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Revised Definition of The GMPLS Switching Capability and Type Fields

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Abstract

GMPLS provides control for multiple switching technologies, and hierarchical switching within a technology. GMPLS routing and signaling use common values to indicate switching technology type. These values are carried in routing in the Switching Capability field, and in signaling in the Switching Type field. While the values using in these fields are the primary indicators of the technology and hierarchy level being controlled, the values are not consistently defined and used across the different technologies supported by GMPLS. This document is intended to resolve the inconsistent definition and use of the Switching Capability and Type fields by narrowly scoping the meaning and use of the fields. This document updates any document that uses the GMPLS Switching Capability and Types fields, in particular RFC 3471, RFC 4202, RFC 4203, and RFC 5307.

Status of this Memo

1. Introduction

Generalized Multi-Protocol Label Switching (GMPLS) provides control for multiple switching technologies. It also supports hierarchical switching within a technology. The original GMPLS Architecture, per [RFC3945], included support for five types of switching capabilities. An additional type was also been defined in [RFC6002]. The switching types defined in these documents include:

1. Packet Switch Capable (PSC)
2. Layer-2 Switch Capable (L2SC)
3. Time-Division Multiplex Capable (TDM)
4. Lambda Switch Capable (LSC)
5. Fiber-Switch Capable (FSC)
6. Data Channel Switching Capable (DCSC)

Support for the original types was defined for routing in [RFC4202], [RFC4203] and [RFC5307], where the types were represented in the Switching Capability (Switching Cap) field. In general, hierarchy within a type is addressed in a type-specific fashion and a single Switching Capability field value is defined per type. The exception to this is PSC which was assigned four values to indicate four levels of hierarchy: PSC-1, PSC-2, PSC-3 and PSC-4. The same values used in routing are defined for signaling in [RFC3471], and are carried in the Switching Type field. Following the IANA registry, we refer to the values used in the routing Switching Capability field and signaling Switching Type field as Switching Types.

In general, a Switching Type does not indicate a specific data plane technology, but rather this needs to be inferred from context. For example L2SC was defined to cover Ethernet and ATM, and TDM was defined to cover both SONET/SDH [RFC4606] and G.709 [RFC4328]. The basic assumption was that different technologies of the same type would never operate within the same control, i.e., signaling and

routing, domains.

The past approach in assignment of Switching Types has proven to be

problematic from two perspectives. The first issue is that there are examples of switching technologies were there are different levels of switching that can be performed within the same technology. For example, there are multiple types of Ethernet switching that may occur within a provider network. The second issues is that the Switching Capability field value is used in routing to indicate the format of the Switching Capability-specific information (SCSI) field, and that an implicit mapping of type to SCSI format is impractical for implementations that support multiple switching technologies. These issues led to the introduction of two new types for Ethernet in [RFC6004] and [RFC6060], namely:

7. Ethernet Virtual Private Line (EVPL)
8. 802_1 PBB-TE

An additional value is also envisioned to be assigned in support of G.709v3 by [GMPLS-G709] in order to disambiguate the format of the SCSI field.

While a common representation of hierarchy levels within a switching technology certainly fits the design objectives of GMPLS, the definition of multiple PSC Switching Types has also proven to be of little value. Notably, there are no known uses of PSC-2, PSC-3 and PSC-4.

This document proposes to resolve such inconsistent definitions and uses of the Switching Types by reducing the scope of the related fields and narrowing their use. In particular this document proposes deprecating the use of the Switching Types as an identifier of hierarchy levels within a switching technology, and limit its use to identification of a per-switching technology SCSI field format. This document also defines, for routing, a generic method for identifying a hierarchy levels within a switching technology.

An alternate approach, which is not advocated by this document, is to ensure that Switching Types are assigned for all hierarchy levels within a switching technology as part of any new work, e.g., as part of [GMPLS-G709].

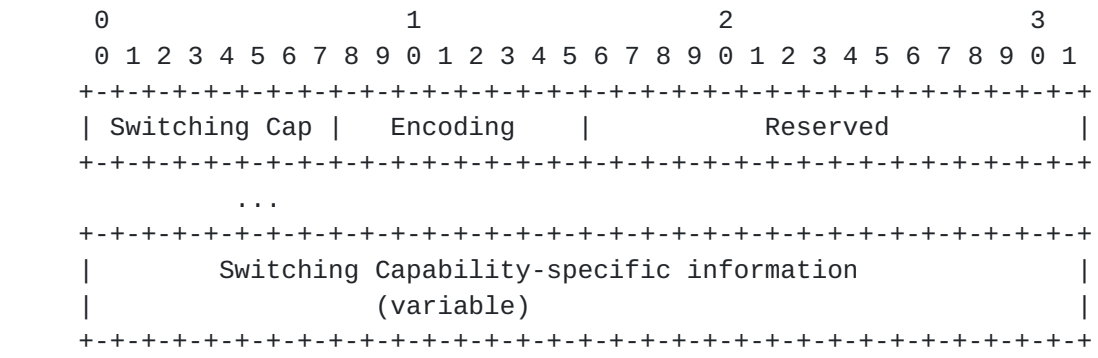
This document updates any document that uses the GMPLS Switching Capability and Switching Type fields, in particular RFCs 3471, 4202, 4203, and 5307.

1.1. Current Switching Type Definition

The Switching Type values are carried in both routing and signaling. Values are identified in the IANA GMPLS Signaling Parameters Switching Type registry, which is currently located at
http://www.iana.org/assignments/gmpls-sig-parameters/gmpls-sig-

parameters.xml

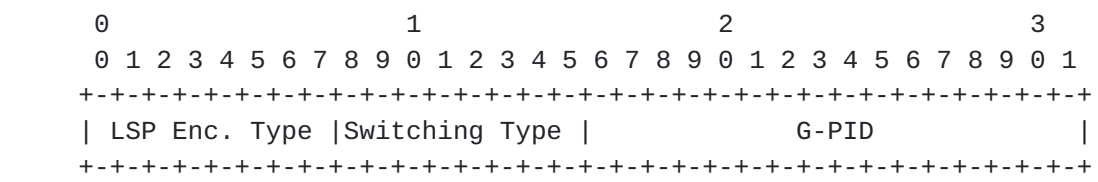
For routing, a common information element is defined to carry switching type values for both OSPF and IS-IS routing protocols in [RFC4202]. Per [RFC4202], switching type values are carried in a Switching Capability (Switching Cap) field in an Interface Switching Capability Descriptor. This information shares a common formatting in both OSPF, as defined by [RFC4203] and in IS-IS, as defined by [RFC5307]:



and

> The content of the Switching Capability specific information field depends on the value of the Switching Capability field.

Similarly, the Switching Type field is defined as part of a common format for use by GMPLS signaling protocols in [RFC3471] and is used by [RFC3473]:



Switching Type: 8 bits

> Indicates the type of switching that should be performed on a particular link. This field is needed for links that advertise more than one type of switching capability. This field should map to one of the values advertised for the corresponding link in the routing Switching Capability Descriptor ...

1.2. Conventions Used In This Document

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].

2. Revised Switching Type Definition

This document modifies the definition of Switching Type. The definitions are slightly different for routing and signaling and are described in the following sections.

2.1. Routing -- Switching Cap Field

For routing, i.e., [RFC4202], [RFC4203] and [RFC5307], the following definition should be used for Switching Cap field:

> The Switching Cap field indicates the type of switching being advertised via GMPLS Switching Type values. A different Switching Type value SHOULD be used for each data plane technology even when those technologies share the same type of multiplexing or switching. For example, Time Division Multiplexing (TDM) technologies that have different multiplexing structures, such as SDH [G.707] and OTN [G.709], should use two different Switching Types.
>
> As the format of the Switching Capability specific information field is dependent on the value of this field, a different Switching Type value MUST be used to differentiate between different Switching Capability specific information field formats.
>
> This definition does not modify the format of the Interface Switching Capability Descriptor.

Note that from a practical standpoint, this means that any time a new switching technology might use a different Switching Capability specific information field format, that a new Switching Type SHOULD be used.

2.2. Signaling -- Switching Type Field

For signaling, i.e., [RFC3471] which is used by [RFC3473], the following definition should be used for Switching Type field:

> Indicates the type of switching that should be performed on a particular link via GMPLS Switching Type values. This field maps to one of the values advertised for the corresponding link in the routing Switching Capability Descriptor, see [RFC4203] and [RFC5307].

Note that from a practical standpoint, there is no change in the definition of this field.

2.3. Assigned Switching Types

This document deprecates the following Switching Types:

Value	Name
2	Packet-Switch Capable-2 (PSC-2)
3	Packet-Switch Capable-3 (PSC-3)
4	Packet-Switch Capable-4 (PSC-4)

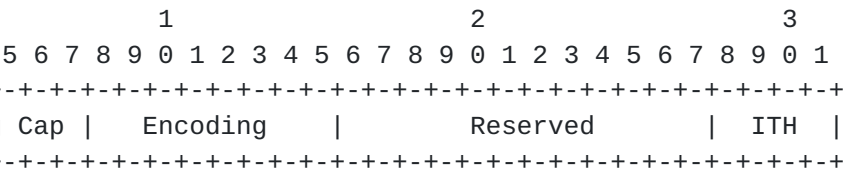
These values SHOULD NOT be treated as reserved values, i.e., SHOULD NOT be generated and SHOULD be ignored upon receipt.

3. Intra-Technology Hierarchy

[Authors note: This section is for discussion and may be dropped. Particularly, need to revisit MLN/IACD/XRO implications to ensure there are no gating issues.]

Multiple switching technologies support forms of hierarchical switching within a particular data plane technology. As discussed above, GMPLS routing originally envisioned support for such cases for packet networks using PSC-2, 3, 4. In other cases, GMPLS defined support using technology specific mechanisms, for example Signal Type was defined for SONET/SDH, see [RFC4606]. Given that one of the objectives of GMPLS is to generalize control plane protocols, it is reasonable to define a method for supporting hierarchical switching within a particular data plane technology that is not specific to any particular technology. This section defines such a mechanism for routing. No additional mechanism is defined for signaling.

In order to support hierarchical switching within a particular data plane technology in routing, this section defines the Intra-Technology Hierarchy, or ITH, field. This field allows for representation of up to 15 levels of hierarchical switching. It, for example, can represent the bottom most level of a multiplexing hierarchy. The ITH field is carried in a portion of the previously defined reserved field of the Interface Switching Capability Descriptor and has the following format:



For compatibility reasons, an ITH value of 0 indicates that the ITH field is not being used. The mapping of ITH values to specific levels of hierarchy within a data plane technology is specific to

each switching technology and is therefore outside the scope of this document.

4. Compatibility

This document has two impacts on existing implementations. Both routing and signaling impacts must be considered.

For existing implementations, the primary impact is deprecating the use of PSC-2, 3 and 4. At the time of publication of this document, there are no known deployments (or even implementations) that make use of these values so there is no compatibility issues for current routing and signaling implementations.

A secondary impact is the use of the previously reserved field of the routing Interface Switching Capability Descriptor. For existing routing implementations, this field should be set to all zeros when generating a Descriptor, and should be ignored on receipt. Furthermore, existing nodes are expected to propagate reserved fields without any modification. Therefore the use of this reserved field is not considered to result in any compatibility issues in routing. As this field is not used in signaling, there are no signaling compatibility issues.

5. Security Considerations

This document impacts the values carried in a single field in signaling and routing. As no new protocol formats or mechanisms are defined, there are no particular security implications raised by this document.

For a general discussion on MPLS and GMPLS related security issues, see the MPLS/GMPLS security framework [RFC5920].

6. IANA Considerations

IANA needs to deprecate and redefine the registry.

7. Acknowledgments

We thank John Drake for highlighting the current inconsistent definitions associated with the Switching Capability and Type Fields. Daniele Ceccarelli provided valuable feedback on this document.

8. References

8.1. Normative References

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