Velkommen til Siemens Webinar: SIMATIC S7-1500 Redundant Systems

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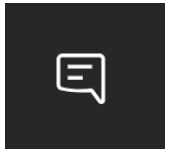
- **Velkommen vi begynner ca : 10.05**

- **Vi tar opptak av presentasjonen (kun selve presentasjonen). Blir delt senere**

- **Full-skjerm:**

- **Vi tar gjerne spørsmål i chatten og vi går gjennom disse til slutt.**



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SIMATIC S7-1500 Redundant System

siemens.com/S7-1500

V16

SIMATIC S7-1500 Redundant Systems

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- Motivation and Product Strategy
- System Overview
- Network Configuration
- Failure Scenarios
- Communication
- Installation Recommendations
- New Features with TIA Portal V16
- Remaining Restrictions
- Demo from TIA Portal

Version 2019-12-13

SIMATIC S7-1500 Redundant Systems
Motivation

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Preventing plant downtime
High availability during operation, Avoidance of loss of production

Prevention of data losses
The data remain intact and long restart times after a failure are eliminated.

Prevention of damages
Avoidance of unplanned production stops where the product to be processed would be permanently damaged

Operation without persons locally
Maintenance trips can be better planned

Save on maintenance
Application solutions are mostly complicated and difficult to maintain

Redundant systems reduce costs

SIMATIC S7-1500 Redundant Systems
Product Strategy S7-1500R/H

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Based on Standard S7-1500 CPUs and PROFINET
- Basis Hardware Standard-CPUs/Fail-safe CPUs

Transparent Programming
- Standard Engineering Tool TIA Portal
  - Redundancy functions fully integrated in TIA Portal
  - General handling like standard
  - No deep Redundancy Know-How needed

Extensive Scalability
- Scalability of switch-over time
- Scalability of the Redundancy Architecture
- Scalability of the CPU Performance (1513 → 1517)

Step by Step Product Launch Strategy
- Step by Step increasing of feature set in future versions

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SIMATIC S7-1500 Redundant Systems
System overview

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Consistent concept – **Identical** synchronization process

Scaling of the switching performance over the **available bandwidth** of the sync connection

	Redundant – S7-1500R	High Available – S7-1500H
		
CPU type	**CPU 1513R / CPU 1515R**	**CPU 1517H**
Synchronization	via **PROFINET Ring (MRP)**	via **Sync-Module**
Switchover time	**300 ms**	**50 ms**
I/O systems	ET 200SP and ET 200MP [1)]	
Type of connection	Single connection (PN redundancy S2) and switched S1	

SIMATIC S7-1500 Redundant Systems
PLC Hardware

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	CPU 1513R-1 PN 6ES7513-1RL00-0AB0	CPU 1515R-2 PN 6ES7515-2RM00-0AB0	CPU 1517H-3 PN 6ES7517-3HP00-0AB0
Program / memory	350 kB code 1,5 MB data	500 kB code 3 MB data	2 MB code 8 MB data
Interfaces	X1	X2 X1	X2 X1 X3 X4
Firmware	V2.8	V2.8	V2.8

Short Distance <= 10m	Long Distance <= 10km
Fiber Optic Cable	
Plastic	Glass fiber
Sync module SFP	
6ES7960-1CB00-0AA5	6ES7960-1FB00-0AA5





X1: PROFINET IO Controller, Supports RT, MRP, Transport Protocol TCP/IP, Open User Communication
X2: PROFINET Basic Services, Transport Protocol TCP/IP, Open User Communication

SFP = Small Form-factor Pluggable

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Highlights

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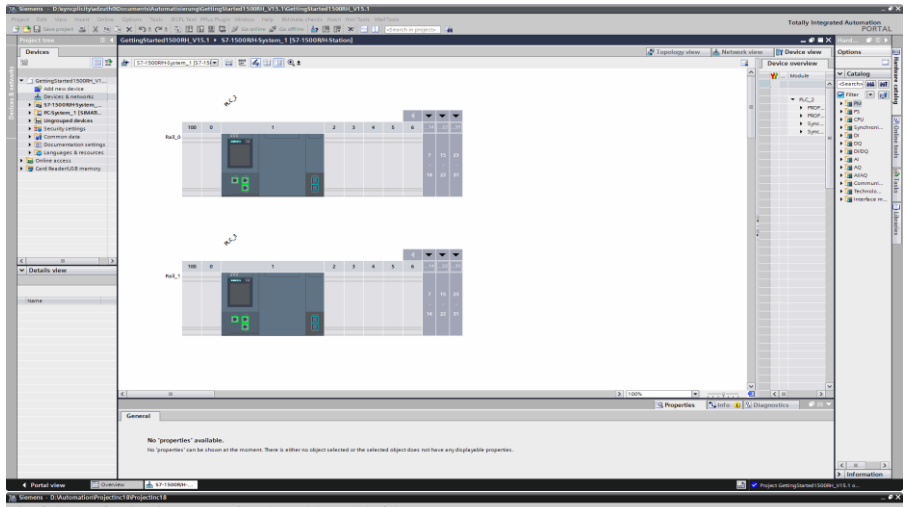

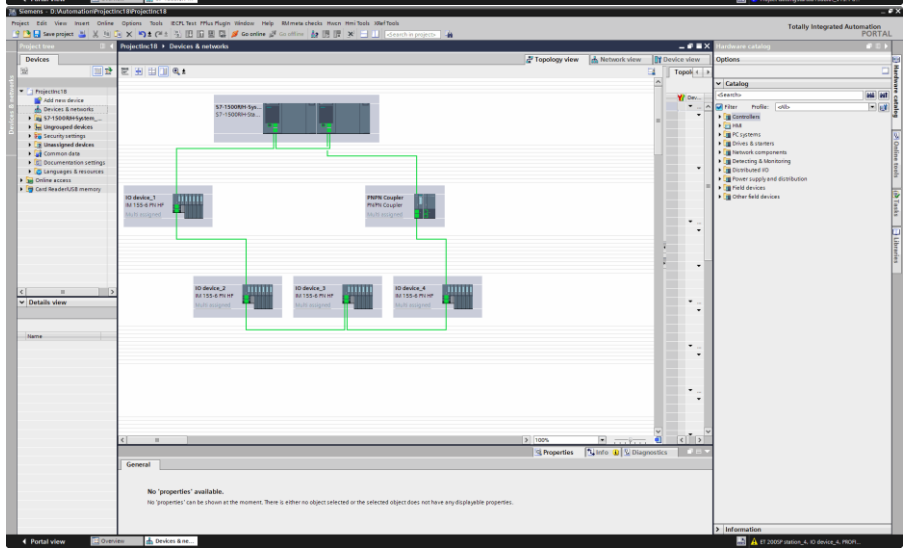

Same Engineering like a single CPU

Multi-Task program structure possible

Automatic data exchange (all data)

Automatic program update
Primary -> Back-Up (Consistency)

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Network Configuration with S7-1500R/H
Requirements

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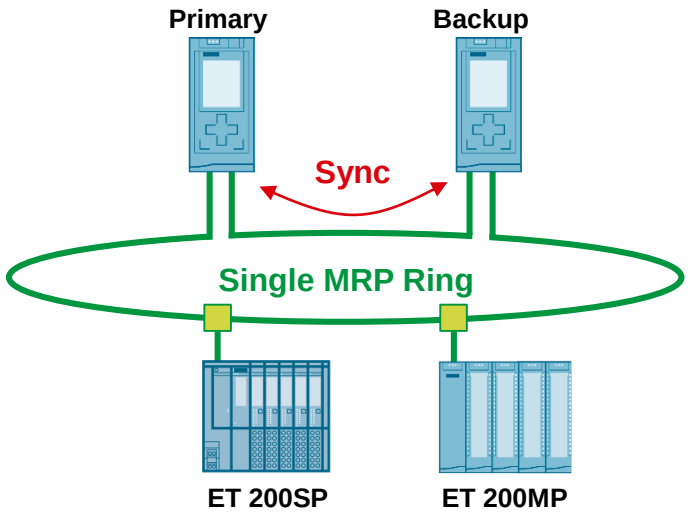
Requirements for the PROFINET network configuration

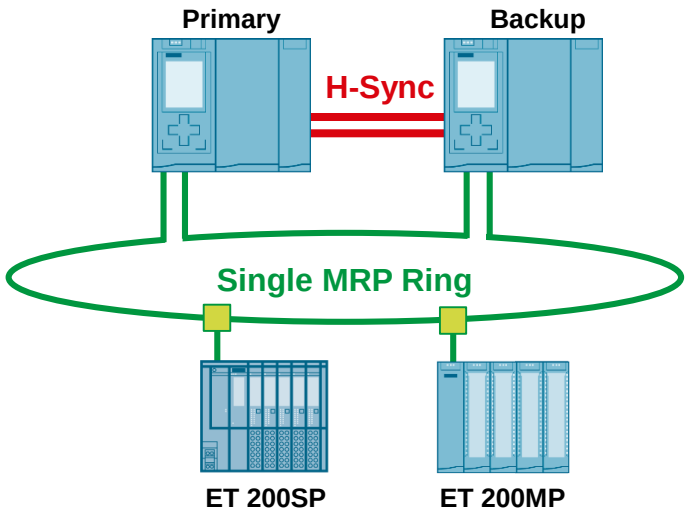
- MRP Ring (default setting in the configuration)
- PN IO only at X1 interface
- PLC's need to be part of the ring
- S7-1500R → no devices in the connection between the two PLC's
- PN Devices need to support PN System redundancy NAP S2 (V1.11)

Redundant – S7-1500R



Max. 16 devices in ring*)

High Available – S7-1500H



Max. 50 devices in ring*)

*) Recommendation

PROFINET System Redundancy
Siemens PN IO-Devices with PN S2 Support

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I/O-Systems

ET 200SP - IM155-6PN HF (FW>=4.2)		6ES7155-6AU01-0CN0 6ES7155-6AU30-0CN0
ET 200MP - IM155-5PN HF (FW>=4.2)		6ES7155-5AA00-0AC0
PN/PN-Koppler		6ES7158-3AD10-0XA0
ET 200eco PN M12-L[1)]		6ES7 14*-6**00-0BB0

1) In Vorbereitung

PROFINET System Redundancy
Siemens PN IO-Devices with PN S2 Support

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Drives

S120, CU310-2PN (FW >=5.2) (with gsdml)		**6SL3040-1LA01-0AA0**
S120, CU320-2PN (FW>=5.2) (with gsdml)		**6SL3040-1MA01-0AA0**

Switches

SCALANCE XC-200 Serie		**6GK5 2 . . - . . . 00 - 2 . C2**
SCALANCE XP-200 Serie		**6GK5 2 . . - 0 . A00 - . . S6**
SCALANCE XF204-2BA		**6GK5 204-2AA00-2GF2**

Network Configuration with S7-1500R
Length of the synchronization connection

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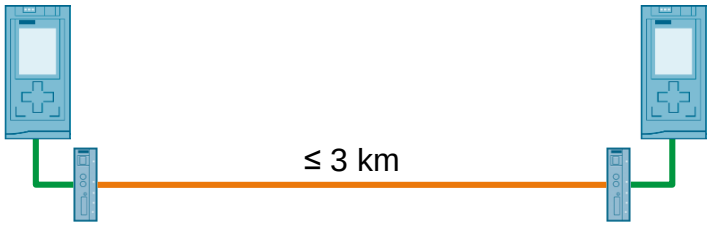
CPU 1513R
CPU 1515R

Direct link up to 100 m

Fiber optic link
(media converter) up to 3 km



Network Configuration with S7-1500H

Length of the synchronization connection

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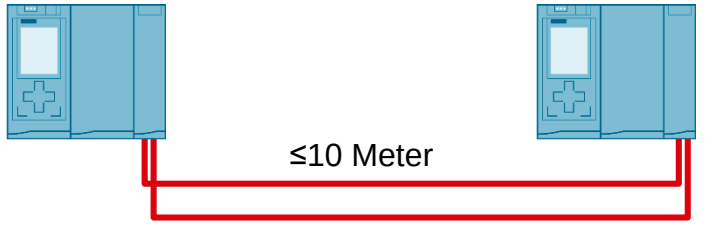
CPU 1517H

Short distance Sync modules up to 10 Meter (LED)



Long distance Sync modules up to 10 km

The sync cables are redundant.
The loss of one fiber optic cable has no impact on the runtime behavior.

Network Configuration with S7-1500R/H
Connection of PROFINET Devices

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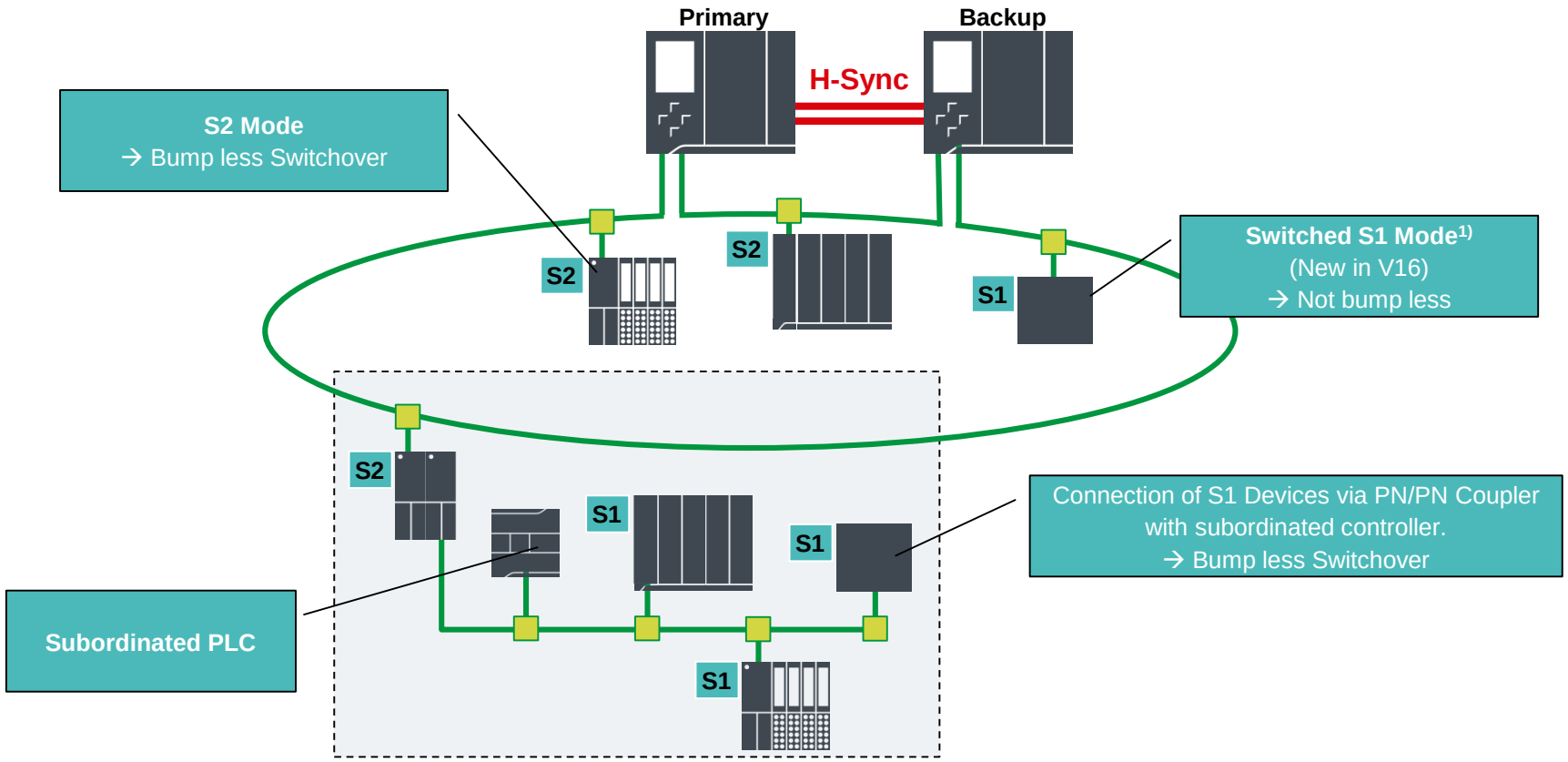
S2 and S1 Devices can be connected



1) For S7-1500R, S1 devices should be connected via a switch to the MRP ring

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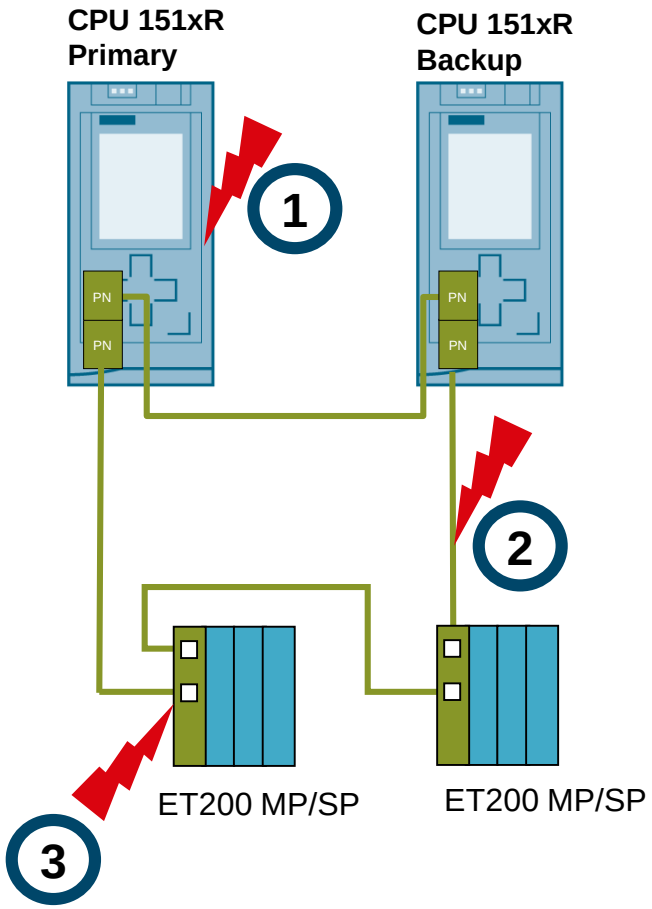
Failure scenarios for S7-1500R



Possible Fault scenarios and Fault reaction

1. Primary CPU fails ➔Backup CPU takes over control ☑
2. Connection Fault ➔ Connection still available via 2. Interface (MRP) ☑
3. Failure of Station (IM) ➔ Other devices not affected (MRP) ☑

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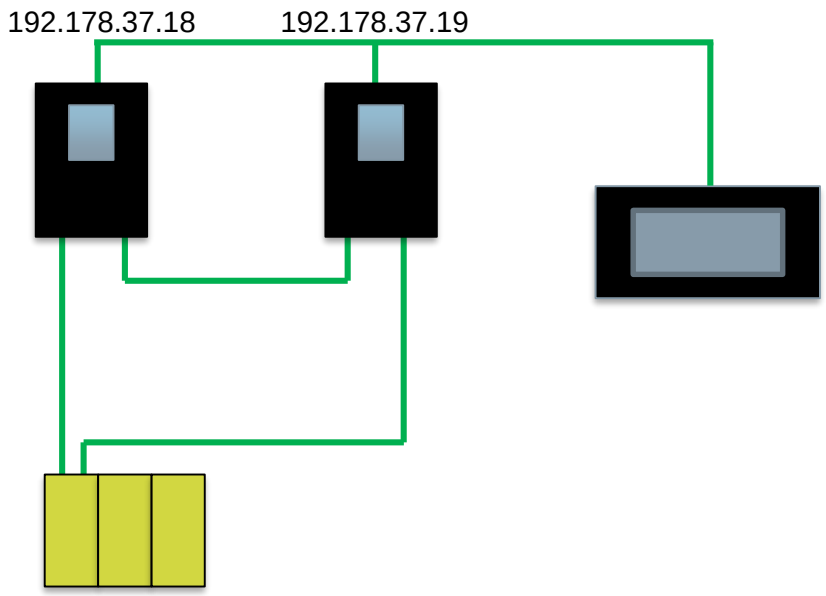
Communication



Feature	Benefit
• One virtual IP Address always assigned to the primary CPU.	• Transparent communication between standard and H-systems • No special add-on needed in the standard components • Standard devices automatically communicate with primary

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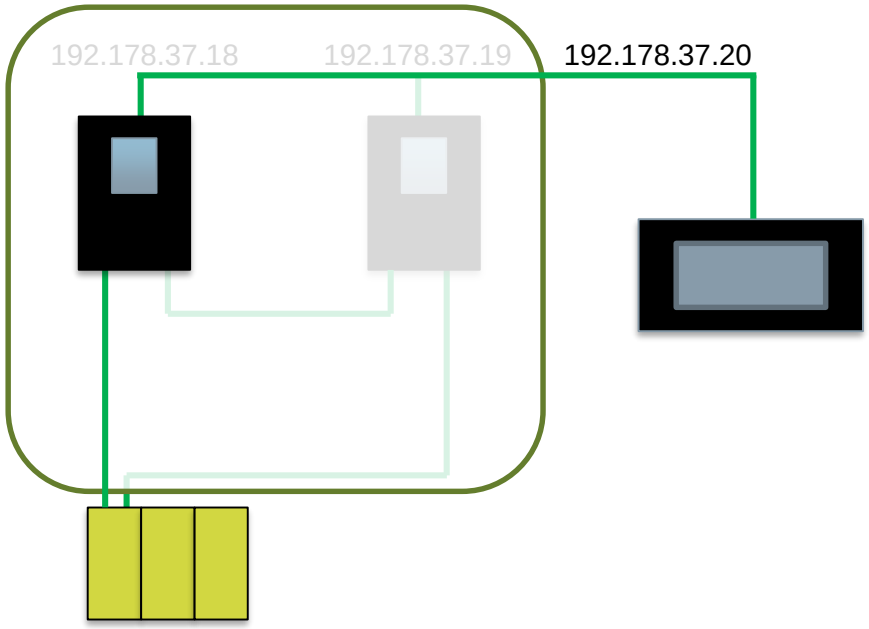
Communication



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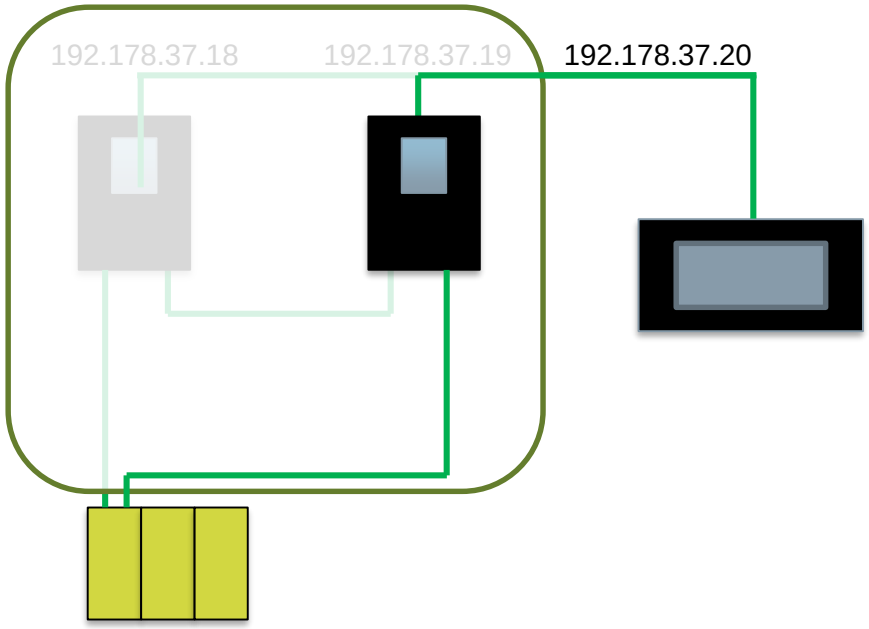

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Installation Recommendations
for CPU 1513R-1 PN

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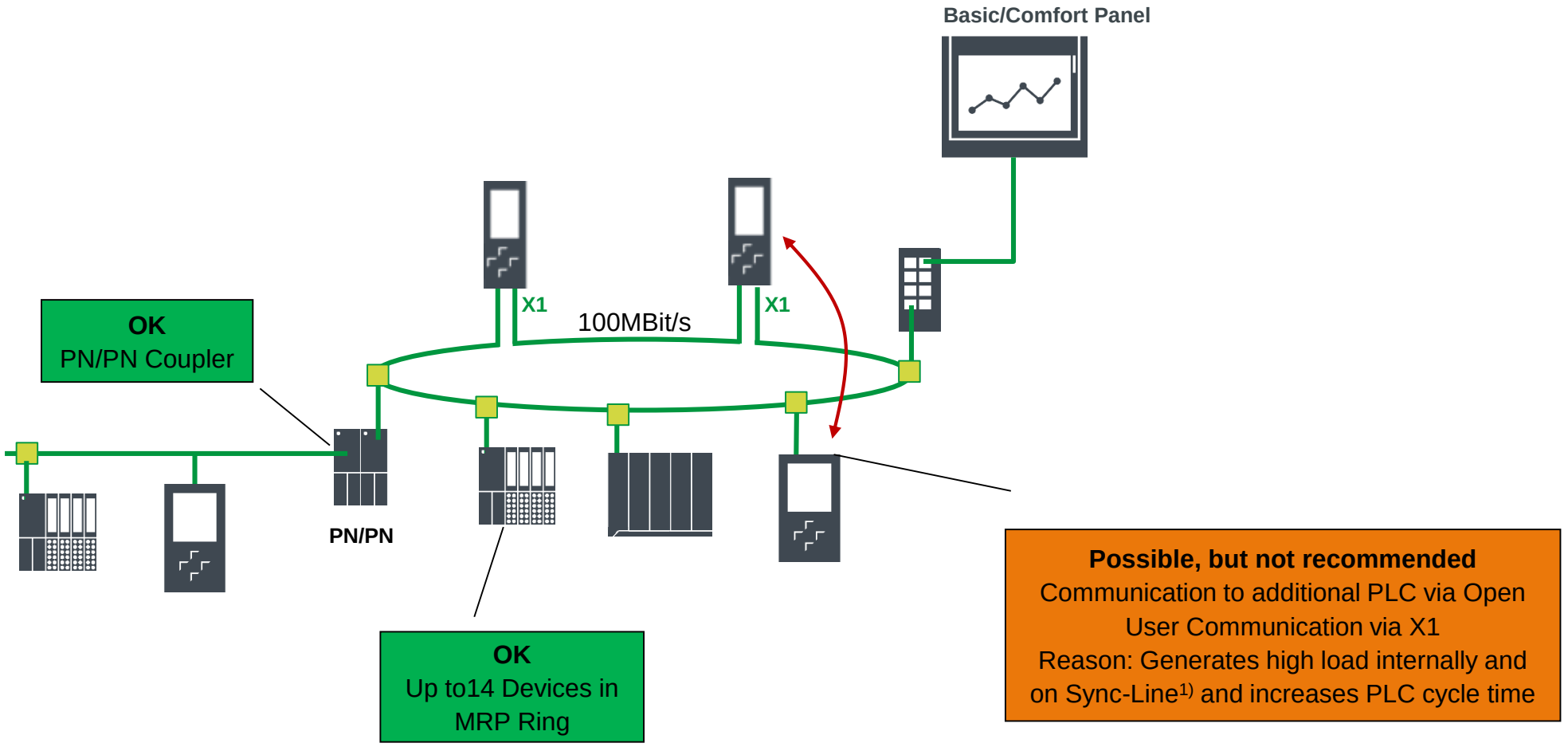

1) Sync-Line runs with 100MBit/s on R-System

Installation Recommendations
for CPU 1515R-2 PN

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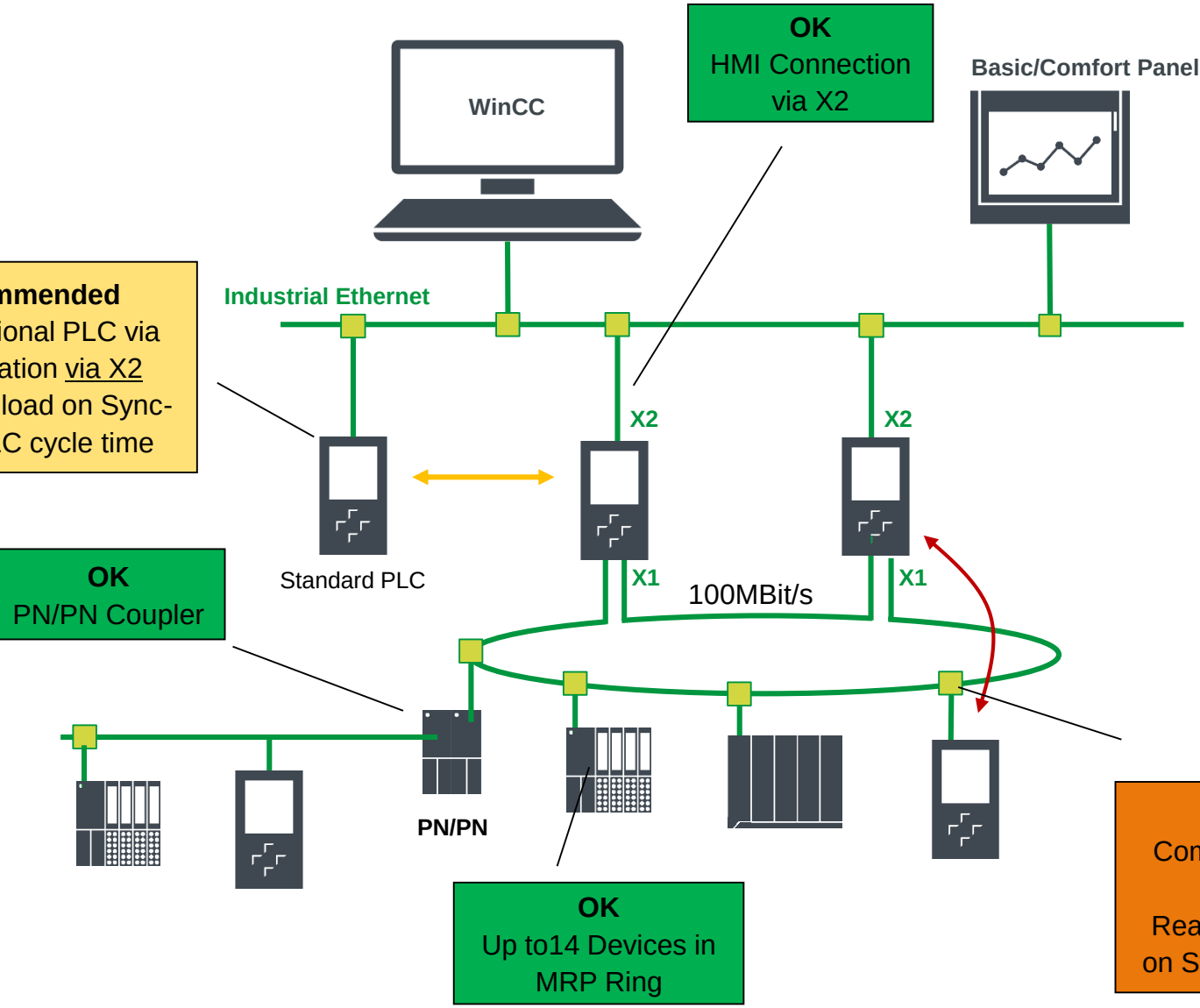

OK
HMI Connection via X2

Conditionally recommended
Communication to additional PLC via Open User Communication via X2
Reason: Generates high load on Sync-Line[1)] and increases PLC cycle time

OK
PN/PN Coupler

OK
Up to14 Devices in MRP Ring

Possible, but not recommended
Communication to additional PLC via Open User Communication via X1
Reason: Generates high load internally and on Sync-Line[1)] and increases PLC cycle time

1) Sync-Line runs with 100MBit/s on R-System

Installation Recommendations
for CPU 1517H-3 PN

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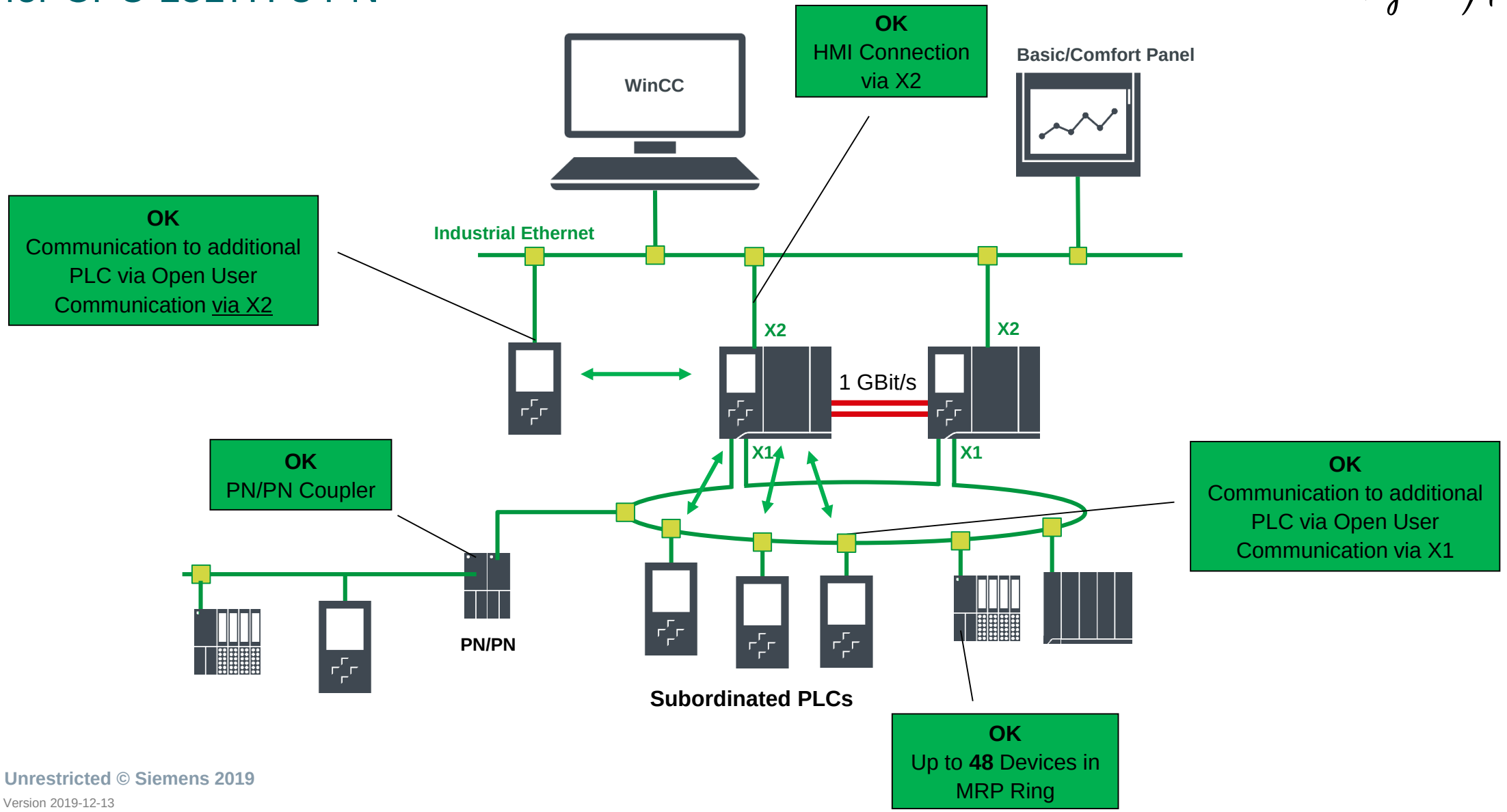

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SIMATIC S7-1500 R/H
New Features with V16 and Firmware Version 2.8

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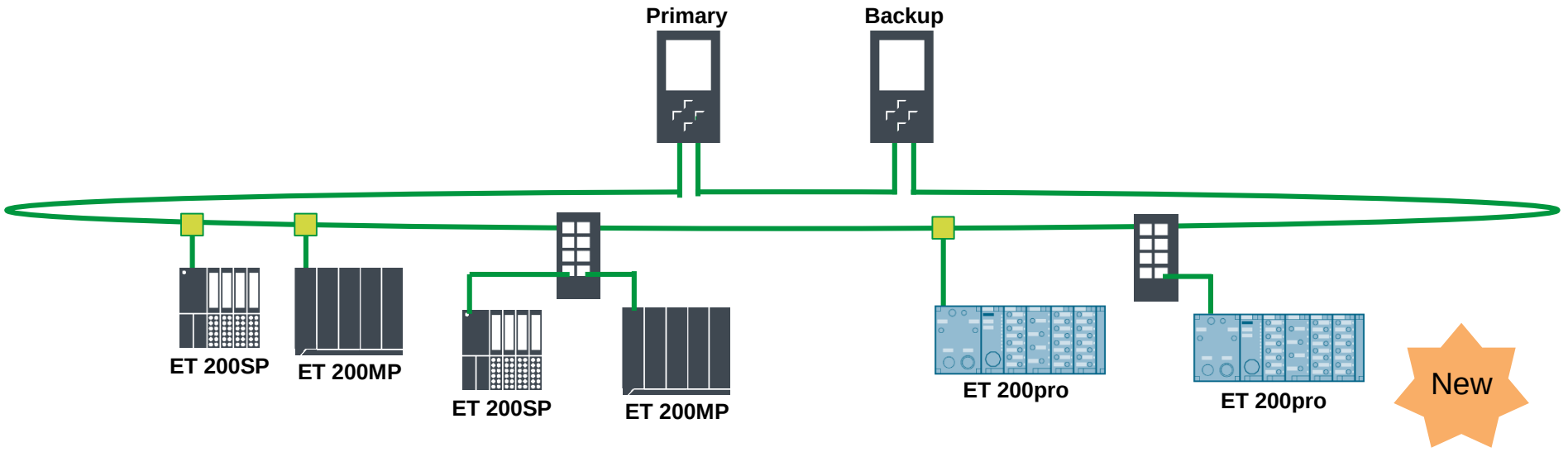
New Features and improvements

- Connection of standard (non redundant) PN devices: Switched S1
- Program Download in Run-Redundant Mode
- IP Forwarding
- Significantly reduced communication breakdown time during Sync-Up

Reduction of functional gaps compared with S7-1500

- Support of Alarm SFC's and Diagnosis SFC's
- Support of ProDiag and S7-Graph
- Support of PNIO SFB's
- Support of Loop Control Blocks (PID)
- S7-Routing

V16 – S1-Devices
S1-Devices can be connected directly to the PN-IO ring



DEVICE	Before Switchover	Switchover	After Switchover
ET 200SP DQ **S2-Device**	1 0		
ET 200pro DQ **S1-Device**	1 0		
ET 200pro DQ HF **S1-Device (with Feature: Keep last Value)**	1 0		

New in V16: Mode „Switched S1 Device“

Visualization of redundancy modes in TIA Portal

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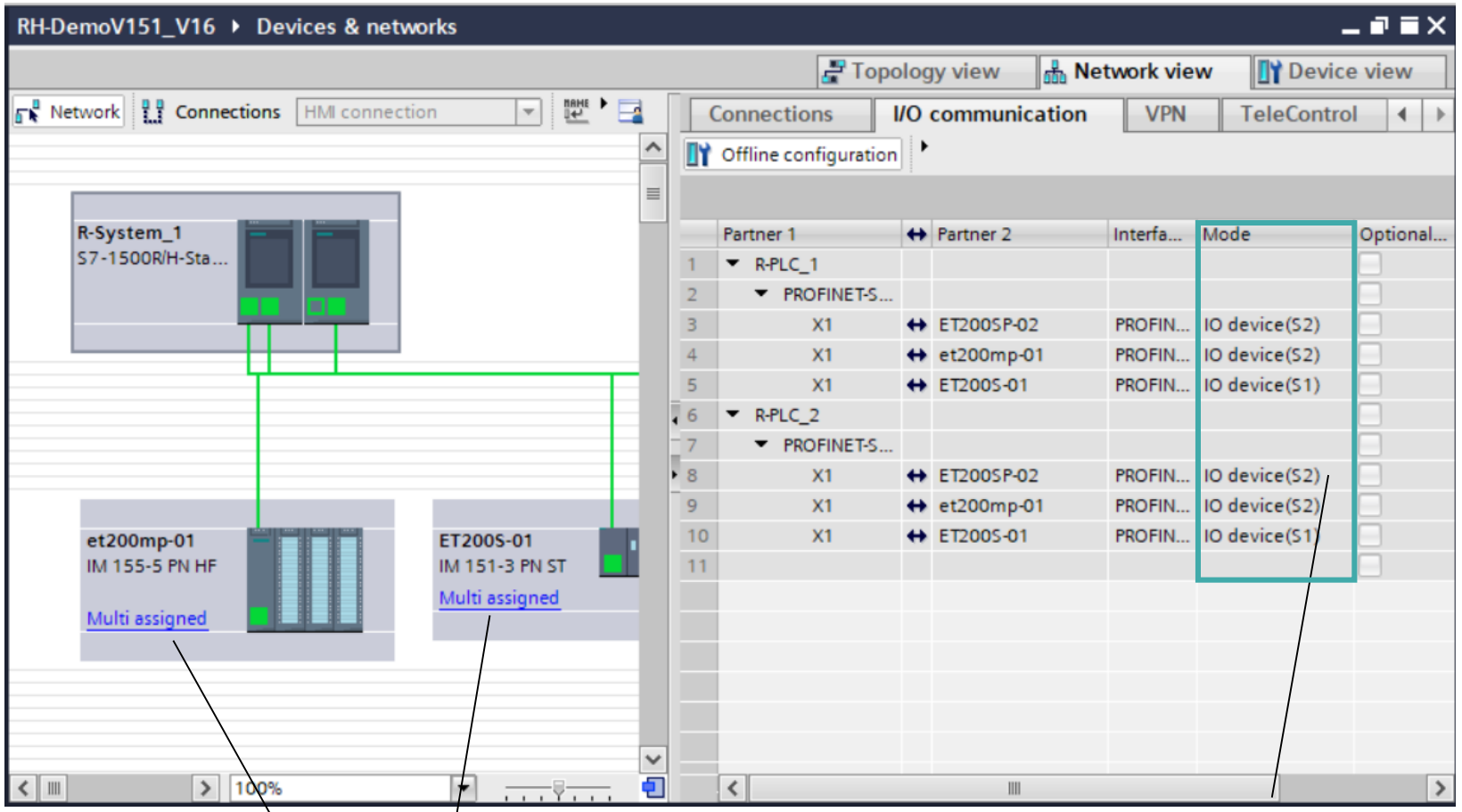

In the network view S1 and S2 devices are marked as „Multi-assigned“

Differences are shown in the column „Mode“ of the I/O communication table. Here: ET 200MP is connected as S2 device

New in V16: Support of additional blocks

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Program Block	
Program_Alarm	Generate program alarm with associated values
Get_AlarmState	Output alarm state
Gen_UsrMsg	Generate user diagnostic messages
Get_Alarm	Read pending alarm
Ack_Alarms	Acknowledge alarms

Technology	
PID_Compact	Universal PID controller with integrated optimization
PID_3Step	PID controller with integrated optimization for valves
PID_Temp	PID controller for temperature

Advances Instructions	
GETIO / GETIO_PART	Read process image
SETIO / SETIO_PART	Transfer process image
GetStationInfo	Read information of an IO device
DeviceStates	Read module state information in an IO system
GEN_DIAG	Generate diagnostics information

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Restrictions for S7-1500R/H

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Restrictions of the configuration for S7-1500R/H

	S7-1500R/H	S7-1500	S7-400H
Single PLC projectable (H/R CPUs as redundant System only)	no	N/A	yes
Central periphery or central CPs / CMs projectable	no	yes	yes
Configure System-PS	no	yes	yes
Only MRP-Ring PN-Networks are supported (no „open Ring“ like in 400H)	yes	no	no
Operation as Shared Device or I-Device	no	yes	no

Restrictions for S7-1500R/H

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Functional restrictions for S7-1500R/H

	S7-1500R/H	S7-1500	S7-400H
S7-Com, E-Mail, FDL, ISO, (OUC with dynamic connections is supported)	no[1)]	yes	yes
OPC UA	no	yes	no
System-supported H-communication (but the System IP-Address)	no	no	yes
Webserver	no	yes	no
System-supported redundant I/Os	no[2)]	no	yes
PROFIsafe	no	F-CPU	yes
Technology Objects	some[3)]	yes	no
Support for MRPD, clock synchrony and IRT	no	yes	no
CiR and firmware update in run is supported	no	no	yes
Direct migration through hardware replacement (Import of user programs via Copy/Paste)	no	n.a.	no
PLCsim and PLCsim advanced are supported	no	yes	yes

1) S7-Communikation as server is supported
2) Can be realized on application layer: See SIOS article 109767576
3)TO Count, Measuring, PID are supported

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Takk for oppmerksomheten

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