



## **Real-Time Ethernet Technology Comparison**

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# Real-Time Ethernet Competition

CC-Link IE

PROFI<sup>®</sup>  
INDUSTRIAL ETHERNET  
NET

EtherNet/IP<sup>™</sup>



EtherCAT<sup>®</sup>

**SERCOS**  
interface

ETHERNET  
POWERLINK

VARAN

# Overview on Real-Time Ethernet Technologies (Selection)



- ▶ CC Link IE
- ▶ Drive CliQ
- ▶ EPA
- ▶ EtherCAT
- ▶ EtherNet/IP + CIP Sync
- ▶ Ethernet Powerlink
- ▶ IEEE 1588 / PTP
- ▶ JetSync
- ▶ Modbus RTPS
- ▶ Mechatrolink III
- ▶ PowerDNA
- ▶ Profinet
- ▶ RAPIEnet
- ▶ RTEX
- ▶ SafetyNET p
- ▶ SERCOS III
- ▶ SynqNet
- ▶ TCnet
- ▶ Varan
- ▶ Vnet/IP

Source: <http://www.real-time-ethernet.de/>

# Overview on Real-Time Ethernet Technologies (Selection)

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**International Standard**

# Overview on Real-Time Ethernet Technologies (Selection)

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- ▶ Ethernet Powerlink
- ▶ Modbus RTPS
- ▶ Profinet
- ▶ SERCOS III
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Source: <http://www.real-time-ethernet.de/>

**User Organization**

# Overview on Real-Time Ethernet Technologies (Selection)

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- ▶ EtherCAT
- ▶ EtherNet/IP + CIP Sync
- ▶ Ethernet Powerlink
- ▶ Profinet
- ▶ SERCOS III

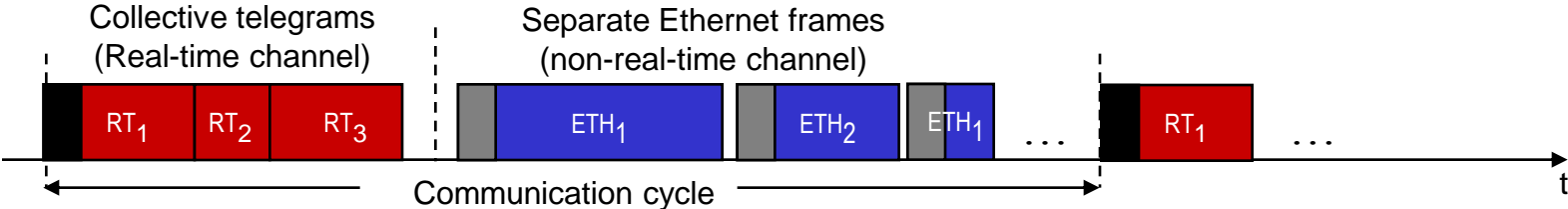
Source: <http://www.real-time-ethernet.de/>

**High-Performance**

# Real-Time Ethernet Protocols: Efficiency / Performance



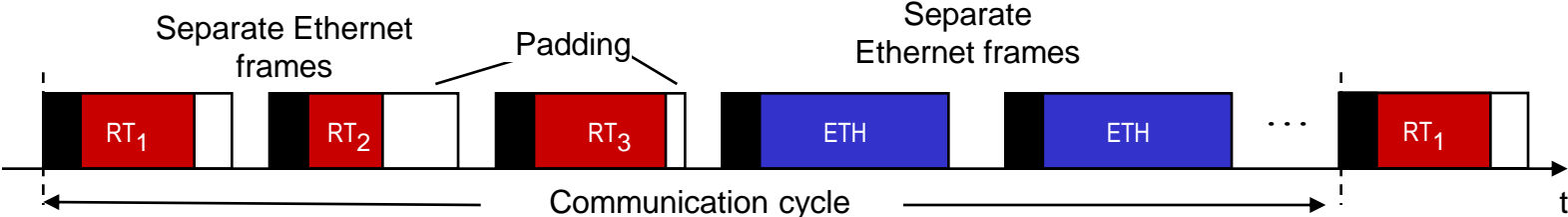
## a) SERCOS III:



## b) EtherCAT:

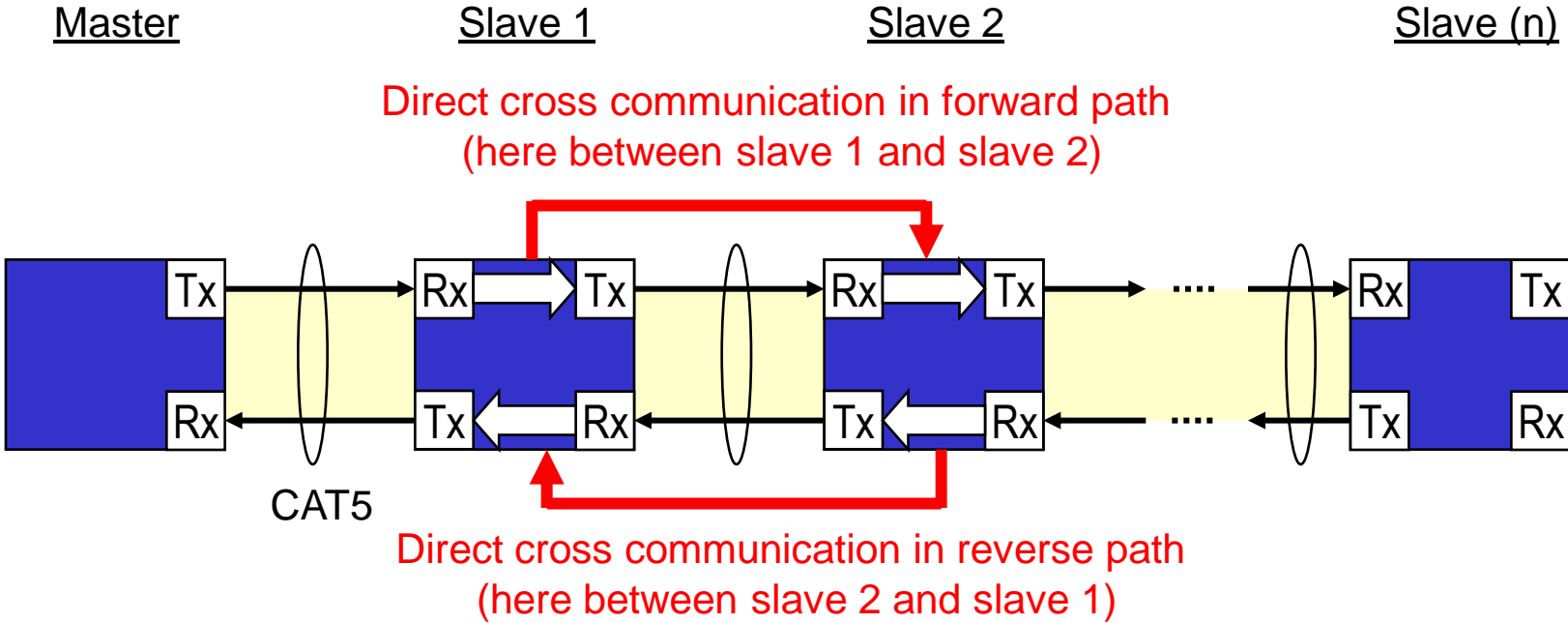




## c) Profinet, Ethernet/IP, Ethernet Powerlink:



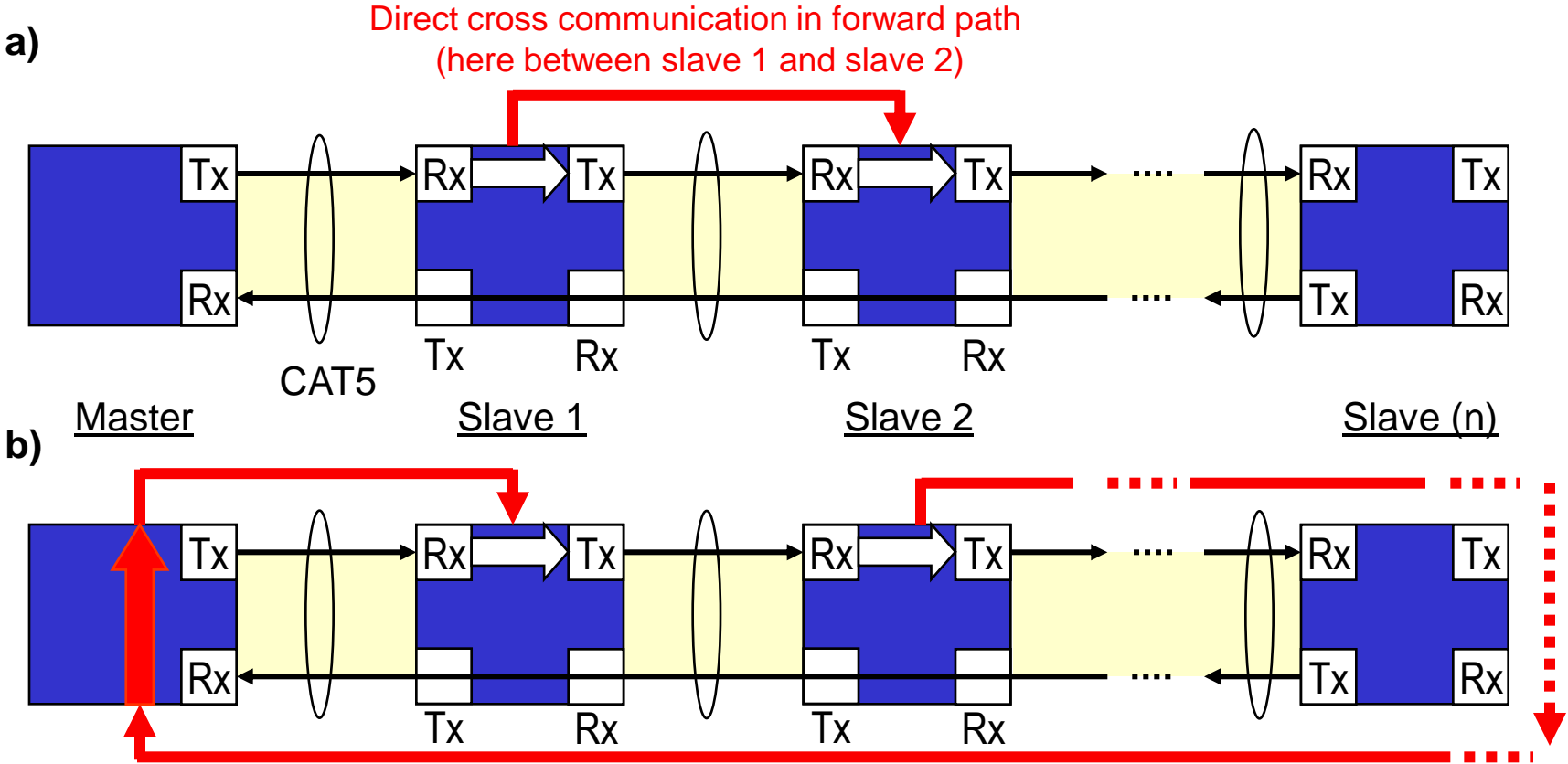
RT<sub>i</sub>: Real-time data of node i, ETH: Ethernet frame with non-real-time data

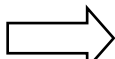
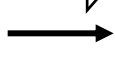
# Example: Cross Communication with SERCOS III



-  Real-time processing during passing through a node
-  Signal transmission without interpretation
- Tx: Ethernet transmitter (Sender), Physical Interface
- Rx: Ethernet receiver (Receiver), Physical Interface

# Example: Cross Communication with EtherCAT

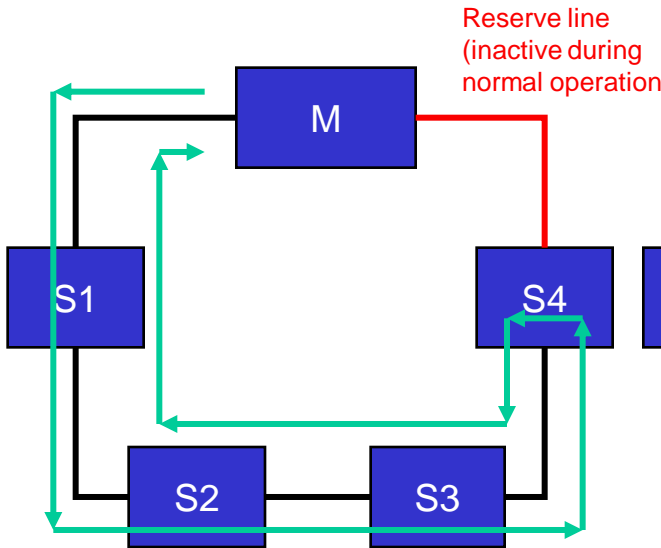


 Real-time processing during passing through a node  
 Signal transmission without interpretation  
 Tx: Ethernet transmitter (Sender), Physical Interface  
 Rx: Ethernet receiver (Receiver), Physical Interface

# Example: Redundancy Concept of EtherCAT

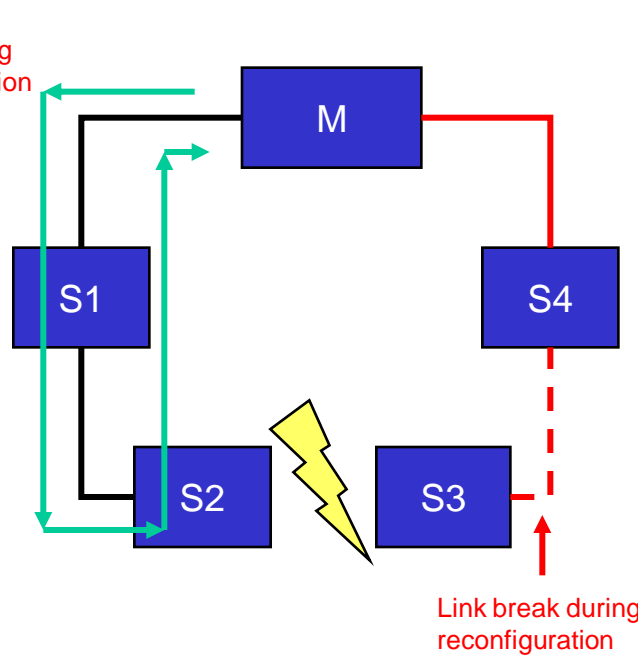
## Normal operation:

Transmission of real-time data in line topology



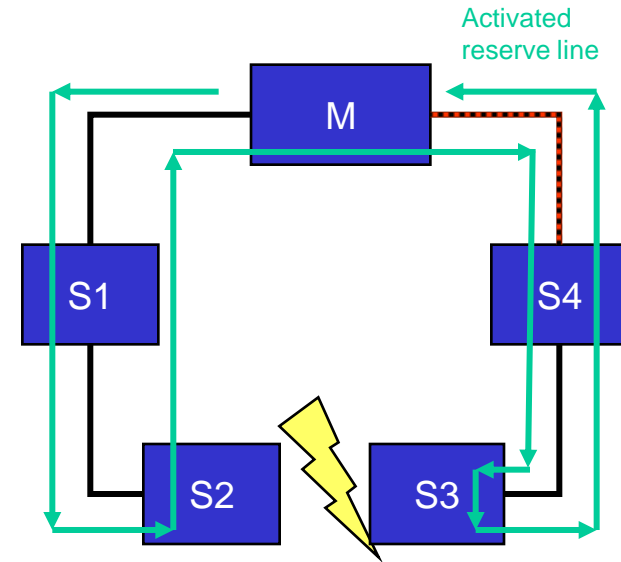
## Fault case:

Detection of redundancy case by redundancy manager (M)



## Fault case:

Activation of reserve line after successful reconfiguration

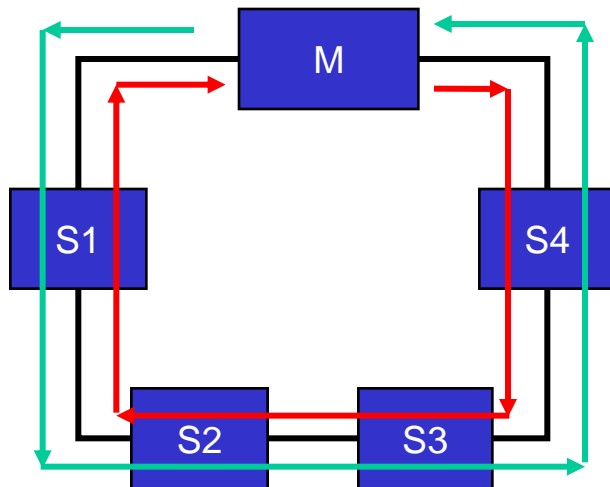


t

# Example: Redundancy Concept of SERCOS III

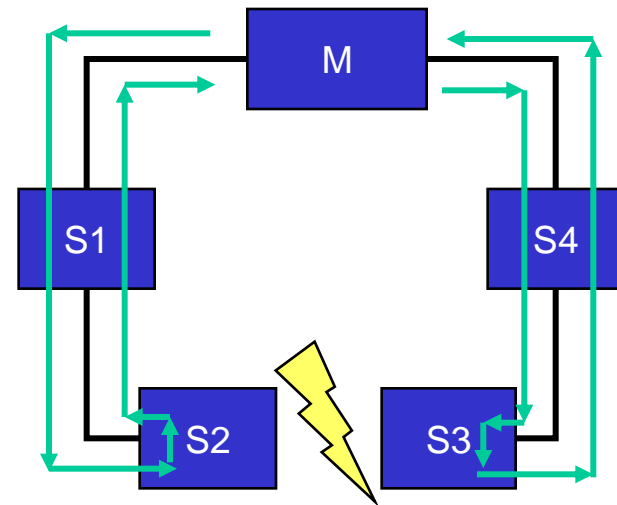
Normal operation:

Cyclic, redundant transmission of real-time data in primary and secondary ring



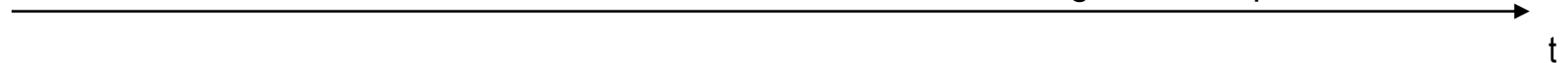
Fault case:

Splitting up into two lines

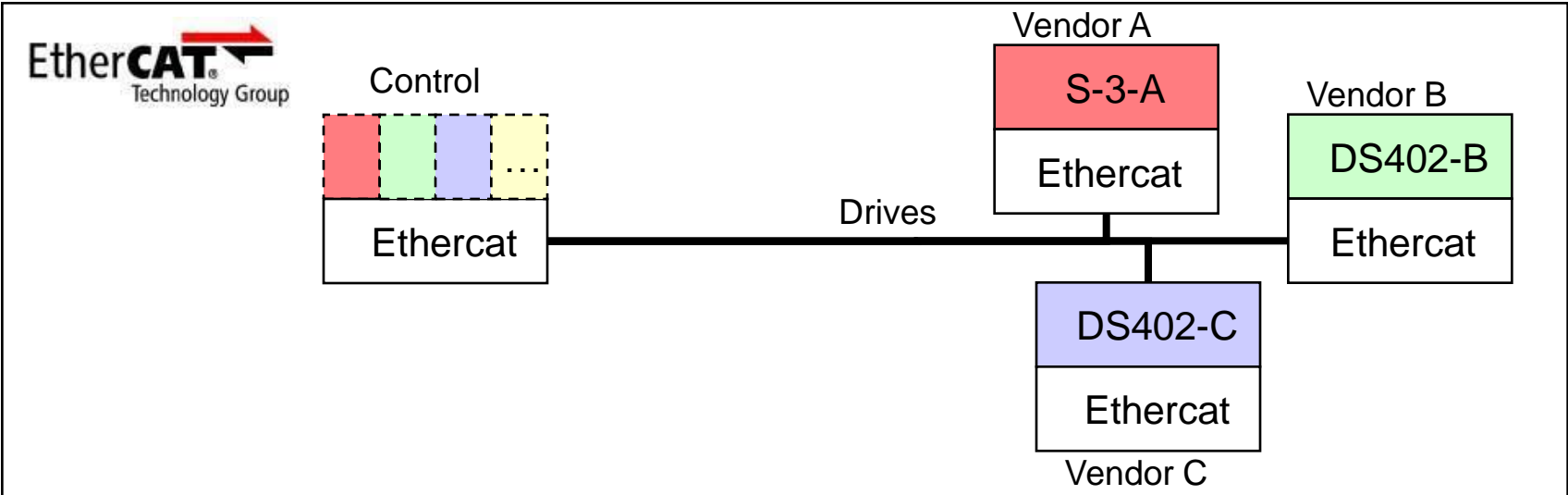
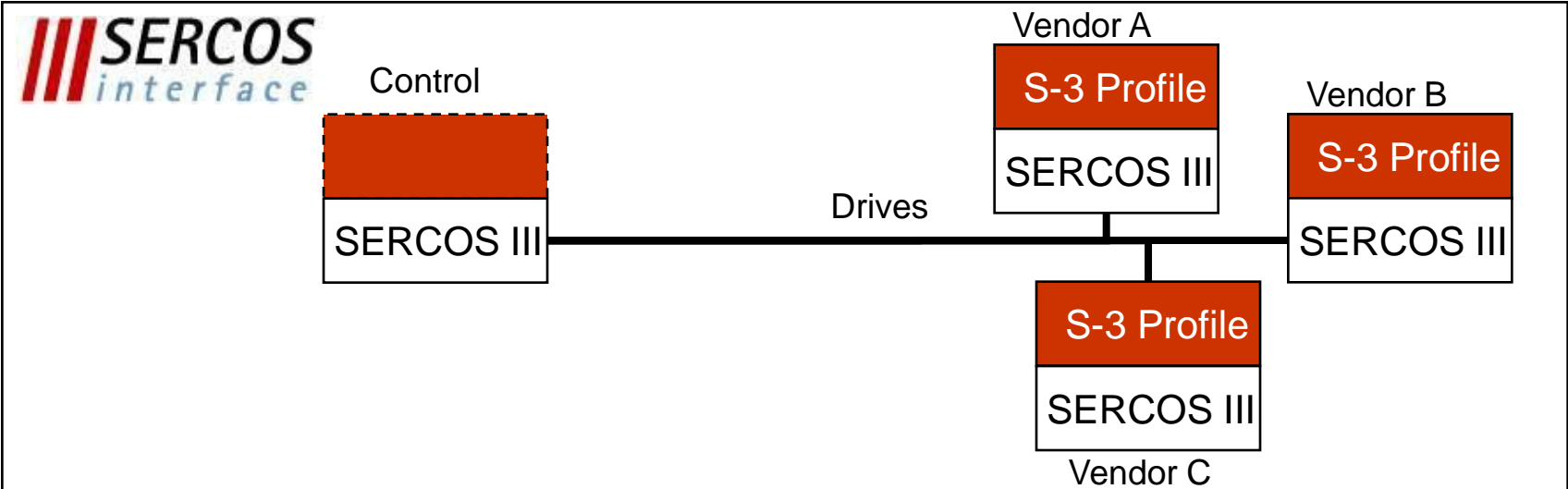


Recovery time:  $< 25 \mu\text{s}$

No reconfiguration required!



# Example: Interoperability with SERCOS III and EtherCAT

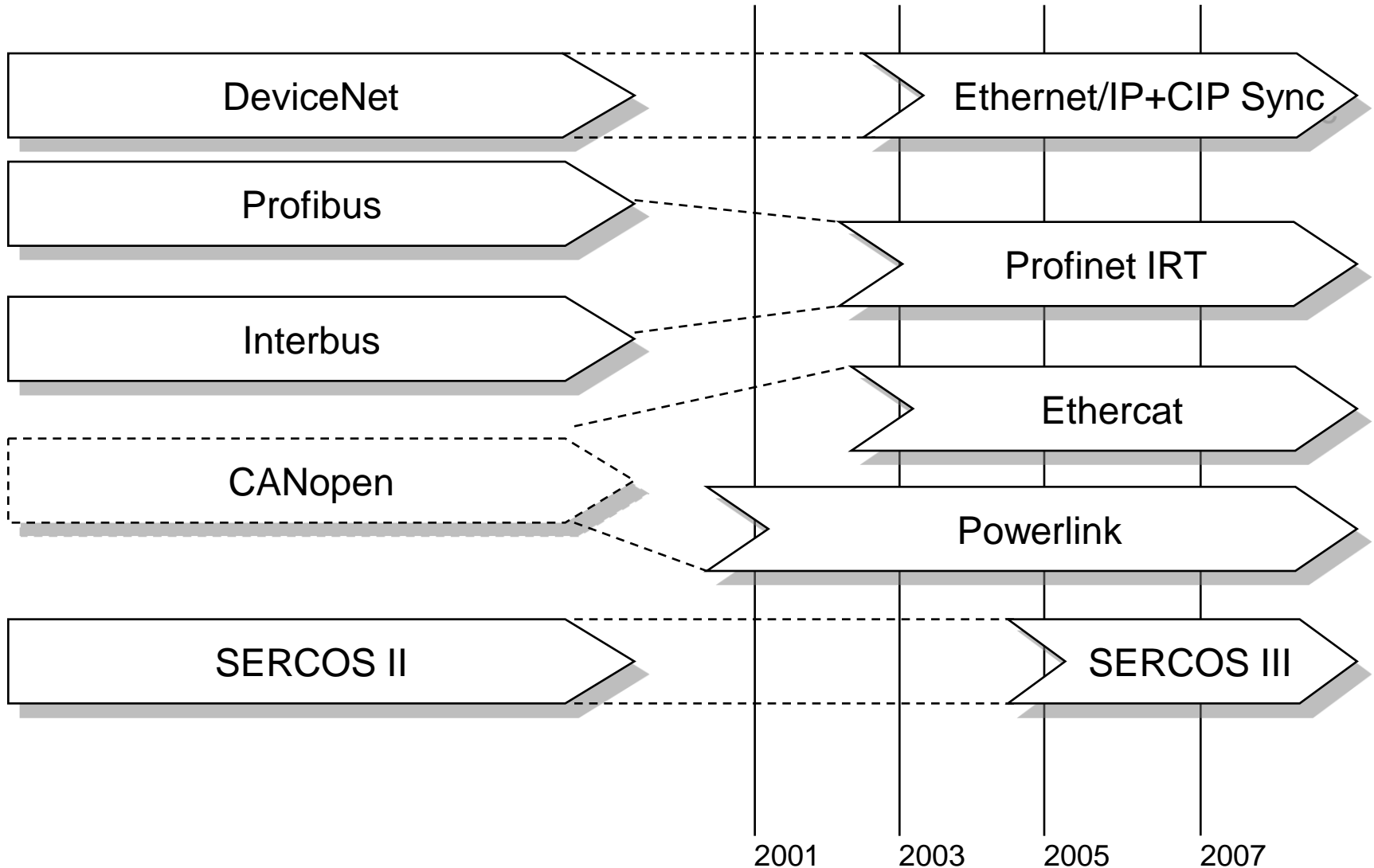


# Comparison of selected Real-Time Ethernet Solutions



	SERCOS III	EtherCAT	PROFINET IRT	Ethernet Powerlink	EtherNet/IP + CIPsync & CIPmotion
Performance	++	++	+	0	0
Ethernet Conformity	+	0	+	++	++
Installed Base	+	++	+	++	0
Variety of Suppliers & Products	+	++	0	0	0
Independence	+	0	0	0	0

# Evolution of Fieldbus and Drivebus Technologies



## SERCOS III ...

- ▶ combines the proven mechanisms of SERCOS interface (IEC 61491) with Ethernet (IEEE 802.3)
- ▶ uses the established and proven synchronization mechanisms and profiles of the existing SERCOS interface
- ▶ allows an easy migration from SERCOS II to SERCOS III
- ▶ is based on a cost-efficient and flexible standard hardware
- ▶ covers all actual and future requirements for motion control applications (C2C, Safety, I/O)
- ▶ develops from a specialized drive bus to an universal real-time Ethernet network