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"MPLS LSP Ping TLVs and sub-TLVs registry"
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Abstract

This document addresses issues with the structure, allocation policies and clarity in the use of the "TLVs and sub-TLVs" of the "Multi-Protocol Label Switching (MPLS) Label Switched Paths (LSPs) Ping Parameters" in the "Multiprotocol Label Switching Architecture (MPLS)" name space.

This document does not change any existing allocations and the new structure is backwards compatible with the existing registries.

The policy for the allocation of TLVs is unchanged but future allocations of sub-TLVs will come from a single namespace, common to all TLVs of LSP Ping Parameters.

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 RFC 2119 [RFC2119].

Status of This Memo

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1. Introduction

This document revises the allocation policies in the use of the TLVs and sub-TLVs of the MPLS LSP Ping Parameters, as defined in [RFC4379].

This document does not change any existing allocations and the new structure is backwards compatible with the existing registries.

The policy for the allocation of TLVs is unchanged but future allocations of sub-TLVs will come from a single namespace, common to all TLVs of MPLS LSP Ping Parameters.

The allocation of existing sub-TLVs is unaltered, so that the meaning of, e.g., sub-TLV sub-Type 1 is dependent on the TLV under which it appears. No future allocations will be made with a sub-Type of less than 32. Future allocations will be made from a single namespace starting at 32; a sub-TLV defined in this way may appear as part of any current or future TLV. The document that specifies such an allocation should state which TLVs the sub-TLV may appear under and indicate any other future use which seems appropriate or inappropriate.

2. Current situation

Today all TLVs and sub-TLVs are found in a single table, and the allocation policies are the same for all TLVs and sub-TLVs. The table below illustrates how the registry is set up.

Initially this might have been a good idea, but over time, with an increasing number of TLVs, and with some sub-TLVs shared across TLVs, it has become increasingly difficult to understand how the allocation policies interact.

2.1. Current situation - model

The table below illustrates how the registry is set up and the allocation policies work currently. We have chosen not to just copy the current registry here, but instead build a model that shows how the allocation policies work.

--Note to RFC Editor; the various RFC aaaa to RFC zzzz are really meant to be like that in the finished document; we are not asking you to replace them with anything:-)

Current TLV and sub-TLV registry (model)

Type	Sub-type	Value field	Reference	
1		TLV # 1	RFC xxxx	(1)
1	1	sub-TLV # 1	RFC xxxx	(2)
1	2	sub-TLV # 2	RFC yyyy	(3)
1	3	sub-TLV # 3	RFC yyyy	(4)
2		TLV # 2	RFC xxxx	(5)
3		TLV # 3	RFC zzzz	(6)
3	1	sub-TLV # 1	RFC zzzz	(7)

3	2	sub-TLV # 2	RFC zzzz	(8)
3	3	sub-TLV # 3	RFC aaaa	(9)
4		TLV # 4	RFC bbbb	(10)
4	1-16383	as specified for type 1	RFC bbbb	(11)
5		TLV # 5	RFC cccc	(12)
5	1-65535	as specified for type 1	RFC cccc	(13)

Note: The row number column to the right is added here to discuss what is on the different rows.

2.2. Allocation policies and Scope

TLV and sub-TLV registration procedures

Range	Registration Procedures	Notes
0-16383	Standards Action	This range is for mandatory TLVs or for optional TLVs that require an error message if not recognized.
16384-31743	Specification Required	Experimental RFC needed
31744-32767	Vendor Private Use	MUST NOT be allocated
32768-49161	Standards Action	This range is for optional TLVs that can be silently dropped if not recognized.
49162-64511	Specification Required	Experimental RFC needed
64512-65535	Vendor Private Use	MUST NOT be allocated

The IANA registry does not give enough information to correctly allocate TLVs and sub-TLVs, instead careful reading of [RFC4379] is necessary.

[RFC4379] says:

The valid range for TLVs and sub-TLVs is 0-65535. Assignments in the range 0-16383 and 32768-49161 are made via Standards Action as defined in Section 5; assignments in the range 16384-31743 and 49162-64511 are made via "Specification Required" as defined above;

values in the range 31744-32767 and 64512-65535 are for Vendor Private Use, and MUST NOT be allocated.

[RFC4379] also says that the sub-TLVs are scoped by the TLVs, i.e. a sub-TLV defined for one TLV is valid for that TLV only. Later the practice to re-define (a block of) sub-TLVs defined for one TLV for another TLV was introduced.

2.3. A closer look at the model

The list below contains what we see as the results of the most common allocation requests for this registry.

1. Row 1 says that IANA has allocated a TLV as requested in RFCxxxx. This TLV is type 1.

   RFCxxxx is the document that defines the registry and sets up the allocation policies.

2. Row 2 says that IANA has allocated a sub-TLV for TLV type 1, "sub-TLV #1", the source for this allocation is the same that defined the registry and allocated the TLV Type 1 (RFCxxxx).

3. Row 3 says that IANA has allocated a second sub-TLV (sub-TLV #2) for TLV type 1, the source for this allocation is RFCyyyy.

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4. Row 4 says that IANA has allocated a third sub-TLV (sub-TLV #3) for TLV type 1, the source for this allocation is RFCyyyy.

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5. Row 5 says that IANA has allocated a new TLV (TLV type 2), the source for this allocation is RFCxxxx, the same RFC that defined the registry.

   TLV type 2 has no sub-TLVs yet defined.

6. Row 6 says that IANA has allocated a new TLV (TLV type 3), the source for this allocation is RFCzzzz.

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7. Row 7 says that IANA has allocated a sub-TLV (sub-TLV # 1) for TLV type 3, the source for this allocation is RFCzzzz.

This means that we have one sub-TLV # 1 for TLV type 1, and another sub-TLV # 1 for TLV type 3. In itself this is not a problem, the sub-TLVs are scoped by the TLVs.

8. Row 8 says that IANA has allocated a sub-TLV (sub-TLV # 2) for TLV type 3, the source for this allocation is RFCzzzz.

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9. Row 9 says that IANA has allocated a sub-TLV (sub-TLV # 2) for TLV type 3, the source for this allocation is RFCaaaa.

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10. Row 10 says that IANA has allocated a new TLV (TLV type 4), the source for this allocation is RFCbbbb.

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11. Row 11 says that IANA has been instructed not to allocate any sub-TLVs from the range 1-16383, but that the sub-TLVs for TLV type 4, shall use the same sub-TLVs that have been specified for TLV type 1 in this range.

    This implies that other ranges for TLV type 4 are open for allocation for "TLV type 4 specific sub-TLVs". This is specified in RFCbbbb.

12. Row 12 says that IANA has allocated a new TLV (TLV type 5), the source for this allocation is RFCcccc.

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13. Row 13 says that IANA has been instructed not to allocate any sub-TLVs from the entire range (1-65535), but that the sub-TLVs for TLV type 5, shall use the same sub-TLVs that have been specified for TLV type 1. This is specified in RFCcccc.

    Close reading of the allocation rules would likely show that disallowing the assignment of vendor-specific sub-TLVs is moot.

3. New registry structure

3.1. If we'd done it from start

The name space of sub-TLVs is very large, 65 535 potential TLVs times 65 535 sub-TLVs per TLV, gives a maximum of 4 294 836 335 sub- TLVs.

There seems no reason why that number of sub-TLVs should be needed; rather, 65 535 sub-TLVs shared among all TLVs would seem to have been more than sufficient. If the IANA registries had been set up with one registry for TLVs and another for sub-TLVs, that would have resulted in registries and allocation policies much easier to understand and comprehend.

In practice, the same sub-TLV number appears more than once under different TLVs with a different meaning on each occasion. Thus sub-TLV 1 appears under TLV Type 1 as LDP IPv4 Prefix, under TLV Type 11 as IPv4 Egress Address P2MP Responder and under TLV Type 20 as Multipath data. At the same time, TLVs Types 16 and 21 reuse sub-TLV 1 with the same meaning as for TLV Type 1.

Thus it is now impossible to create a single registry for sub-TLVs which encompasses all existing sub-TLVs. At the same time, such a registry would simplify future registration and use, allowing, for example, a sub-TLV to be defined for an IPv6 address that would then be used wherever such an address is required. Hence, the future policy for the registration of sub-TLVs is to have a single registry regardless of which TLV the sub-TLV appears under. This registry follows the same pattern as the existing registries, namely of

0-16383	Standards Action	Mandatory (sub)TLVs
16384-31743	Specification Required	Mandatory Experimental RFC needed
31744-32767	Vendor Private Use	MUST NOT be allocated
32768-49161	Standards Action	Optional (sub)TLVs
49162-64511	Specification Required	Optional Experimental RFC needed
64512-65535	Vendor Private Use	MUST NOT be allocated

excepting that the range 0 to 31 is now reserved and MUST NOT be assigned lest there is an overlap with existing definitions. The choice of 32 is somewhat greater than the greatest, existing, defined

sub-TLV, 25 for TLV Type 1, and is chosen to be a more user-friendly, easier to remember, number than, say, 26 or 29.

The examples in TLV Registry and allocation procedures (Section 3.2) and Sub-TLV registries and allocation policies (Section 3.3) are the actual allocations in the IANA registry as they are found at the time of writing of this document (January 2013).

3.2. TLV Registry and allocation procedures

TLV registration procedures

Range	Registration Procedures	Notes
0-16383	Standards Action	This range is for mandatory TLVs or for optional TLVs that require an error message if not recognized.
16384-31743	Specification Required	Experimental RFC needed This range is for mandatory TLVs or for optional TLVs that require an error message if not recognized.
31744-32767	Vendor Private Use	MUST NOT be allocated
32768-49161	Standards Action	This range is for optional TLVs that can be silently discarded if not recognized.
49162-64511	Specification Required	Experimental RFC needed This range is for optional TLVs that can be silently discarded if not recognized.
64512-65535	Vendor Private Use	MUST NOT be allocated

LSP Ping TLV Registry

Type	Value Field	Reference
1	Target FEC Stack	[RFC4379]
2	Downstream Mapping (DEPRECATED)	[RFC4379] [RFC6424]

3	Pad	[RFC4379]
4	Not Assigned	[RFC4379]
5	Vendor Enterprise Number	[RFC4379]
6	Not Assigned	[RFC4379]
7	Interface and Label Stack	[RFC4379]
8	Not Assigned	[RFC4379]
9	Errored TLVs	[RFC4379]
10	Reply TOS Byte	[RFC4379]
11	P2MP Responder Identifier	[RFC6425]
12	Echo Jitter	[RFC6425]
13	Source ID	[RFC6426]
14	Destination ID	[RFC6426]
15	BFD Discriminator	[RFC5884]
16	Reverse-path Target FEC Stack	[RFC6426]
17-19	Unassigned	
20	Downstream Detailed Mapping	[RFC6424]
22-31743	Unassigned	
31744-32767	Reserved for Vendor private use	[RFC4379]
32768-64511	Unassigned	
64512-65535	Reserved for Vendor private use	[RFC4379]

3.3. Sub-TLV registries and allocation policies

3.3.1. Sub-TLV registry for all TLVs

Registration procedures for all sub-TLVs

Range	Registration Procedures	Notes
0-31	Reserved	Existing allocations in this range are unaltered. No future allocations are to be made from this range.
32-16383	Standards Action	This range is for mandatory sub-TLVs or for optional sub-TLVs that require an error message if not recognized.
16384-31743	Specification Required	Experimental RFC needed This range is for mandatory sub-TLVs or for optional sub-TLVs that require an error message if not recognized.
31744-32767	Vendor Private Use	MUST NOT be allocated
32768-49161	Standards Action	This range is for optional sub-TLVs that can be silently discarded if not recognized.
49162-64511	Specification Required	Experimental RFC needed This range is for optional sub-TLVs that can be silently discarded if not recognized.
64512-65535	Vendor Private Use	MUST NOT be allocated

Type 1 TLV sub-TLVs

Sub-TLVs for TLV Type 1

Sub-TLV	Value Field	Reference
0	Reserved - do not assign	This document

1	LDP IPv4 prefix	[RFC4379]
2	LDP IPv6 prefix	[RFC4379]
3	RSVP IPv4 LSP	[RFC4379]
4	RSVP IPv6 LSP	[RFC4379]
5	Not Assigned	[RFC4379]
6	VPN IPv4 prefix	[RFC4379]
7	VPN IPv6 prefix	[RFC4379]
8	L2 VPN endpoint	[RFC4379]
9	"FEC 128" Pseudowire - IPv4 (DEPRECATED)	[RFC4379] [RFC6829]
10	"FEC 128" Pseudowire - IPv4	[RFC4379] [RFC6829]
11	"FEC 129" Pseudowire - IPv4	[RFC4379] [RFC6829]
12	BGP labeled IPv4 prefix	[RFC4379]
13	BGP labeled IPv6 prefix	[RFC4379]
14	Generic IPv4 prefix	[RFC4379]
15	Generic IPv6 prefix	[RFC4379]
16	Nil FEC	[RFC4379]
17	RSVP P2MP IPv4 Session	[RFC6425]
18	RSVP P2MP IPv6 Session	[RFC6425]
19	Multicast P2MP LDP FEC Stack	[RFC6425]
20	Multicast MP2MP LDP FEC Stack	[RFC6425]
21	Unassigned	
22	Static LSP	[RFC6426]
23	Static Pseudowire	[RFC6426]

24	"FEC 128" Pseudowire - IPv6	[RFC6829]
25	"FEC 129" Pseudowire - IPv6	[RFC6829]

3.3.2. Sub TLV registry for TLV Type 9

TLV Type 9 has a very different allocation policy to all other TLVs; any value carried in the Value field of the TLV is a copy of a TLV that has not been understood or recognized. It is even doubtful that "All values" technically is a sub-TLV, but both the IANA registry and [RFC4379] says it is. Equally, it is unclear whether or not TLV Type 9 should be used to report a sub-TLV that has not been recognised and if it is, how that sub-TLV should appear in the Type 9 TLV. More work on this is needed but that falls outside the scope of this document.

Registration procedures TLV type 9 sub-TLVs

Range	Registration Procedures	Notes
0-65635	Reserved MUST NOT be assigned	Any value carried in the value field of TLV type 9 means that a TLV has not been understood.

Type 9 TLV sub-TLVs

Sub-TLVs for TLV Type 9

Sub-TLV	Value Field	Reference
All values	TLV that is not understood	[RFC4379]

3.3.3. Sub TLV registry for TLV Type 11

Registration procedures TLV type 11 sub-TLVs
(as specified by RFC6425)

Range	Registration Procedures	Notes
0-16383	Standards Action	This range is for mandatory TLVs or for optional TLVs that require an error message if not recognized.
16384-31743	Specification Required	Experimental RFC needed
31744-32767	Vendor Private Use	MUST NOT be allocated
32768-49161	Standards Action	This range is for optional TLVs that can be silently dropped if not recognized.
49162-64511	Specification Required	Experimental RFC needed
64512-65535	Vendor Private Use	MUST NOT be allocated

Type 11 TLV sub-TLVs

sub-TLV	Value Field	Reference
0	Reserved not to be assigned	This document
1	IPv4 Egress Address P2MP Responder	[RFC6425]
2	IPv6 Egress Address P2MP Responder	[RFC6425]
3	IPv4 Node Address P2MP Responder	[RFC6425]
4	IPv6 Node Address P2MP Responder	[RFC6425]

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3.3.4. Sub TLV registry for TLV Type 20

Registration procedures TLV type 20 sub-TLVs
(as specified by RFC6424)

Range	Registration Procedures	Notes
0-16383	Standards Action	This range is for mandatory TLVs or for optional TLVs that require an error message if not recognized.
16384-31743	Specification Required	Experimental RFC needed
31744-32767	Vendor Private Use	MUST NOT be allocated
32768-49161	Standards Action	This range is for optional TLVs that can be silently dropped if not recognized.
49162-64511	Specification Required	Experimental RFC needed
64512-65535	Vendor Private Use	MUST NOT be allocated

Type 20 TLV sub-TLVs

sub-TLV	Value Field	Reference
1	Multipath data	[RFC6424]
2	Label stack	[RFC6424]
3	FEC stack change	[RFC6424]

4. Security Considerations

This document amends the policy for the registration of sub-TLVs of MPLS LSP Ping. As such, it does not introduce any additional security considerations over and above those included with the specification of the sub-TLVs themselves.

5. IANA considerations

This document revises the allocation policies in the use of the TLVs and sub-TLVs of the MPLS LSP Ping Parameters, as previously defined in [RFC4379].

The allocation policy for TLVs is unaltered from RFC4379 but the IANA registry should be updated to refer to this document, lest users of this information do not appreciate that the policies for sub-TLVs, as specified in [RFC4379], no longer apply; that is, users are directed here first, so that they have the current, overall procedures.

The allocation policy for sub-TLVs is that all sub-TLVS now come from a common pool so that a sub-TLV sub-Type number is now unique within all of MPLS LSP Ping Parameters.

The lowest value for allocation of any sub-TLV sub-Type is 32, so as to avoid overlap with any sub-TLV Type currently defined or under consideration.

The registration procedure is as specified in Sub-TLV registry for all TLVs (Section 3.3.1), namely

Range	Registration Procedures	Notes
0-31	Reserved	Existing allocations in this range are unaltered. No future allocations are to be made from this range.
32-16383	Standards Action	This range is for mandatory sub-TLVs or for optional sub-TLVs that require an error message if not recognized.
16384-31743	Specification Required	Experimental RFC needed This range is for mandatory sub-TLVs or for optional

		sub-TLVs that require an error message if not recognized.
31744-32767	Vendor Private Use	MUST NOT be allocated
32768-49161	Standards Action	This range is for optional sub-TLVs that can be silently discarded if not recognized.
49162-64511	Specification Required	Experimental RFC needed This range is for optional sub-TLVs that can be silently discarded if not recognized.
64512-65535	Vendor Private Use	MUST NOT be allocated

6. Acknowledgments

TBD

7. References

7.1. Normative References

[RFC2119] Bradner, S., "Key words for use in RFCs to Indicate Requirement Levels", BCP 14, RFC 2119, March 1997.

[RFC4379] Kompella, K. and G. Swallow, "Detecting Multi-Protocol Label Switched (MPLS) Data Plane Failures", RFC 4379, February 2006.

7.2. Informative references

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[RFC6424] Bahadur, N., Kompella, K., and G. Swallow, "Mechanism for Performing Label Switched Path Ping (LSP Ping) over MPLS Tunnels", RFC 6424, November 2011.

[RFC6425] Saxena, S., Swallow, G., Ali, Z., Farrel, A., Yasukawa, S., and T. Nadeau, "Detecting Data-Plane Failures in Point-to-Multipoint MPLS - Extensions to LSP Ping", RFC 6425, November 2011.

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