Encapsulation choices

MPL domain multicast destination address
• Consistent with unencapsulated MPL domain multicast
• Inner packet is effectively tunneled to border routers
• Issues:
  • Is it legitimate to alter the inner packet when forwarding? Strictly speaking no, if treating as tunneled
  • Therefore, how is the inner packet hop count decremented properly?
  • One solution could be to decrement by the appropriate amount when decapsulating. This would then render the hop count accurate at every point where it is processed, at the intermediate routers and the border router. The appropriate amount would be how much the outer header has been decremented, i.e. the radius of propagation. If the initial hop count is known, then this is possible

Link local multicast destination address
• Not consistent with unencapsulated MPL domain multicast (cannot use link local unencapsulated of course)
• Consistent with sending RPL HbH headers
• Inner packet is extracted and recapsulated every hop
• Inner packet hop count can be decremented as it is extracted

Conclusion
• Neither is wrong, neither is exactly right, so which is “more right”?
• The main issue with the MPL Option multicast address encapsulation is it is not strictly legal to manipulate the inner packet as it is being multicast tunneled
Rough analogies

MPL domain multicast: Tunnel propagates through MPL domain; inner packet is “tee’d” off at every node. Outer packet is forwarded as is. MPL Option (and maybe unicast prefix-based multicast group) used to control propagation

Link local multicast: Outer packet only goes one hop. Receiving node decapsulates and recapsulates at every node before further rebroadcast at link local scope. MPL Option (and maybe unicast prefix-based multicast group) used to control propagation
• Outer header broadcasts link local scope; outer packet only goes one hop.
• Receiving node decapsulates at every node for potential processing.
• For interfaces subscribed to inner header multicast address (administration needed):
  • If interface is MPL-aware
    • Decapsulated packet has hop count decremented, is recapsulated with link local scope and rebroadcast. MPL Option used to control propagation
  • If interface is not MPL-aware:
    • Decapsulated packet has hop count decremented and rebroadcast
• Outer header broadcasts MPL domain scope; outer packet is effectively forwarded
• Receiving node decapsulates at every node for potential processing
• For interfaces subscribed to outer header multicast address (administration needed):
  • If interface is MPL-aware
    • Encapsulated packet is rebroadcasted due to forwarding. MPL Option used to control propagation. **Problem – how is hop count decremented?**
  • If interface is not MPL-aware:
    • Decapsulated packet has hop count decremented and rebroadcast
Processing graph of MPL domain unencapsulated packet

Header broadcasts subnet local scope; packet is effectively forwarded
Receiving node potentially processes unencapsulated packet

- For interfaces subscribed to header multicast address (administration needed):
  - If interface is MPL-aware
    - Packet has hop count decremented and is rebroadcasted due to forwarding. MPL Option used to control propagation.
  - If interface is not MPL-aware:
    - Packet should not be rebroadcast as MPL Option is still present

Packet forwarded according to MPL rules

Packet for processing
Decapsulated and forwarded on other network interface

Notes

● Host is “MPL-aware”. Packet may be unicast to A
● Destination is site local, therefore need encapsulation at (1) as it may emanate from the BR
● Source addresses change per hop; inner packet decapsulated for processing and hop count decrementing and recapsulated every hop
● MPL Option controls forwarding of outer packet
● Remains decapsulated at (3) as it is leaving the MPL domain

Site local multicast originating from MPL-aware 6LH using link local multicast
Decapsulated and forwarded on other network interface

Notes

● Host is “MPL-aware”. Packet may be unicast to A
● Destination is site local, therefore need encapsulation at (1) as it may emanate from the BR
● Source address does not change per hop; inner packet decapsulated for processing. Packet forwarded (how is hop count decremented?)
● MPL Option controls forwarding of outer packet
● Remains decapsulated at (3) as it is leaving the MPL domain

Site local multicast originating from MPL-aware 6LH using MPL domain multicast
Site local multicast originating from 6LH using link local multicast

Notes

- Host is not “MPL-aware”. Packet may be unicast to A
- Destination is site local, therefore need encapsulation at (2) as it may emanate from the BR
- Source addresses change per hop; inner packet decapsulated for processing and hop count decrementing and recapsulated every hop
- MPL Option controls forwarding of outer packet
- Remains decapsulated at (3) as it is leaving the MPL domain
Decapsulated and forwarded on other network interface

Notes

- Host is not “MPL-aware”. Packet may be unicast to A
- Destination is site local, therefore need encapsulation at (2) as it may emanate from the BR
- Source address does not change per hop; inner packet decapsulated for processing. Packet forwarded (how is hop count decremented?)
- MPL Option controls forwarding of outer packet
- Remains decapsulated at (3) as it is leaving the MPL domain

Site local multicast originating from 6LH using MPL domain multicast
Notes

- Destination is site local, therefore need encapsulation at (1) as it may emanate from the BR
- Source addresses change per hop; inner packet decapsulated for processing and hop count decrementing and recapsulated every hop
- MPL Option controls forwarding of outer packet
- Remains decapsulated at (3) as it is leaving the MPL domain

Site local multicast originating from 6LR using link local multicast
Notes

- Destination is site local, therefore need encapsulation at (1) as it may emanate from the BR.
- Source address does not change per hop; inner packet decapsulated for processing. Packet forwarded (how is hop count decremented?)
- MPL Option controls forwarding of outer packet
- Remains decapsulated at (3) as it is leaving the MPL domain

Site local multicast originating from 6LR using MPL domain multicast
Notes

- BR encapsulates as it originates from outside MPL domain. Note there may need to be a policy to determine which traffic gets routed to LLN.
- Source addresses change per hop; inner packet decapsulated for processing and hop count decrementing and recapsulated every hop.
- MPL Option controls forwarding of outer packet.

Site local multicast originating externally using link local multicast
No MPL multicast information

BR encapsulates as it originates from outside MPL domain. Note there may need to be a policy to determine which traffic gets routed to LLN.

Source address does not change per hop; inner packet decapsulated for processing. Packet forwarded (how is hop count decremented?)

MPL Option controls forwarding of outer packet.

Site local multicast originating externally using MPL domain multicast
Notes

- Host is “MPL-aware”.
- Destination is subnet local and assumed to be within MPL domain (administration needed), therefore no encapsulation needed at (1)
- Source address does not change per hop. MPL forwarding forwards packet as per MPL rules
- MPL Option controls forwarding of outer packet

MPL domain multicast within MPL domain