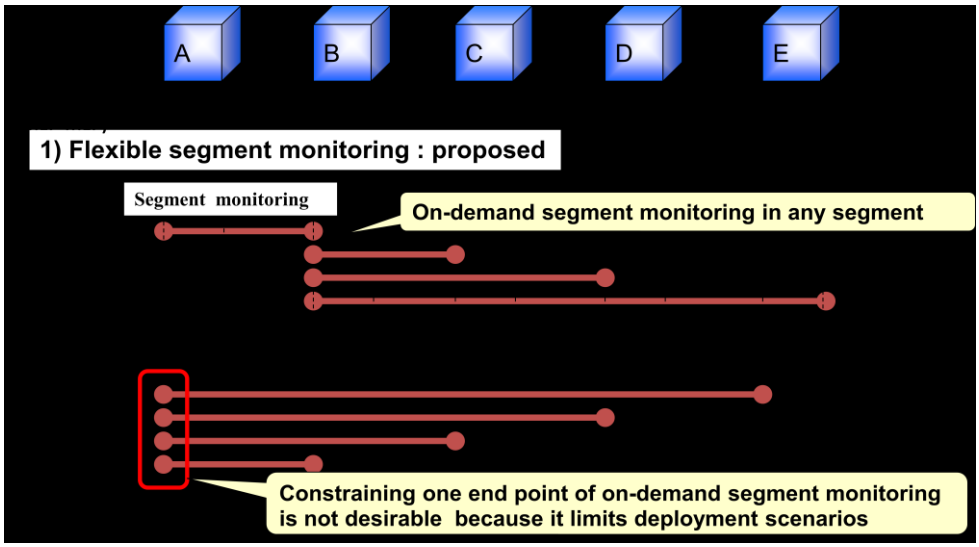

Figure 3: Examples: 1) on-demand monitoring can be configured in arbitrary segments, 2) one end point of on-demand segment monitoring is fixed

4. Further discussion

The internet-draft [2] created based on the ITU-T liaison [2] is getting close to completion as a requirement document. Accordingly we would like to ask comments from ITU-T to make sure whether or not there is any problems we need to solve in the document, because it is originally requested as a liaison from ITU-T officially.

If there is no further comments on the requirement that we would like to propose to send a liaison again to IETF to request to make it a WG document.

We also would like to propose to assign a liaison person to IETF only on this specific HPSM issue in MPLS-TP, if there is a consensus to progress work and target to standardize this item.

In addition, there are a few discussion items regarding the procedure after this, if the necessity of HPSM is agreed in ITU-T.

1) How to proceed with the discussion of OAM solution for HPSM? (G.8113.1 is not discussed in IETF)
2) How to generalize this new requirement in ITU-T Recommendation? (Which document should cover this HPSM as a general function?)
3) If one of the possible solutions which was proposed in IETF and is based on MIP insertion is applied, there is a technical issue which must be solved. The issue is that when a protection switching occurs during the segment monitoring, it could cause traffic congestion at the node which is different from the target node of the segment monitoring due to the change of total hops after the switching.

5. Conclusion

1) We reported the progress on hitless path segment monitoring in IETF is reported
2) We would like to solicit comments on the contents of this report or the Internet-draft [3]. If there is no comment, we propose to send a liaison to IETF and request a WG draft adoption in order to make RFC as soon as possible.

3) We propose to assign a liaison person to IETF only on this topic.

4) We introduced further discussion items to solicit comments.

References

[1] C944 (NTT) “Proposal of extending solution for temporal and hitless pass segment monitoring and sending liaison to IETF”, June 2010

[2] LS210 “Request and problem statements for temporal and hitless path segment monitoring”, https://datatracker.ietf.org/documents/LIAISON/file1060.pdf.

[3] http://tools.ietf.org/html/draft-koike-mpls-tp-temporal-hitless-psm-03

[4] http://tools.ietf.org/html/draft-ietf-mpls-tp-oam-framework-11