Description of Explicit Topologies

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March 27, 2014

Notes

- This document is Version 02: http://www.ieee802.org/1/files/public/docs2014/ca-farkas-topology-description-0314-v02.pdf
- Changes compared to Version 01:
  - Updates in the *size* of the topology descriptors
    - 2 Bytes have been added for each Hop
      - Type field: 1 Byte
      - Length field: 1 Byte
  - Mixing strict and loose hops (pages 14-16)
    - As per the resolution of comment #55 on P802.1Qca D0.6, the option of mixing strict and loose hops in the same explicit tree *will be removed from the next draft (D0.7)*

Format *A*: Port ID Based

- This is the format of 802.1Qca D0.6
- Format A is based on listing Bridge Ports that are part of the topology, where a Bridge Port is identified by an IS-IS System ID, Circuit ID tuple
- The connectivity provided by a Bridge Port is included in the topology if the Port ID is included; therefore, each bridge or station connected to the same LAN is also included in the topology
- Format A only requires ordering for a loose hop of a p2p path that mixes loose and strict hops
  - Ordering is not required either in fully specified or in completely loose cases
  - A tree (mp2mp) is always either fully specified or completely loose
- Otherwise, Format A does not require any particular ordering of the hops, but ordering is allowed in case of p2p paths
- Tie-breaking for a link: use the numerically lower System ID

Format *B*: Order Based

- Format B is based on the ordered list of Nodal IDs for describing all kinds of topologies
- A chain (or ear) out of the topology is described by an ordered list
  - A p2p path is a single chain
  - The smallest chain is a single link
- Arbitrary order between chains
- Each node involved in the topology appears at least once in the descriptor
- The System ID is the Nodal ID for IS-IS

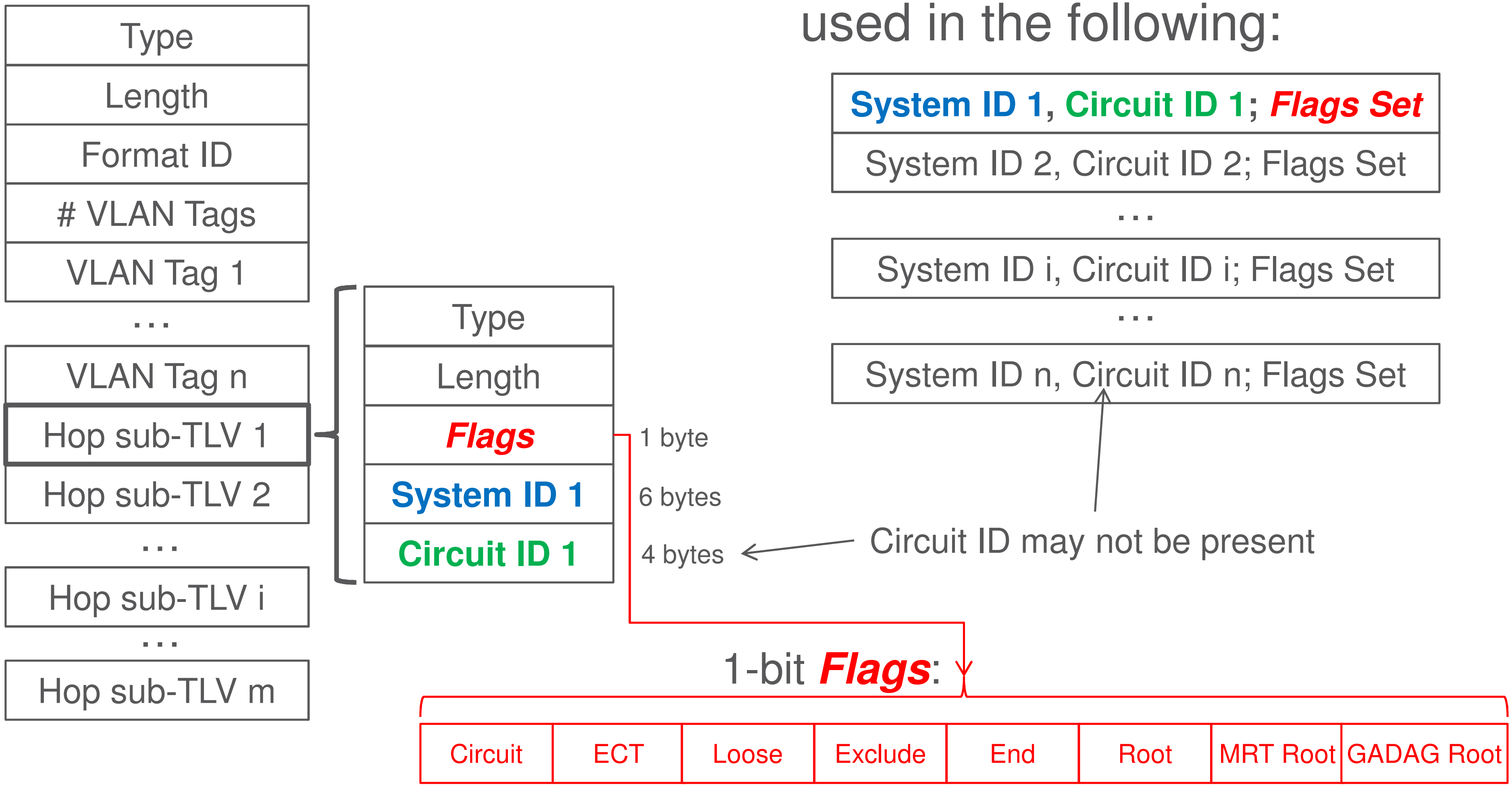
Parallel Links

- Port ID has to be also supported in case of Format B in order to be able to distinguish parallel links between a pair of bridges
- Therefore, the same TLV structure can be used for both formats

Descriptor

- 802.1Qca D0.6

- This ‘translated’ version is used in the following:



Type

Length

Format ID

# VLAN Tags

VLAN Tag 1

. . .

VLAN Tag n

Hop sub-TLV 1

Hop sub-TLV 2

. . .

Hop sub-TLV i

. . .

Hop sub-TLV m

Type

Length

Flags 1 byte

System ID 1 6 bytes

Circuit ID 1 4 bytes

Circuit ID may not be present

1-bit ***Flags***:

Circuit	ECT	Loose	Exclude	End	Root	MRT Root	GADAG Root

System ID 1, **Circuit ID 1**; ***Flags Set***

System ID 2, Circuit ID 2; Flags Set

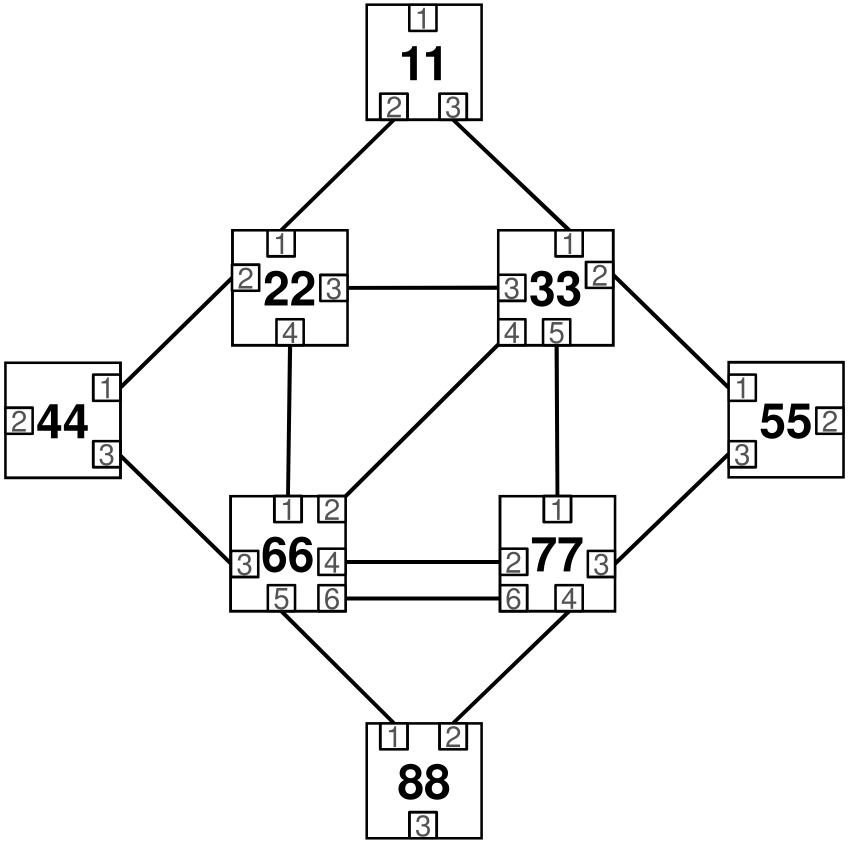
. . .

System ID i, Circuit ID i; Flags Set

. . .

System ID n, Circuit ID n; Flags Set

Example Network

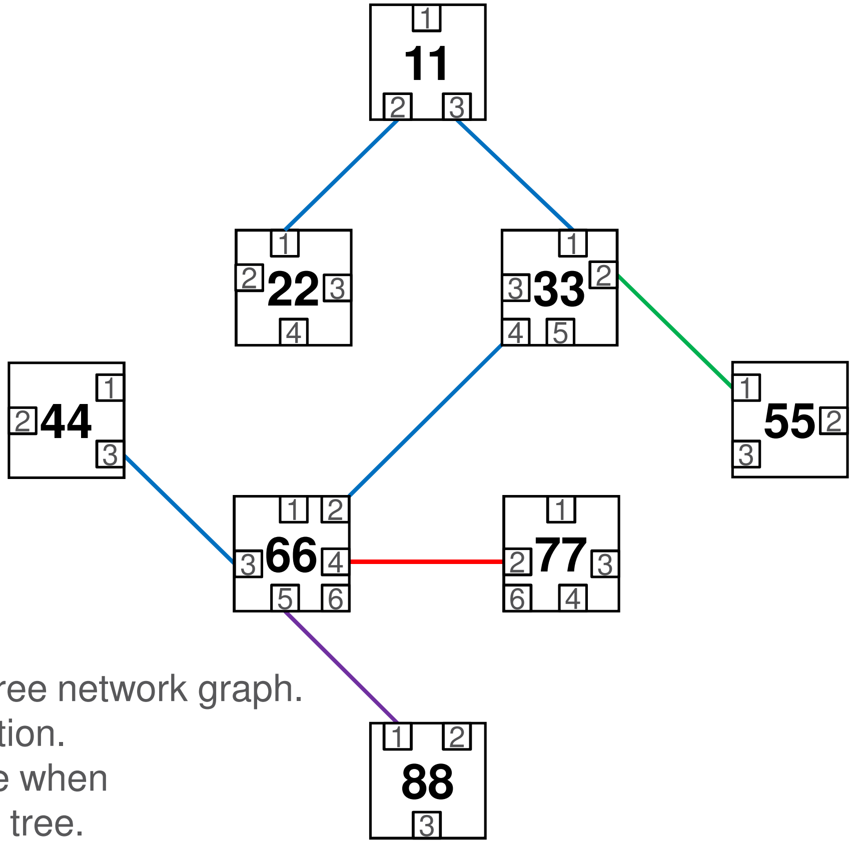


A Fully Specified Spanning Tree

Format A
arbitrary order

11, 2; Circuit, End
11, 3; Circuit, End
44, 3; Circuit, End
55, 1; Circuit, End
88, 1; Circuit, End
33, 4; Circuit
66, 4; Circuit

91 bytes



Format B
exact order
for each chain

22
11; End
33
66
44; End
33
55; End
66, 4; Circuit
77
66
88; End

103 bytes

Note that a tree is just a loop-free network graph.
Root only matters for computation.
Root does not matter any more when
just describing a fully specified tree.

Circuit ID has to be used for parallel links in every case

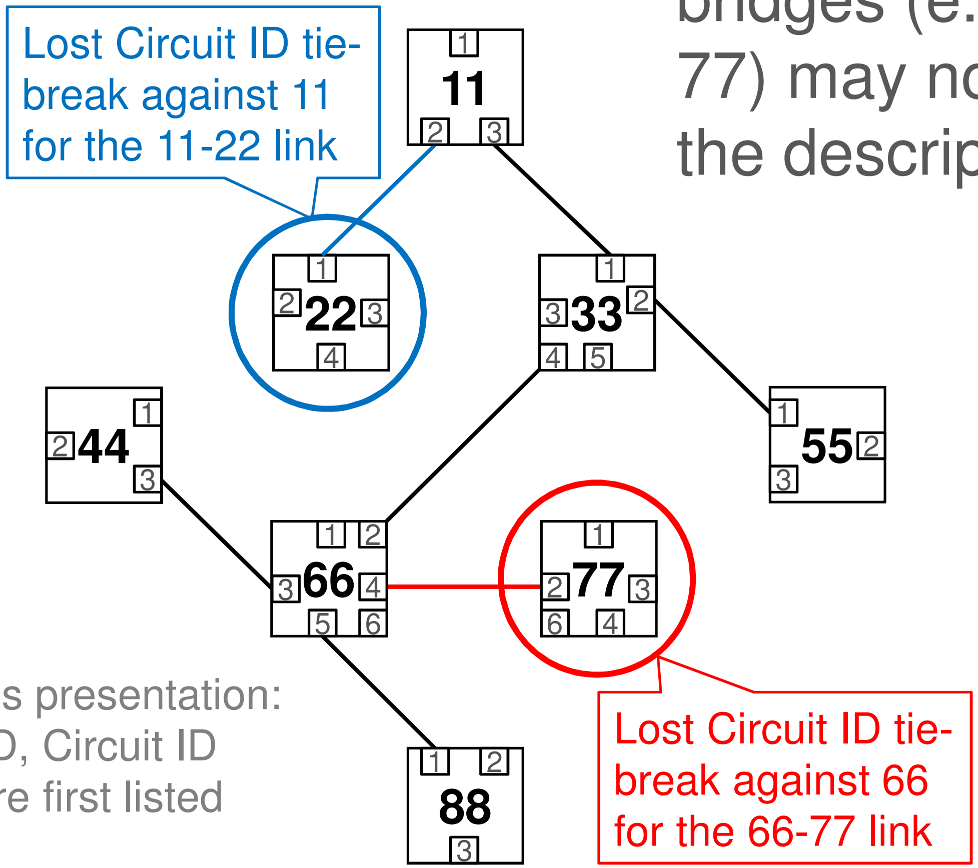
A Fully Specified Spanning Tree Format *A* Peculiarities

Format A

arbitrary order

11, 2; Circuit, End
11, 3; Circuit, End
44, 3; Circuit, End
55, 1; Circuit, End
88, 1; Circuit, End
33, 4; Circuit
66, 4; Circuit

91 bytes



Lost Circuit ID tie-break against 11 for the 11-22 link

Lost Circuit ID tie-break against 66 for the 66-77 link

- Tie-breaking looser bridges (e.g. 22 and 77) may not appear in the descriptor

The order applied in this presentation:
Ascending in System ID, Circuit ID
such that End Points are first listed

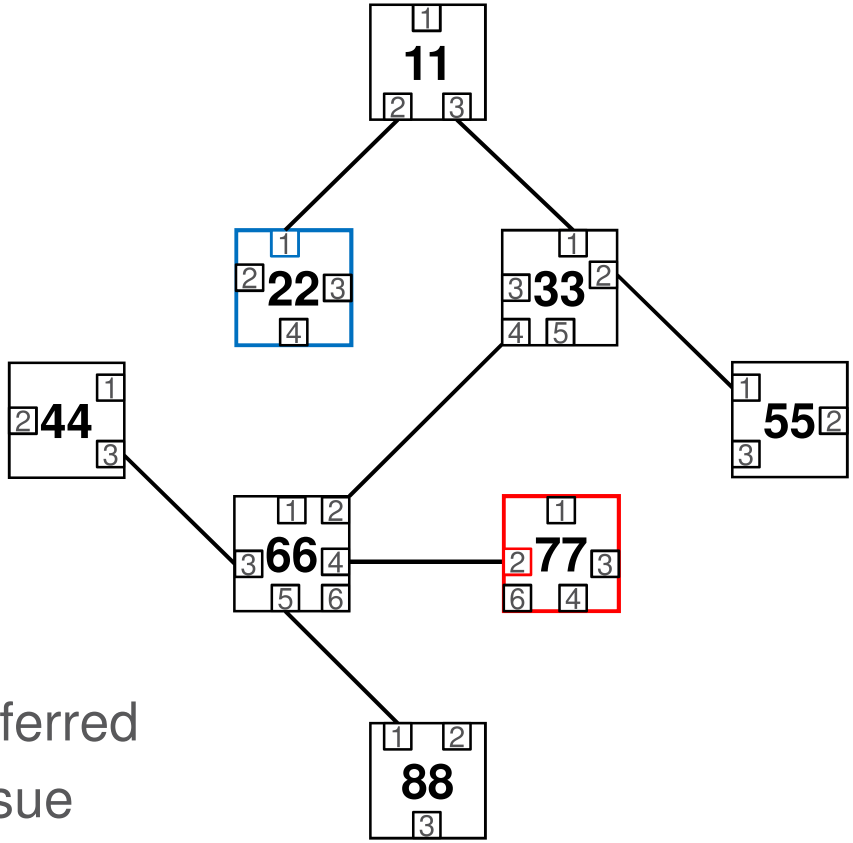
A Fully Specified Spanning Tree Format *A* Peculiarities – cont'd

Format A arbitrary order
11, 2; Circuit, End
11, 3; Circuit, End
44, 3; Circuit, End
55, 1; Circuit, End
88, 1; Circuit, End
33, 4; Circuit
66, 4; Circuit

91 bytes

Format A arbitrary order
11, 2; Circuit, End
11, 3; Circuit, End
44, 3; Circuit, End
55, 1; Circuit, End
88, 1; Circuit, End
22, 1; Circuit
33, 4; Circuit
66, 4; Circuit
77, 2; Circuit

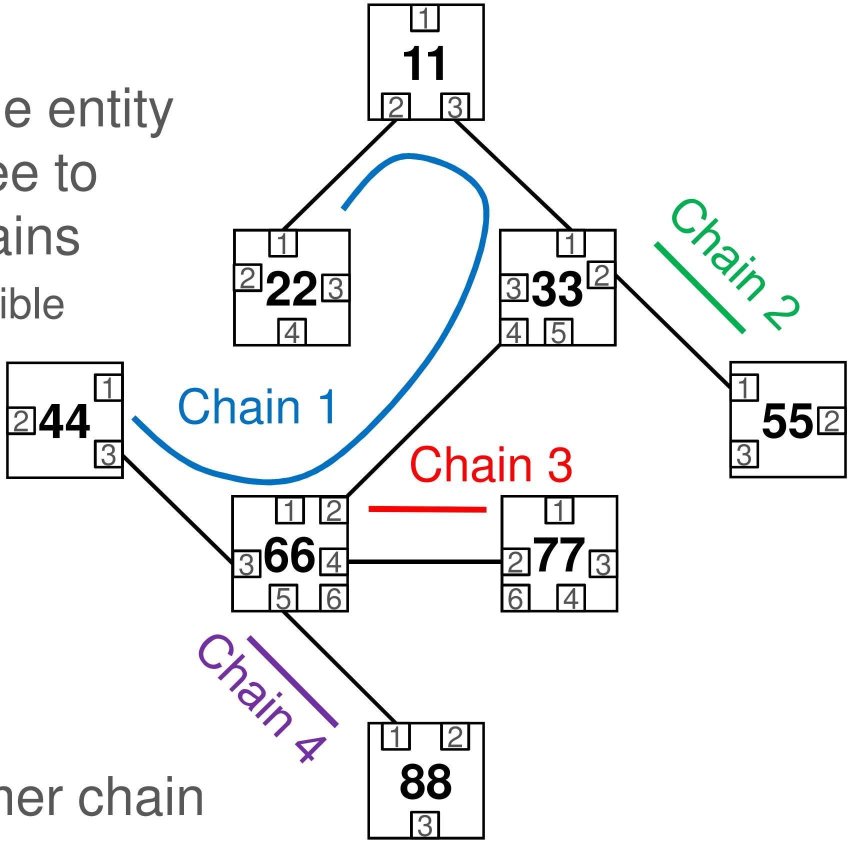
117 bytes



- Each bridge can be listed if that is preferred
- Redundant items do not cause any issue

A Fully Specified Spanning Tree Format *B* Peculiarities

- Exact order for each chain
- Arbitrary order between chains
- It is the task of the entity describing the tree to figure out the chains
  - e.g. longest possible chains for least bytes descriptor
- Beginning of new chain is indicated by a System ID that already appears in a former chain



Format B

22	Chain 1
11; End	
33	
66	
44; End	
33	Chain 2
55; End	
66, 4; Circuit	Chain 3
77	
66	Chain 4
88; End	

103 bytes

A Completely Loose Tree

Note that order does not matter
in either format

Format A

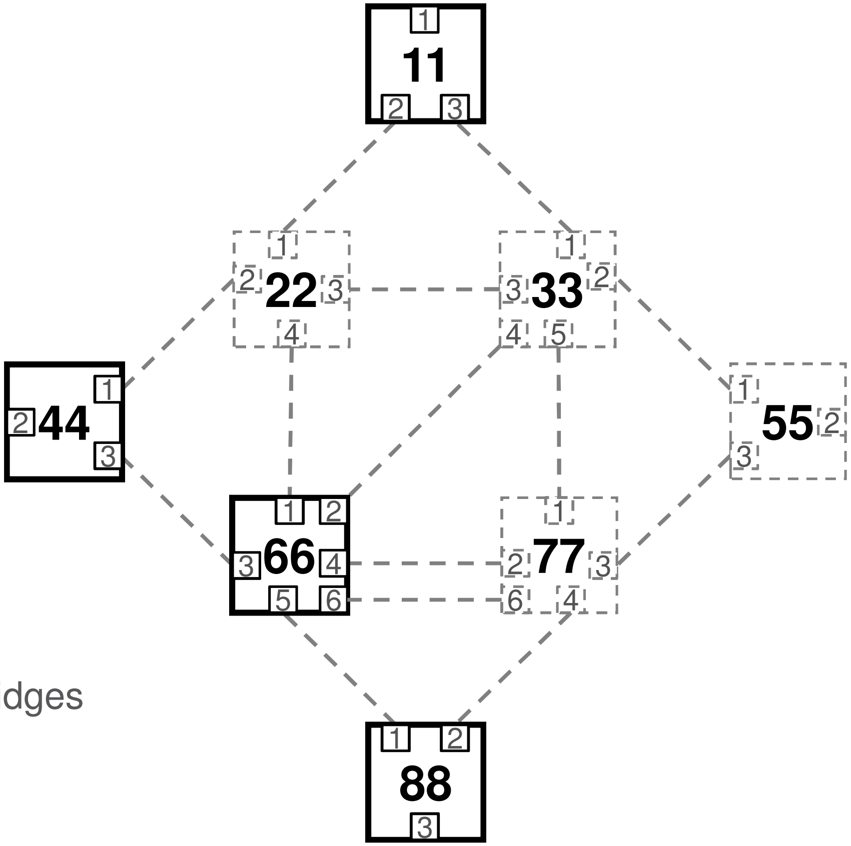
11; Loose, End
44; Loose, End
88; Loose, End
66; Loose, Root

36 bytes

Format B

11; Loose, End
44; Loose, End
66; Loose, Root
88; Loose, End

36 bytes



Root matters because the bridges
have to compute.

A Fully Specified P2P Path

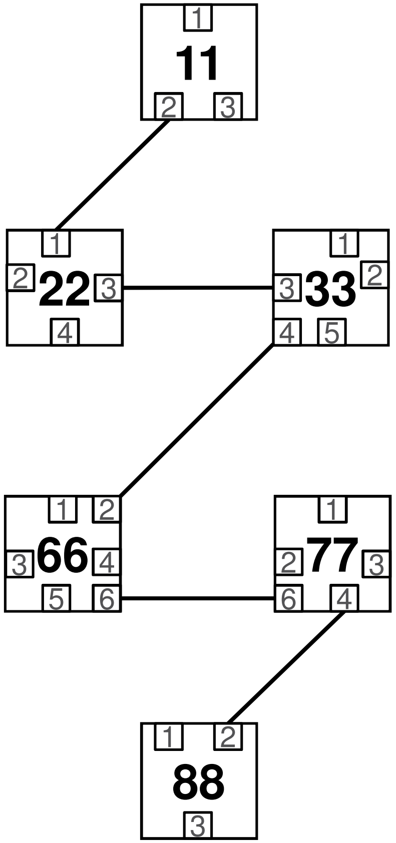
Format A in arbitrary order
11, 2; Circuit, End
88, 2; Circuit, End
22, 3; Circuit
33, 4; Circuit
66, 6; Circuit

65 bytes

77 lost Circuit ID tie-break against 66 for the 66-77 link

Format A in exact order
11; End
22
33
66, 6; Circuit
77
88; End

58 bytes



Format B exact order
11; End
22
33
66, 6; Circuit
77
88; End

58 bytes

Format A (802.1Qca D0.6) allows
exact order of System IDs for p2p paths:
Exact order has to be followed if Circuit ID is not present

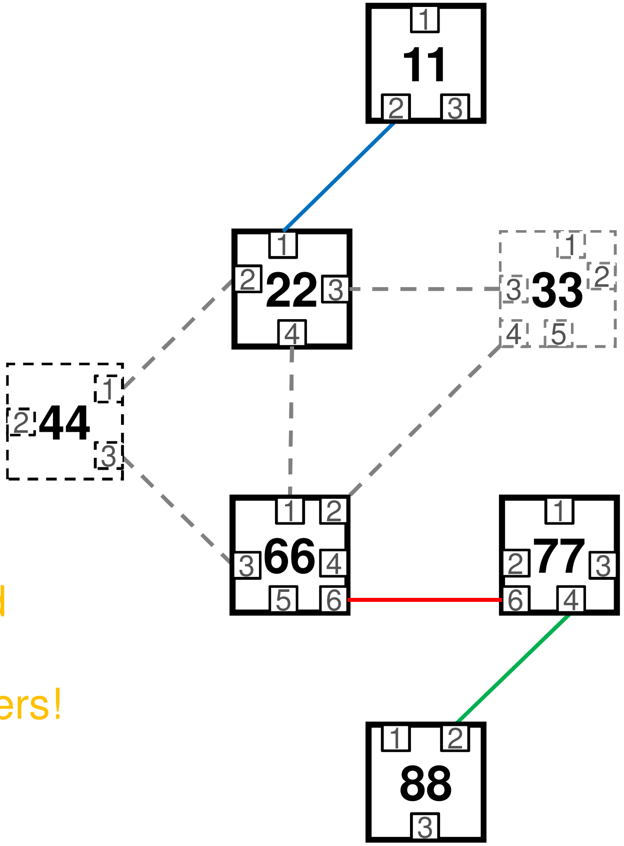
A Mixed P2P Path
(Mixed Strict and Loose Hops)
Will be removed from D0.7

Format A

exact order for loose hop
arbitrary order otherwise

11, 2; Circuit, End
66, 6; Circuit, Loose
88, 3; Circuit, End

39 bytes



Format B

exact order

11; End
22
66, 6; Circuit, Loose
77
88; End

49 bytes

a loose hop is related
to the previous hop;
therefore, order matters!

Circuit ID has to be used for parallel links in every case

A Mixed P2P Path
Format *A* Peculiarities
Will be removed from D0.7

Format A

exact order for loose hop
arbitrary order otherwise

11, 2; Circuit, End
66, 6; Circuit, Loose
88, 3; Circuit, End

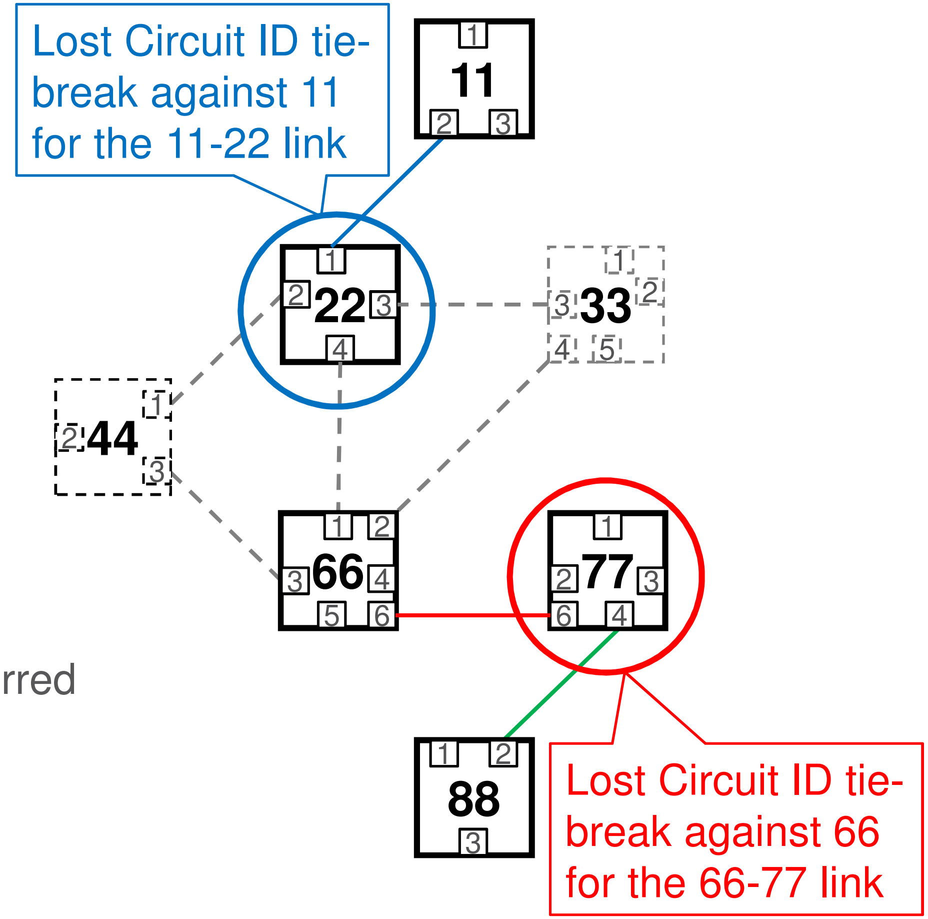
39 bytes

a loose hop is related to the previous hop; therefore, order matters!

11, 2; Circuit, End
88, 3; Circuit, End
22, 1; Circuit
66, 6; Circuit, Loose
77, 6; Circuit

65 bytes

Each bridge can be listed if that is preferred


Lost Circuit ID tie-break against 11 for the 11-22 link

Lost Circuit ID tie-break against 66 for the 66-77 link

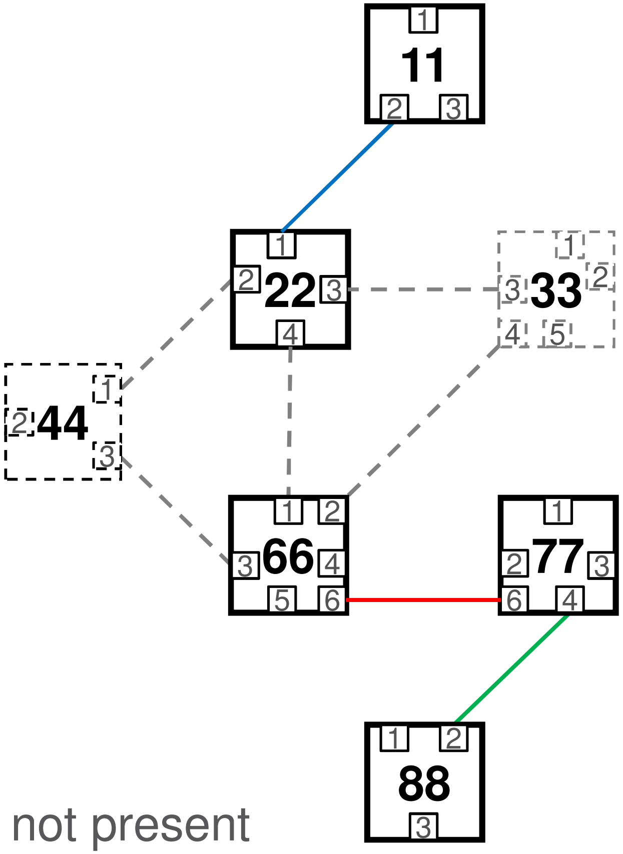
A Mixed P2P Path
Format *A* Peculiarities – cont’d
Will be removed from D0.7

Format A

exact order

11; End
22
66, 6; Circuit, Loose
77
88; End

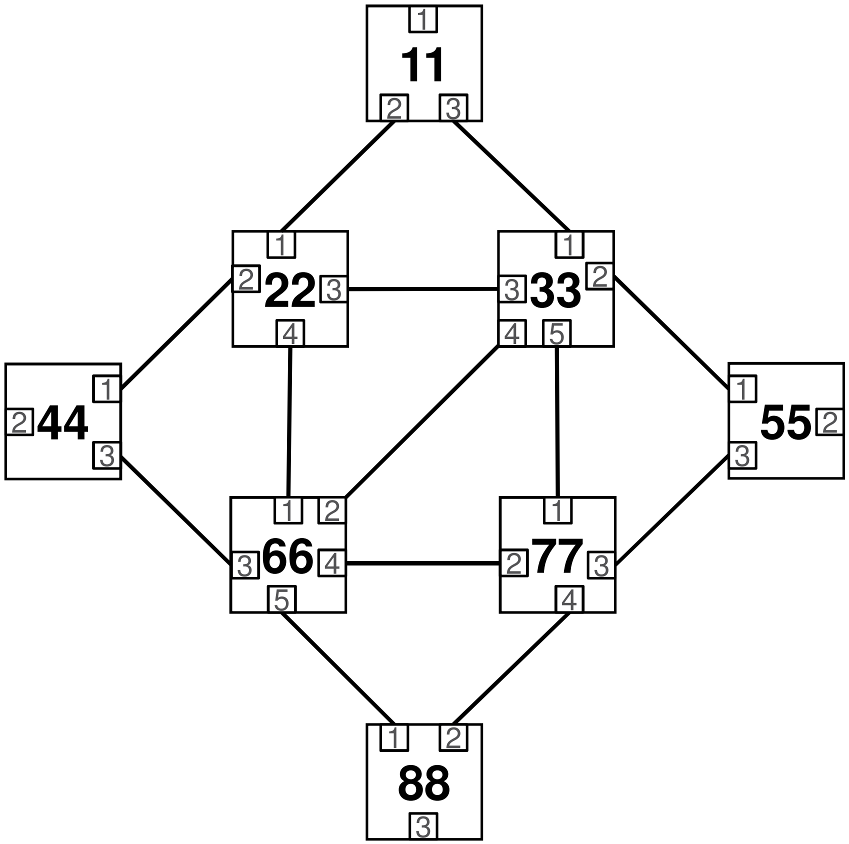
49 bytes



Format A (802.1Qca D0.6) allows
exact order of System IDs for p2p paths:
Exact order has to be followed if Circuit ID is not present

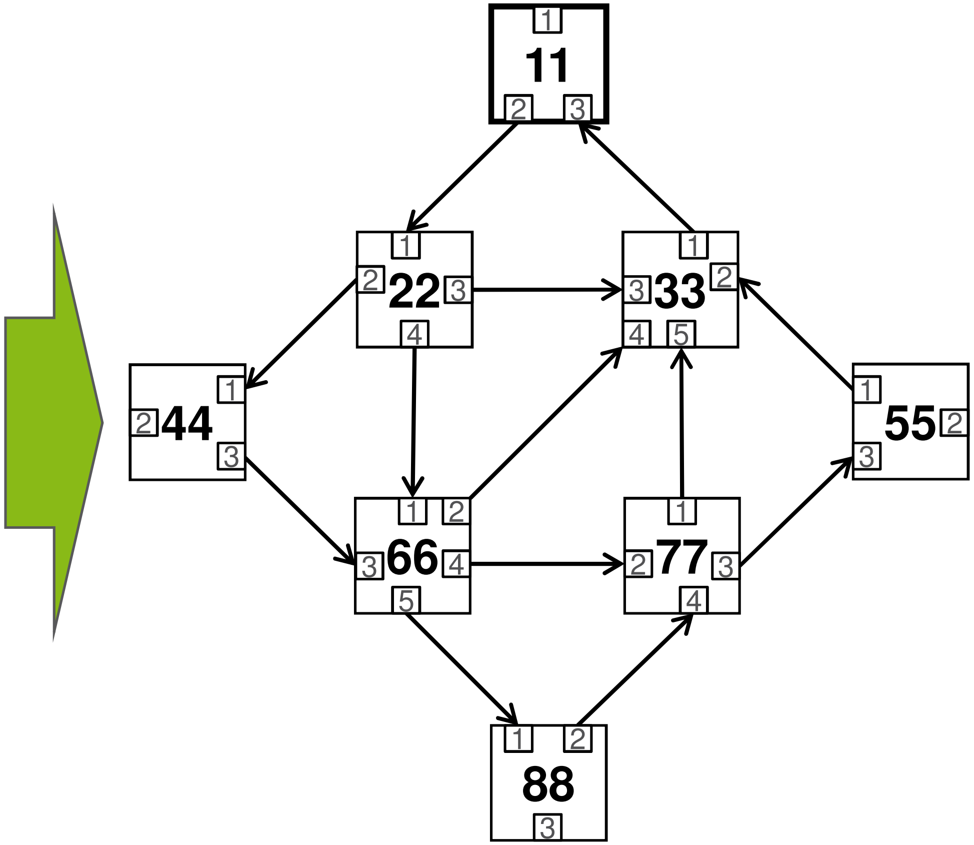
A GADAG Example

Network Topology



GADAG

GADAG Root = 11

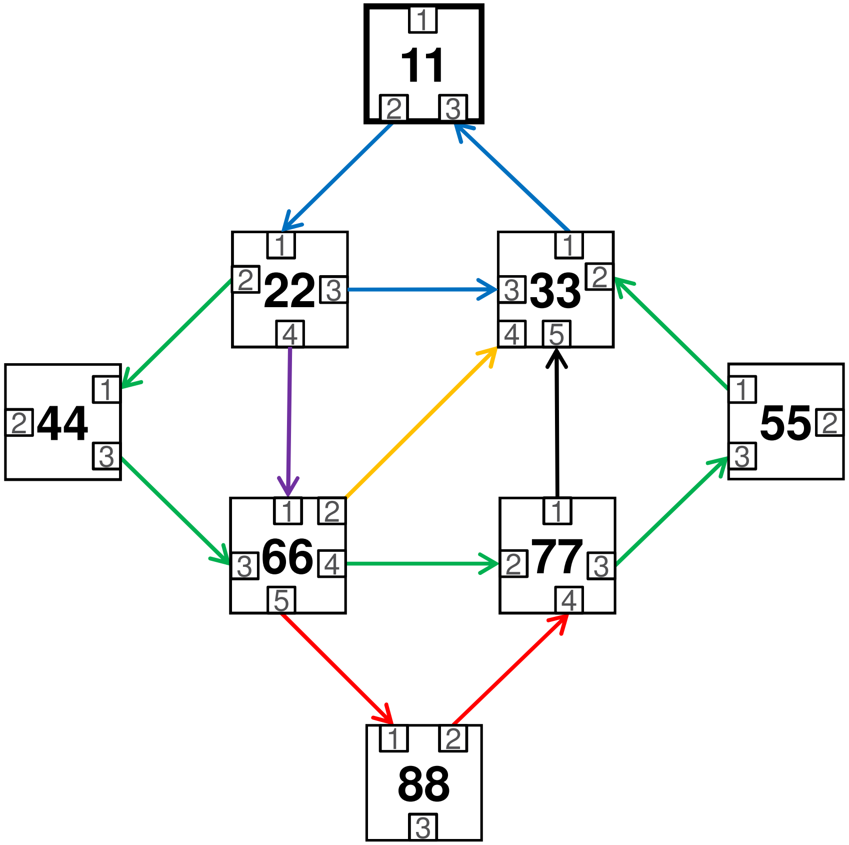


GADAG Description

Format A
arbitrary order

11, 2; Circuit, GADAG Root
22, 2; Circuit
22, 3; Circuit
22, 4; Circuit
33, 1; Circuit
44, 3; Circuit
55, 1; Circuit
66, 2; Circuit
66, 4; Circuit
66, 5; Circuit
77, 1; Circuit
77, 3; Circuit
88, 2; Circuit

169 bytes



Format B
specific order

11; GADAG Root
22
33
11; GADAG Root
22
44
66
77
55
33
66
88
77
22
66
66
33
77
33

171 bytes

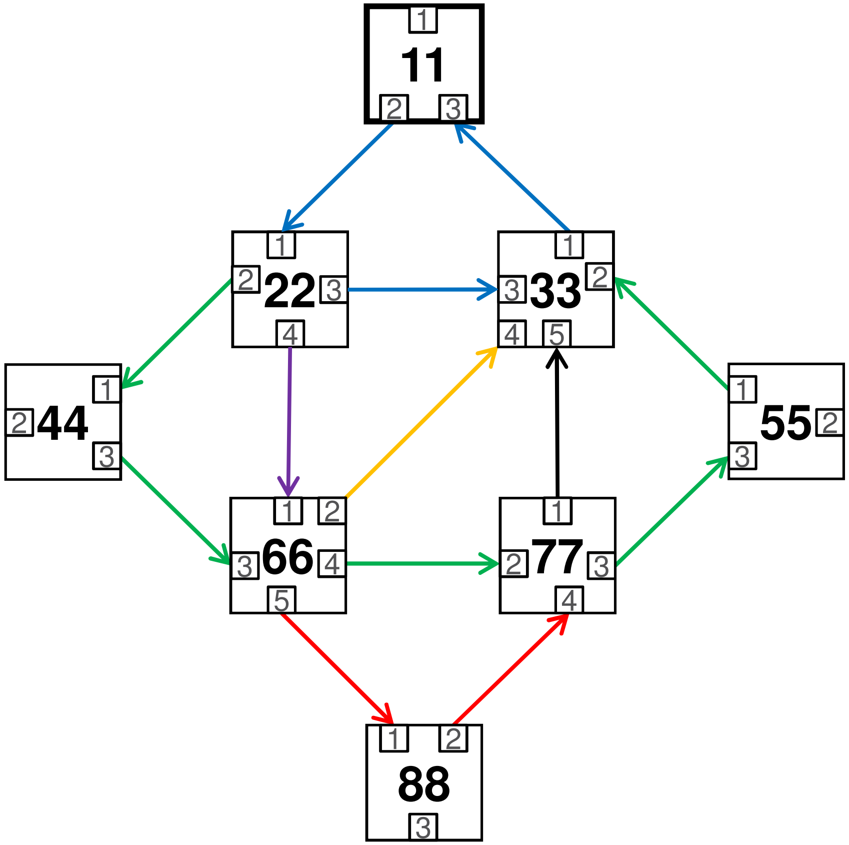
GADAG Description Format *A* Peculiarities

Format A
11, 2; Circuit, GADAG Root
22, 2; Circuit
22, 3; Circuit
22, 4; Circuit
33, 1; Circuit
44, 3; Circuit
55, 1; Circuit
66, 2; Circuit
66, 4; Circuit
66, 5; Circuit
77, 1; Circuit
77, 3; Circuit
88, 2; Circuit

Bridge, Port order

Format A
11, 2; Circuit, GADAG Root
22, 3; Circuit
33, 1; Circuit
22, 2; Circuit
44, 3; Circuit
66, 4; Circuit
77, 3; Circuit
55, 1; Circuit
66, 5; Circuit
88, 2; Circuit
22, 4; Circuit
66, 2; Circuit
77, 1; Circuit

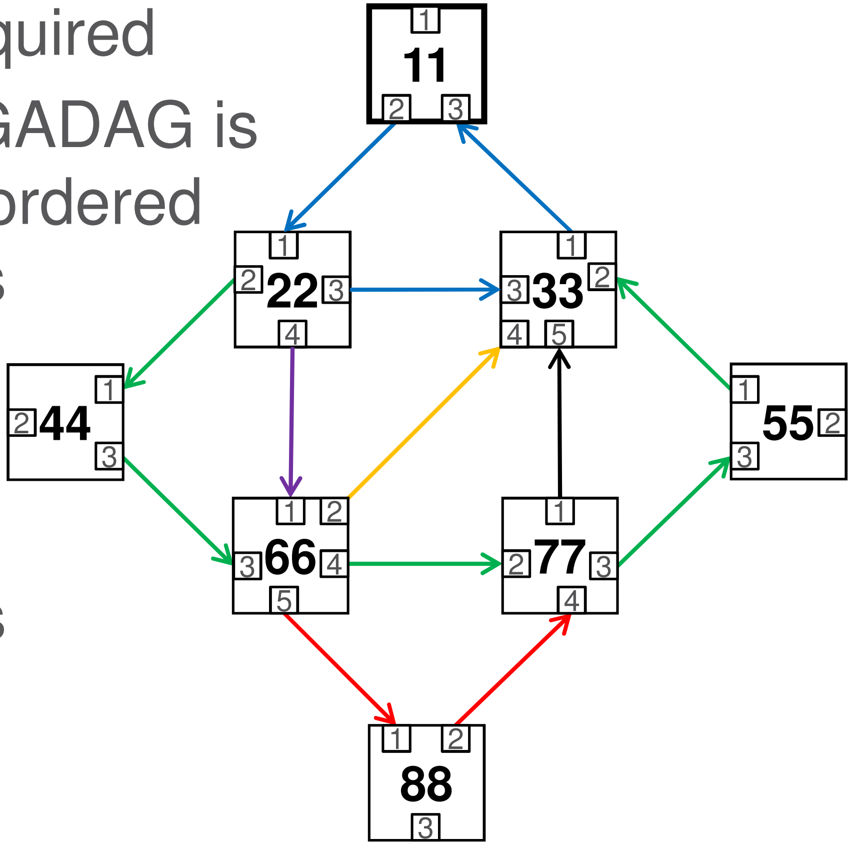
ear order



- Each edge of the graph is specified by the outbound port
- Arbitrary order can be applied; therefore,
- The graph can be described bridge by bridge and port by port

GADAG Description
Format *B* Peculiarities

- Specific order required
- Each ear of the GADAG is described by an ordered list of System IDs
- Arbitrary order among ears (e.g. comp order)
- A new ear begins and ends with a System ID that is already in the list



Format B
specific order

11; GADAG Root	Ear 1
22	
33	
11; GADAG Root	
22	Ear 2
44	
66	
77	
55	
33	
66	Ear 3
88	
77	
22	Ear 4
66	
66	Ear 5
33	
77	Ear 6
33	

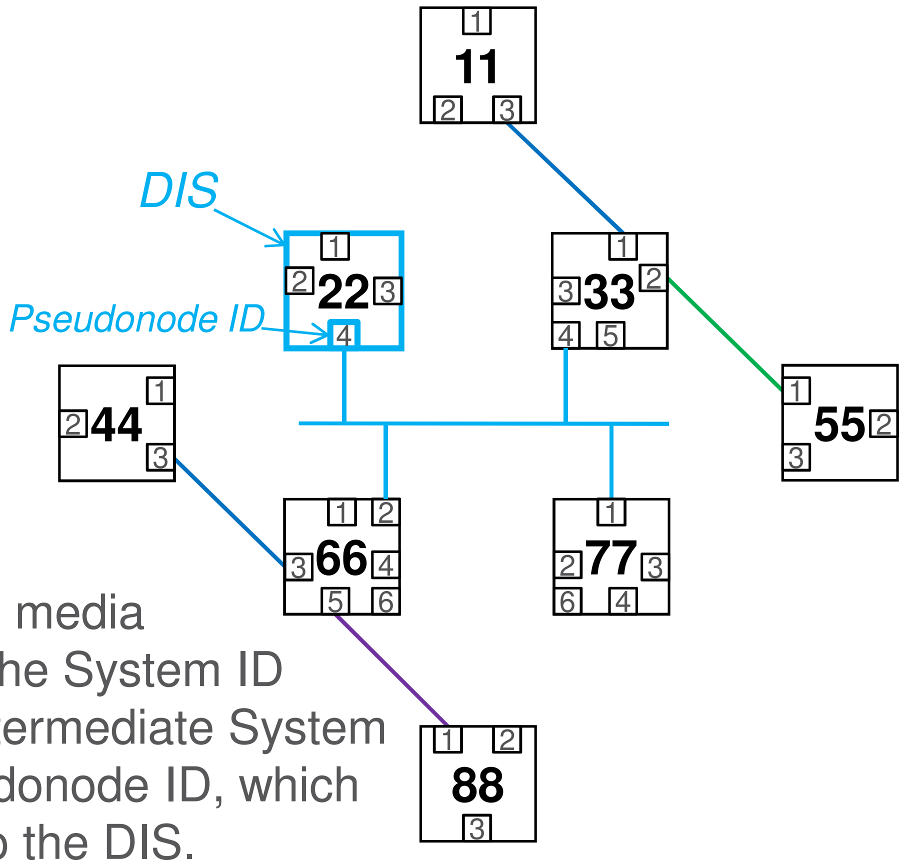
171 bytes

Shared Media LAN Example

Format A
arbitrary order

11, 3; Circuit, End
44, 3; Circuit, End
55, 1; Circuit, End
88, 1; Circuit, End
22, 4; Circuit

65 bytes



Format B
exact order
for each chain

11; End
33
22, 4; Circuit
66
44; End
33
55; End
22, 4; Circuit
77
66
88; End

107 bytes

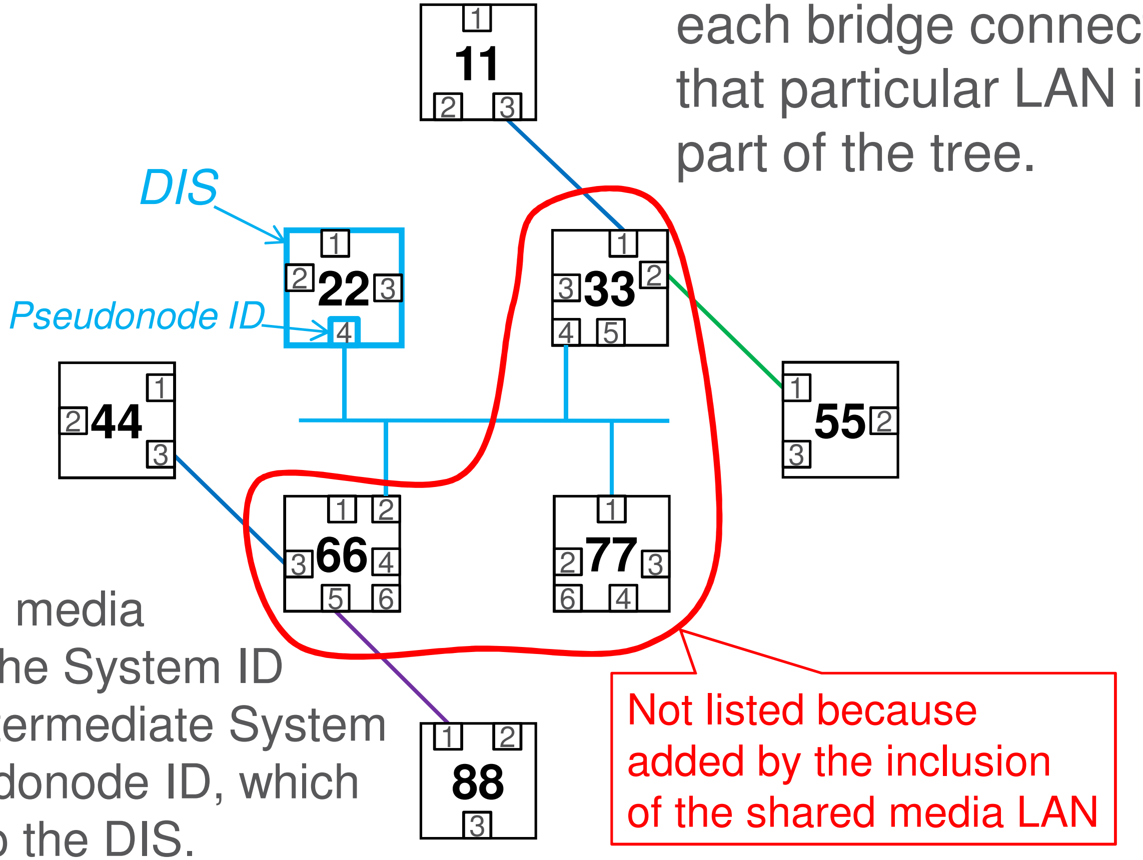
ISO 10589: A shared media LAN is identified by the System ID of the Designated Intermediate System (DIS) and by a Pseudonode ID, which is a Circuit ID local to the DIS.

Shared Media LAN Example Format *A* Peculiarities

Format A arbitrary order
11, 3; Circuit, End
44, 3; Circuit, End
55, 1; Circuit, End
88, 1; Circuit, End
22, 4; Circuit

65 bytes

- If a shared media LAN is part of an explicit tree, then each bridge connected by that particular LAN is also part of the tree.

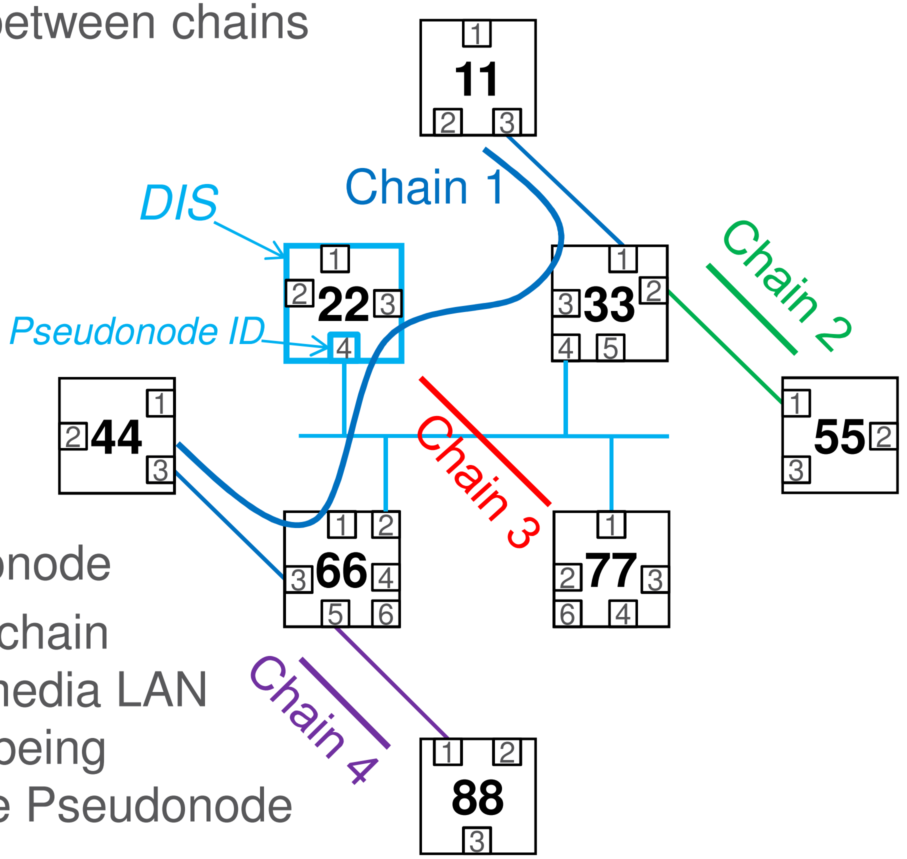


Not listed because added by the inclusion of the shared media LAN

ISO 10589: A shared media LAN is identified by the System ID of the Designated Intermediate System (DIS) and by a Pseudonode ID, which is a Circuit ID local to the DIS.

Shared Media LAN Example Format ***B*** Peculiarities

- Exact order for each chain
- Arbitrary order between chains
- Beginning of new chain is indicated by a System ID that already appears in a former chain
- Circuit ID to be used for Pseudonode
- Taking part in a chain via the shared media LAN is described by being connected to the Pseudonode



Format B
exact order
for each chain

11; End	Chain 1
33	
22, 4; Circuit	
66	
44; End	
33	Chain 2
55; End	
22, 4; Circuit	Chain 3
77	
66	Chain 4
88; End	

107 bytes

Note

- 802.1Qca is not about p2p paths
- Mixing strict and loose hops in an explicit tree makes it too complicated
- Mixing strict and loose hops in a p2p path may be not that useful
- Order is only mandatory for a loose hop, because it is related to the preceding hop
- Ordering is unnecessary if it is not allowed to mix strict and loose hops

Programming

- ***Format A***
- Easy
- PCE
  - e.g. go through the topology sequentially per bridge per port
- Bridge
  - Just include the hops to the topology

- ***Format B***
- More complex
- PCE
  - Longest possible chains to be find
  - Encode the chain as ordered list
- Bridge
  - It has to be detected when a chain begins and ends
  - Worst case: each link is an individual chain

Summary

- The original intention determines the pros and cons
  - Format A: describe a generic graph, network topology
  - Format B: describe a p2p path

- ***Format A***
- Easier to program
- Shared media LAN
  - Simple, in-line with IS-IS
- Size
  - Can be 2 bytes smaller per hop

- ***Format B***
- Easier to read by human
- Shared media LAN
  - Messy
- Size
  - 2 bytes larger in worst case (single hop chain)

- Same TLV structure can be used for the two formats