IEEE 802.1Qca + .1Qcc+.. for Industrial Networks

TSN with Dynamic Registration & Stream Reservation on Bridge Local Computing Elements (BLCEs)

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Outline

- Recap AVB: Dynamic Stream Reservation based on RSTP
- Why dynamic Registration & Reservation on Bridge Local Computing Elements?
- Proposal: Dynamic Stream Reservation based on ISIS-PCR
- Proposal: MRRP – Multiple Relation Registration Protocol
- Dynamic Registration & Reservation on calculated Redundant Trees
- Dynamic Registration & Reservation on redundant Trees combined with Seamless Failover
- Summary

Recap – AVB
Dynamic Stream Reservation based on RSTP

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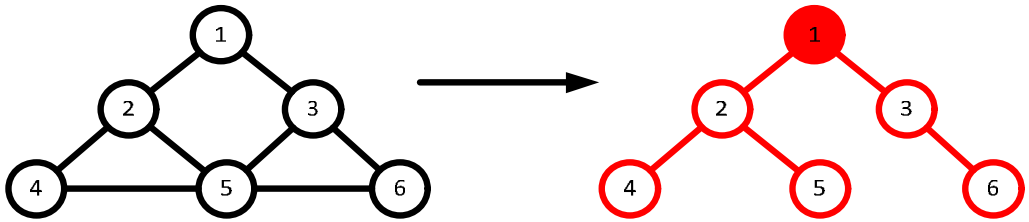
AVB has specified guaranteed QoS for AV-Streams!

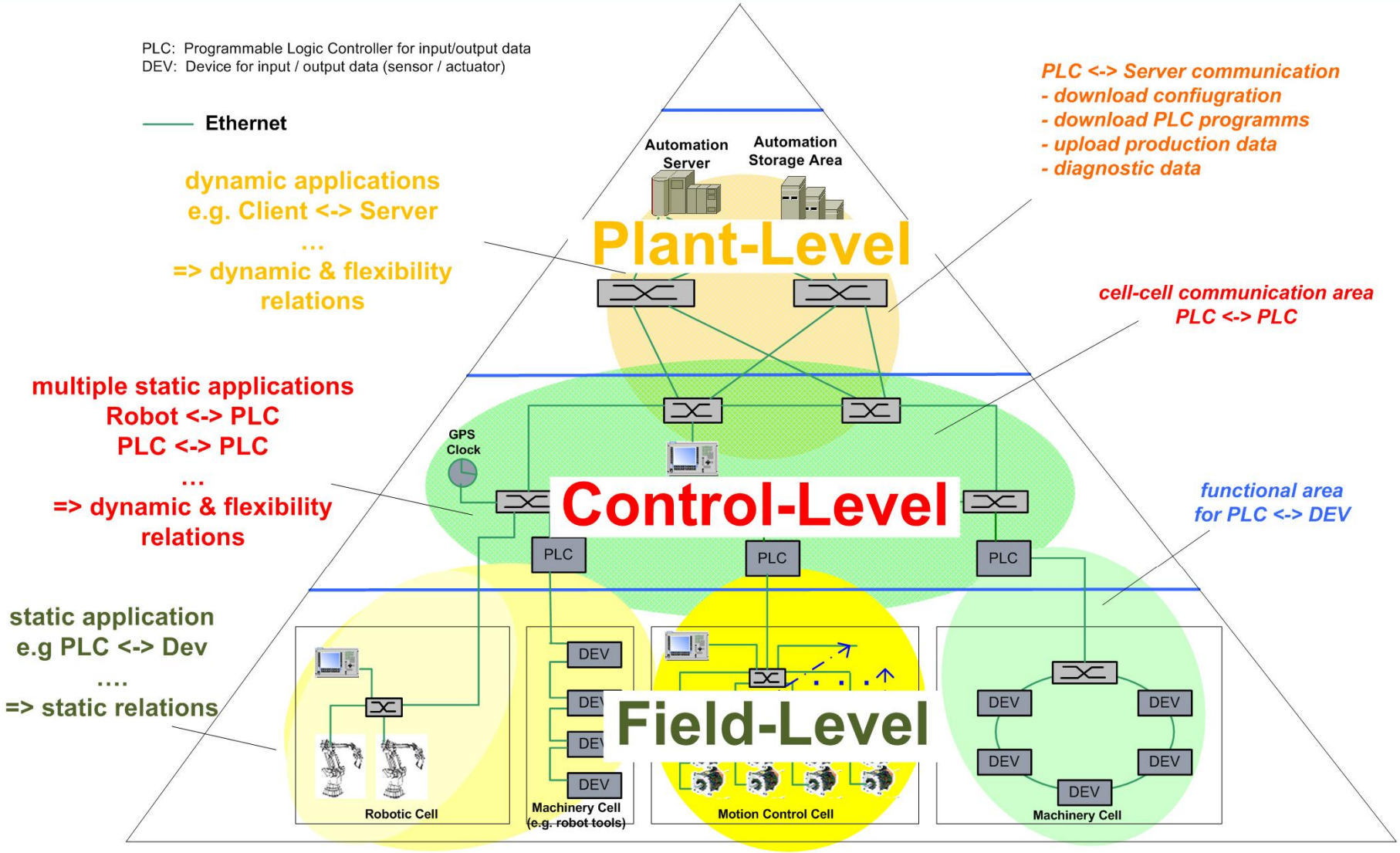
Used mechanism:

- RSTP – Rapid Spanning Tree Algorithm and Protocol (grantees a loop free data tree)



- MRP - Multiple Registration Protocol (template to register attributes like VID, MAC address, …)
  - MVRP – Multiple VLAN Registration Protocl
    (used to register and update their knowlidge of set of VID's – e.g. VID used for Streams)
  - MMRP – Multiple MAC Registration Protocol
    (used to register "Group Filtering Behavior" – e.g. for Streams with VID x filter unregistered groups)
  - MSRP – Multiple Stream Reservation Protocol
    (used to register stream membership, resources, bandwidth, ….)

Why dynamic Registration & Reservation on Bridge Local Computing Elements?



Proposal for TSN
Dynamic Stream Reservation based on ISIS-PCR

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TSN will specify guaranteed QoS for Streams (e.g. *Control-Data-, AV-, Measurement-Streams, …*)**!**

Industrial application have higher requirements on Streams e.g. latency, robustness and availability!
=> Redundant path/trees are required to fulfill the availability requirements but still flexibility is desired!

IEEE 802.1Qca (ISIS-PCR) is working on a solution with centralized PCE's to establish ""explicit path" and do reservations for streams.

This presentation is a proposal doing registration & reservation on decentralized BLCEs – Bridge Local Computing Element!

Proposal for dynamic Stream Reservation
MRRP – Multiple Relation Registration Protocol

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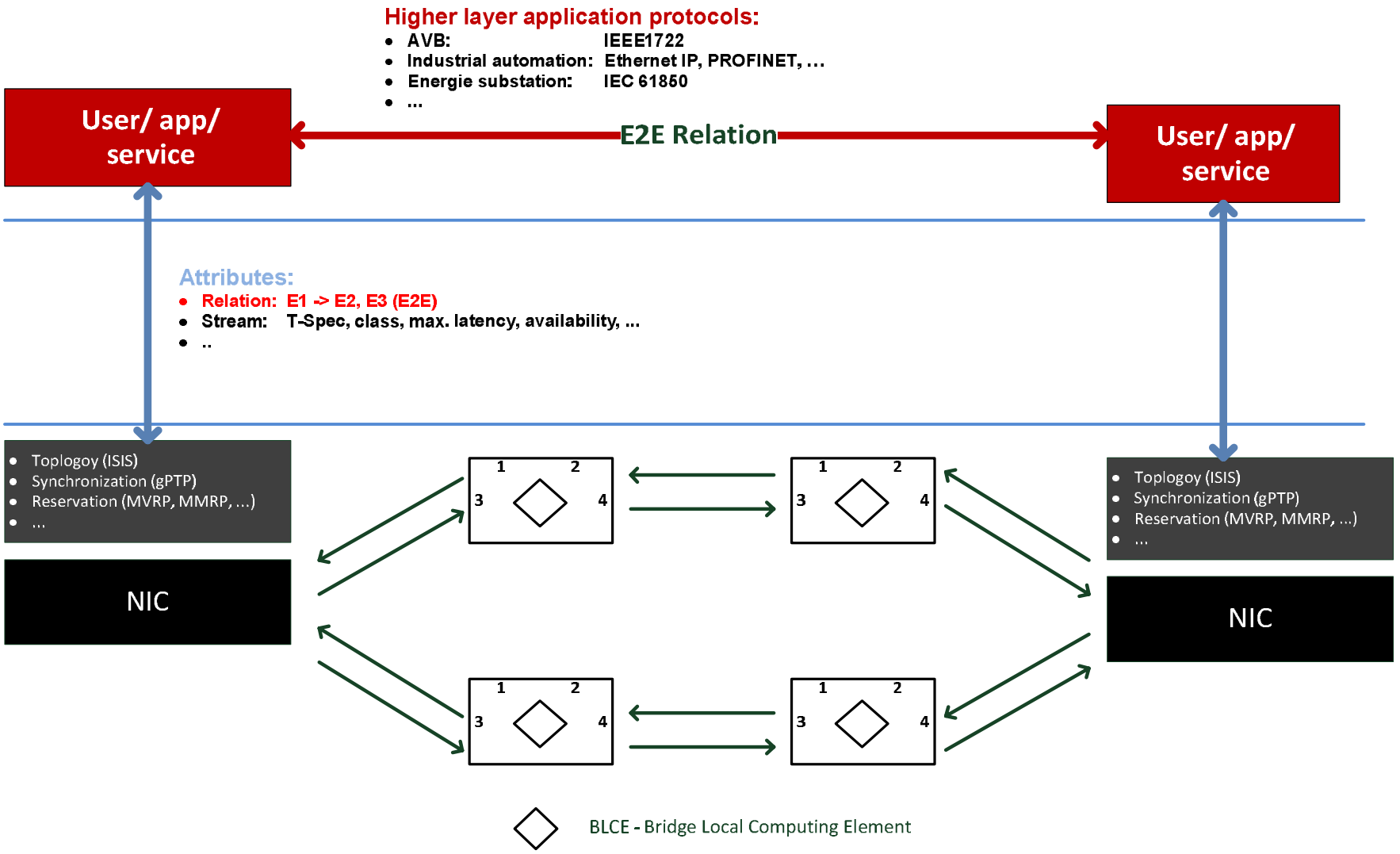
TSN will specified guaranteed QoS for Streams!

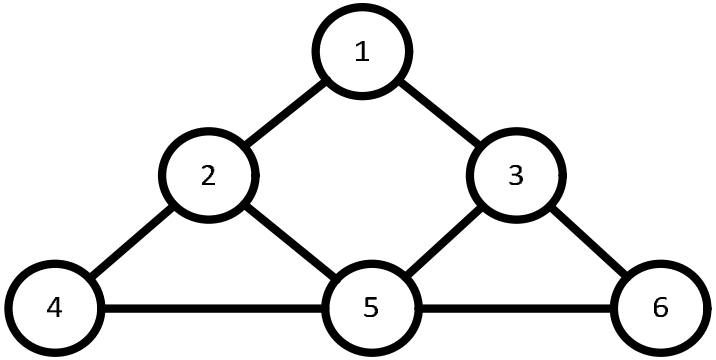
Proposed mechanism:

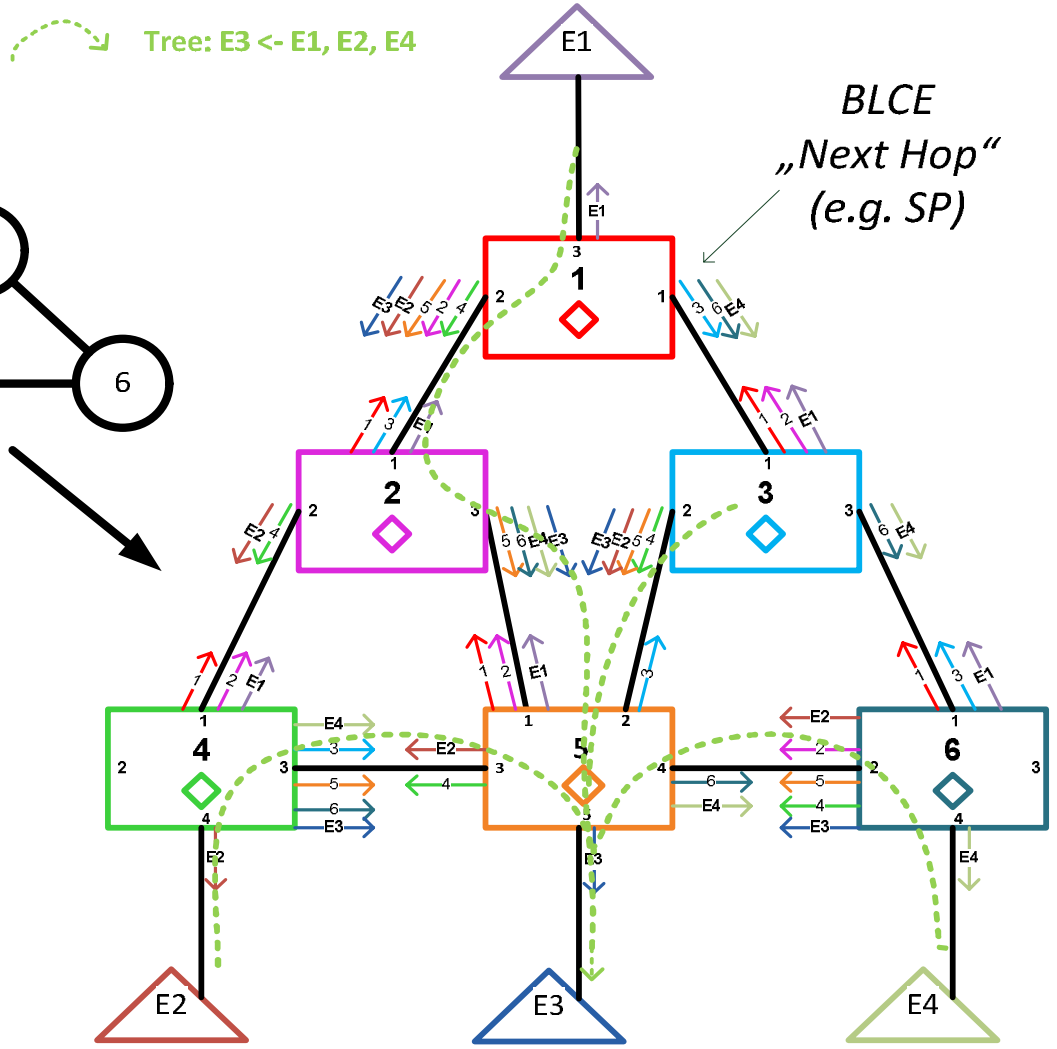
- MRP - Multiple Reservation Protocol (template to register attributes like VID, MAC address, …)
  - MRRP – Multiple Relation Registration Protocol NEW!!!!
    (used to register relations for e.g. streams)
  - MVRP – Multiple VLAN Registration Protocol
    (used to register and update their knowledge of set of VID's – e.g. VID used for Streams)
  - MMRP – Multiple MAC Registration Protocol
    (used to register "Group Filtering Behavior" – e.g. for Streams with VID x filter unregistered groups)
  - MSRP – Multiple Stream Reservation Protocol
    (used to register resources, bandwidth, …. for streams)

Assumption:
Application Relations established by Higher Layer Protocols



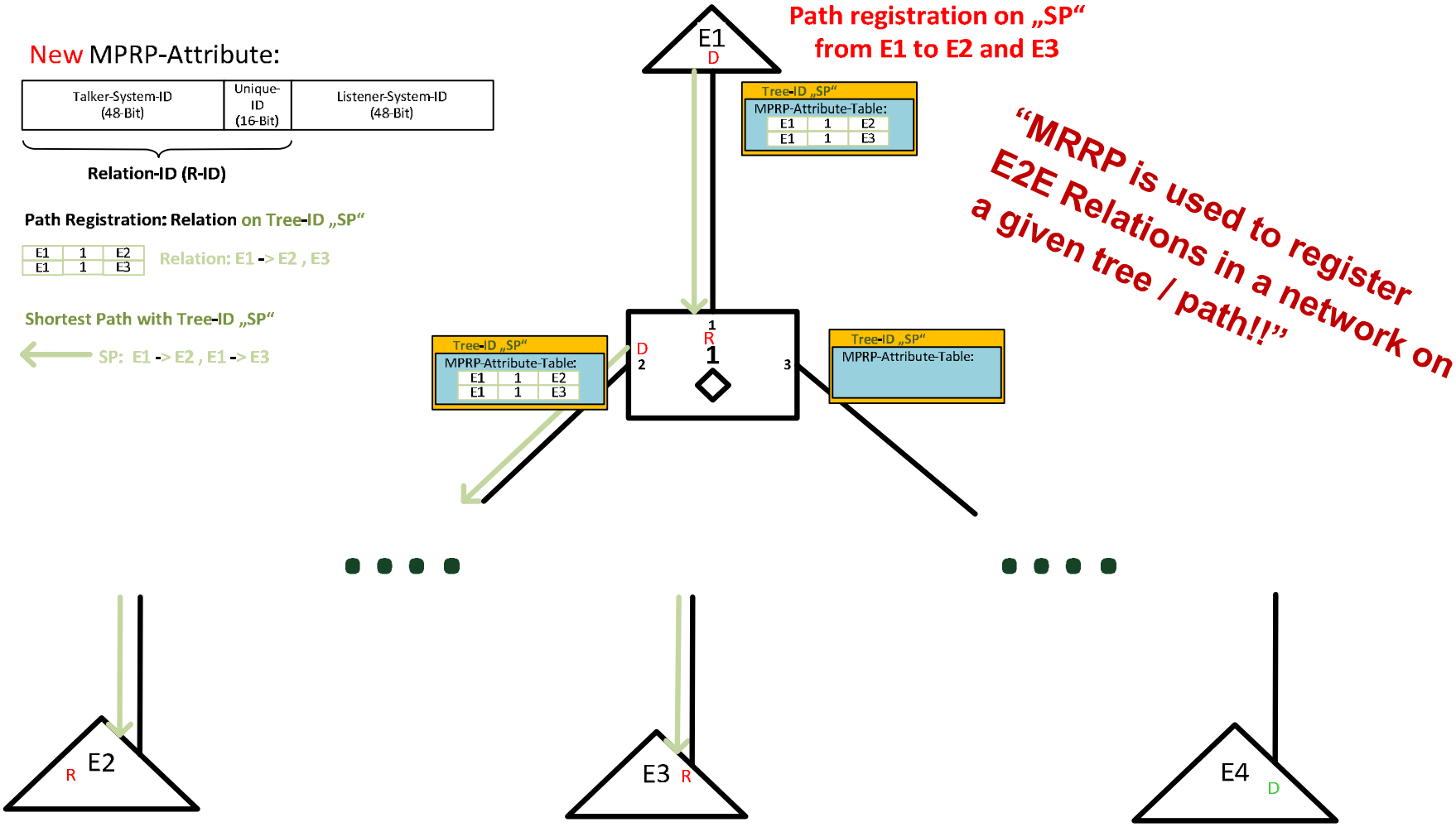
“Next Hop”
Path Computing Result of decentralized BLCE for SP



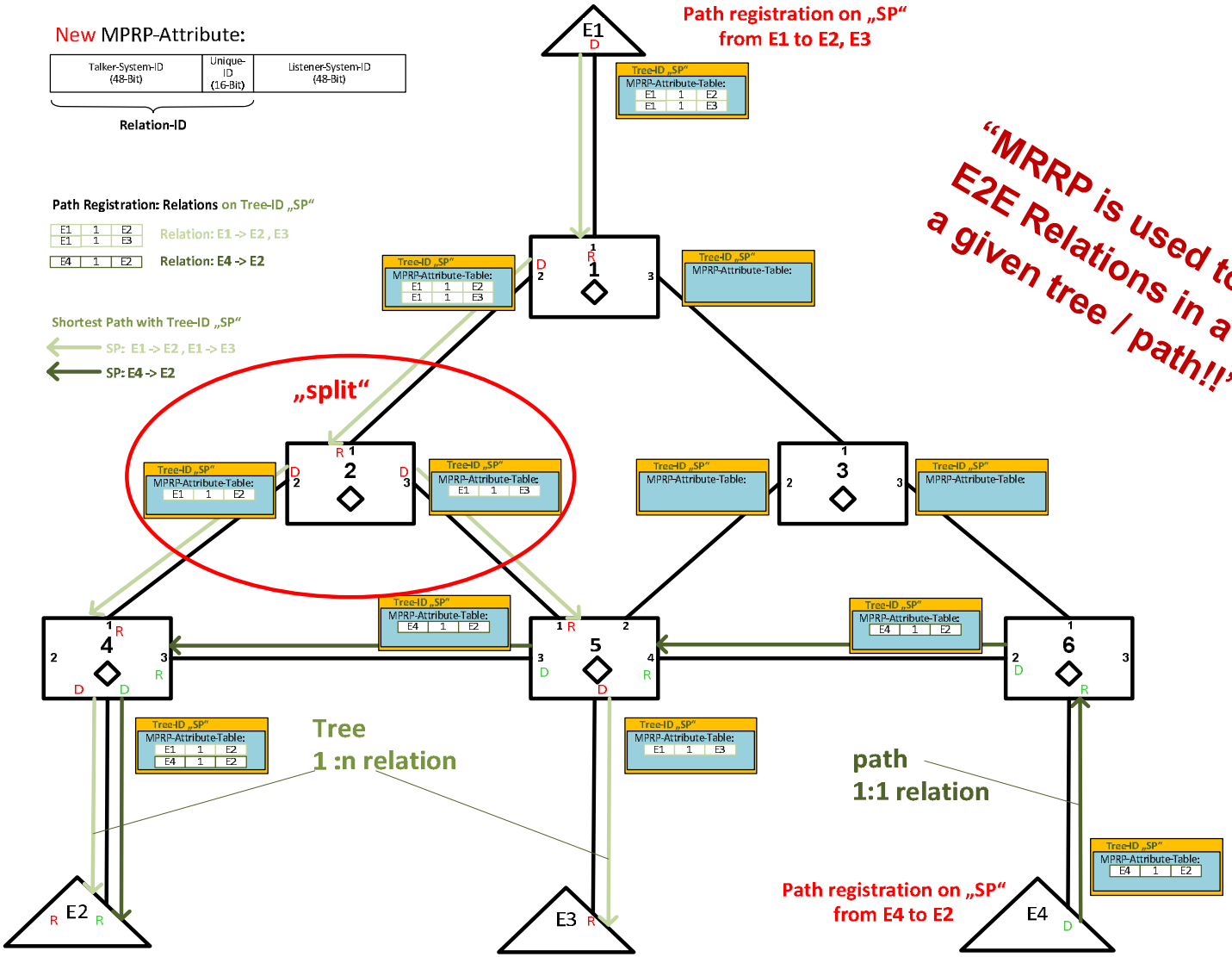


- **Network topology with end stations!**
- **“Next Hop” path calculation for SP (Shortest Path)**
- **“Each bridge component calculates for its own over which port a message for a certain destination must be forwarded”**

Proposal
MRRP – Multiple Relation Registration Protocol

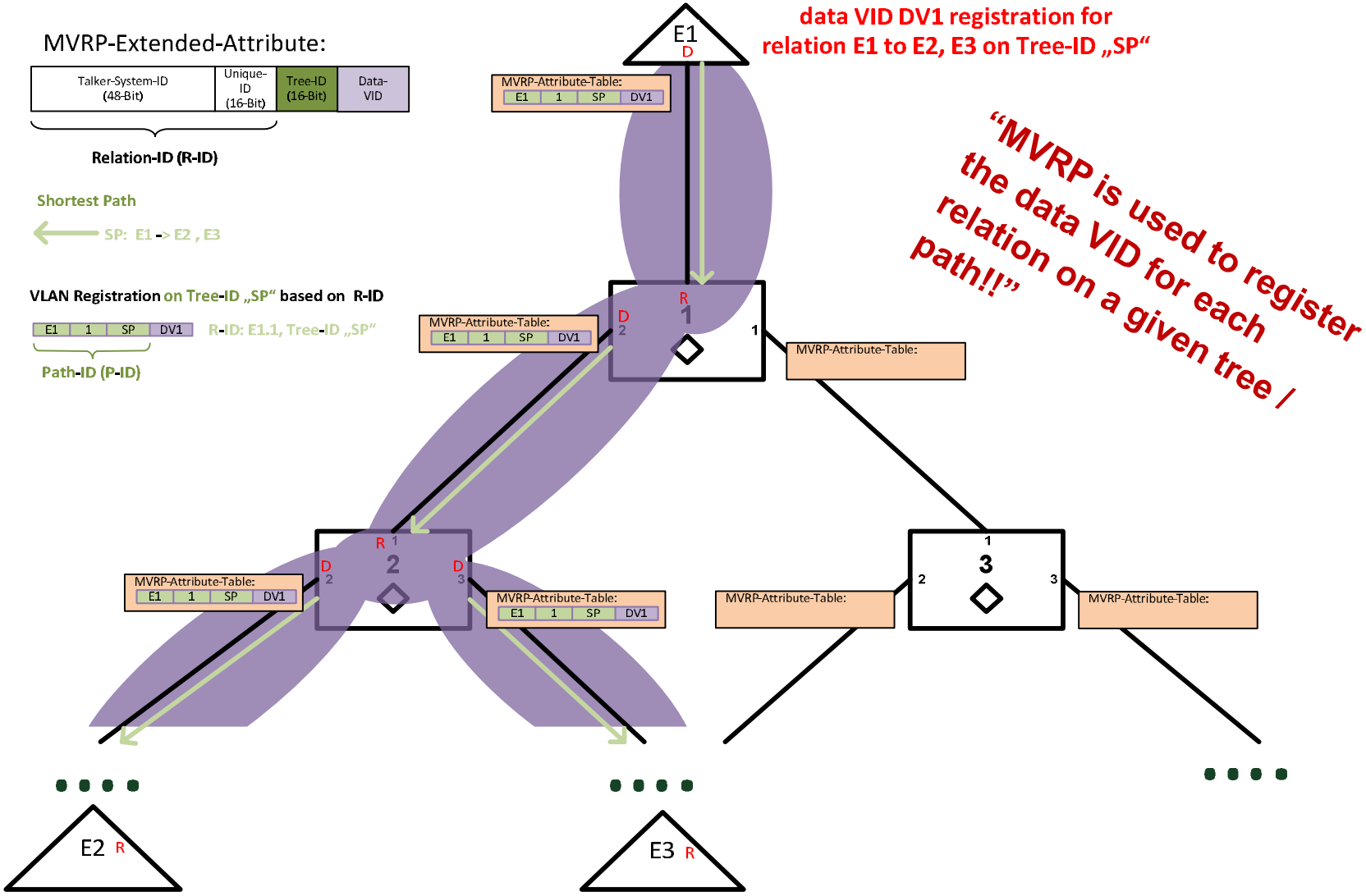


Proposal
MRRP – Multiple Relation Registration Protocol



MVRP - Multiple VLAN Registration Protocol

Based on registered Relation and computed Tree



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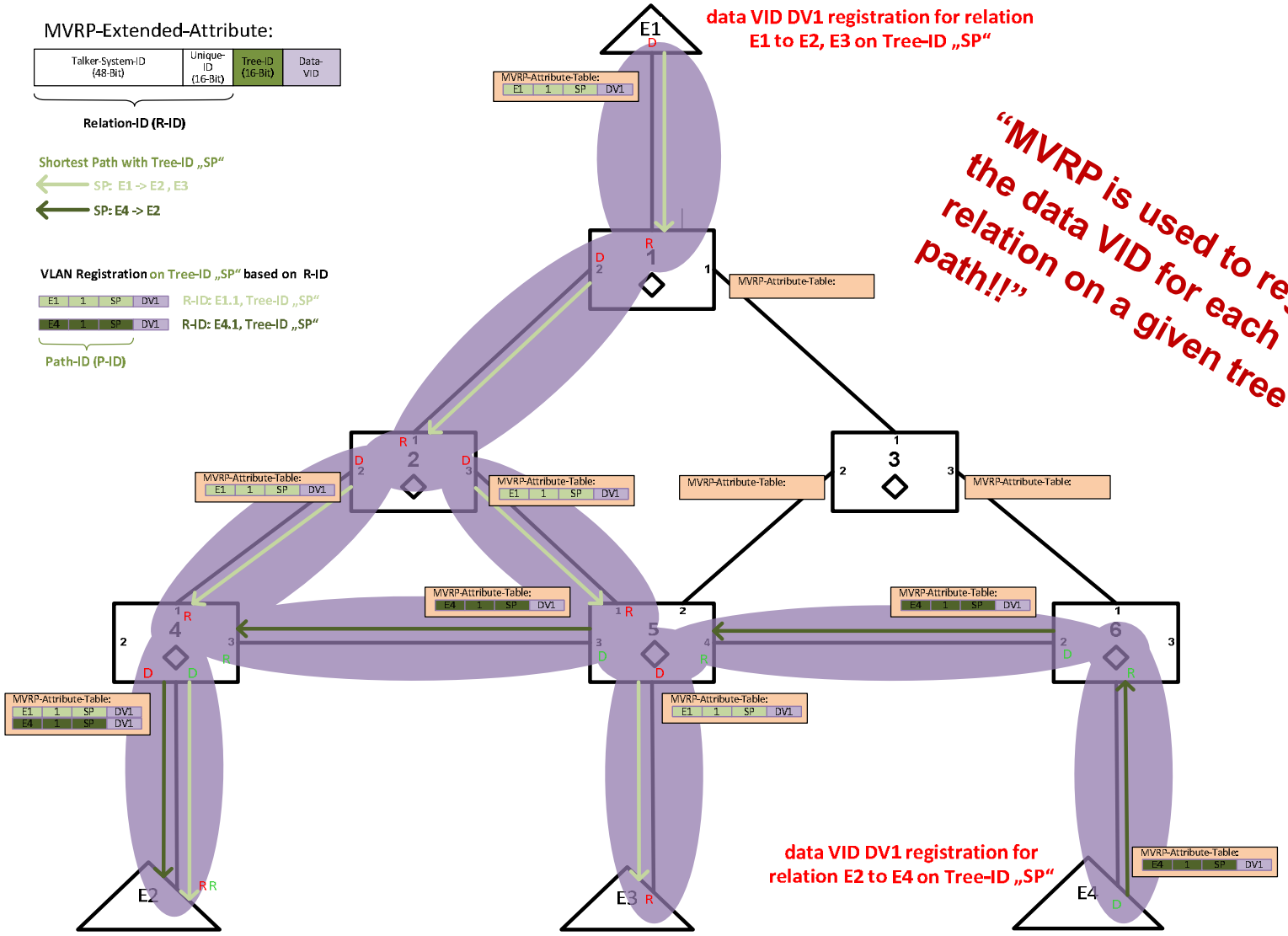
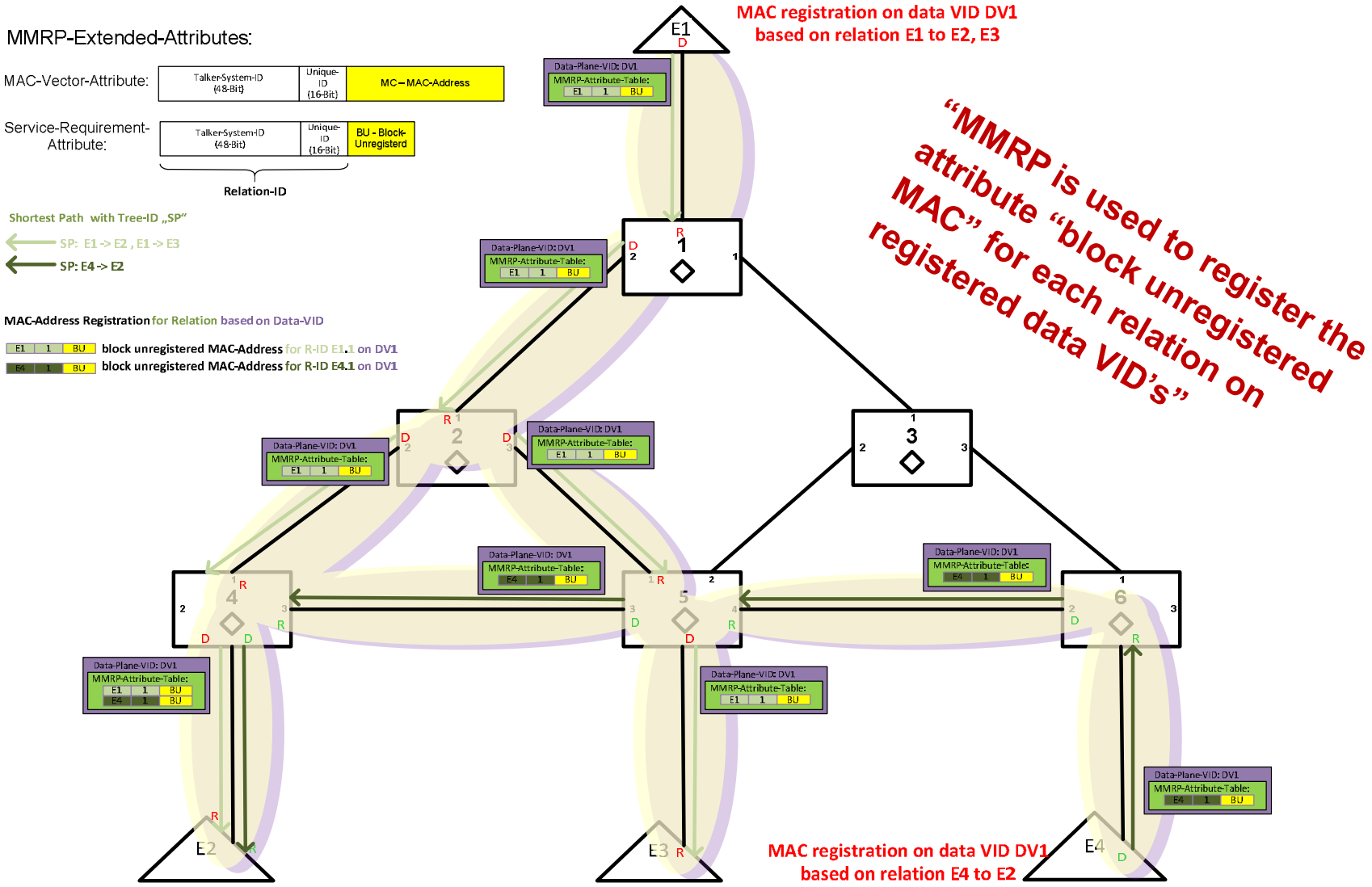


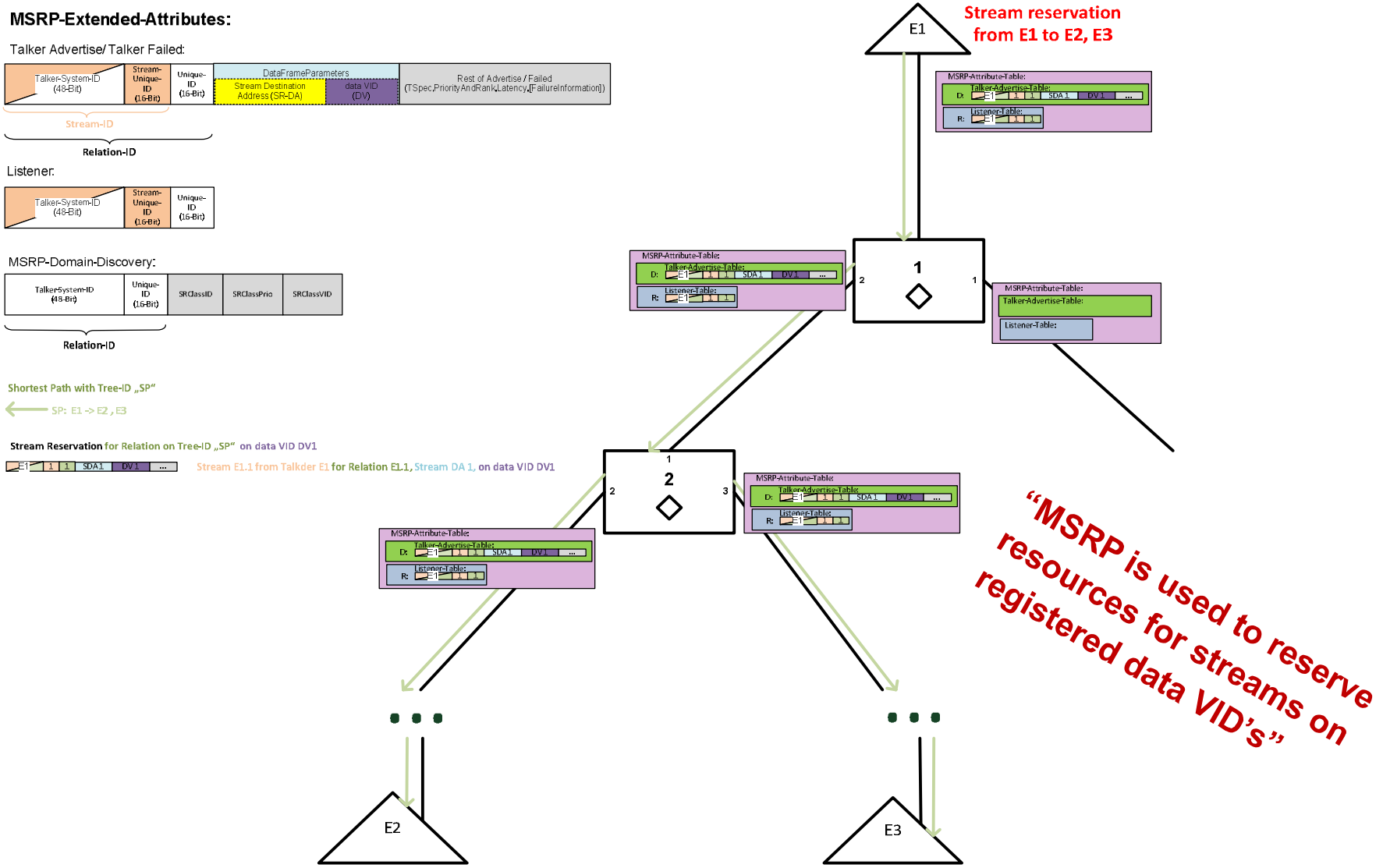
MMRP - Multiple MAC Registration Protocol

Based on registered Relation and registered VID (Data Plane)



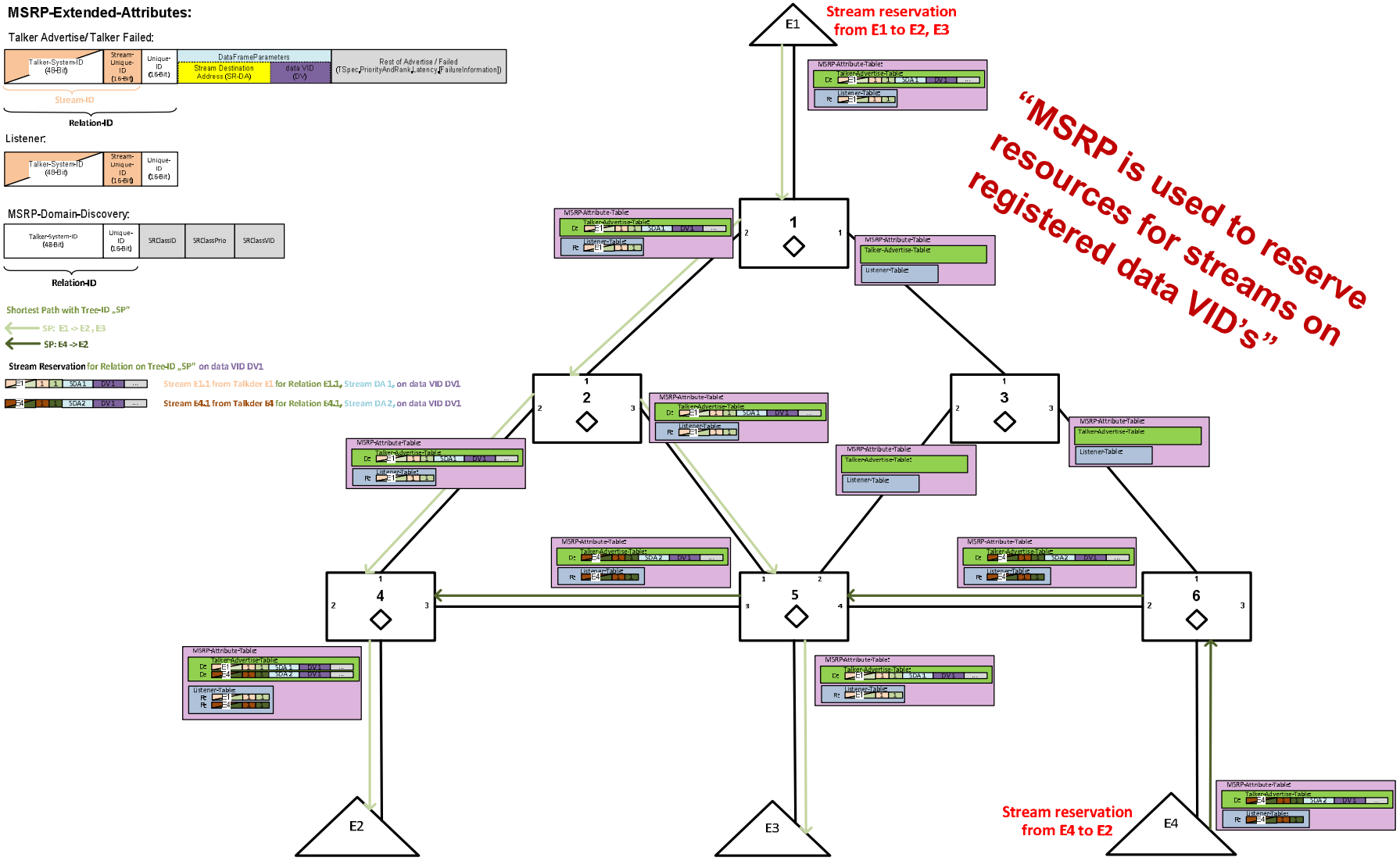
MSRP - Multiple Stream Reservation Protocol

Based on registered Relation and registered VID (Data Plane)



MSRP - Multiple Stream Reservation Protocol

Based on registered Relation and registered VID (Data Plane)



Dynamic Registration & Reservation on calculated Redundant Trees

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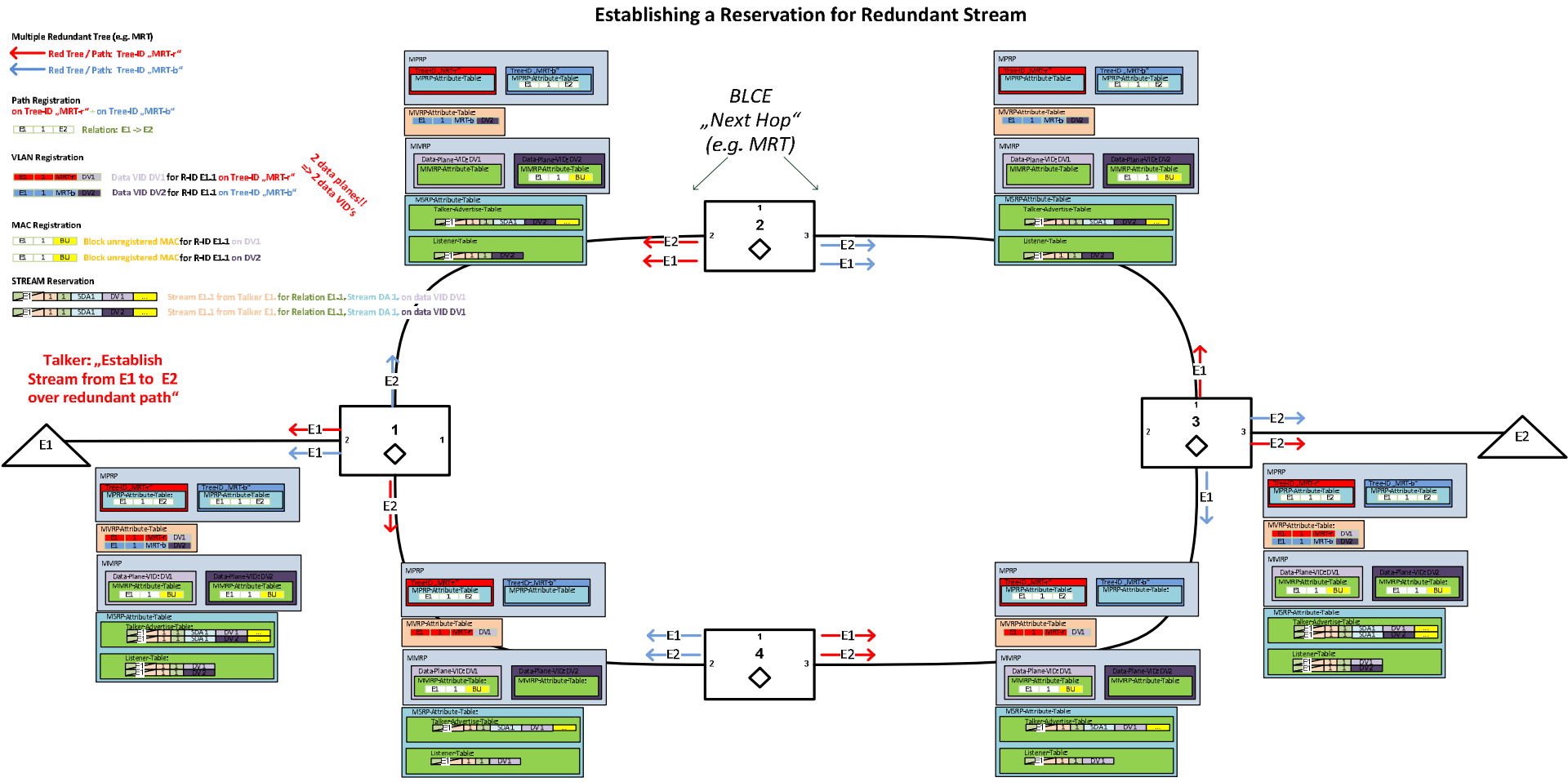

Dynamic Registration & Reservation on redundant Trees combined with Seamless Failover

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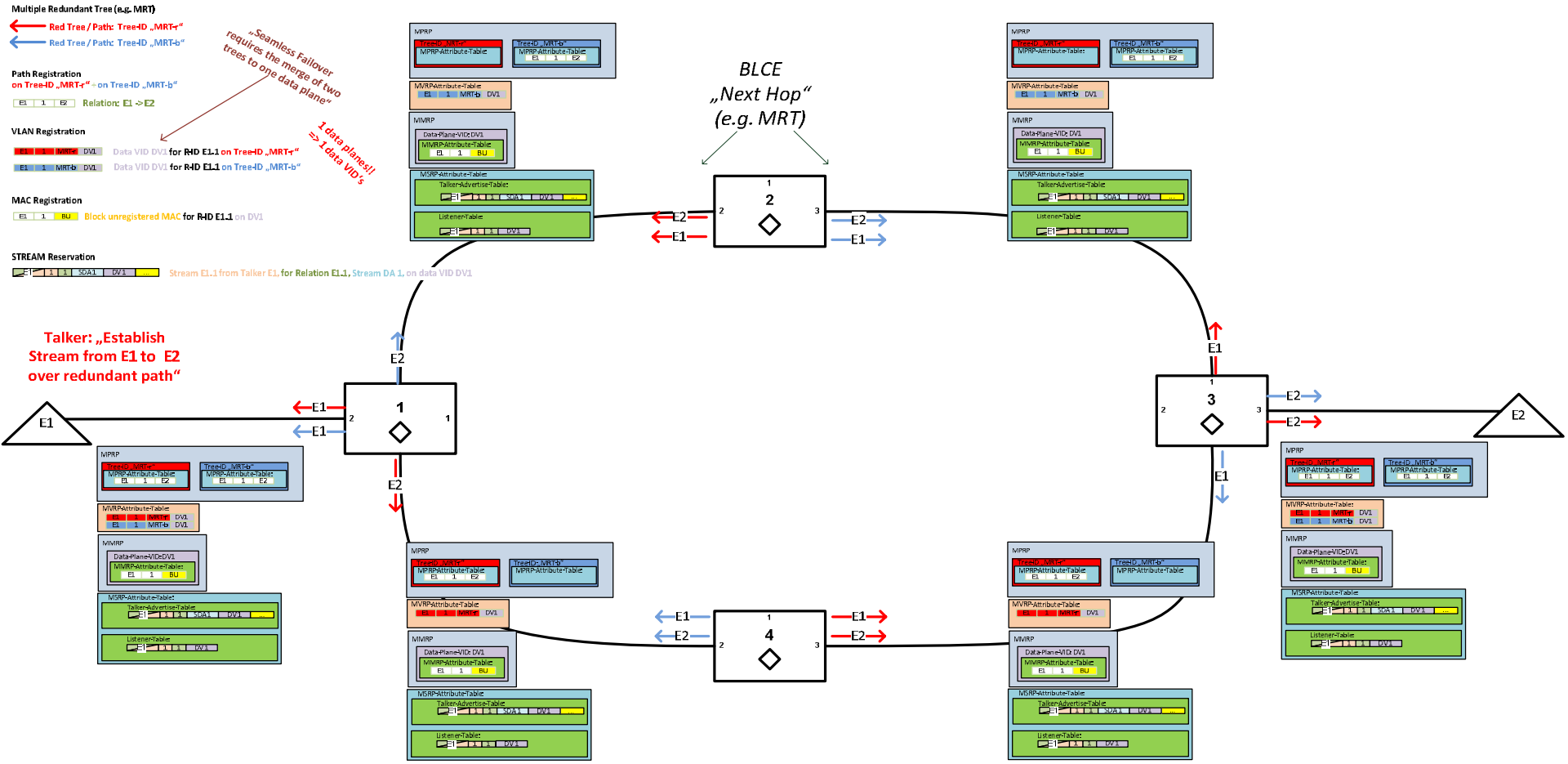
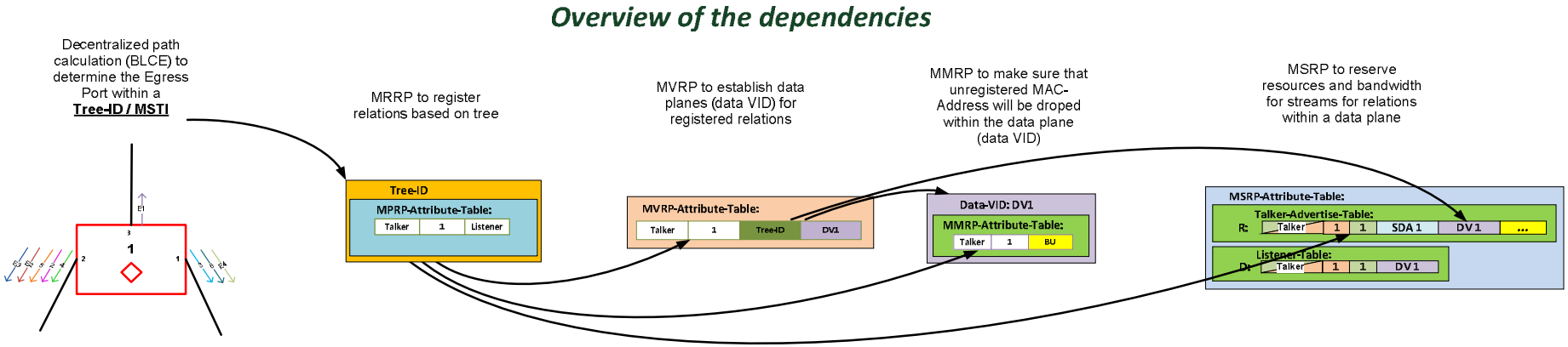
Establishing a Reservation for redundant Streams based on „Seamless Failover“ IEEE 802.1CB



Summary

Registering the communication relations along the Tree to establish a “**Tree per Relation**” in a distributed organized network.

=> For dynamic registration and reservation the hole MRP-Protocol family can be used.
Only MRRP and small extensions for the existing MRP-Protocol family are necessary!



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Summary

“Plug & Play” was very essential feature for Ethernet and is one of the features which makes Ethernet so successful!!!

“Plug & Play” for robust QoS based on BLCE to support shortest path or redundancy is a valuable feature for a lot of industries (not only industrial automation).

- Is **relation** registration (MRRP) based on MRP for BLCE Ethernet networks acceptable?
- **Next Steps?**

Thank you for your attention!

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