Resolving the Single vs. Multiple Address Table Issue

IEEE 802.1q
July 7-11, 1997
Maui, Hawai’i
The Impasse

- Within the context of the current model:
- Support a range of network configurations and behaviors
  - Leakiness and security characteristics
  - ‘Bouncing address’ problems
  - Address resolution ambiguity
- Support a variety of switch implementations
  - # of VLANs
  - # of address tables
Restate the problem

- Define two VLAN types
- Formalize VLAN to address table mapping
- Define learning behavior as a function of VLAN type
There are two types of VLANs

- ‘Asymmetric’ or ‘Leaky’
- ‘Symmetric’ or ‘Secure’
Address table mapping

- Postulate an association of VLANs to address tables within a switch

<table>
<thead>
<tr>
<th>VLAN 1</th>
<th>VLAN 2</th>
<th>VLAN 3</th>
<th>VLAN 4</th>
<th>VLAN 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Address Table A</td>
<td>Address Table B</td>
<td>Address Table C</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Learning behavior

- Both types of VLANs may be simultaneously supported by a single switch.
- Conventional source address learning populates one or more address tables based on the VLAN type according to the following rules:
Address Table Mapping Rules

- Symmetric
  - All symmetric VLANs supported by a switch must populate different address tables

- Asymmetric
  - All asymmetric VLANs supported by a switch must populate a single address table
Indication of VLAN type

- Each VLAN must have an associated ‘symmetry’ attribute that is communicated to the switches supporting that VLAN
- Explicit indication
  - GVRP carries the symmetry bit with each VLAN registration
- Implicit indication
  - Define ‘symmetry’ as a bit within the existing 12-bit VLAN tag
We could be done here, but...

- The rules as stated above allow for the co-existence and interoperation of both types of VLANs
- However, the rules do not allow any latitude in address table assignment
- There is an additional refinement to the model to allow address table mapping to be more flexible and thereby allow the mapping to be optimized for a given switch implementation
Enhancements to the model

• Derive additional flexibility in address table usage by defining groups of VLANs of a given type
  – Asymmetric groups
  – Symmetric groups
Enhanced Address Table Mapping

Rules

- **Asymmetric**
  - Within a switch, all asymmetric VLANs *in a given asymmetric group* must populate a single address table

- **Symmetric**
  - Within a switch, all symmetric VLANs *in a given symmetric group* must populate address tables distinct from each other and distinct from any asymmetric group
Two Observations on the Enhanced Rules

• Any number of asymmetric groups may share the same address table. In fact, all asymmetric groups, and therefore all asymmetric VLANs could share a single address table in all switches.

• A single address table can further be shared by any number of symmetric VLANs, provided none of them are in symmetric groups.
Two Possible Address Table Assignment Strategies

• Goal: Minimize number of address tables in use
  – Start with the notion that all VLANs populate a single address table
  – Assign each symmetric VLAN in each symmetric group to additional address tables

• Goal: Maximize number of address tables in use
  – Start with the notion that each VLAN populates a different address table
  – Collapse the asymmetric VLANs in each asymmetric group into a single address table
Additional Configuration Requirement

- Each VLAN must have an associated group number that is communicated to the switches supporting that VLAN
  - Explicit indication
    - GVRP carries the group number with each VLAN registration
  - Implicit indication
    - Define ‘group number’ as few bits within the existing 12-bit VLAN tag
Conclusion

- Define VLAN-to-address table assignment
- Simple model
  - Defines VLAN types
- Enhanced model
  - Defines VLAN types and groupings