Single VID ECMP
Frame Format Considerations

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Goals

- Efficient data path processing
- Maintain existing field format and function
- Keep the frame overhead small

These goals may lead in different directions…
tradeoffs may be necessary

New Frame Information

- Flow ID
  - Enables deep packet hash (e.g., 5-tuple hash) at edge only
  - Reduces frame processing at intermediate hops
  - Maintains independence from client at internal interfaces
  - Needs to be big enough to support sufficient entropy for ECMP
- TTL
  - Protects network from temporary loops during reconfiguration
  - Enables more rapid recovery in some cases (no need to wait for Agreement Protocol)
  - Protects network from control software variations (implementation bugs) that can cause forwarding loops
  - Need to be big enough to cover ECMP network domain diameter

Existing Frame Information

- I-SID
  - Backbone service instance identifier
  - Needs to be big enough to support maximum number of services
  - Currently 24 bits

- BSI PCP and DEI
  - Copy of priority and discard eligibility for service
  - Enables service values to be different from backbone values
  - 4 bits

- UCA bit
  - Indicates distinct addressing carried in I-Tag
  - Used for OAM to allow standard MEPs/MIPs to work for BSIs

New Format Requires

- EtherType
  - Tags use fixed format
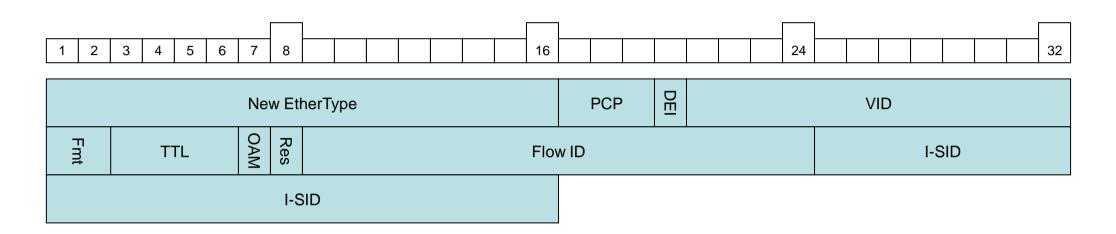 - EtherType is format indicator

IEEE RAC Rules…

- A number of tags have been defined by 802.1
  - Originally
    - C-Tag
    - S-Tag
  - Recent past
    - I-Tag
    - CN-Tag
  - Potential future
    - Port Extension
    - Single VID ECMP
    - Other new functions (we may not stop working on bridging anytime soon)
  - IEEE RAC rules strongly recommend a subtype field be included so that new EtherTypes are not required for new versions or revisions

New Tag Format Considerations
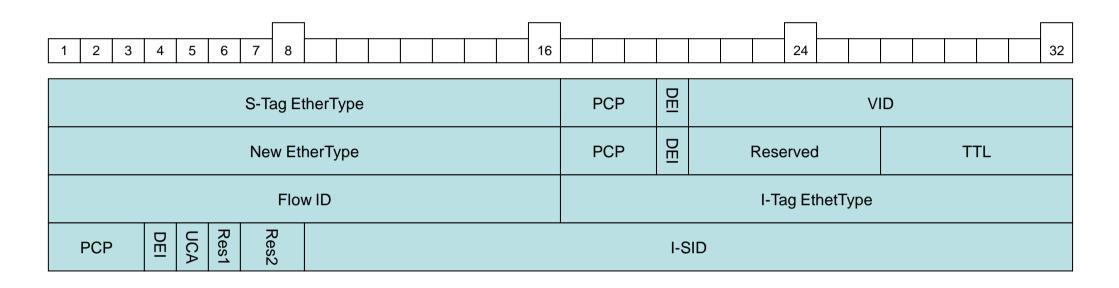
1) Subtype/format field for new EtherType
2) Explicit vs. implicit Flow ID
3) Flow ID field size
4) TTL field size
5) OAM frame identification
6) Reserved bits in tag (potential future evolution)
7) Maintain existing field formats
8) Overall size

Flexible Tag with Explicit Flow ID

1	2	3	4	5	6	7	8								16							24								32

New EtherType		PCP	DEI	VID

Fmt	TTL	OAM	Res	Flow ID	I-SID

I-SID

Notes:
1) 2 bit subtype/format field (can reserve a value for extending subtype/format field)
2) Explicit Flow ID (preserves independent semantics, simplifies processing, no new fault modes, etc.)
3) 16 bit Flow ID
4) 4 bit TTL
5) OAM indicator bit
6) 1 reserved bit
7) I-SID remains 24 bits, first part of tag is identical to B-Tag/S-Tag
   • Easy to convert to B-Tag or B-Tag+I-Tag at domain boundary, if needed (just overwrite some fields)
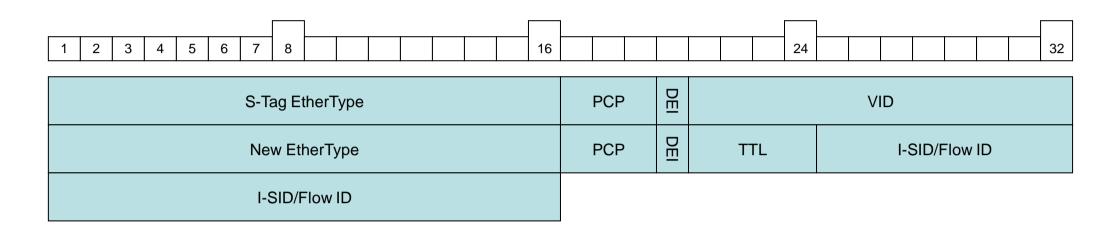8) 80 bits including B-VID and I-SID

New F-Tag with Flow ID and TTL

1	2	3	4	5	6	7	8						16					24					32

S-Tag EtherType							PCP	DEI	VID		
New EtherType							PCP	DEI	Reserved		TTL
Flow ID							I-Tag EthetType				
PCP	DEI	UCA	Res1	Res2	I-SID						

Notes:
1) No subtype or format field to support extension or revision (could be taken from reserved field?)
2) Explicit Flow ID (preserves independent semantics, simplifies processing, no new fault modes, etc.)
3) 16 bit Flow ID
4) 6 bit TTL
5) No OAM indicator (could be taken from reserved field?)
6) 6 reserved bits
7) B-Tag and I-Tag remain unchanged
8) 128 bits including B-VID and I-SID; 96 bits without B-VID

Previous Tag Formats Considered

ECMP-only Tag with I-SID/Flow ID

1	2	3	4	5	6	7	8							16							24							32

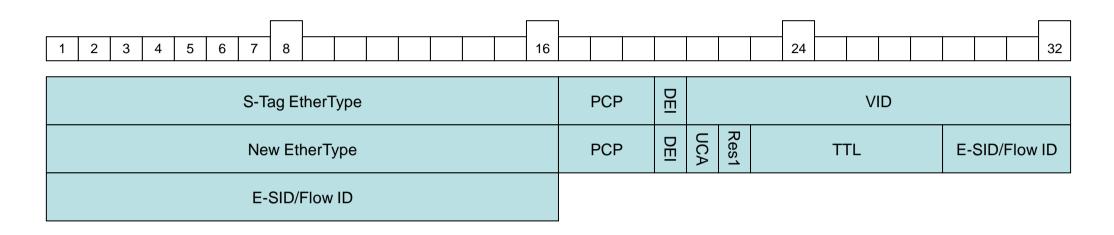| S-Tag EtherType		PCP	DEI	VID	
New EtherType		PCP	DEI	TTL	I-SID/Flow ID
I-SID/Flow ID					

Notes:
1) No subtype or format field to support extension or revision
2) Implicit Flow ID (Flow ID modulated over I-SID field)
   - Impacts egress processing efficiency
   - Introduces new failure mode
   - Hash mismatch can cause frame discard or mis-delivery
   - New CFM required?
   - Cannot mix hash algorithms in a single VLAN
3) 24 bit Flow ID (modulated with I-SID)
4) 4 bit TTL
5) Second new EthetType for OAM
6) No reserved bits
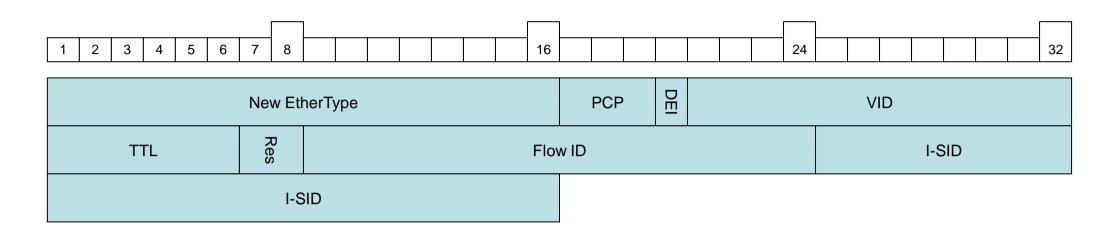7) I-SID remains 24 bits , first part of frame is B-Tag/S-Tag

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Replace I-Tag with New Tag (E-SID)

1	2	3	4	5	6	7	8								16							24							32

S-Tag EtherType	PCP	DEI			VID	
New EtherType	PCP	DEI	UCA	Res1	TTL	E-SID/Flow ID
E-SID/Flow ID						

Notes:
1) Standard B-Tag
2) New tag replacing I-Tag
3) I-SID replaced by 20 bit E-SID
4) Flow ID modulated over E-SID field
5) 6 bit TTL
6) Retains UCA to support OAM (are the semantics changed?)
7) 1 reserved bit
8) Uses two EtherTypes (one for B-VLAN and one for BSI/ECMP)
9) Concern that modulation requires hash calculation before forwarding lookup at egress (serializes otherwise parallel functions)

New Tag with Both VID and I-SID

1	2	3	4	5	6	7	8								16							24								32

New EtherType	PCP	DEI	VID
TTL	Res	Flow ID	I-SID
I-SID			

Notes:
1) Single tag does not require reading/checking a second EtherType (consistent with 802.1 practice)
2) Saves 2 octets in frame (does not require a second EtherType value)
3) First part of tag is identical to B-Tag/S-Tag
4) 24 bit I-SID
5) No separate service and backbone PCP/DEI (S-Tag can carry service values if needed)
6) Flow ID and I-SID independent (no field modulation)
7) 16 bit Flow ID
8) 6 bit TTL
9) 2 reserved bits (need to use one for OAM?)