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Unsolved Challenges of IS-IS MP-TLV Proposal
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Abstract

The IS-IS routing protocol uses TLV (Type-Length-Value) encoding in a variety of protocol messages. The original IS-IS TLV definition allows only for 255 octets of value in maximum. MP-TLV [I-D.ietf-lsr-multi-tlv] gives one proposal trying to solve this issue, but has some unsolved challenges for its implementations and deployment. This document analyzes in detail these challenges and proposes the community to find other better solution.

Requirements Language

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in [RFC2119] [RFC8174] when, and only when, they appear in all capitals, as shown here.

Status of This Memo

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Table of Contents

1. Introduction

[I-D.ietf-lsr-multi-tlv] describes one proposal that tries to solve the big TLV issue(we call big-TLV, which the length of the contents within the TLV is exceed 255 bytes). It declares that：

"The encoding of TLVs is not altered by the introduction of MP-TLV support. In particular, the "key" that is used to identify the set of TLVs that form an MP-TLV is the same key used in the absence of MP-TLV support. Also note the definition of the "key" is part of the specification(s) that define(s) the TLV and is therefore outside the scope of this document.

NOTE: This document intentionally does not include a definition of the key for each codepoint. To do so would be redundant and risk unintentionally deviating from the definition that already exists in the relevant specifications. Also, the term "key" is a generic term that is not used in the relevant specifications. "

Actually, there is no any such "key" or some other "generic term" definition of the same purpose in the related RFCs.

And, under the proposed mechanism, it will be very difficult and inefficient to concatenate the several sub-sub-TLV pieces into the original top-TLV and associated parent sub-TLV with the undefined "key".

It proposes to introduce the advertisement of "MP-TLV Capabilities Advertisement", but the proposed encoding is not codepoint dependent, which is not only useless for the implementation, but also mislead the operator.

Finally, there is no length boundary for all the possible IS-IS MP-TLV codepoints that listed in the section-9.2 of [I-D.ietf-lsr-multi-tlv], which can lead the potential memory crush of the MP-TLV receivers when the sender has abnormal behavior.

These unsolved issues challenge the implements and deployment of this document and after the analysis below, we recommend the community to consider other direction to solve the mentioned big-TLV problem of the IS-IS standard.

2. General Process of Segmentation and Concatenation

It is well known that when one sender wants to send one large packet that exceeds the Maximum Transmit Unit(MTU) of the path, it must segment the large packet, and encapsulate each segment with one unique identifier to identify each segment of the large packet.

The header of IPv4 datagram header is one example to show such knob: the "identification" field is defined as "Unique Packet Id for identifying the group of fragments of a single IP datagram".

It is impossible to concatenate the segments of one large packet together without the explicit unique identifier.

Such principle can apply also the segmentation of MP-TLV at the sender side and its concatenation at the receiver side, that is to say, there must exist the "key" information for the MP-TLV and every piece of the MP-TLV must carry the same "key" field.

3. Unsolved "Key" Information for MP-TLV Proposal

Take the "Extended IS Reachability" (TLV 22) as the example. This TLV is defined in [RFC5305]. The original text regards to this TLV, is the followings:

The proposed extended IS reachability TLV contains a new data structure, consisting of
:

```
   7 octets of system ID and pseudonode number
   3 octets of default metric
   1 octet of length of sub-TLVs
   0-244 octets of sub-TLVs
```

Figure 1: Extended IS Reachability(TLV 22)

No "key" definition for this TLV in the specific RFC.

Take the "Extended IP Reachability" (TLV 135) as another example.
This TLV is defined also in [RFC5305]. The original text regards to
this TLV, is the followings:

The proposed extended IP reachability TLV contains a new data structure, consisting of
:

```
4 octets of metric information
1 octet of control information, consisting of
   1 bit of up/down information
   1 bit indicating the presence of sub-TLVs
   6 bits of prefix length
0-4 octets of IPv4 prefix
0-250 optional octets of sub-TLVs, if present consisting of
   1 octet of length of sub-TLVs
   0-249 octets of sub-TLVs, where each sub-TLV consists of a sequence of
      1 octet of sub-type
      1 octet of length of the Value field of the sub-TLV
      0-247 octets of value
```

Figure 2: Extended IP Reachability(TLV 135)

No "key" definition information for this TLV in the specific RFC.

Such "key" definition information defined only in the
[I-D.ietf-lsr-multi-tlv], which illustrates that this document change
or add more restraints to the specification that defines these IS-IS
TLVs.

3.1. Ambigious "key" definition for TLV 22

Even we accept the newly definition of "key" definition for TLV 22 in
[I-D.ietf-lsr-multi-tlv], as illustrated below that extract directly
from this document:

As an example, consider the Extended IS Reachability TLV (type 22). A neighbor in this TLV is specified by:

* 7 octets of system ID and pseudonode number
* 3 octets of default metric
* Optionally one or more of the following link identifiers:
  - IPv4 interface address and IPv4 neighbor address as specified in [RFC5305]
  - IPv6 interface address and IPv6 neighbor address as specified in [RFC6119]
  - Link Local/Remote Identifiers as specified in [RFC5307]

The key consists of the 7 octets of system ID and pseudonode number plus the set of link identifiers which are present.

Figure 3: Ambigious "Key" definition for TLV 22

Here, we should notice that "the set of link identifiers", which is the newly defined "key" in this document, is "Optionally". That is to say, any vendor can select any one of them as the "key" information to segment the MP-TLV. This will certainly lead the confusion on the receiver when it receives the segments of MP-TLV from different vendors and try to concatenate them respectively. Take the example below:

If vendor A send pieces of TLV 22 instance A

<22, Neighbor System ID, other possible sub-TLVs, IPv4 Local/Remote Address> + object info !!V4 addresses only
<22, Neighbor System ID, IPv4 Local/Remote Address> + object info !!V4 addresses only

Figure 4: Instance A of TLV 22 from vendor A

vendor B send pieces of TLV 22 instance B:

<22, Neighbor System ID, other possible sub-TLVs, IPv6 Local/Remote Address> + additional object info !!V6 addresses only
<22, Neighbor System ID, IPv6 Local/Remote Address> + additional object info !!V6 addresses only

Figure 5: Instance B of TLV 22 from vendor B

How vendor A determine the “key” parts for concatenating the different pieces of TLV 22 instance B, considering there may be several IPv6 address for one link.

How vendor B determine the “key” parts for concatenating the different pieces of TLV 22 instance A,considering there may be several IPv4 address for one link?

Imaging there is another vendor C, receive both of these pieces for another two instances, how does vendor C determine such information solely from the ambiguous segmented pieces?

From the above scenario, we can see there will be many chaos for the interoperability issues within the operator network, which should be avoided by the publish of the network protocol standard. But [I-D.ietf-lsr-multi-tlv] can’t accomplish such task, it can only lead more chaos in the operator’s network.

3.2. Concatenation Challenge of the Nested sub-sub-TLV

[I-D.ietf-lsr-multi-tlv] states that "the mechanism described in this document is applicable to top level TLVs as well as any level of sub-TLVs that may appear within a top level TLV.", but it will be very very challenging and inefficient. Let’s take one example to illustrate it:

Suppose we have one sub-sub-TLV that has exceed the 255 bytes, and needs to be sent in three pieces(let’ s call them P1, P2,P3).

Under the current MP-TLV proposal, these pieces must be sent in the following format in one or more LSPs:

```
   TOP_TLV?undefined ?key1?, sub-TLV?undefined ?key2?, sub-sub-TLV(undefined ?key3?, P
1)??
   TOP_TLV?undefined ?key1?, sub-TLV?undefined ?key2?, sub-sub-TLV(undefined ?key3?, P
2)??
   TOP_TLV?undefined ?key1?, sub-TLV?undefined ?key2?, sub-sub-TLV(undefined ?key3?, P
3)??
```

Figure 6: Concatenation Challenge of the Nested sub-sub-TLV

Besides the ambiguity of the undefined ‘key1’ , ‘key2’ , ‘key3’ in the above nest encapsulations, which can lead to enormous challenges for the interoperability, such encapsulation proposal, is very inefficient.

The IETF community should try to find other general and efficient solution..

4. Unsolved Length Boundary for MP-TLV Proposal

As the draft [I-D.ietf-lsr-multi-tlv] emphasize that "The encoding of TLVs is not altered by the introduction of MP-TLV support.", then, there is no any place to encode the actual length of the big-TLV.

In theory, the sender can send unlimited occurrences of any MP-TLV codepoints listed in section-9.2 of [I-D.ietf-lsr-multi-tlv]. This will make huge burden for the memory allocation of the receiver on these possible MP-TLV codepoint, and also the potential attacks from one abnormal sender.

5. Ambiguous "MP-TLV" Capabilities Definition

In order to assure the interoperability and deployment of MP-TLV feature in operator's network, the document [I-D.ietf-lsr-multi-tlv] introduces the "MP-TLV Capability Advertisement" sub-TLV within the IS-IS Router CAPABILITY TLV, but it is IS-IS TLV/sub-TLV codepoint independent.

It is also impossible that let the sender don't send such announcements until only after it supports the concatenation of MP-TLV codepoints illustrated in section-9.2 of [I-D.ietf-lsr-multi-tlv]. Then the sending of such capabilities announcements gives no any clues for the receiver, and also the operator. It can only mislead the operator the support of MP-TLV for some expected MP-TLV is achieved, but in actually it does not.

6. Security Considerations

The mechanism described in this document does not raise any new security issues for the IS-IS protocols.

7. Acknowledgement

Thanks Les, Acee, David, Adrian, Robert, Tony Li , Ketan etc. for the detail discussion to foster this analysis document.

8. IANA Considerations

None.

9. References

9.1. Normative References

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