Link State Over Ether

What Changed in -01?

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A Light Refresher
MAC Link State exchanged over raw Ethernet and pushed up stack

Add the AFI/SAFI data

IP-Level Liveness Check

BGP-SPF uses link data to discover and build the topology database
Inter-Link Ether Protocol

Hello / KeepAlive (type=0)  MACs and Liveness
Mandatory

Timers (type=1, cap 1)
Optional
Renegotiate at Any Time

Link AFI/SAFIs (type=1, cap 4)
AFI/SAFI Support (type 1, cap 4)
Mandatory
Renegotiate at Any Time

Interface IPv4 Addresses (type=14)
Interface IPv4 Addresses
Optional
Renegotiate at Any Time

Interface IPv6 Addresses (type=16)
Interface IPv6 Addresses
Optional
Renegotiate at Any Time

Interface MPLS Labels (type=10)
Interface Labels
Optional
Renegotiate at Any Time

Find Each Other's MACs & IDs and Start MAC KeepAlive Checks
Negotiate Timers for KeepAlives and ACKs
Negotiate Encaps Supported On Link
Announce Link IPv4 Addresses (there is an ACK)
Announce Link IPv6 Addresses (there is an ACK)
Announce Interface MPLS Labels and Other types of Tunnels (there is an ACK)
Hello/KeepAlive

<table>
<thead>
<tr>
<th>PDU Sequence No</th>
<th>Frame No</th>
<th>Flags</th>
</tr>
</thead>
<tbody>
<tr>
<td>Checksum</td>
<td>Length = 25</td>
<td></td>
</tr>
<tr>
<td>Type = 0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Local ID</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Remote ID (or Zero)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Inter-Link Ether Protocol

Find Each Other's MACs & IDs and Start MAC KeepAlive Checks

Hello / KeepAlive (type=0)

MACs and Liveness Mandatory

Hello / KeepAlive (type=0)

Timers (type=1, cap 1)

Timers (type 1, cap 1)

Optional

Renegotiate at Any Time

Timers (type=1, cap 1)

Link AFI/SAFIs (type=1, cap 4)

Link AFI/SAFIs (type=1, cap 4)

AFI/SAFI Support (type 1, cap 4)

Mandatory

Renegotiate at Any Time

Interface IPv4 Addresses (type=14)

Interface IPv4 Addresses (type=14)

Interface IPv4 Addresses

Optional

Renegotiate at Any Time

Interface IPv6 Addresses (type=16)

Interface IPv6 Addresses (type=16)

Interface IPv6 Addresses

Optional

Renegotiate at Any Time

Interface MPLS Labels (type=10)

Interface MPLS Labels (type=10)

Interface Labels

Optional

Renegotiate at Any Time

Announce Link IPv4 Addresses (there is an ACK)

Announce Link IPv6 Addresses (there is an ACK)

Announce Interface MPLS Labels and Other types of Tunnels (there is an ACK)
The AFI/SAFIs currently defined are as follows:

10 - IPv4
11 - IPv6
12 - MPLS IPv4
13 - MPLS IPv6
... - other tunnels (e.g. GRE)
Inter-Link Ether Protocol

- **Hello / KeepAlive (type=0)**
  - MACs and Liveness
  - Mandatory
- **Hello / KeepAlive (type=0)**
- **Timers (type=1, cap 1)**
  - Timers (type 1, cap 1)
  - Optional
  - Renegotiate at Any Time
- **Timers (type=1, cap 1)**
- **Link AFI/SAFIs (type=1, cap 4)**
  - AFI/SAFI Support (type 1, cap 4)
  - Mandatory
  - Renegotiate at Any Time
- **Link AFI/SAFIs (type=1, cap 4)**
- **Interface IPv4 Addresses (type=14)**
  - Interface IPv4 Addresses
  - Optional
  - Renegotiate at Any Time
- **Interface IPv4 Addresses (type=14)**
- **Interface IPv6 Addresses (type=16)**
  - Interface IPv6 Addresses
  - Optional
  - Renegotiate at Any Time
- **Interface IPv6 Addresses (type=16)**
- **Interface MPLS Labels (type=10)**
  - Interface Labels
  - Optional
  - Renegotiate at Any Time
- **Interface MPLS Labels (type=10)**

Find Each Other's MACs & IDs and Start MAC KeepAlive Checks

Negotiate Timers for KeepAlives and ACKs

Negotiate AFIs/SAFIs Supported On Link

Announce Link IPv4 Addresses (there is an ACK)

Announce Link IPv6 Addresses (there is an ACK)

Announce Interface MPLS Labels and Other types of Tunnels (there is an ACK)
IPv4 Link Addresses

---

0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1
+---------------------------------------------------------------------+
| PDU Sequence No          | Frame No    | Flags            |
+---------------------------------------------------------------------+
| Checksum                 | Length      |
+---------------------------------------------------------------------+
| Type = 11                | Sequence Number |
+---------------------------------------------------------------------+
| AFI/SAFI Count           | Add/Drop/Prim |
+---------------------------------------------------------------------+
| IPv4 Prefix/Len           |
+---------------------------------------------------------------------+
| Add/Drop/Prim             |
+---------------------------------------------------------------------+
| IPv4 Prefix/Len           | more ...    |
+---------------------------------------------------------------------+
Summary of Changes

• Node Identifier - no longer ASN, but choose ASN, RouterID, anything unique
• MPLS Label became a Label List
• Northbound Protocol - Custom protocol replaced by using BGP-LS and extensions
• Administrivia (IANA cons, refs, ...)
Node Identifier

An ID can be an **ASN** with high order bits zero, a classic **RouterID** with high order bits zero, a catenation of the two, a 48-bit **ISO System-ID**, or any other **identifier** unique to a single **device** in the BGP-SPF routing space.
**MPLS Label List**

<table>
<thead>
<tr>
<th>Label Count</th>
<th>Label</th>
<th>Exp</th>
<th>IS</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>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</td>
<td>++++++</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>++++++</td>
<td>++++++</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>++++++</td>
<td>++++++</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>++++++</td>
<td>++++++</td>
<td></td>
</tr>
</tbody>
</table>
Ripped out the whole Northbound protocol and use BGP-LS TLV API

Stolen from BGP-SPF

For IPv4 links, TLVs 259 and 260 are used. And for IPv6 links, TLVs and 262. If there are multiple addresses on a link, multiple TLV pairs are pushed North, having the same ID pairs.
Node Descriptors

Similarly to BGP-SPF, the BGP protocol is used in the Protocol-ID field specified in table 1 of bgpls-segment-routing-epe. The local and remote node descriptors for all NLRI are the ID's described in Section 5.2.2.
Northbound MPLS

Label Sub-TLVs from idr-bgp-ls-segment-routing-ext Section 2.1.1, are used to associate one or more MPLS Labels with a link.
~Security

• This version has no security

• Waiting for basic skeleton to settle

• Want to add Authentication and maybe Integrity

• One of the things which are likely to drive the size over 1,500