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Documentation of IANA assignments for Constraint-Based LSP setup using LDP (CR-LDP) Extensions for Automatic Switched Optical Network (ASON)

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Abstract

Automatic Switched Optical Network (ASON) is an architecture, specified by ITU-T Study Group 15, for the introduction of a control plane for optical networks. The ASON architecture specifies a set of reference points that defines the relationship between the ASON architectural entities. Signaling over interfaces defined in those reference points can make use of protocols that are defined by the IETF in the context of Generalized Multi-Protocol Label Switching (GMPLS) work. This document describes Constraint-Based LSP setup using LDP (CR-LDP) extensions for signaling over the interfaces defined in the ASON reference points. The purpose of the document is to request that the IANA assigns code points necessary for the CR-LDP extensions. The protocol specifications for the use of the CR-LDP extensions are found in ITU-T documents.

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1. Introduction

Automatic Switched Optical Network (ASON) is an architecture, specified by ITU-T Study Group 15 (SG15), for the introduction of a control plane for optical networks. The development and the standardization of ASON has been done by ITU-T SG15 and is documented in recommendation G.8080 [1]. The architecture includes a control plane with a set of reference points between the architectural components. The ASON signaling that runs over interfaces defined in those reference points are described in ITU-T recommendation G.7713 [2].

Constraint-Based LSP Setup using LDP (CR-LDP) [3] is one of the protocols selected by the ITU for the realization of G.7713 and its dynamic connection management. The work specific to CR-LDP extensions for ASON is documented in ITU-T recommendation G.7713.3 [8].

This document introduces those CR-LDP extensions that are specific to ASON and requests IANA allocation of code points for these extensions. The document does not specify how these extensions are used; that is the subject of the above mentioned ITU-T documents. This document should be considered in conjunction with RFC 3036 [4], RFC 3212 [3], and CR-LDP extensions for GMPLS [5].

2. Overview of CR-LDP Extensions for ASON

This document describes ASON specific CR-LDP extensions covering the following ASON signaling requirements:

- Call and connection control separation
- Support of Soft Permanent Connections (SPC)
- Crankback
- Additional error codes

An important ASON architectural principle is the separation between the call and the connection controllers as described in G.8080. Call and connection control separation allows for a call with multiple connections associated with it. It also allows for a call with no

connections (a temporary situation that might be useful during recovery).

The separation of the call and the connection controllers could be achieved using one of two models. The first model is one where the call set up request is always accompanied by a connection request. The second model is one in which call set up is done independently from connection set up. The first model is usually referred to as logical separation, while the second model is usually referred to as complete separation. CR-LDP extensions for ASON support the two separation models.

Two new messages are introduced for call operations (set up and release). The Call Setup message is used for those cases where complete separation is required. Otherwise the LDP Label Request message is used for logical separation.

A connection set up request must indicate the call to which the connection needs to be associated. A Call ID TLV is introduced to achieve this goal. The structure of the Call ID allows it to have a global or an operator scope.

Call release is always achieved using the Call Release message. The reception of the call Release messages signifies the intention to remove all connections that are associated to the call. Connection release is achieved using the CR-LDP label release procedure (using LDP Label Release and Label Withdraw messages) as defined in [4].

A Call Capability TLV is also introduced to explicitly indicate the capability of the requested call.

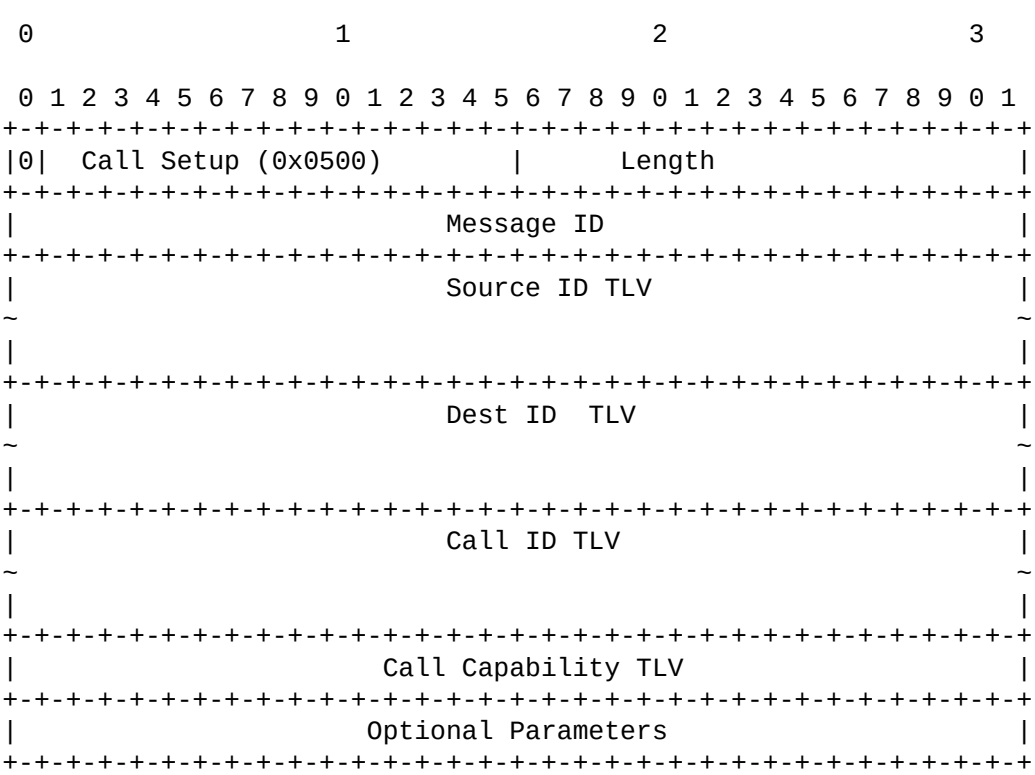
An Soft Permanent Connection (SPC) service assumes that both source and destination user-to-network connection segments are provisioned while the network connection segment is set up via the control plane. For example when the initial request is received from an external source, e.g. from a management system, there is an implicit assumption that the control plane has adequate information to determine the specific destination (network-to-user) link connection to use. Support for CR-LDP is provided by the use of the Egress Label TLV as defined in the OIF UNI 1.0 section 11.7.5 [6] from the Optical Internetworking Forum and in RFC3476 [7].

3. CR-LDP Messages for ASON

This section describes the formats and the procedures of the two messages that are required for ASON call and connection control separation. Those messages are the Call Setup messages and the Call Release message.

3.1 Call Setup Message

The format of the Call Setup message is:



Message ID:
Is as defined in RFC3036 [4].

Source ID TLV:
Is as defined in UNI 1.0 [6] and in [7].

Dest ID TLV:
Is as defined in UNI 1.0 [6] and in [7].

Call ID TLV:
Is as defined in section 4.1 of this document.

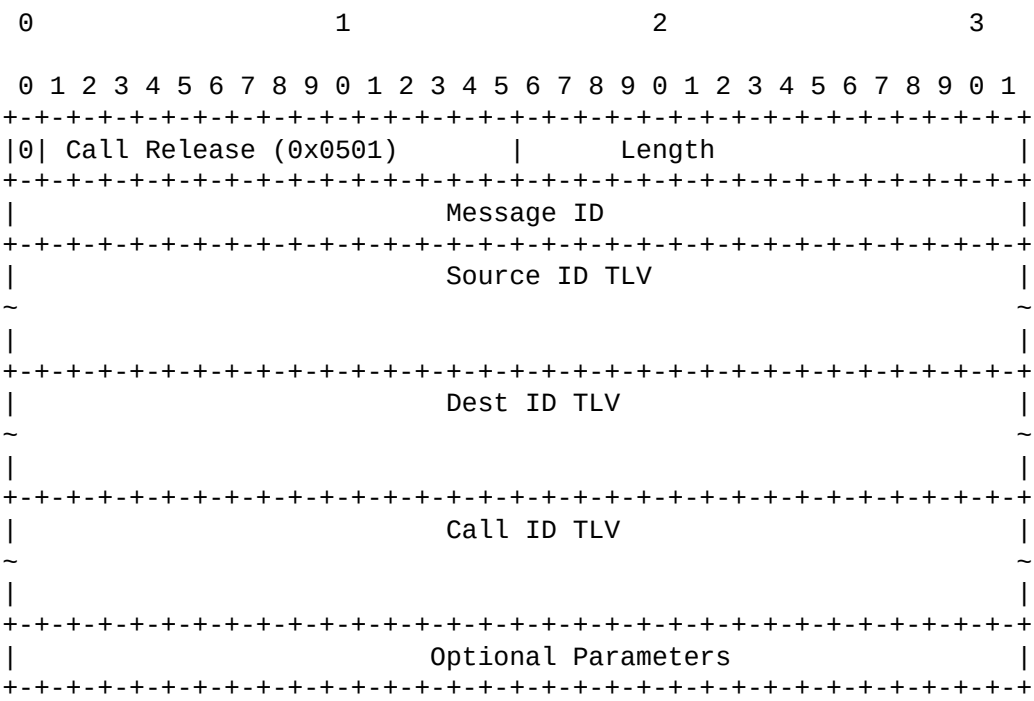
Call Capability TLV:
Is as defined in section 4.2 of this document.

3.1.2 Call Setup Procedure

The Calling party sends the Call Setup message whenever a new call needs to be set up with no connection associated with it. The Call Setup message shall contain all the information required by the network to process the call. In particular, the Call Setup message shall include the calling and called party addresses as specified by the Source ID and Dest ID TLV. The setup message must include Call ID TLV. The call control entity shall identify the call using the selected identifier for the lifetime of the call. The Call Setup message shall progress through the network to the called party. The called party may accept or reject the incoming call. An LDP Notification message with the appropriate status code shall be used to inform the calling party whether the setup is successful. The call can be rejected by either the network, e.g. for policy reasons, or by the called party.

3.2 The Call Release Message

This format of the Call Release message is:



3.2.1 Call Release Procedure

The Call Release message is sent by any entity of the network to terminate an already established call. The Call Release message must include the Call ID TLV of the call to be terminated. Confirmation of call release is indicated to the request initiator using a Notification message with the appropriate status code. Reception and processing of the Call Release message must trigger the release of all connections that are associated with that call. Connection release follows the normal CR-LDP procedure using Label Release and Label Withdraw messages.

4. CR-LDP TLVs for ASON

This section describes the operator specific Call ID TLV, the globally unique Call ID TLV, the Call Capability TLV and the Crankback TLV introduced for ASON.

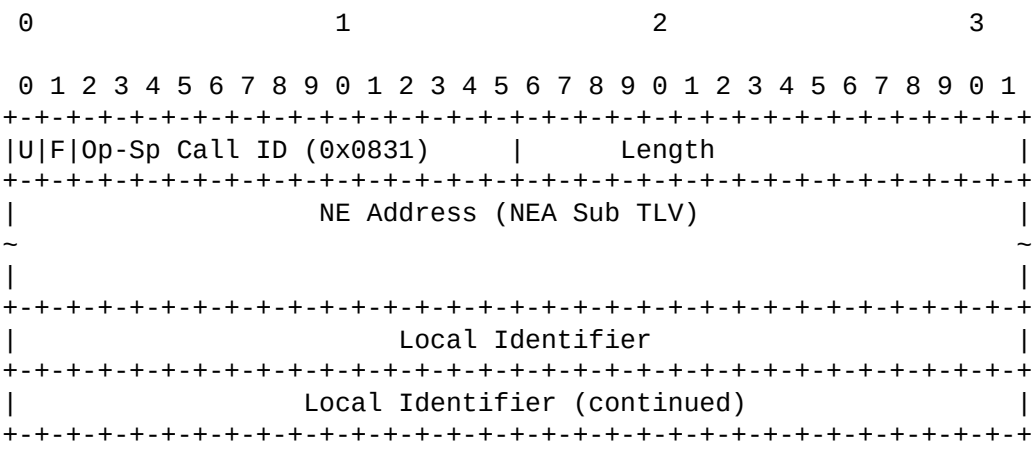
4.1 Call ID TLV

An established call may be identified by a Call ID. The Call ID is a globally unique identifier that is set by the source network. The structure for the Call ID (to guarantee global uniqueness) is to concatenate a globally unique fixed identifier (composed of country code, carrier code, unique access point code) with an operator specific identifier (where the operator specific identifier is composed of ingress network element (NE) address and a local Identifier).

Therefore, a generic CALL_ID with global uniqueness includes <global Id> (composed of <country code> plus <carrier code> plus <unique access point code>) and <operator specific Id> (composed of <NE address> plus <local Identifier>). For a CALL_ID that requires only operator specific uniqueness, only the <operator specific Id> is needed, while for a CALL_ID that is required to be globally unique both <global ID> and <operator specific Id> are needed.

The <global Id> shall consist of a three-character International Segment (the <country code>) and a twelve-character National Segment (the <carrier code> plus <unique access point code>). These characters shall be coded according to ITU-T Recommendation T.50.

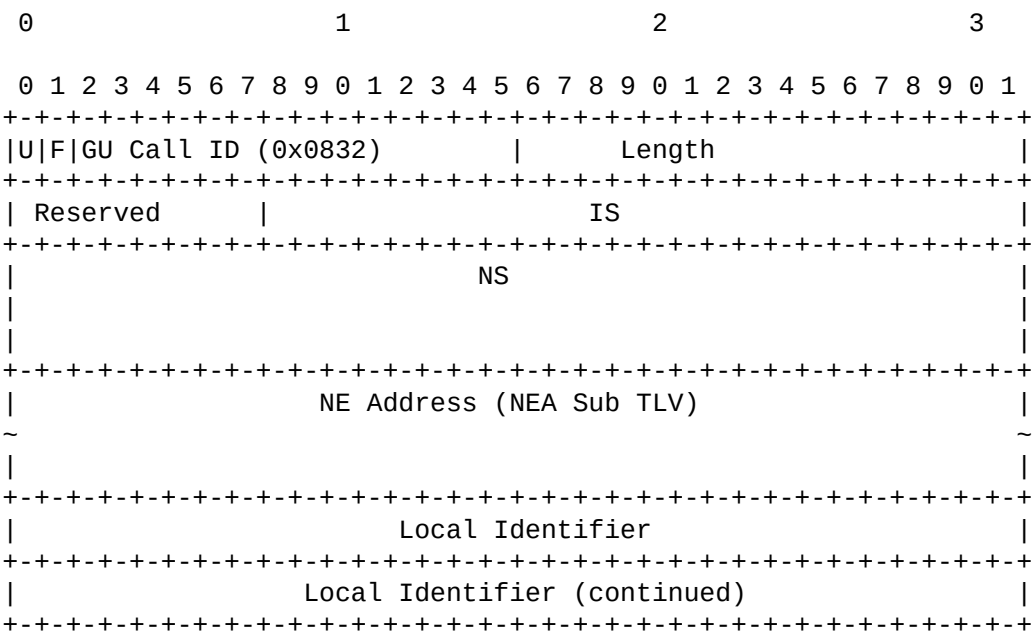
The format of the operator specific (Op-Sp) CALL_ID TLV:



NEA Sub TLV:
The Source NE Address is an address of the transport network element controlled by the source network. Its length can be 4, 6, 16, or 20 bytes long. The NEA Sub TLV is TLV Type 1.

Local Identifier:
A 64-bit identifier that remains constant over the life of the call.

The format of the globally unique (GU) Call ID TLV:



International Segment (IS):
To be coded according to ITU-T recommendation T.50. The International Segment (IS) field provides a 3 character ISO 3166 Geographic/Political Country Code. The country code is based on the three-character uppercase alphabetic ISO 3166 Country Code (e.g., USA, FRA).

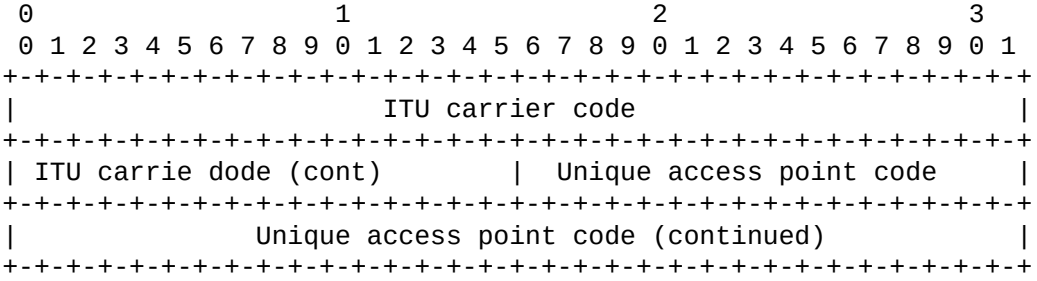
National Segment (NS):
The National Segment (NS) field consists of two sub-fields:

- the first subfield contains the ITU Carrier Code
- the second subfield contains a Unique Access Point Code.

The ITU Carrier Code is a code assigned to a network operator/service provider, maintained by the ITU-T Telecommunication Service Bureauin association with Recommendation M.1400. This code consists of 1-6 left-justified alphabetic, or leading alphabetic followed by numeric, characters (bytes). If the code is less than 6 characters (bytes), it is padded with a trailing NULL to fill the subfield.

The Unique Access Point Code is a matter for the organization to which the country code and ITU carrier code have been assigned, provided that uniqueness is guaranteed. This code consists of 1-6 characters (bytes), trailing NULL, completing the 12-character National Segment. If the code is less than 6 characters, it is padded by a trailing NULL to fill the subfield.

Format of the National Segment



4.1.1 Call ID Procedure

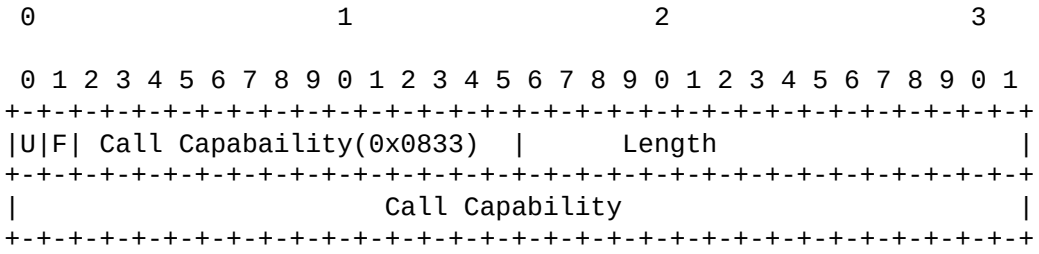
The following processing rules are applicable to the CALL ID TLV:

- For initial calls, the calling/originating party call controller must set the CALL ID values to all-zeros.

- For a new call request, the source networks call controller (SNCC) sets the appropriate type and value for the CALL ID.
- For an existing call (in case Call ID is non zero) the SNCC verifies existence of the call.
- Intermediate nodes are not allowed to alter the Call ID TLV set by the ingress node.
- The destination user/client receiving the request uses the CALL ID values as a reference to the requested call between the source user and itself. Subsequent actions related to the call uses the CALL ID as the reference identifier.

4.2 Call Capability TLV

The format of the Call Capability TLV is:



The Call Capability TLV contains a 4 byte Call Capability field. The Call Capability Field is used to explicitly indicate the configuration potentiality of the call.

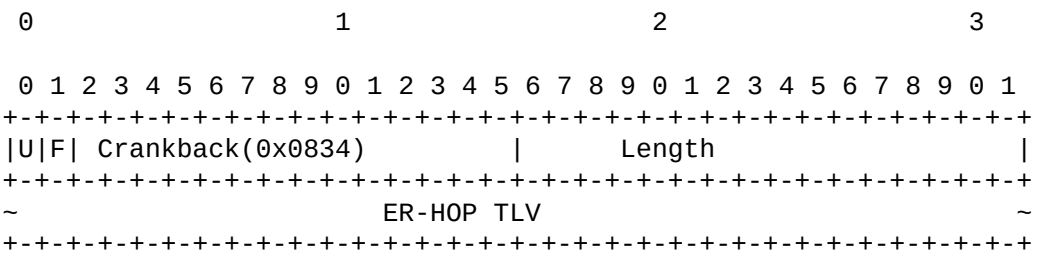
An example of values of the Call Capability field is:

0x0000 Point to Point call

4.3 Crankback TLV

Crankback requires that when the Label Request message is blocked at a particular node due to unavailable resources, the node will inform the initiator of the Label Request message of the location of the blockage. The initiator can then re-compute new explicit routes that avoid the area where resource shortage is detected. A new Label Request message is sent that includes the new route.

The support of crankback in CR-LDP is facilitated by the introduction of a Crankback TLV. An LDP Notification message is used to inform the Label Request message initiator of the blocking condition. The Notification message includes the Crankback TLV that indicates the location of resource shortage. The location of the resource shortage is identified using the ER-HOP TLV. The encoding of the Crankback TLV is:



The ER-HOP TLV is specified in rfc3212 [3], and consists of an n x 4 bytes field, it could e.g. contain an IPv4 or an IPv6 address.

5. Additional Error Codes

G.7713 includes a number of error codes that are currently not defined in earlier CR-LDP related RFCs. The list of those error conditions is given below:

Invalid SNP ID (0x04000009)
Calling Party busy (0x0400000a)
Unavailable SNP ID (0x0400000b)
Invalid SNPP ID (0x0400000c)
Unavailable SNPP ID (0x0400000d)

Failed to create SNC (0x0400000e)
Failed to establish LC (0x040000f)
Invalid Source End-User Name (0x04000010)
Invalid Destination End-User Name (0x04000011)
Invalid CoS (0x04000012)
Unavailable CoS (0x04000013)
Invalid GoS (0x04000014)
Unavailable GoS (0x04000015)
Failed Security Check (0x04000016)
TimeOut (0x04000017)
Invalid Call Name (0x04000018)
Failed to Release SNC (0x04000019)
Failed to Free LC (0x0400001a)

Acronyms used in above error codes:

SNP	Sub-network Point
SNPP	Sub-network Point Pool
SNC	Sub-network Connection
LC	Link Connection
CoS	Class of Service
GoS	Grade of Service

6. IANA Consideration

This document uses the LDP RFC 3036 [4] name spaces; see http://www.iana.org/assignments/ldp-namespaces.

Call Setup (0x0500)
Call Release (0x0501)

The assignment for the following TLVs:

Op-Sp Call ID TLV (0x0831)
GU Call ID TLV (0x0832)
Call Capability TLV (0x0833)
Crankback TLV (0x0834)

The assignment for the new error codes as listed in section 5 of this document.

9. Security Considerations

This document does not introduce any new security concerns other than those defined in RFC 3036 and RFC 3212.

Security aspects (if any) w.r.t. the G.8080 and G.7713 documents need to be addressed in those documents.

10. Normative References

[1] Architecture for Automatically Switched Optical Network (ASON), ITU-T recommendation G.8080, Nov. 2001

[2] Distributed Call and Connection Management (DCM), ITU-T recommendation G.7713, Dec. 2001

[3] Jamoussi, B., Ed., Andersson, L., Callon, R., Dantu, R., Wu, L., Doolan, P., Worster, T., Feldman, N., Fredette, A., Girish, M., Gray, E., Heinanen, J., Kilty, T. and A. Malis, "Constraint-Based LSP Setup using LDP", RFC 3212, January 2002.

[4] Andersson, L., Doolan, P., Feldman, N., Fredette, A. and B. Thomas, "LDP Specifications", RFC 3036, January 2001.

[5] Ashwood-Smith, P. and L. Berger, (Editors),"Generalized Multi-Protocol Label Switching (GMPLS) Signaling Constraint-based Routed Label Distribution Protocol (CR-LDP) Extensions", RFC 3472, January 2003.

[6] UNI 1.0 Signaling Specification, The Optical Internetworking Forum, http://www.oiforum.com/public/UNI_1.0_ia.html

[7] Rajagopalan, B., "Label Distribution Protocol (LDP) and Resource ReserVation Protocol (RSVP) Extensions for Optical UNI Signaling", RFC 3476, March 2003.

[8] Distributed Call and Connection Management signalling using GMPLS CR-LDP, ITU G.7713.3, Januray 2003.

11. Intellectual Property

12. Author's Addresses

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13. Full Copyright Statement

Acknowledgement

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