Dynamic Virtual Links

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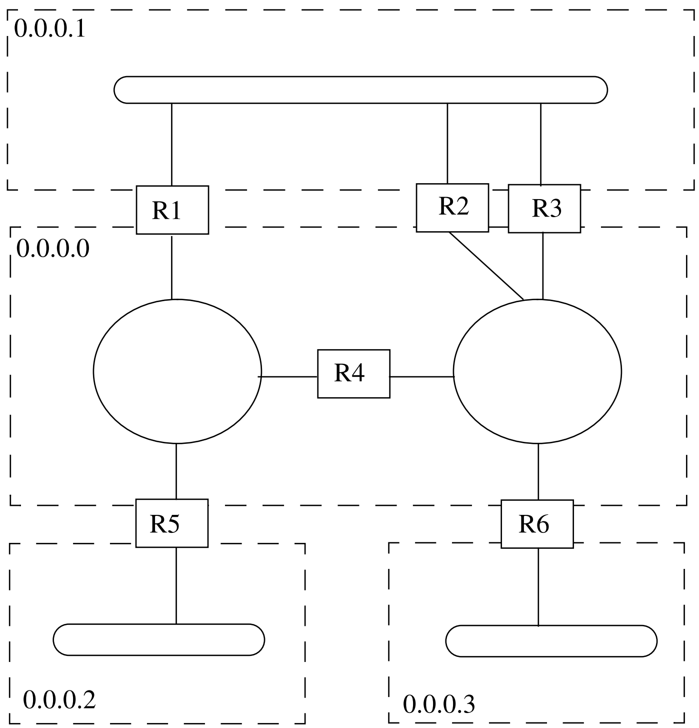
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R1
R2
R3
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Why

Inter-area routing does not work if the backbone area is partitioned

OSPF does not deal with area partition

Virtual Links can provide or enhance backbone connectivity

Redundant static VLs ensure backbone connectivity, but they incur overhead

How

An ABR can detect backbone partition by checking if it can reach other ABRs in the same transit area via backbone area

If not, DVLs are created to fix the partition

If it can reach other ABRs via backbone without using an existing DVL, the DVL is deleted

Spanning Tree

Only least number of DVLs, which form a spanning tree, are created/kept

In one area - DVLs among disjoint groups of ABRs

In multiple areas - Using tie-breakers

In all cases - DVLs are deleted when not needed

Spanning tree in one area

ABRs are split into disjoint groups

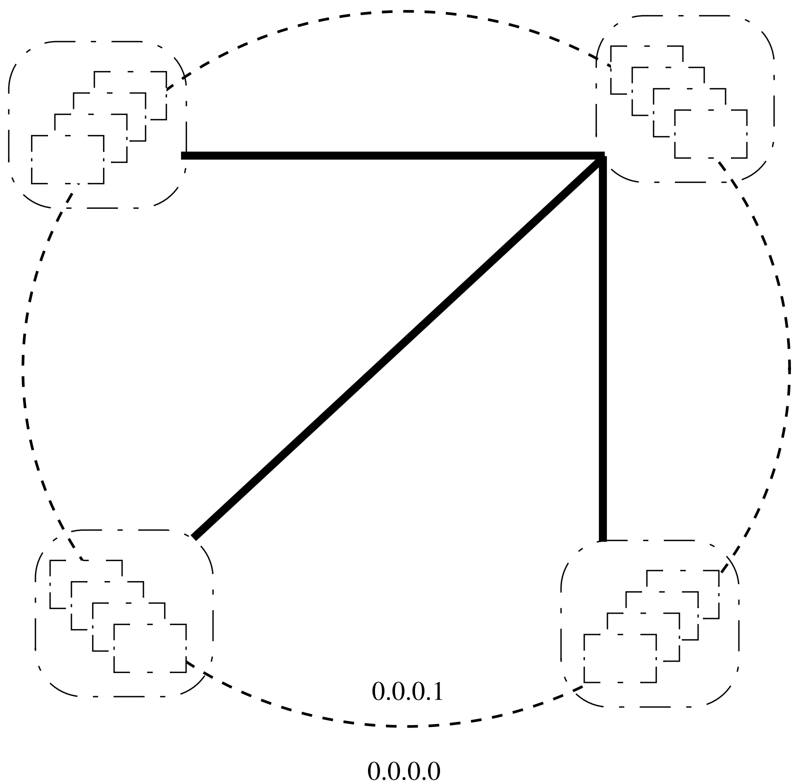
The ABR with the highest ID becomes the center

The ABR with the highest ID in a non-center group, called a leaf, creates a DVL to the center

When a center receives the first Hello packet for a DVL, it creates its end of the DVL

A leaf may initiate deleting a DVL, but the center does not.

A point-to-multipoint DVL can be used on the center to replace a bunch of DVLs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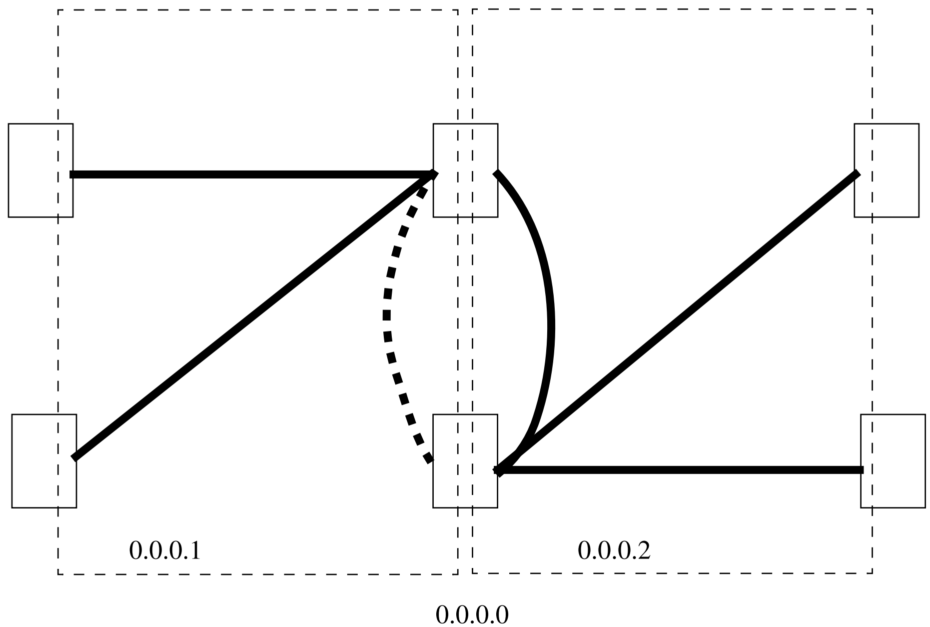
Spanning tree in the entire domain



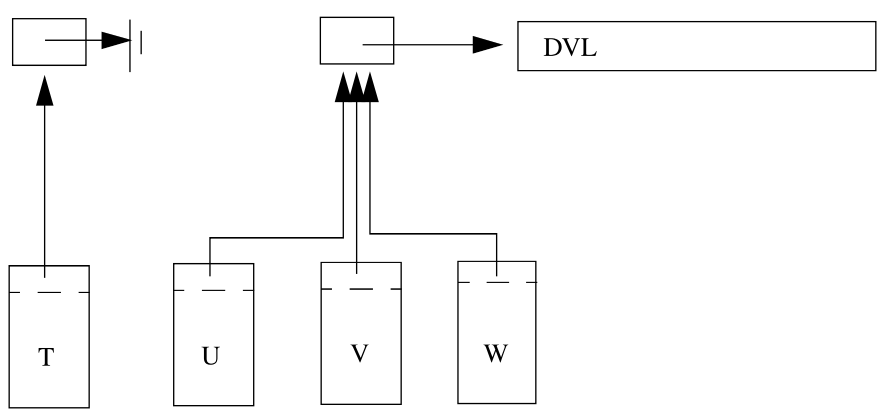
If an ABR can not reach the center of one transit area via backbone, but they are reachable in another transit area with higher ID, a DVL is not created in this area but in the area with higher ID.

Is a DVL needed to reach a center?

Associate the used DVL with vertices when calculating a tree

Clean the association when a vertex can be reached via a new path without using the DVL

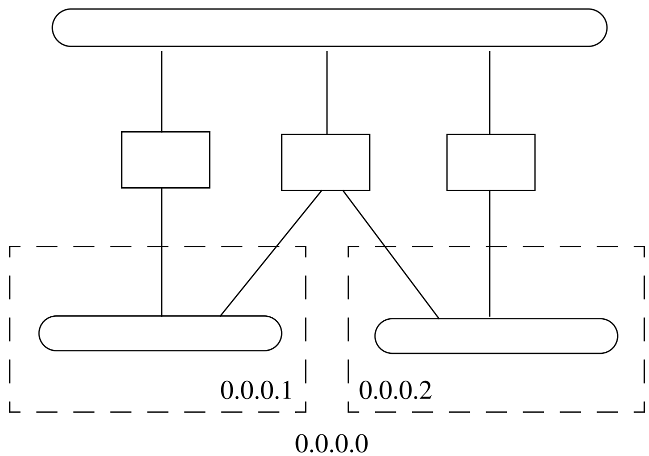
Pointer operation makes the cleaning job easier



Deleting a DVL

When it is not needed

A random timer is needed to prevent oscillation



Acknowledgments

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