

TSN inter domain communication concept

Josef Dorr (Siemens AG)

Stephan Höme (Siemens AG)

Sven Kerschbaum (Siemens AG)

Günter Steindl (Siemens AG)

Continuation of work from ...

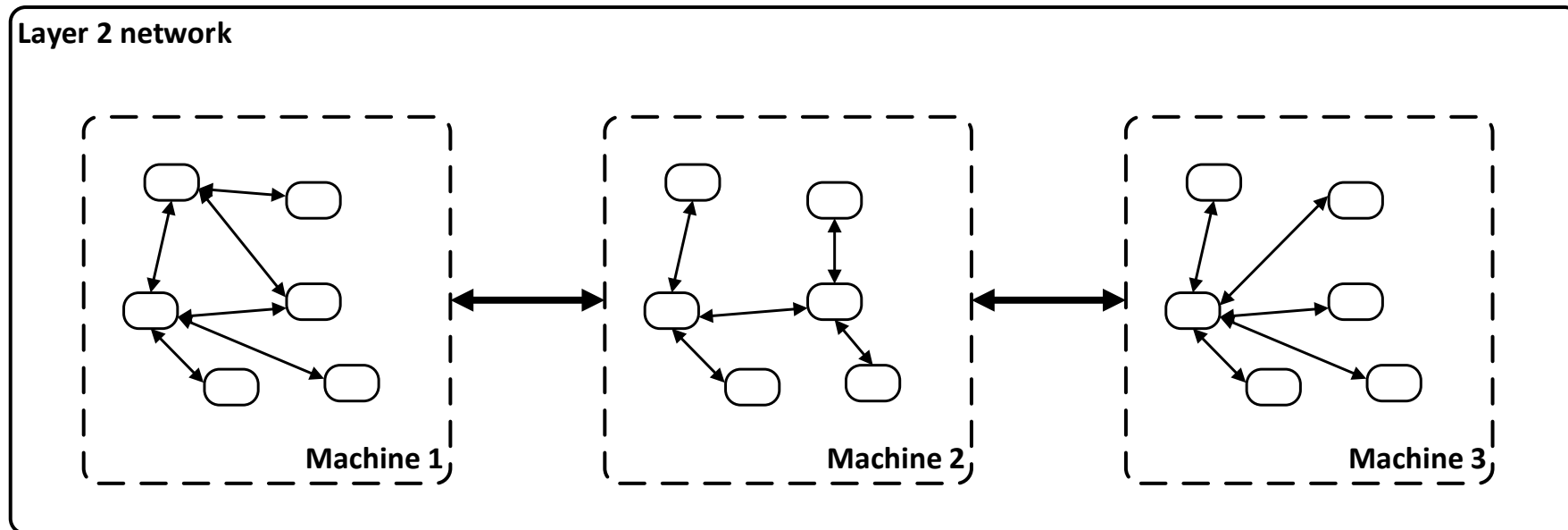
- “Use Cases IEC/IEEE 60802” by IEEE/IEC 60802
<http://www.ieee802.org/1/files/public/docs2018/60802-industrial-use-cases-0918-v13.pdf>
- “TSN Interdomain Communications” by Mark Hantel (Rockwell Automation)
<http://www.ieee802.org/1/files/public/docs2018/60802-Hantel-TSN-Interdomain-Communications-0718.pdf>
- “TSN Configuration Interaction” by Lihao Chen (Huawei Technologies)
<http://www.ieee802.org/1/files/public/docs2019/new-chen-TSN-Configuration-Interaction-0719-v01.pdf>

Mission and Scope

- **TSN domain [IEC/IEEE 60802, Rev d1-1]:**
 - The term “TSN domain” is work in progress in IEC/IEEE 60802: “A TSN domain is an administrative group of devices.”
- **Problem statement: How can the use cases (e.g. machine-to-machine communication) be realized?**
 - Machines can be in different TSN domain
 - Converged TSN (multiple applications) should run on top of the whole Layer 2 network
 - Any configuration model (e.g. centralized or distributed) can be applied inside a TSN domain
 - ➔ Goal: One solution for communication between TSN domains
- **Concept:**
 - TSN domains are considered as black boxes
 - TSN domains should be specified in P802.1Qdj

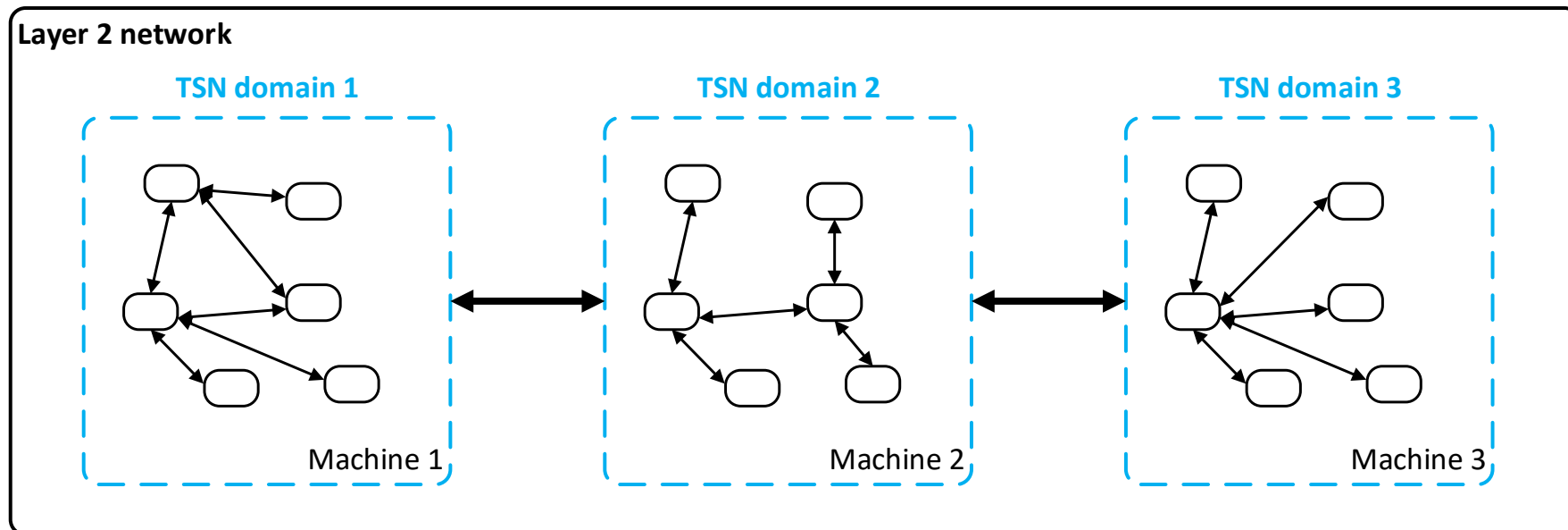
Why TSN domains in IEC/IEEE 60802?

- **TSN domains** are required:
 - To assign TSN functional responsibility and provide an operational guarantee of a subsystem to a supplier (e.g. for one machine or production cell)
 - While working within the product limitations of the used automation components (constrained devices)
 - Structuring of the network using TSN domains reduces the complexity (e.g. path finding, resource management)



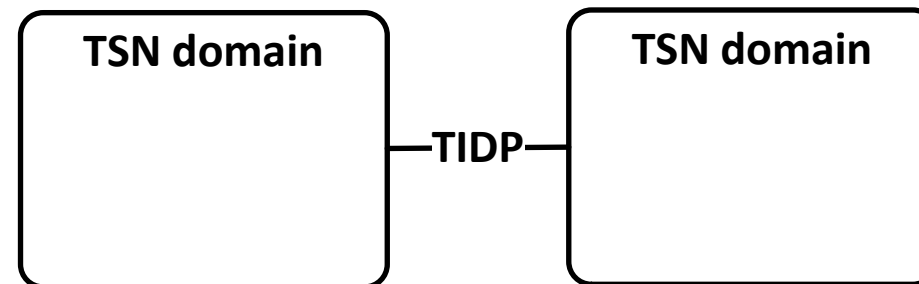
Why TSN domains in IEC/IEEE 60802?

- **TSN domains** are required:
 - To assign TSN functional responsibility and provide an operational guarantee of a subsystem to a supplier (e.g. for one machine or production cell)
 - While working within the product limitations of the used automation components (constrained devices)
 - Structuring of the network using TSN domains reduces the complexity (e.g. path finding, resource management)



Approach: Considering TSN domains as black boxes

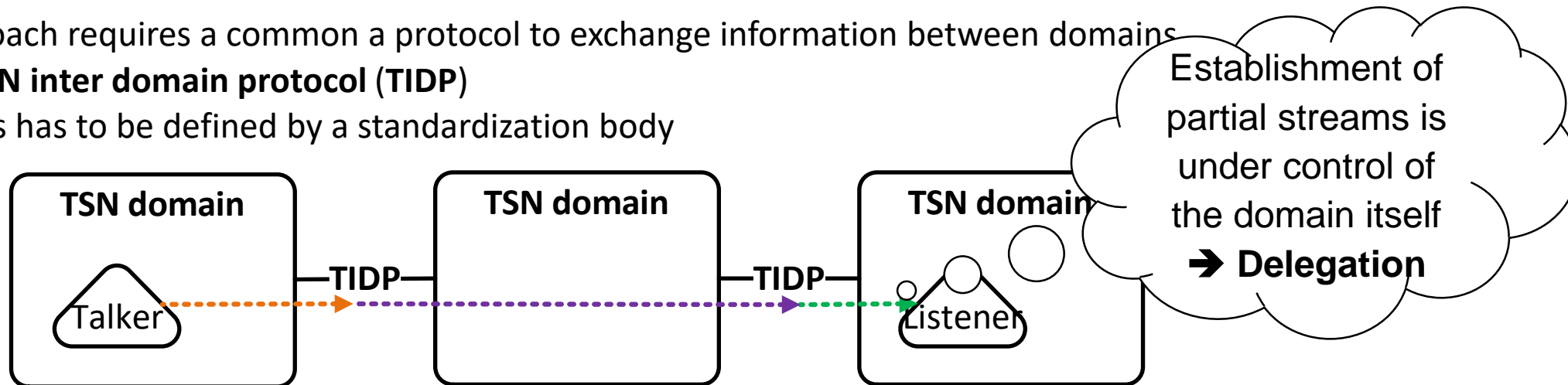
- **TSN domains are black boxes**, i.e. their internals doesn't matter to the outside world
 - Each TSN domain is responsible for the stream establishment and teardown inside its domain
- Black box approach requires a common a protocol to exchange information between domains
 - Let's call it **TSN inter domain protocol (TIDP)**
 - Obviously this has to be defined by a standardization body



- Similar activities in IEC/IEEE 60802 (e.g. Huawei “CCP based on LRP”¹)

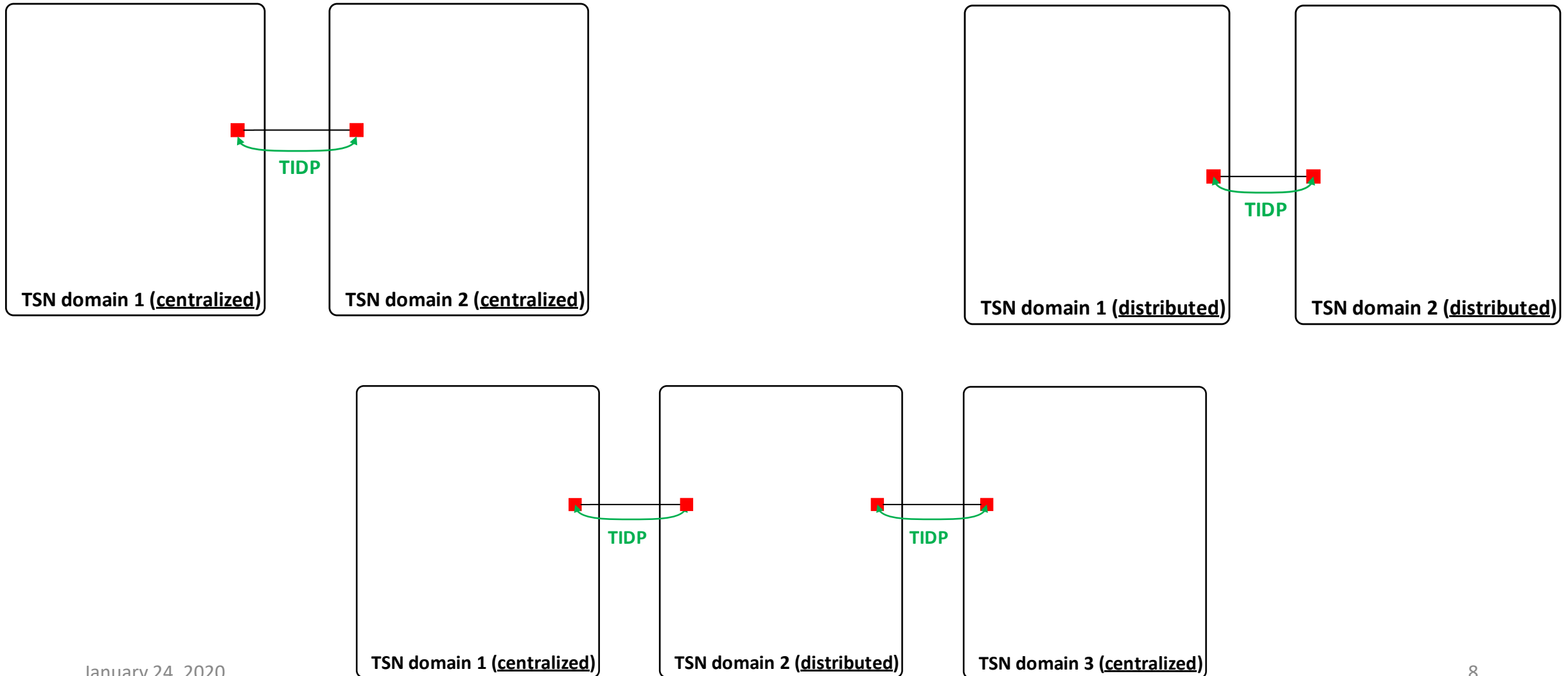
Approach: Considering TSN domains as black boxes

- **TSN domains are black boxes**, i.e. their internals doesn't matter to the outside world
 - Each TSN domain is responsible for the stream establishment and teardown inside its domain
- Black box approach requires a common a protocol to exchange information between domains
 - Let's call it **TSN inter domain protocol (TIDP)**
 - Obviously this has to be defined by a standardization body

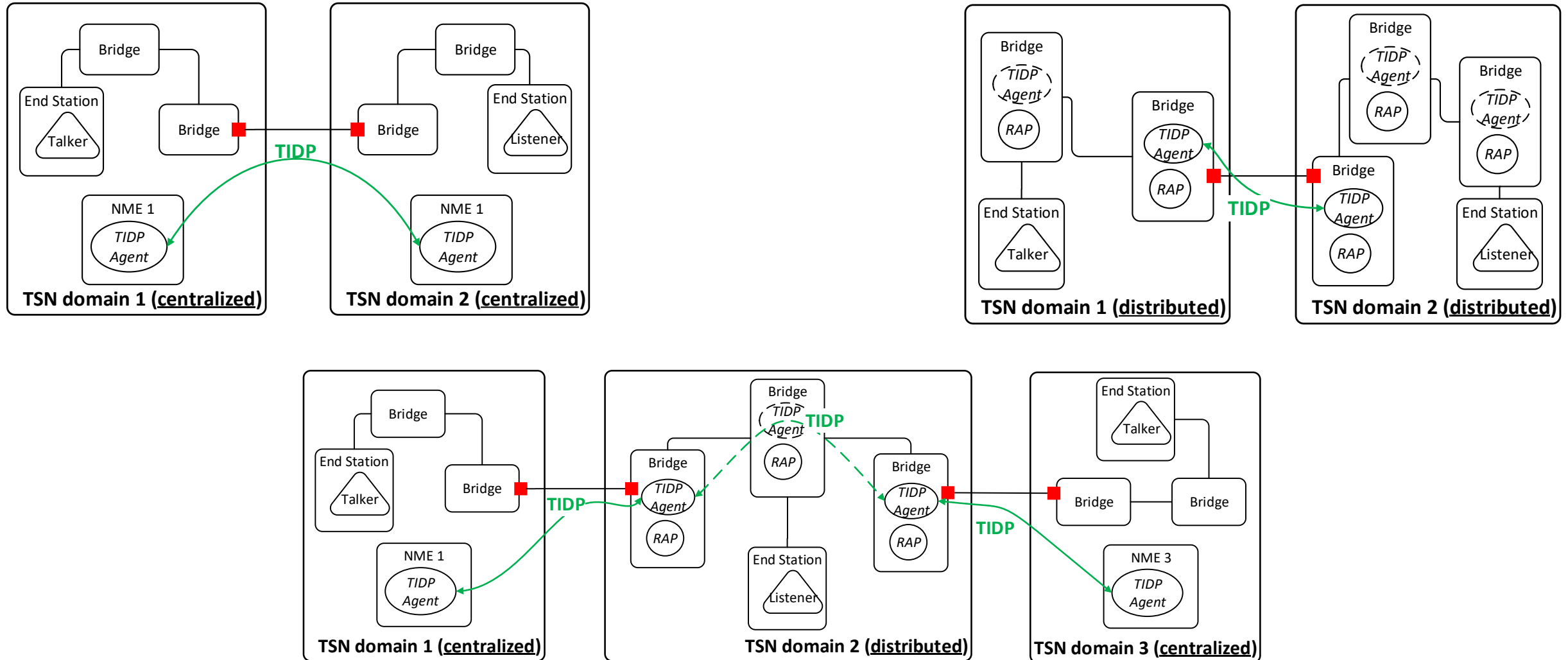


- Similar activities in IEC/IEEE 60802 (e.g. Huawei “CCP based on LRP”¹)

Approach: Considering TSN domains as black boxes in different scenarios

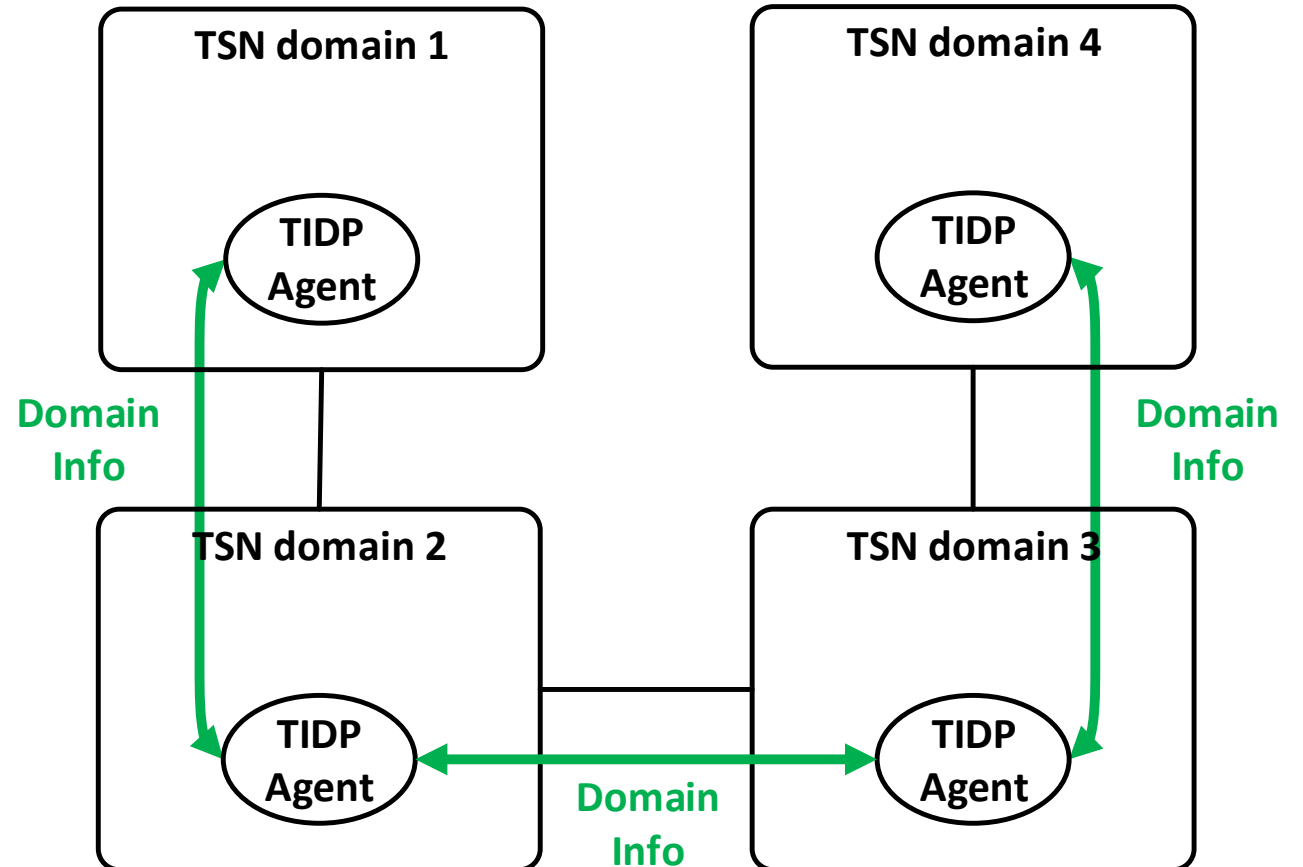


Approach: Considering TSN domains as black boxes in different scenarios – inside view



TIDP: Exchange of TSN domain information

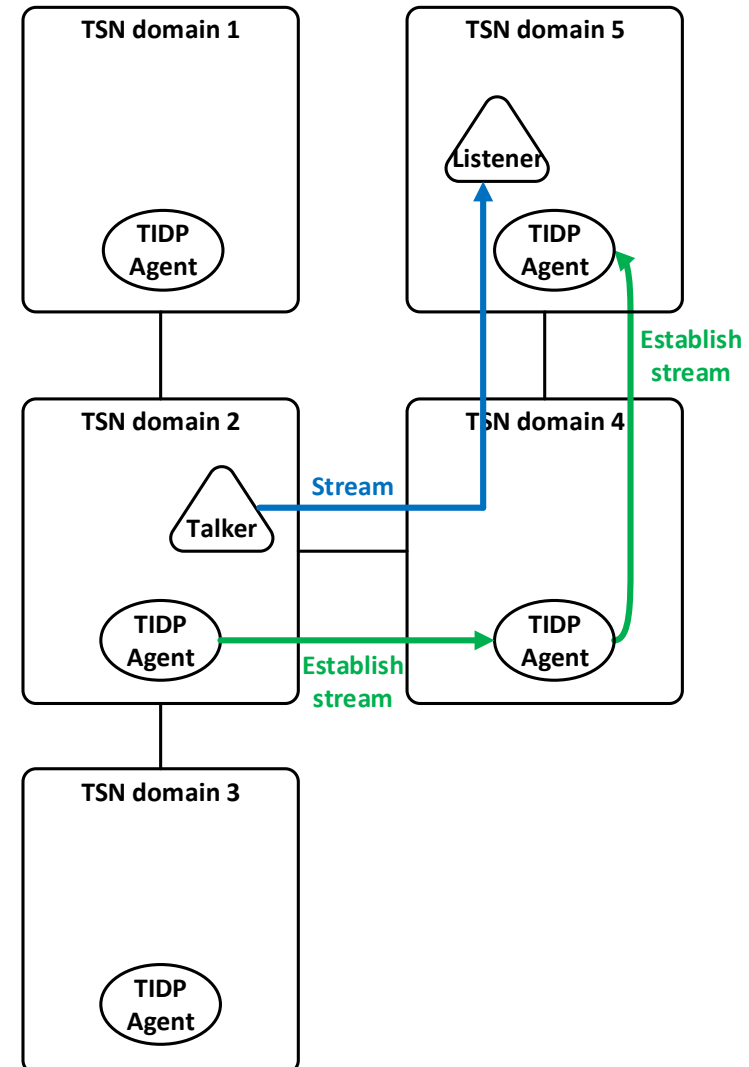
- Finding a path to a destination is necessary
- **Exchange of organizational information:**
 - Own TSN domain IDs
 - Reachable TSN domain IDs
 - Address of TIDP agent
 - ...



Note: TSN domains may be centralized or distributed

TIDP: Establishment of TSN inter domain streams

- **Setup of TSN inter domain streams:**
 - Stream information:
 - Who is the talker?
 - Who is/are the listener?
 - QoS parameters (e.g. TSpec)
 - TSN domain of listener
 - Address of listener inside domain
 - Result of stream establishment must be propagated back
 - ...



Summary

- TSN domain concept seems suitable for structuring layer 2 networks (e.g. into different machines)
- TSN domain as a black box allows usage of centralized and distributed configuration model in one layer 2 network
- TSN inter domain communication is necessary
- TIDP as a proposal for the one TSN inter domain communication protocol
- Protocol used for TIDP need to be selected
- Idea: Could TIDP be based on LRP?

Questions?