Behavior Negotiation in The Link Management Protocol

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Abstract

The Link Management Protocol (LMP) is used to coordinate the
properties, use, and faults of data links in Generalized
Multiprotocol Label Switching (GMPLS) networks. Various proposals
have been advanced to provide extensions to the base LMP
specification. This document defines an extension to negotiate
capabilities and support for those extensions, and provides a
generic procedure for LMP implementations that do not recognize or
do not support any one of these extensions.

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].

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1. Introduction

The Link Management Protocol (LMP) [RFC4204] has been successfully
deployed in Generalized Multiprotocol Label Switching (GMPLS)-
controlled networks.

New LMP behaviors and protocol extensions have been introduced in a
number of IETF documents as set out later in this section. It is
likely that future extensions will be made to support additional
functions.

In the network, if one GMPLS Label Switch Router (LSR) supports a
new behavior or protocol extension, but its peer LSR does not, it is
necessary to have a protocol mechanism for resolving issues that may
arise. It is also beneficial to have a protocol mechanism to
discover the capabilities of peer LSRs so that the right protocol
extensions can be selected and the correct features enabled. There
are no such procedures defined in the base LMP specification
[RFC4204], so this document defines how to handle LMP extensions
both at legacy LSRs and at upgraded LSRs that would communicate with
legacy LSRs.

In [RFC4204], the basic behaviors have been defined around the use
of the standard LMP messages, which include Config, Hello, Verify,
Test, LinkSummary, and ChannelStatus. Per [RCF4204], these behaviors
MUST be supported when LMP is implemented, and the message types
from 1 to 20 have been assigned by IANA for these messages.

In [RFC4207], the SONET/SDH technology-specific behavior and
information for LMP is defined. The Trace behavior is added to LMP,
and the message types from 21 to 31 were assigned by IANA for the
messages that provide the TRACE function. The Trace function has
been extended for the support of OTNs (Optical Transport Networks)
in [LMP-TEST].

In [RFC4209], extensions to LMP are defined to allow it to be used
between a peer node and an adjacent Optical Line System (OLS). The
LMP object class type and sub-object class name have been extended
to support DWDM behavior.

In [RFC5818], the data channel consistency check behavior is defined,
and the message types from 32 to 34 have been assigned by IANA for
messages that provide this behavior.

It is likely that future extensions to LMP for other functions or
technologies will require the definition of further LMP messages.

This document describes the behavior negotiation procedure to make
sure both LSRs at the ends of each link understand the LMP messages
that they exchange.

2. **LMP Behavior Negotiation Procedure**

The Config message is used in the control channel negotiation phase
of LMP [RFC4204]. The LMP behavior negotiation procedure is defined
in this document as an addition to this phase.

The Config message is defined in Section 12.3.1 of [RFC4204] and
carries the <CONFIG> object (class name 6) as defined in Section
13.6 of [RFC4204].

Two class types have been defined:

- C-Type = 1, HelloConfig, defined in [RFC4204]

- C-Type = 2, LMP_WDM_CONFIG, defined in [RFC4209]

This document defines a third C-Type with value 3 (TBD by IANA) to
report and negotiate currently defined LMP mechanisms and behaviors,
and to allow future LMP extensions to be reported and negotiated.

- C-Type = 3, BEHAVIOR_CONFIG

The format of the new type of CONFIG Class is defined as follows:

```
 0                   1                   2                   3
 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|    Length     |B|S|D|C|            MUST_BE_ZERO               |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

Length: 8 bits

   This field indicates the total length of the objects expressed in
   multiples of 4 bytes.

Flags:

  B: 1 bit

   This bit indicates support for the basic behaviors defined in
   [RFC4204].

  S: 1 bit

   This bit indicates support for the Trace behavior of SONET/SDH
   technology-specific defined in [RFC4207].

  D: 1 bit

   This bit indicates support for the DWDM behavior defined in
   [RFC4209].

   C: 1 bit

      This bit indicates support for the data channel consistency check
      behavior defined in [RFC5818].

   Further bits may be defined in future documents.

   The MUST_BE_ZERO field MUST be sent as zero and MUST NOT be ignored
   on receipt. This allows the detection of unsupported or unknown LMP
   behaviors when new bits are allocated to indicate further
   capabilities and are sent as one.

   Upon receiving a bit set related to an unsupported or unknown
   behavior, a ConfigNack message MUST be sent with a <CONFIG> object,
   the BEHAVIOR_CONFIG C-Type representing the supported LMP behaviors.
   An LSR receiving such a ConfigNack SHOULD select a supported set of
   capabilities and send a further Config message, or MAY raise an
   alert to the management system (or log an error) and stop trying to
   perform LMP communications with its neighbor.

   Note that multiple <CONFIG> objects (each with a different Class
   Type) MAY be present on a Config message in which case all of the
   objects SHOULD be processed, but see the note on backward
   compatibility in the next section. However, if more than one
   <CONFIG> object with the same Class Type is present on a Config
   message, the message SHOULD be rejected.

3. **Backward Compatibility**

   An LSR that receives a Config message containing a <CONFIG> object
   with a C-Type that it does not recognize should respond with a
   ConfigNack message as described in [RFC4204]. Thus, legacy LMP nodes
   that do not support the BEHAVIOR_CONFIG C-Type defined in this
   document will respond with a ConfigNack message.

   Note that [RFC4204] does not describe how multiple <CONFIG> objects
   with different C-Types should be processed. Thus it is possible that
   a legacy node receiving a BEHAVIOR_CONFIG object on a Config message
   that also includes a HelloConfig or LMP_WDM_CONFIG object might
   react as follows:

   - Reject the message because of the unknown BEHAVIOR_CONFIG object
      as described above.

- Reject the message because of multiple <CONFIG> objects. This
  achieves the same effective result.

- Ignore the second <CONFIG> object. This would result in the
  BEHAVIOR_CONFIG object being unprocessed and also not rejected.

An LSR that receives a ConfigNack message rejecting a Config message
that it sent containing the BEHAVIOR CONFIG C-Type because that
object variant is not supported by its peer MUST NOT draw any
conclusions about the level of support at the peer for LMP options
described by bits B, S, D, and C. Instead, the LSR MUST revert to
current practices of configuration or discovery through attempts to
exercise the options.

However, as future documents are published describing new LMP
features, and those documents require support of the BEHAVIOR CONFIG
C-Type, an LSR that receives a ConfigNack message rejecting a Config
message that it sent containing the BEHAVIOR CONFIG C-Type because
that object variant is not supported by its peer SHOULD conclude
that the additional options it wants to use are not supported by the
peer.

4. Security Considerations

[RFC4204] describes how LMP messages between peers can be secured,
and these measures are equally applicable to messages carrying the
new <CONFIG> object defined in this document.

The operation of the procedures described in this document does not
of itself constitute a security risk since they do not cause any
change in network state. It would be possible, if the messages were
intercepted or spoofed to cause bogus alerts in the management plane,
or to cause LMP peers to consider that they could or could not
operate protocol extensions, and so the use of the LMP security
measures are RECOMMENDED.

Note, however, that [RFC4204] refers to [RFC2401], which has been
replaced by [RFC4301]. Also, the reference to IKEv2 in [RFC4301] is
out of date, and the current reference for IKEv2 is [RFC5996].

5. IANA Considerations

5.1. New LMP Class Type

IANA maintains the "Link Management Protocol (LMP)" registry which
has a subregistry called "LMP Object Class name space and Class type
(C-Type)".

IANA is requested to make an assignment from this registry as
follows:

    6   CONFIG   [RFC4204]

CONFIG Object Class type name space:

```
C-Type   Description                   Reference
------   ------------------------      ---------
    3    BEHAVIOR_CONFIG               [This.I-D]
```

5.2. New Capabilities Registry

IANA is requested to create a new subregistry of the "Link
Management Protocol (LMP)" registry to track the Behaviour
Configuration bits defined in Section 2 of this document. It is
suggested that this registry be called "LMP Behaviour Configuration
Flags".

Allocations from this registry are by Standards Action.

Bits in this registry are numbered from zero as the most significant
bit (transmitted first). The number of bits that can be present is
limited by the length field of the <CONFIG> object which gives rise
to (255 x 32)-8 = 8152. IANA is strongly recommended to allocate new
bits with the lowest available unused number.

The registry is initially populated as follows:

Bit Number	Bit Name	Meaning	Reference
0	B	Basic LMP behavior support	[This.ID]
1	S	SONET/SDH Test support	[This.ID]
2	D	DWDM support	[This.ID]
3	C	Data Channel consistency check support	[This.ID]

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7. Acknowledgments

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8. References

8.1. Normative References

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8.2. Informative References

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