Webinar and demo: New IEC 61850 Features and PRP Support for the RTDS Simulator

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AGENDA

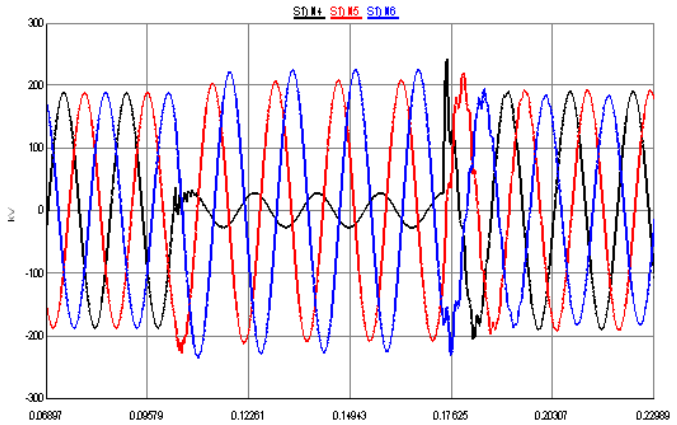
- General introduction
- Review of new GTNET-MU model (combined IEC 61850 features)
- Review of PRP support on the GTNETx2 card
- Case demo in RSCAD FX software
- Q&A

About RTDS Technologies

- Headquarters in Winnipeg, Canada
- Pioneered real-time power system simulation in the 1980s
- The RTDS Simulator is the industry standard for real-time simulation and closed-loop testing, used by utilities, manufacturers, research and educational institutions, and consultants worldwide
- Learn more at www.rtds.com or the large library of videos on the RTDS Technologies YouTube channel

EMT power system simulation

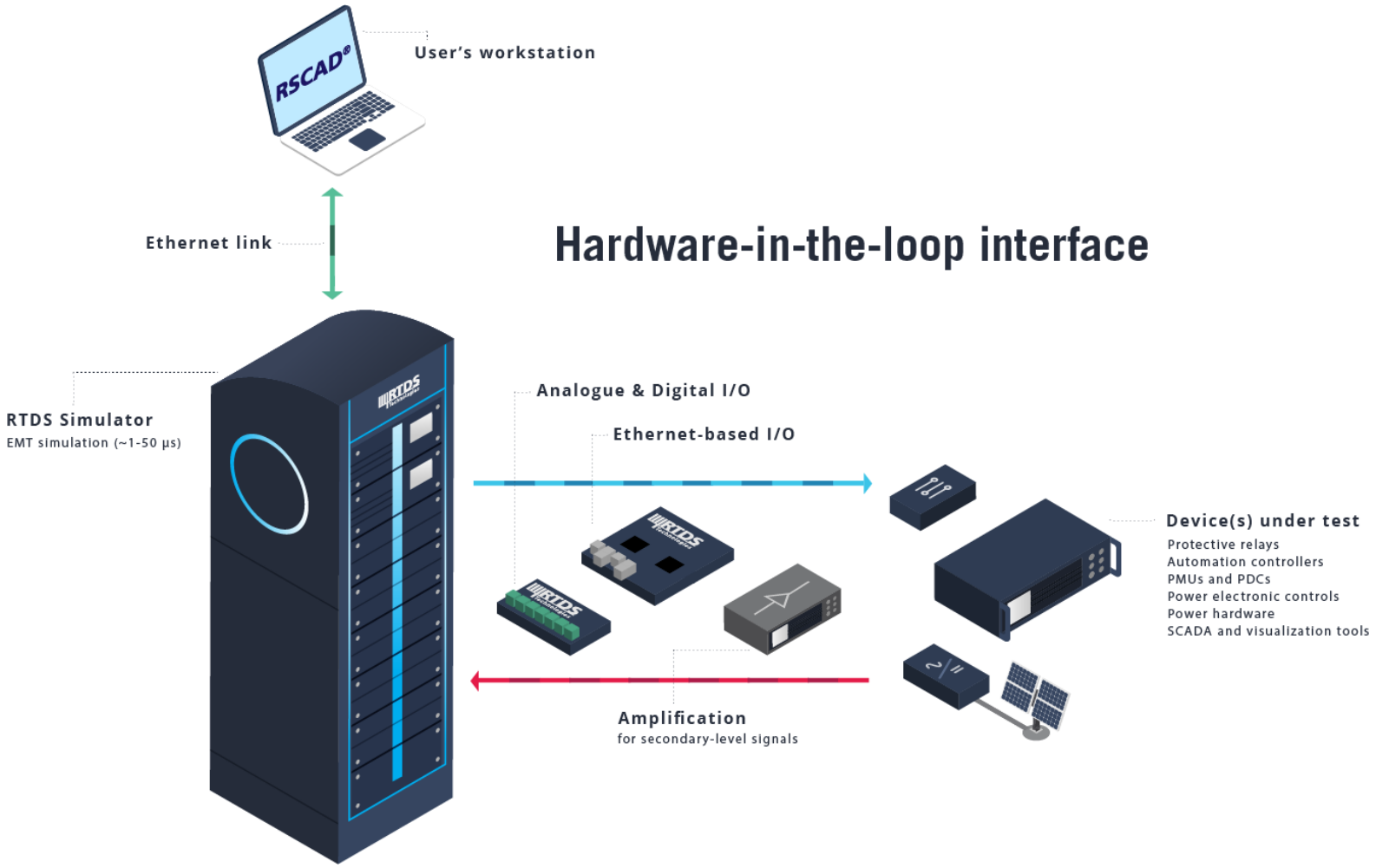
Type of Simulation	Load Flow	Transient Stability Analysis (TSA)	Electromagnetic Transient (EMT)
Typical timestep	Single solution	~ 8 ms	~ 2 - 50 µs
Output	Magnitude and angle	Magnitude and angle	Instantaneous values
Frequency range	Nominal frequency	Nominal and off-nominal frequency	0 – 3 kHz (<15 kHz)



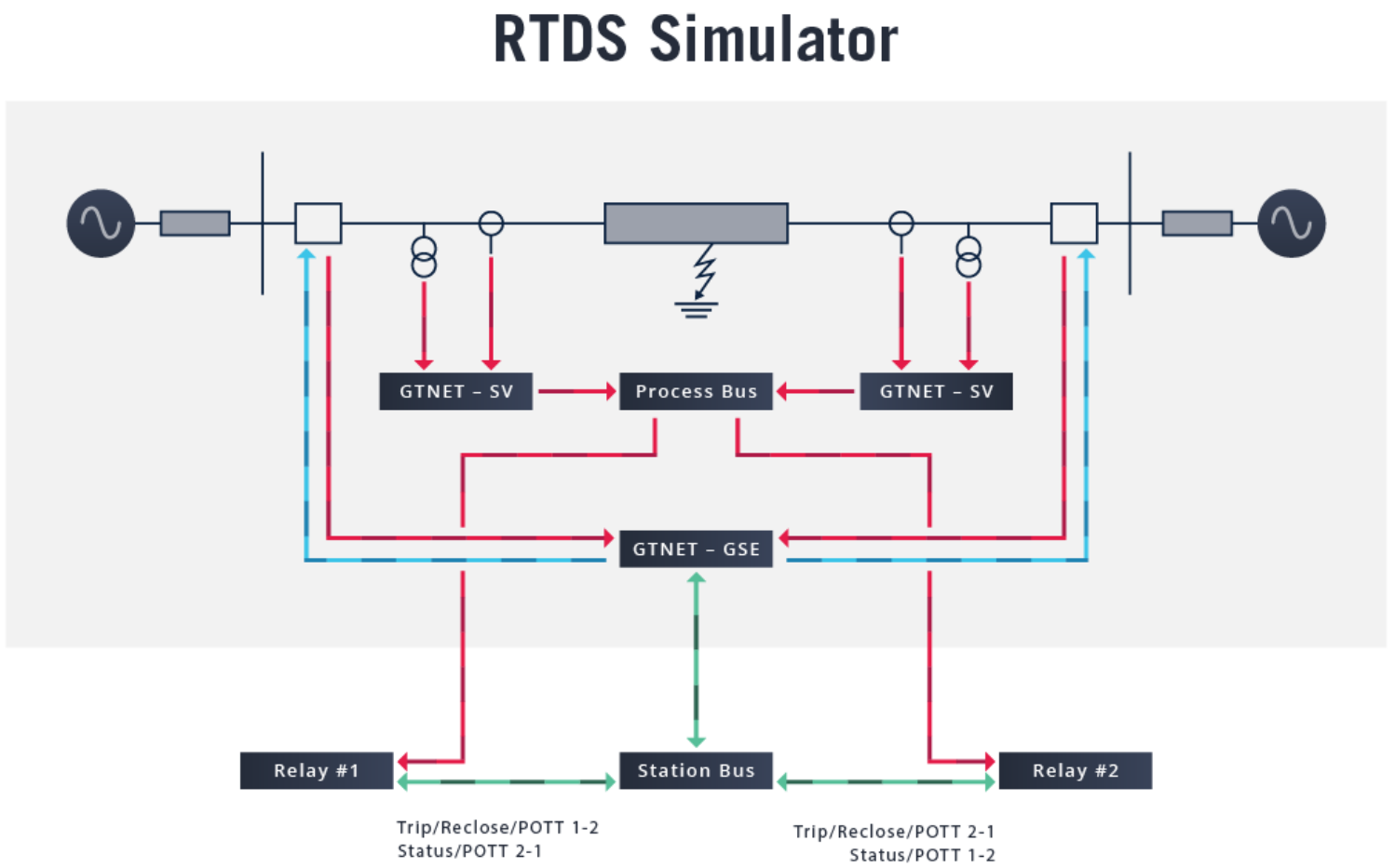
- Greater depth of analysis than traditional phasor domain (RMS) representations
- EMT models are needed to represent inner loop controls of inverter-based resources and related stability issues

HIL testing with a real-time simulator

- **True closed-loop testing** is only possible with a real time simulator
  - Test multiple devices (and entire schemes) at once
  - Much more detailed system representation than open-loop test systems provide (e.g. modelling power electronics)
  - Provides unique insights on interactions & dependencies that traditional modelling/ testing may be blind to



HIL testing via IEC 61850



GTNET-MU AND GTNETx2 PRP FEATURE

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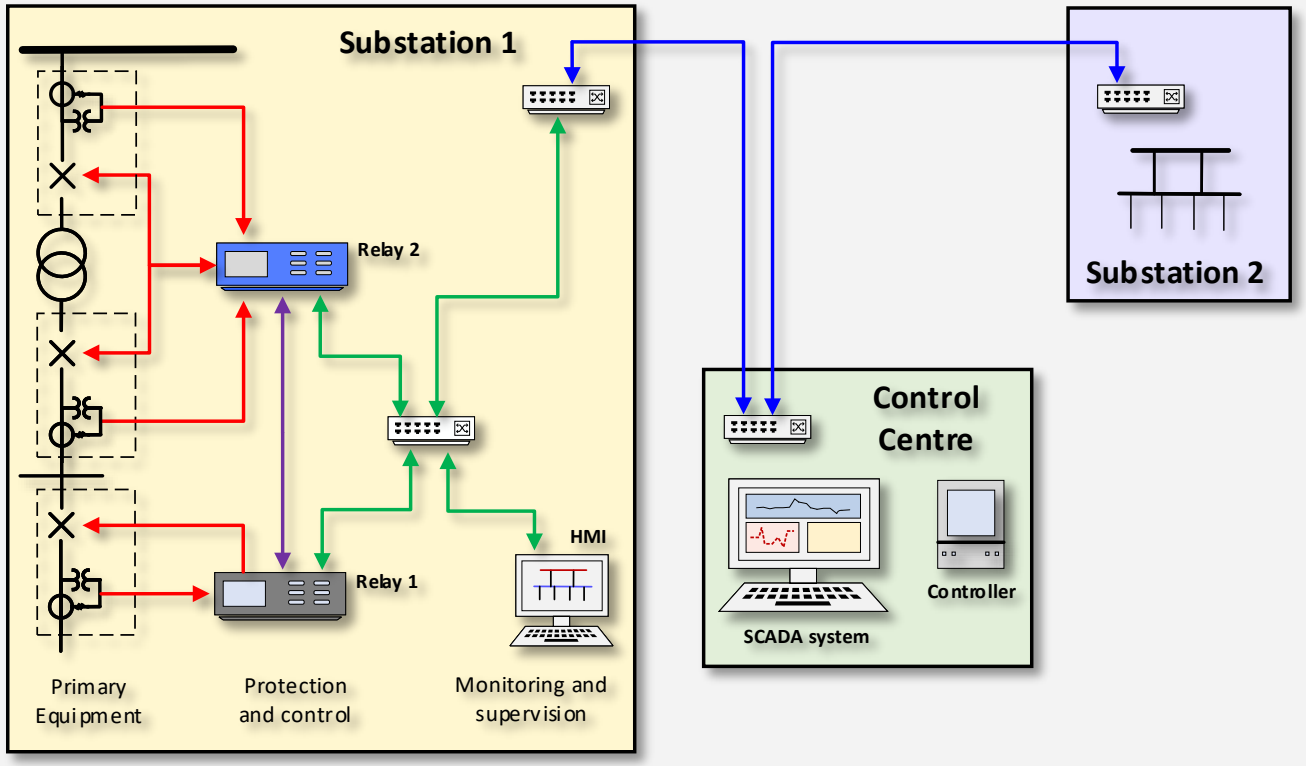
OUTLINE

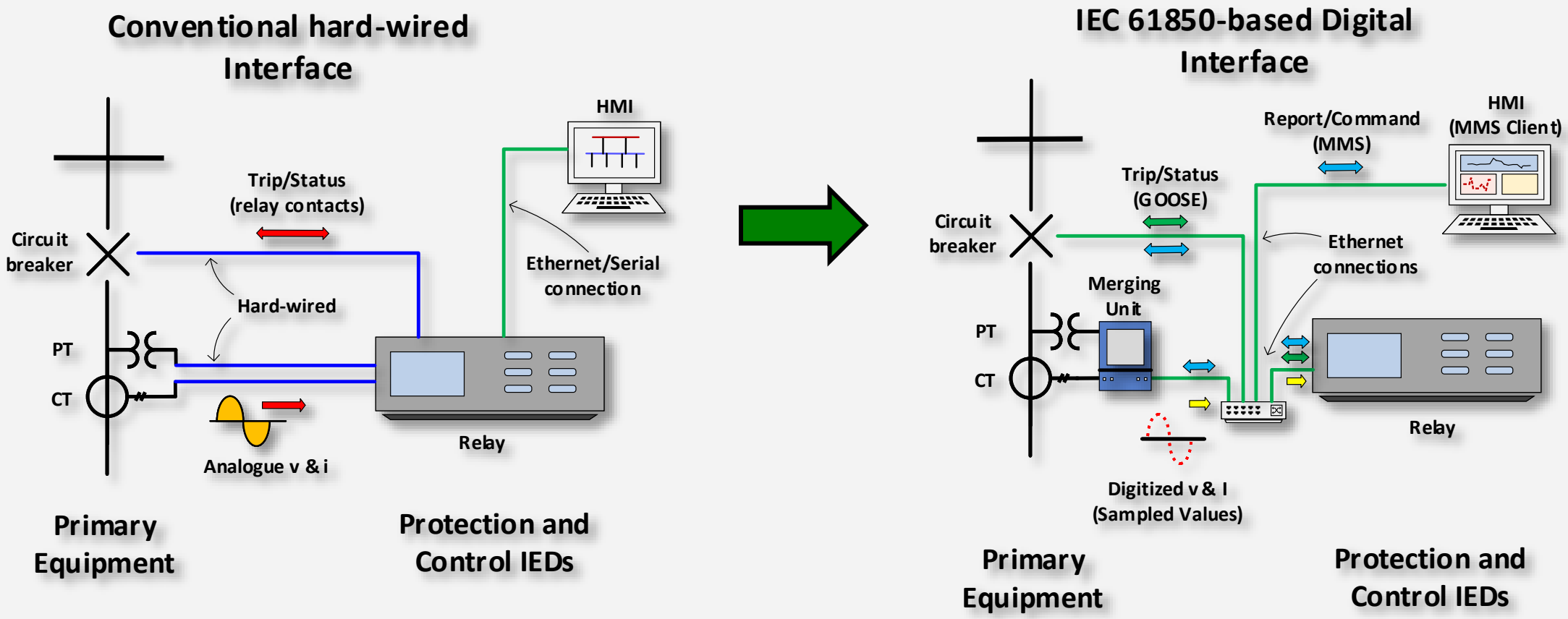
- Introduction of Digital Substations
- GTNET-MU: Features and Configuration
- Network Redundancy
- GTNETx2 PRP
- Demo
- Q & A

SYSTEM PROTECTION, AUTOMATION & CONTROL

- **Information Exchanged in Power Systems**
  - Instantaneous measurements
  - Trip/status signals and alarms
  - Control commands
  - Phasor measurements
  - Communication-aided protection

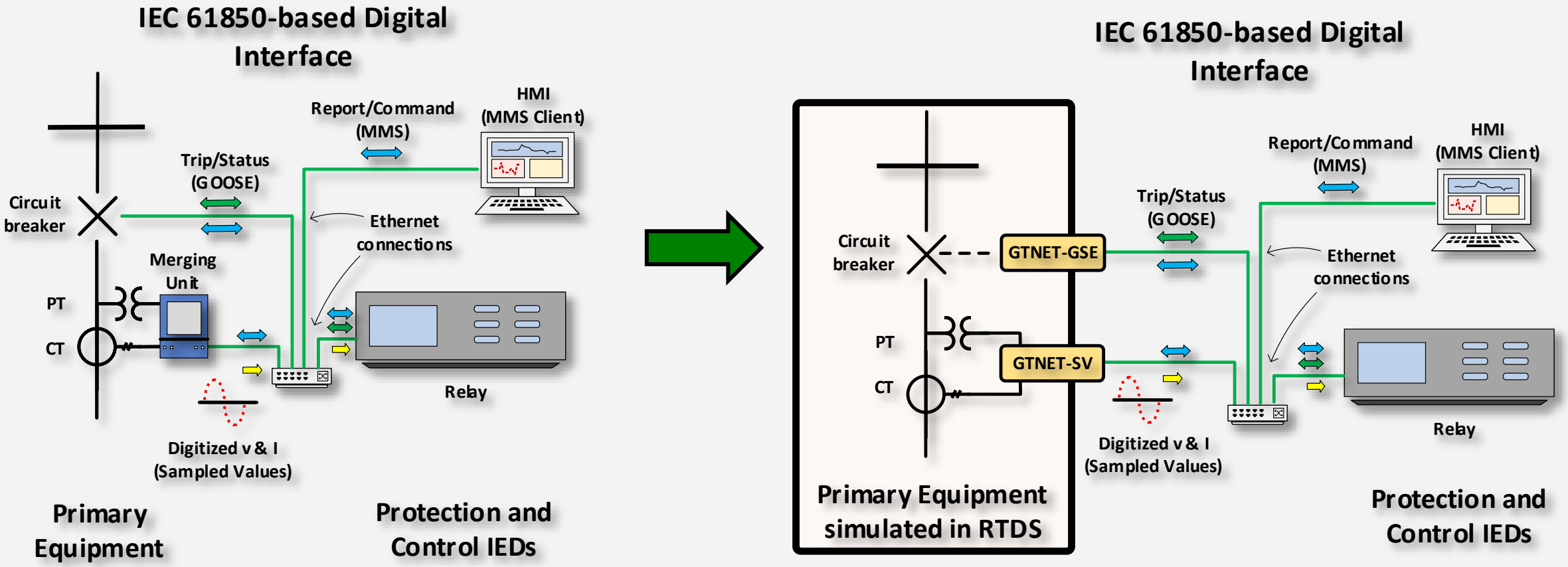


SUBSTATION ARCHITECTURE



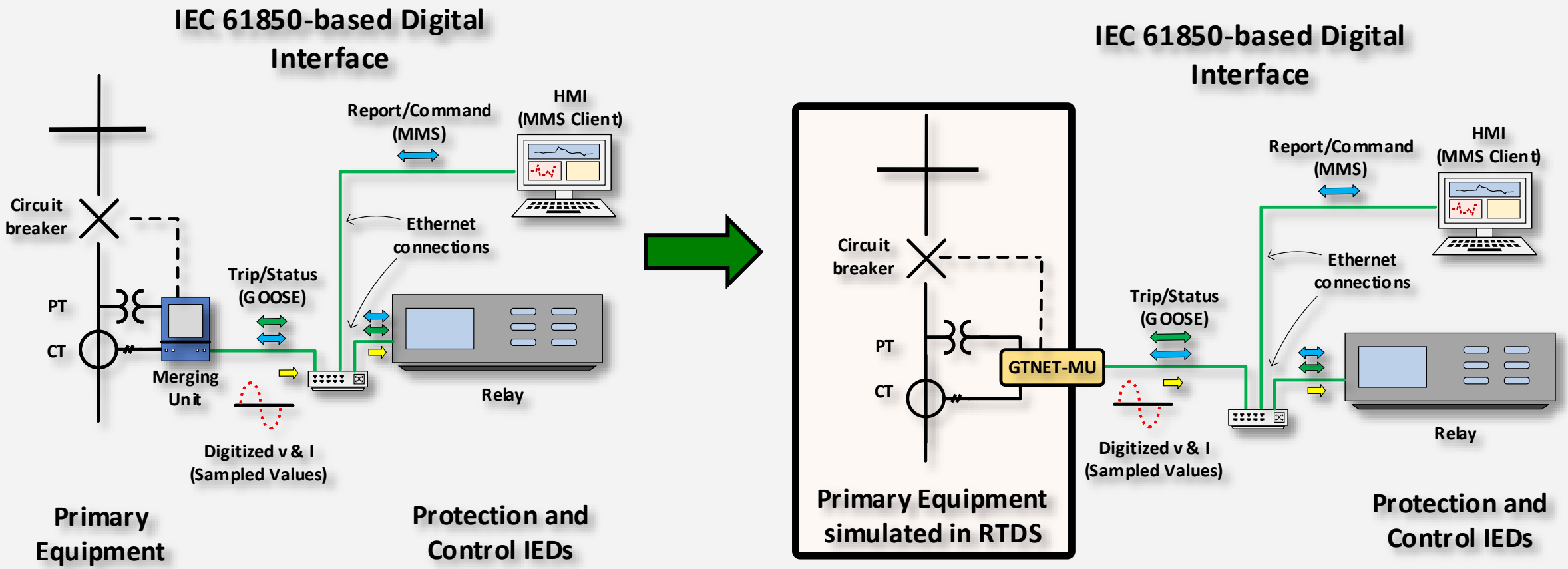
IEC 61850 INTERFACING WITH RTDS SIMULATOR

GTNET-SV / GTNET-GSE



IEC 61850 INTERFACING WITH RTDS SIMULATOR

GTNET-MU



GTNETx2 HARDWARE

- **The GTNETx2 card is the network interface of the RTDS simulator**
- **One GTNETx2 card has two identical modules**
  - Modules are independent
  - Each module has one Ethernet port
  - Supports 100/1000 Copper, 100BASE-FX or 1000BASE-SX connections
- **GTNETx2 module connects to the simulator by a fibre-optic cable**

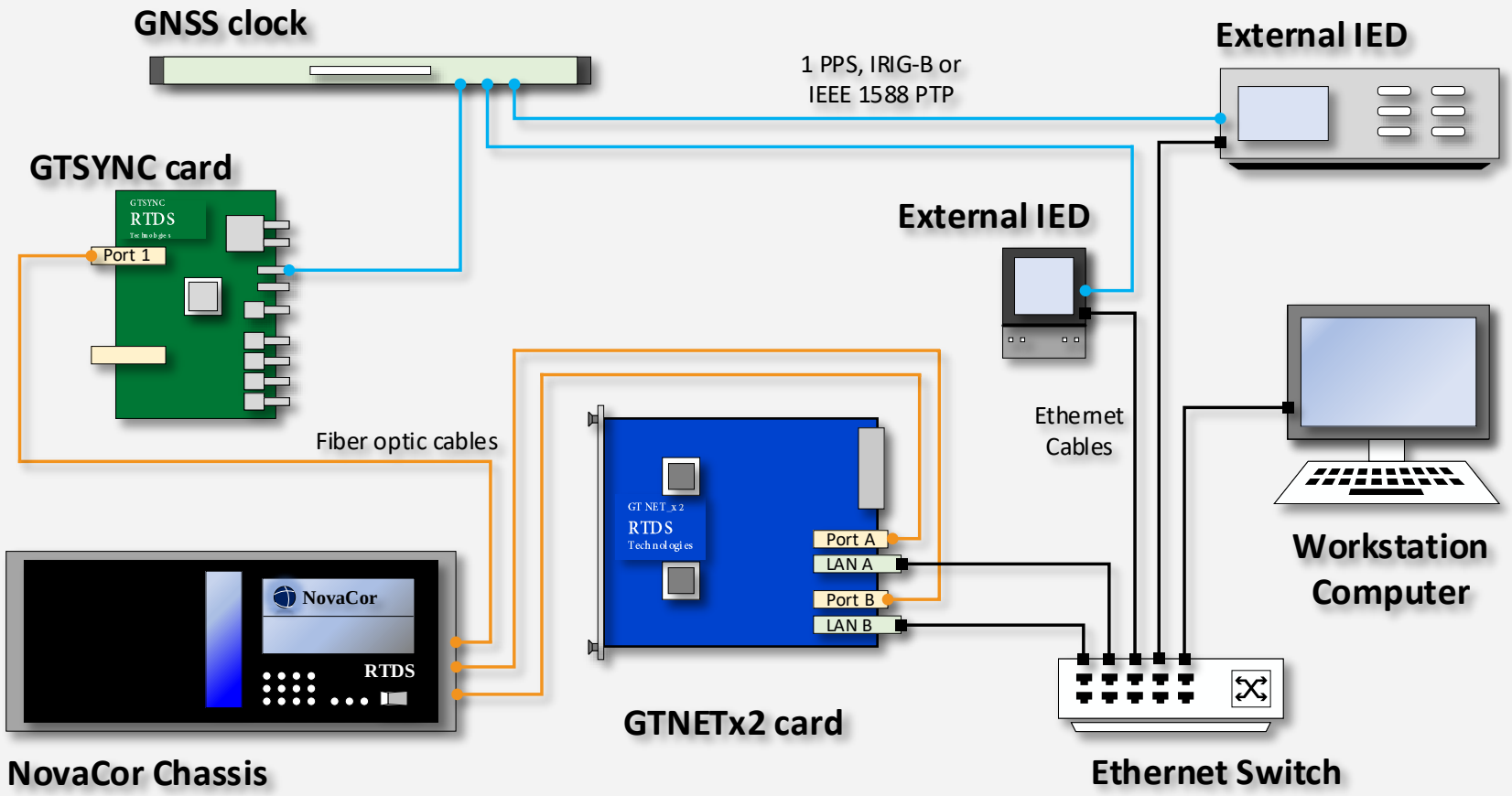
GTNETx2 HARDWARE

- **Supported System Automation Protocols,**

SV	IEC 61850 9-2 / IEC 61869-9 Sampled Values (SV) communication
GSE	IEC 61850-8-1 GOOSE and MMS communication
MU	IEC 61850 SV, GOOSE and MMS communication
PMU	IEEE C37.118: 2011 format data streaming
DNP	IEEE 1815: 2012 Distributed Network Protocol
IEC104	IEC 60870-5-104
MODBUS	Modbus communication over TCP/IP and UDP/IP
PB	Playback recorded waveform data
SKT	TCP/UDP socket communication

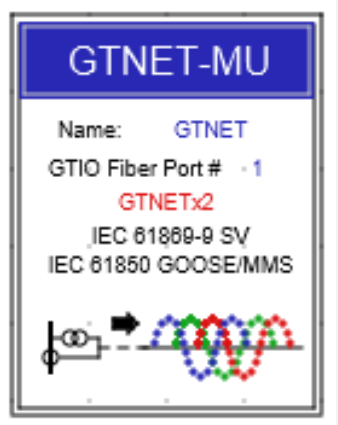
- **Each protocol runs on one of the two modules of a GTNETx2 card**

TYPICAL CONNECTIONS



GTNET-MU

- **GTNETx2 hardware already supports IEC 61850 GOOSE, SV and MMS functionalities**
- **GTNET-MU implementation provides the GOOSE, SV and MMS simultaneously, mimicking the operation of Process Interface Units**
- **This integration allows our users to minimize the use of GTNETx2 hardware and reduce the required no. of Ethernet connections**
  - Save money!!
  - Save space



GTNET-MU: SV FEATURES

- **Provides IEC 61850 9-2 / IEC 61869-9 Sampled Values communications**
- **Supports,**
  - Publish (output)
  - Time-stamping published SV with GTSYNC time
  - Simulated SV and subscription monitoring (LSVS)

Number of SV Streams	Sampling Rate	Max. Number of Channels per Stream
1	80 s/c, 96 s/c, 4800 Hz	24
	256 s/c, 14400 Hz	9

GTNET MU: GOOSE FEATURES

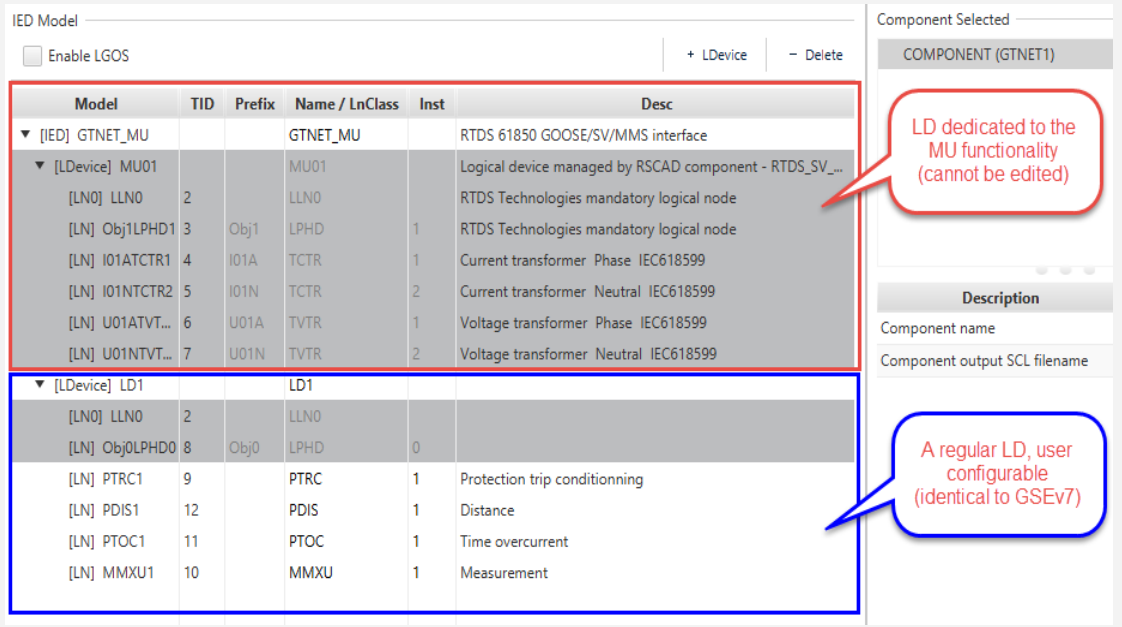
- **Provides IEC 61850-8-1 Ed. 2.0 / 2.1 GOOSE communication**
- **Supports,**
  - Simulating one IED per component
    - can build a generic IEC 61850 data model for GOOSE/MMS from the inbuilt LN database
    - can simulate the IEC 61850 data model of commercial IEDs by importing SCL files
  - Publish up to 8 GOOSE messages
    - up to 512 data items in total
  - GOOSE subscription up to 8 different GOOSE streams
    - up to 512 data items in total
  - Simulated GOOSE and subscription monitoring (LGOS)

GTNET MU: MMS FEATURES

- **Supports,**
  - RTDS switch-objects to simulate switchgear operations
    - Provides circuit breaker control via MMS
  - IEC 61850 MMS communication
    - act as an IEC 61850 MMS server device
    - buffered and unbuffered reports
  - Publish up to 8 RCBs (Report Control Block)
    - up to 512 data items in total

GTNET-MU: ICT UPDATES

- **Supports,**
  - Simulating a **Generic IEC 61850 Merging Units or Process Interface Units (PIUs)** using Templates
  - Simulating **Third-Party IEC 61850 Merging Units or PIUs**

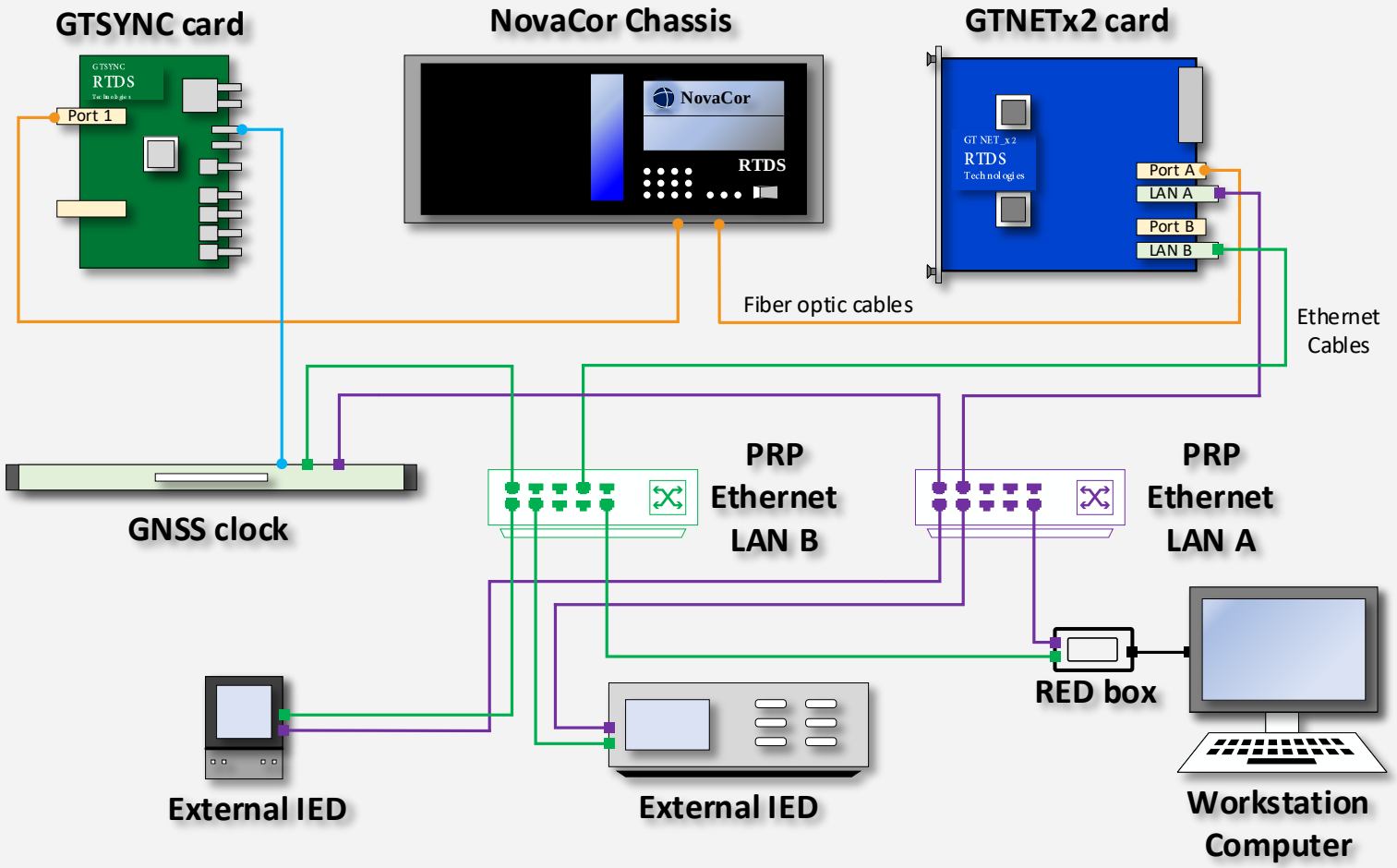


GTNETx2 PRP

NETWORK REDUNDANCY

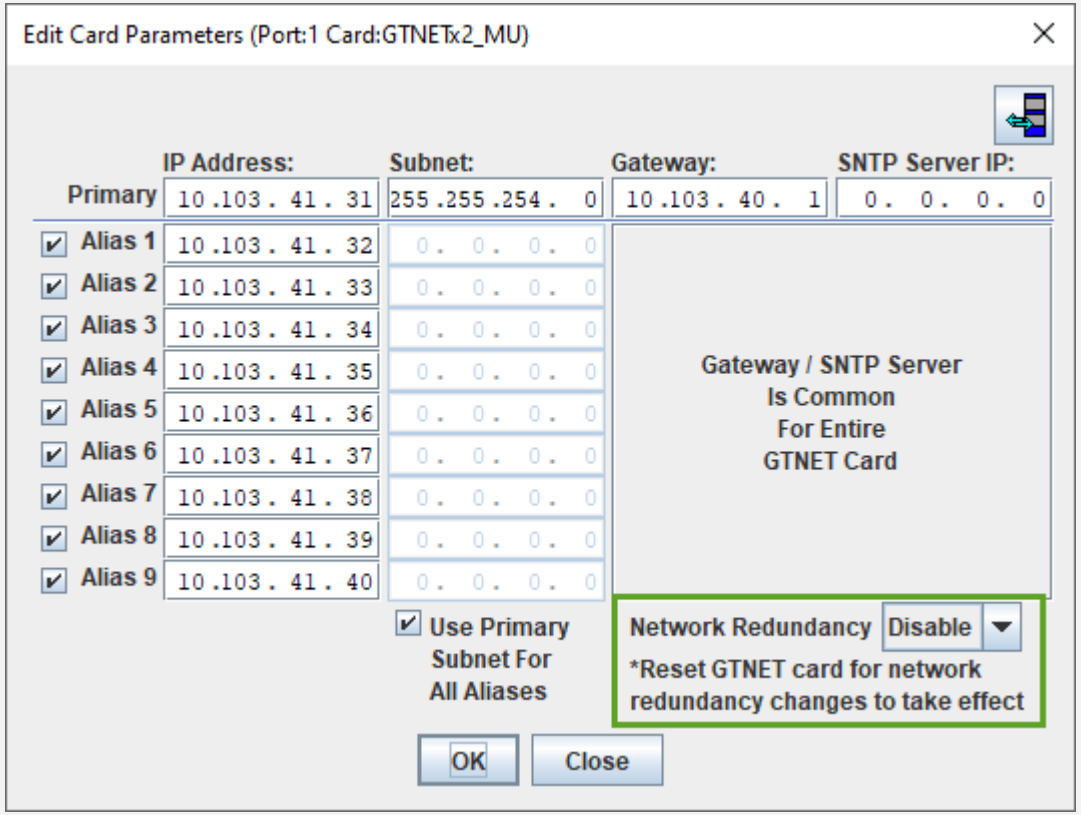
- **IEC 62439-3: 2016 defines Parallel Redundancy Protocol (PRP)**
  - Provides **zero** recovery time for time-critical applications
  - Uses two independent parallel networks of any topology
    - Duplication of the network: LAN A and LAN B
  - Network may contain normal switches (except for IEEE 1588 or IEC/IEEE 61850-9-3 PTP, which requires special switches)
  - Data frame last 16-bit tag identifier: 0x88FB
  - Each PRP node sends periodic (typically every 2 s) supervision frames

PRP CONNECTION OF GTNETx2 CARD



PRP SUPPORT GTNETx2 FIRMWARE FEATURES

- Supports all 9 GTNET protocols
- Requires **entire GTNETx2 card**
  - Both Ethernet LAN transceivers of a GTNETx2 card to obtain two redundant network connections (LAN A and LAN B)
- In order to enable network redundancy support, select the "**PRP**" option under "Network Redundancy"



Demo

THANK YOU!

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