

Network Working Group
Internet Draft
Updates: [RFC4204](#)
Category: Standards Track

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Expires: September 2011

March 14, 2011

Behavior Negotiation in The Link Management Protocol

[draft-ietf-ccamp-lmp-behavior-negotiation-02.txt](#)

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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 [RFC4204], 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								Reserved															

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 Reserved 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.

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)".

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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 $(255 \times 32) - 8 = 8152$. 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](#)

Thanks to Adrian Farrel and Lou Berger for their useful comments.

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