Hierarchical LAN Services

Providing Scalability in L2 Virtual Private Networks by using a MAC-n-MAC Frame Encapsulation and a Larger Service-tag

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Topics

• Brief Description
• Market Potential and Advantages
• Compatibility Goals
Hierarchical LAN Services

- CE – Customer Edge Device (standard device)
- L2PE – Layer 2 Provider Edge Switch (supports HLS)

* May be either transparent or non-transparent with respect to CE defined VLAN’s
Hierarchical LAN Services
Alternative Architectures

- Initial deployments can be based on Ethernet
- Allows service providers to gradually evolve from a bridged architecture to a MPLS composite architecture
Alternatives (2)
Encapsulation

- **Ethernet**

<table>
<thead>
<tr>
<th>MACDA</th>
<th>MACSA</th>
<th>T/L</th>
<th>INFO</th>
<th>CRC32</th>
</tr>
</thead>
</table>

- **MAC-in-MAC**

<table>
<thead>
<tr>
<th>L2PE-MACDA</th>
<th>L2PE-MACSA</th>
<th>ETYPE</th>
<th>Id/Control</th>
<th>CE / L2PE Frame</th>
<th>CRC32</th>
</tr>
</thead>
</table>
Service Tag

Includes the following fields

- 24-bit Virtual Private Network (VPN) Identifier
- 3-bit Quality of Service
- Other control bits as needed for example:
  - 1-bit MAC-in-MAC indicator
  - 1-bit OAM indicator
  - 1-bit CRC indicator
Market Potential

• Service Providers are requesting scalable Layer 2 services for Connecting POPs (MANs and WANs)
• Simplicity of Ethernet Bridged Networks in Enterprise or University campus Backbones viewed positively
• With MAC-in-MAC, LANs can be connected by Service Provider without limiting service to router connections
Advantages

• Large VPN Identifier number space
• Due to MAC-in-MAC size of MAC address table is lower on Intermediate network elements
• Customer Isolation: encapsulated customer traffic cannot gain in-band access to devices within the service provider’s network
• Scales network size while preserving plug-and-play characteristics of bridging
Compatibility

• Ethernet
• Q-in-Q
• MAC-in-MAC
• Virtual Private LAN Services (IETF)
• 802.3 Length Issue
Bridged Ethernet

- Single .Q domain
- Single MAC Address Table
- No customer separation
Switched Ethernet + Q-in-Q

- Edge .Q domain and Service .Q domain separation
- Single MAC Address domain
- Service .Q provides customer separation
Q-in-Q + VPLS

- VPLS connects Q-in-Q islands
- VPLS connections can be inter or intra service provider
- Single MAC address domain
- VPLS and Q-in-Q used to provide customer separation (Q-in-Q limited to 4K instances)
Switched Ethernet + MAC-in-MAC

- Hierarchical MAC Address domains provide MAC address table scalability
- Service Tag provides customer separation (much greater than 4K VLAN Tag limitation)
Q-in-Q + MAC-in-MAC

- Hierarchical MAC Address domains provide MAC address table scalability
- Service Tag provides customer separation (much greater than 4K VLAN Tag limitation)
- Q-in-Q must be translated to Service Tag at boundaries
MAC-in-MAC + VPLS

- VPLS connects MAC-in-MAC islands
- VPLS connections can be inter or intra service provider
- Hierarchical MAC Address domains provide MAC address table scalability
- Single MAC address domain for flows that traverse VPLS domain
- VPLS and Mac-in-Mac used to provide customer separation (Service Tag limit is much larger than 4K VLAN limit)
MAC-in-MAC + VPLS + Q-in-Q

- VPLS connects MAC-in-MAC or Q-in-Q islands
- VPLS connections can be inter or intra service provider
- Hierarchical MAC Address domains provide MAC address table scalability
- Single MAC address domain for flows that traverse VPLS domain
- MAC-in-MAC Service Tag provides customer separation, limit much larger than 4K VLAN Limit
- Q-in-Q provides customer separation, limit is 4K
802.3 Length

Proposal: Request that MAC-in-MAC be supported by full-duplex Ethernet only and the frame length be extended for this subset of interfaces.