Industrial Redundancy Requirements

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Network Topologies (1)

Redundant link networks:

- Eliminate single points of failure by introducing multiple links
- A redundancy control protocol (like e.g. RSTP) is needed to prevent loops.
- Rings map very well to common use cases
- Ring = closed (well-known) line structure

Pictures taken from IEC 62439-1
Redundant link networks - possible combinations:

- coupled single rings
- ring with subrings
- full mesh

- More complex networks may be derived from the single ring structure - in practical applications, network topologies are very diverse and specially suited to individual application requirements
- Full meshes are mostly avoided due to complexity (deterministic recovery after media failure is considerably harder to achieve in a mesh than in a ring)
Eliminate single points of failure by doubling network infrastructure

- Devices can be double-attached to each network (DAN = Double Attached Node) without bridging from LAN A to LAN B
- Networks are (usually) independent layer 2 broadcast domains (LAN A/B)
- Independent networks can be of any topology and may/may not make use of redundant links themselves
T\_rec + T\_stream !< T\_grace

- T\_rec = network reconfiguration time
- T\_stream = stream reconfiguration time
- T\_grace = application grace time

- **Requirement:** The time needed to reestablish a stream after a (media) failure needs to be pre-determinable.
Many Diversified Solutions For Many Different Requirements

Media redundancy „taxonomy“:

- **with network interruption***:
  - redundant links
  - redundant networks
    - RSTP, used in ring configurations (IEEE 802.1D-2004)
    - MRP, ring red. protocol (IEC 62439-2)
    - (proprietary) „Dual Homing“ setups with multiple network interfaces

- **without network interruption***:
  - redundant links
  - redundant networks
    - HSR, ring redundancy protocol (IEC 62439-3)
    - PRP, parallel redundancy protocol (IEC 62439-3)

* Network interruption = end-to-end communication experiences outage in case of fault
Thank you for your attention!