Shortest Path Tree ID allocation for IEEE 802.1aq

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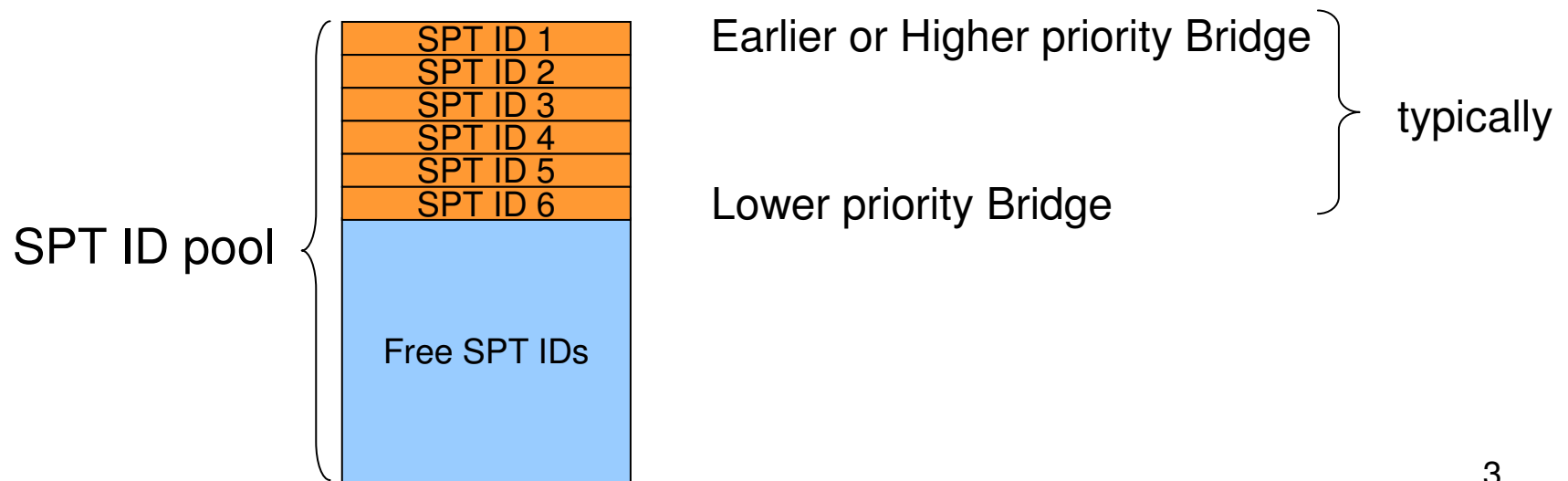
Mick Seaman

Basic idea

- Distributed deterministic allocation mechanism based on the IS-IS topology database
- The allocation mechanism takes values from the pool of SPT IDs
- The mechanism is the same both for SPVID and Nickname
  - Both are SPT IDs but different size
  - SPVID: 12 bits
  - Nickname: 20 bits
- Requirements
  - Consistent allocation
  - Conflict resolution
  - Support configuration

Basic operation

- Allocations are made based on the IS-IS topology individually by each bridge itself
- SPT IDs are taken from a pool sequentially
    - A newcomer simply takes the first free SPT ID (or SPT IDs)
- SPT IDs basically assigned to bridges ties based on Bridge Priority

SPT ID 1	Earlier or Higher priority Bridge
SPT ID 2	
SPT ID 3	
SPT ID 4	
SPT ID 5	
SPT ID 6	Lower priority Bridge

typically

SPT ID pool

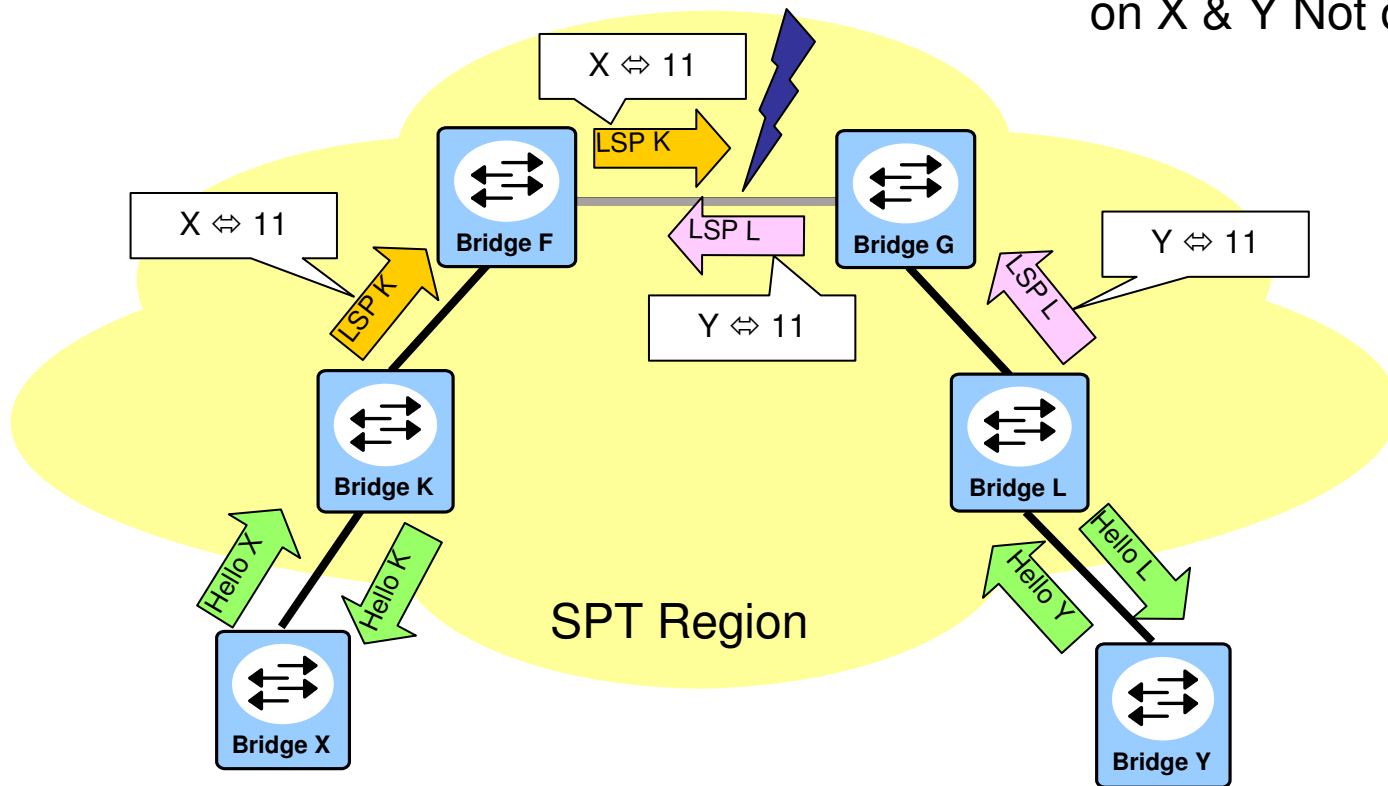Free SPT IDs

Conflict resolution

- Priority order for conflict resolution
  - Configured allocation
  - Allocation time (existing allocation is not kicked out by newcomers)
  - Bridge Priority
  - If Two or more Bridges have same configuration value Bridge Priority determines which bridge will be disabled as far as this VLAN is considered
- If allocation fails, then the Base VID is assigned to the bridge, which thus uses the IST in the SPT Region
  - Either conflicting configurations or running out of IDs
- Conflicts are resolved automatically at each bridge individually as LSPs propagated through the network
- Tree Agreement Protocol (TAP) ensures that neighbor bridges stay loop free
  - Neighbors only activate changes if their digest matches
  - The digest is made on the LSPs

Bridges attached almost the same time
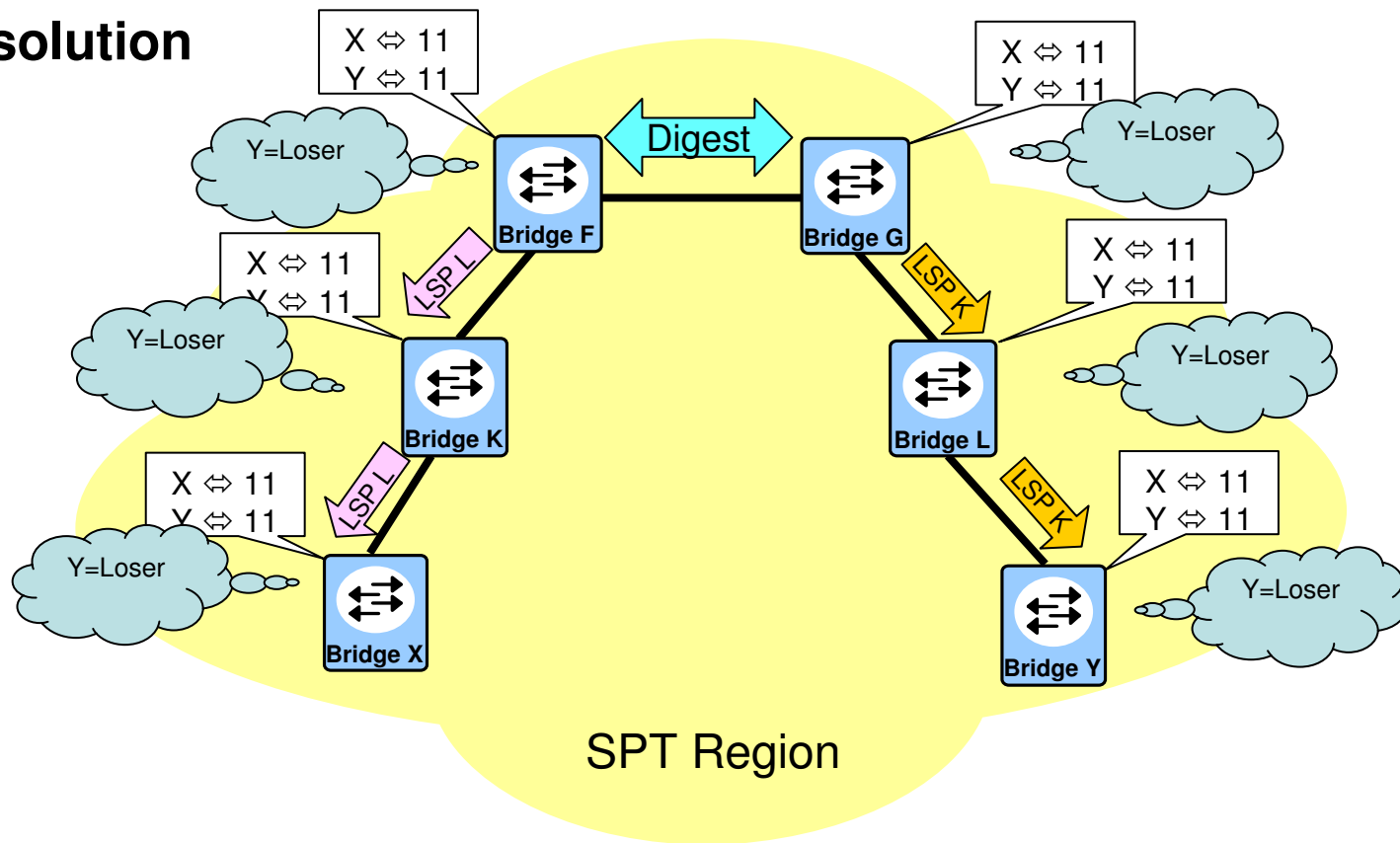
Allocation Conflict

Conflict
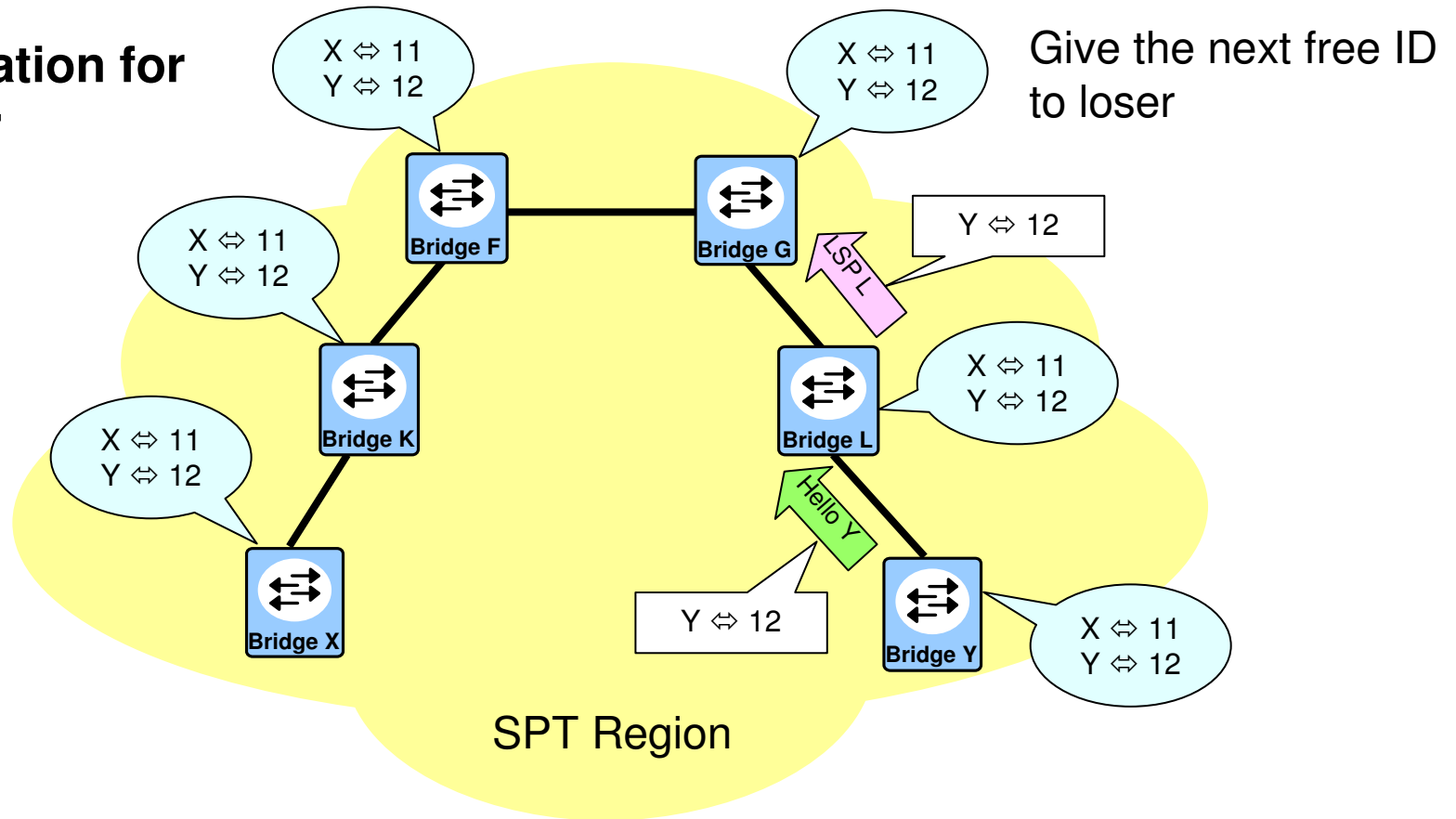
Resolution is based only on X & Y Not on F or G

X ⇔ 11

LSP K

Bridge F

LSP L

Bridge G

X ⇔ 11

LSP K

Y ⇔ 11

Y ⇔ 11

LSP L

Bridge K

Bridge L

Hello X

Hello K

Hello Y

Hello L

SPT Region

Bridge X

Bridge Y

Bridges attached almost the same time:

Resolution

| X ⇔ 11 | |
| Y ⇔ 11 | |

Digest

Y=Loser

Bridge F

LSP L

X ⇔ 11
Y ⇔ 11

Y=Loser

Bridge K

LSP L

X ⇔ 11
Y ⇔ 11

Y=Loser

Bridge X

X ⇔ 11
Y ⇔ 11

Y=Loser

Bridge G

LSP K

X ⇔ 11
Y ⇔ 11

Y=Loser

Bridge L

LSP K

X ⇔ 11
Y ⇔ 11

Y=Loser

Bridge Y

SPT Region

Bridges attached almost the same time:

Allocation for Loser

Give the next free ID to loser

X ⇔ 11
Y ⇔ 12

X ⇔ 11
Y ⇔ 12

X ⇔ 11
Y ⇔ 12

X ⇔ 11
Y ⇔ 12

X ⇔ 11
Y ⇔ 12

X ⇔ 11
Y ⇔ 12

Y ⇔ 12

Y ⇔ 12

LSP L

Hello Y

Bridge F

Bridge G

Bridge K

Bridge L

Bridge X

Bridge Y

SPT Region

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Two regions attached

SPT Region 1
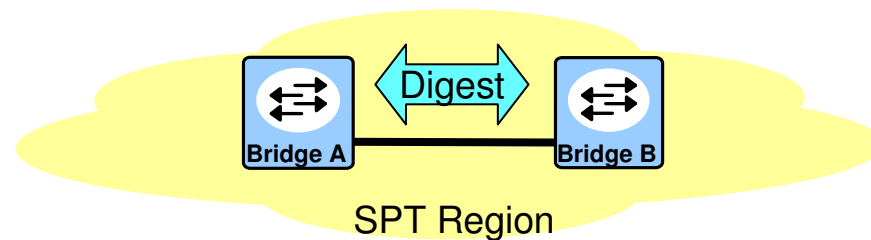
SPT Region 2
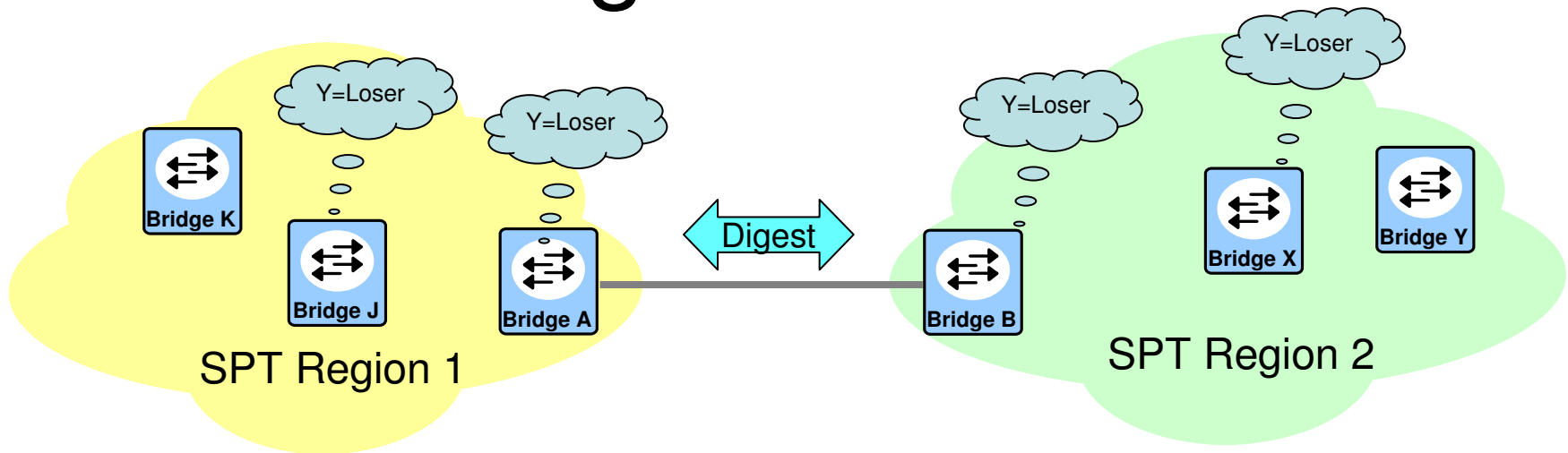
- Multiple conflicts
- TAP handshake blocks until digest matches
- As soon as everybody has all the LSPs they make the very same allocations thus neighbor digest matches

Further details

- SPT ID allocation ages with LSP ageing

- Reconnected bridge gets the same ID if it was not taken while the bridge was away

- Holes in the SPT ID pool are only filled in when the sequential space has been exhausted.

SPT Allocation Table

- Bridges don't need an allocation table but they may maintain the allocations if desired for operations

SPB, SPBB Format a

SPT ID	Base VID	Bridge ID	Configured
$SPT\ ID_1$	$Base\ VID_1$	$Bridge\ ID_1$	1
$SPT\ ID_2$	$Base\ VID_1$	$Bridge\ ID_2$	1
$SPT\ ID_3$	$Base\ VID_1$	$Bridge\ ID_3$	1
$SPT\ ID_4$	$Base\ VID_1$	$Bridge\ ID_4$	1
$SPT\ ID_5$	$Base\ VID_2$	$Bridge\ ID_1$	0
$SPT\ ID_6$	$Base\ VID_2$	$Bridge\ ID_2$	0
$SPT\ ID_7$	$Base\ VID_2$	$Bridge\ ID_3$	0
$SPT\ ID_8$	$Base\ VID_2$	$Bridge\ ID_4$	0
…	…	…	

SPBB Format b

SPT ID	Base VID	Bridge ID	Configured
$Nickname_1$	all	$Bridge\ ID_1$	1
$Nickname_2$	all	$Bridge\ ID_2$	0
$Nickname_3$	all	$Bridge\ ID_3$	0
$Nickname_4$	all	$Bridge\ ID_4$	1
…	…	…	