



Setting the Standard for Automation™

Sistemas de Telemetria e Telecontrole em Projetos de Saneamento IEC60870 e DNP3.0

Standards

Certification

Education & Training

Publishing

Conferences & Exhibits

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Siemens Brasil

Telecontrol Sectors

SIEMENS

Sectors

- Water / wastewater
- Oil & gas
- Power
- Others

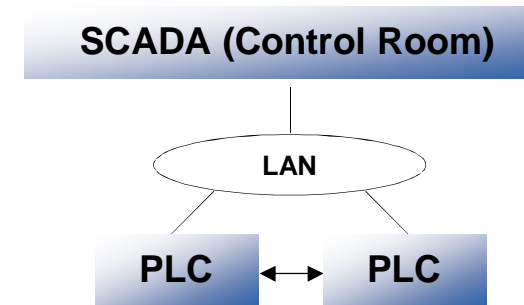
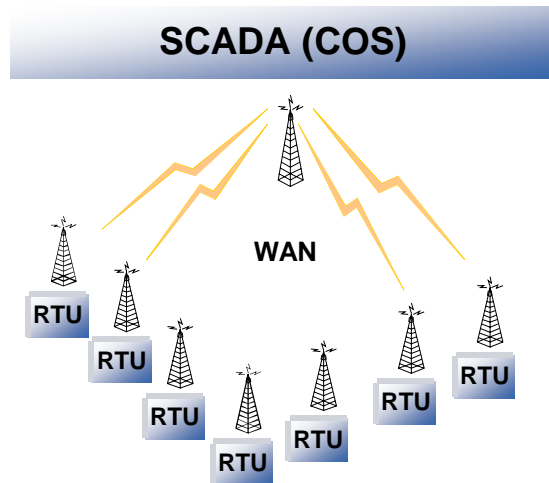
Customers

- Municipal suppliers
- Oil & gas customers
- Energy suppliers
- Water suppliers



Telecontrol

Why telecontrol?



widely distributed process

↔

local process

slow process

↔

fast process

many small stations (RTU)

↔

few, complex PLC

WAN communication

↔

bus communication

TeleControl protocols

↔

Ethernet

slow (kBit/s)

↔

fast (GBit/s)

various media, complex

↔

transparent

unreliable (connection failures)

↔

reliable

event driven

↔

polling

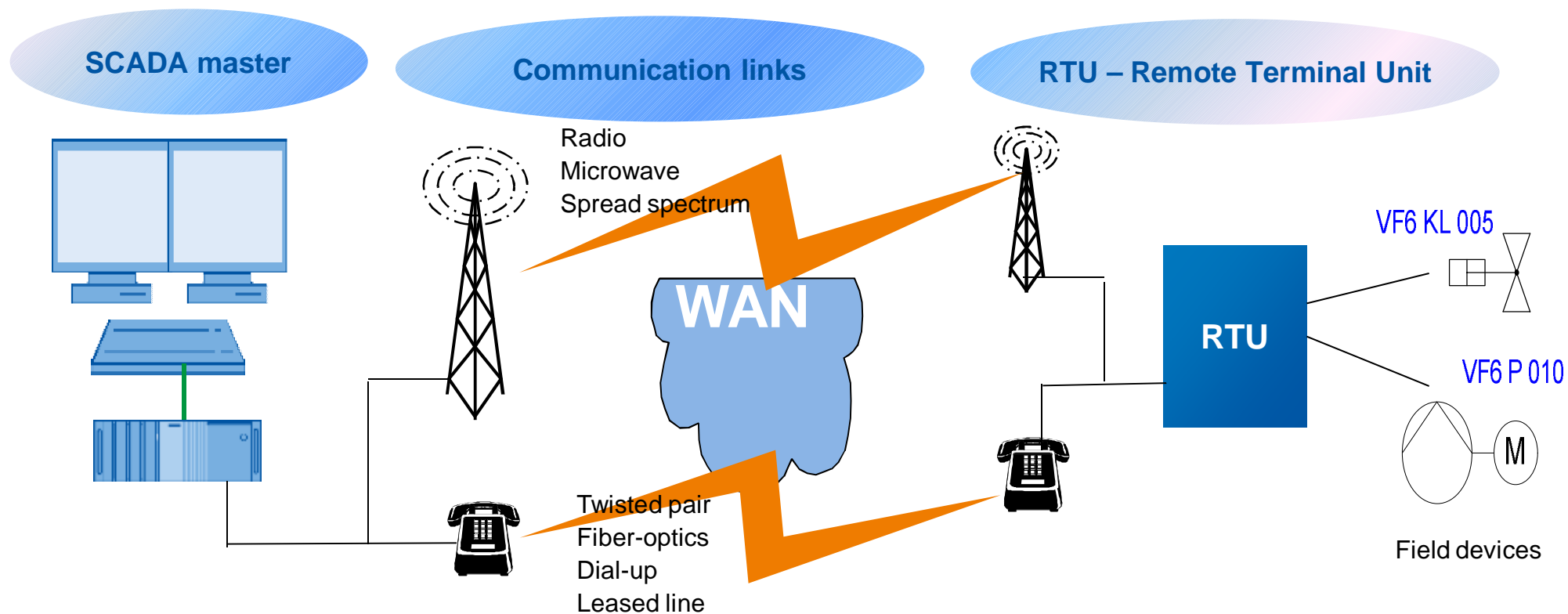
time stamped, buffered transmission

↔

no time stamped events

Telecontrol

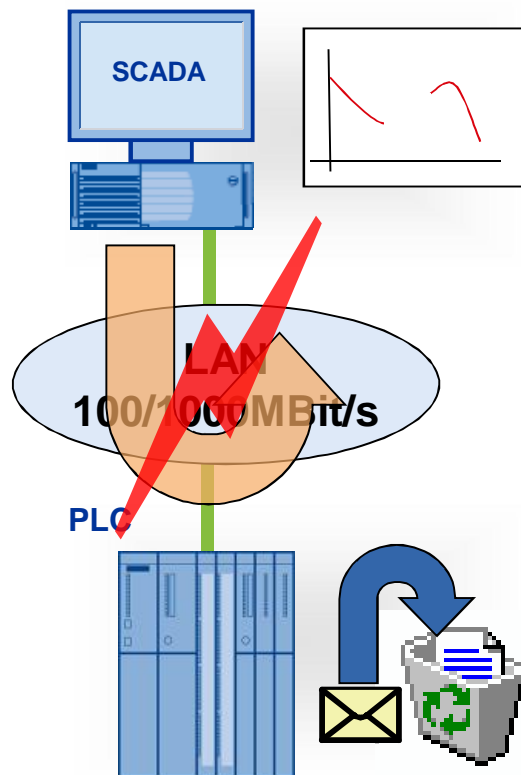
Why telecontrol?



Telecontrol

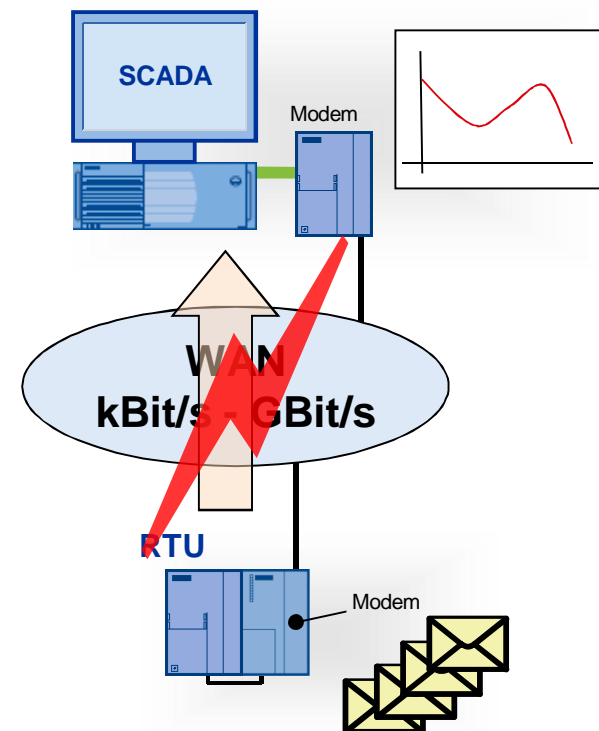
Why telecontrol?

LAN communication



Data loss during connection breaks.

WAN communication

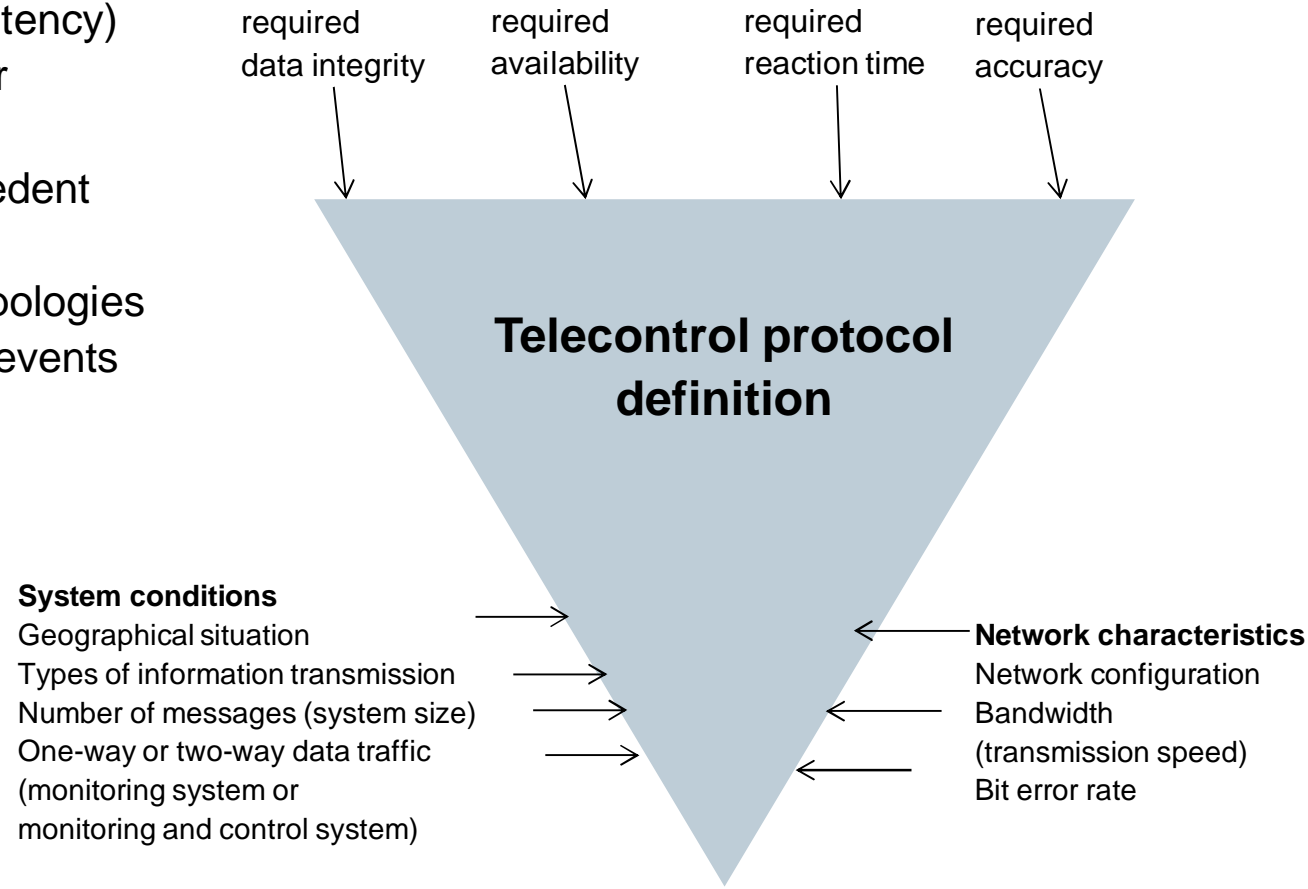


Data buffering during connection breaks, in order to **avoid data loss**.

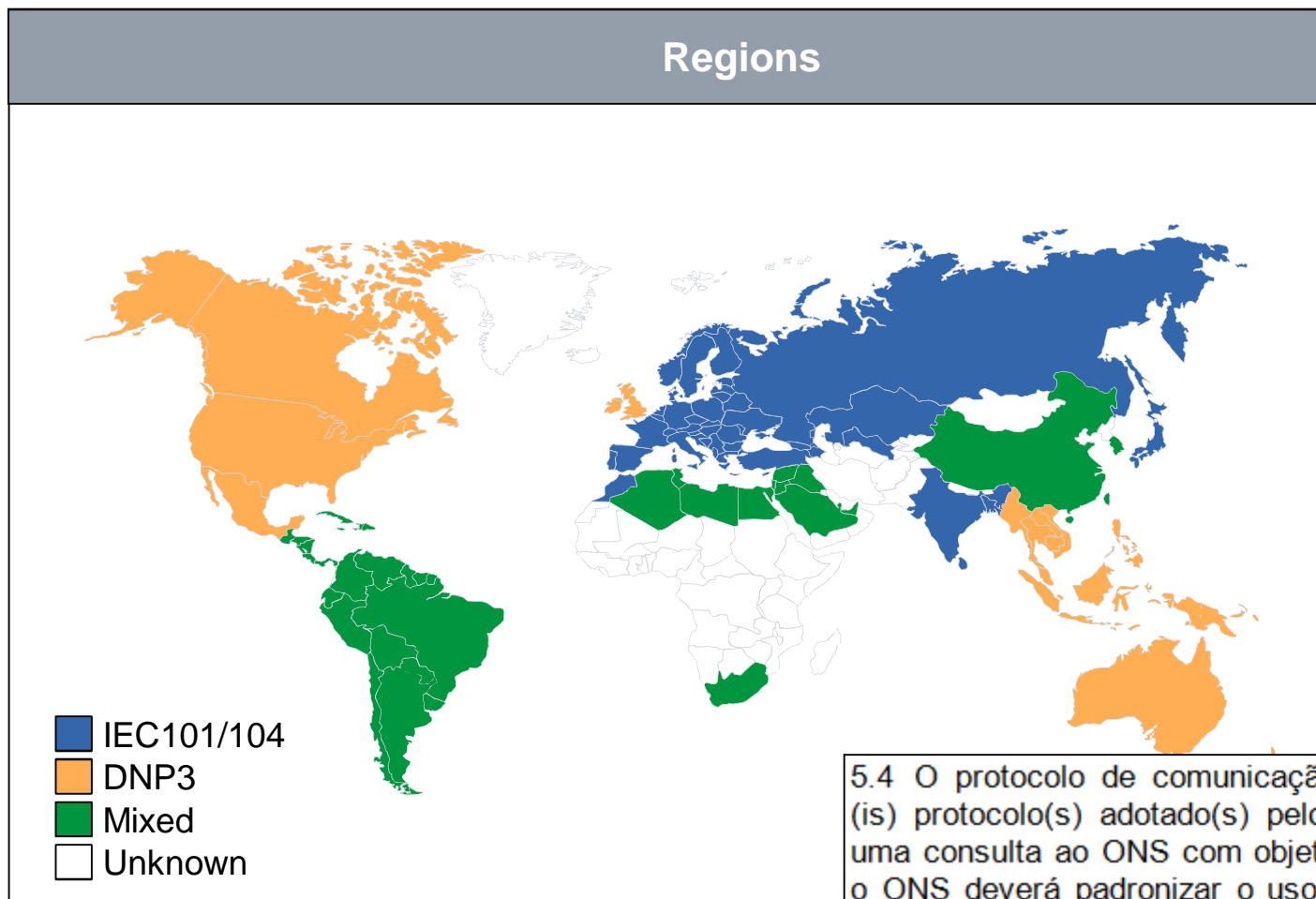
Telecontrol

Aims of telecontrol protocols

- ❑ High data reliability
(data integrity and data consistency)
- ❑ Fast and efficient data transfer
- ❑ Interoperability /
company/mmanufacturer indepedent
standard
- ❑ Support of various network topologies
- ❑ Short transfer times following events
(short reaction time)



Telecontrol Regions vs Standards?



**Operador Nacional
do Sistema Elétrico**

5.4 O protocolo de comunicação adotado pelo Agente deverá ser compatível com o(s) atual (is) protocolo(s) adotado(s) pelo(s) centro(s) designado(s) pelo ONS, devendo o Agente fazer uma consulta ao ONS com objetivo de identificar os protocolos a serem utilizados. Além destes, o ONS deverá padronizar o uso dos seguintes protocolos que deverão também ser suportados pelos Agentes, conforme apropriado:

- (a) Para comunicação com remotas: IEC 870-5-101/104 ou DNP V3.0;
- (b) Para interligação com outros centros de controle: ICCP.

Telecontrol

What is IEC 60870?

- ❑ IEC 60870 is a standard of the IEC - International Electrotechnical Commission
- ❑ SCADA protocol for low bandwidth telecontrol application
- ❑ Can use serial link as well as IP link
- ❑ Data types organized in data identification objects
- ❑ Conformity level according to interoperability list



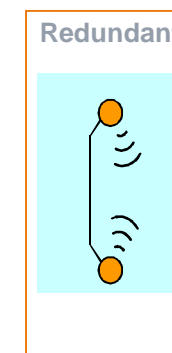
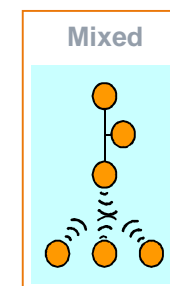
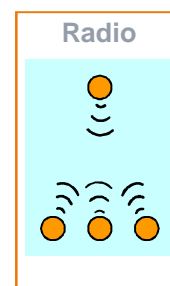
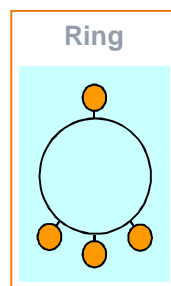
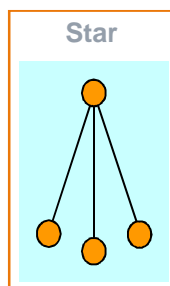
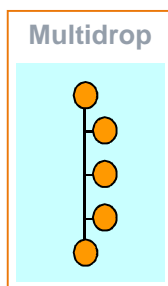
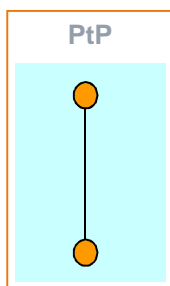
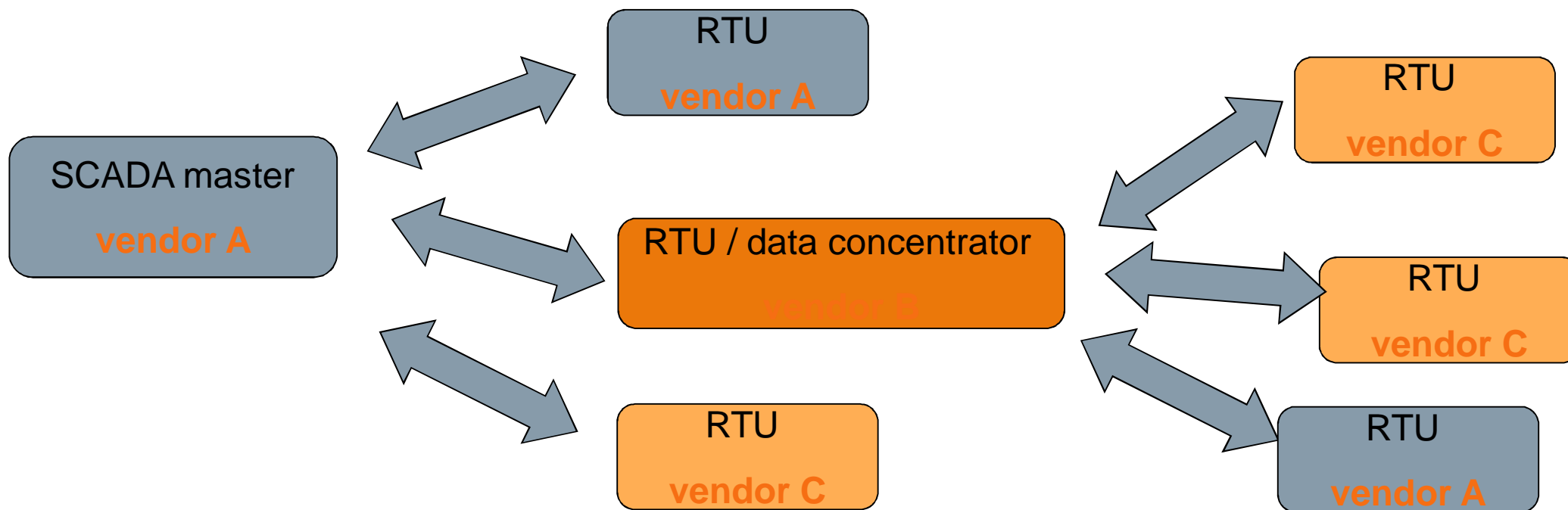
IEC 60870	Telecontrol equipment and systems
IEC 60870-5	Transmission protocols
IEC 60870-5-101	Application-related standard for basic telecontrol tasks (serial communication)
IEC 60870-5-103	Standard for protective equipment within a switching station
IEC 60870-5-104	Application-related standard for telecontrol tasks in IP networks

Telecontrol

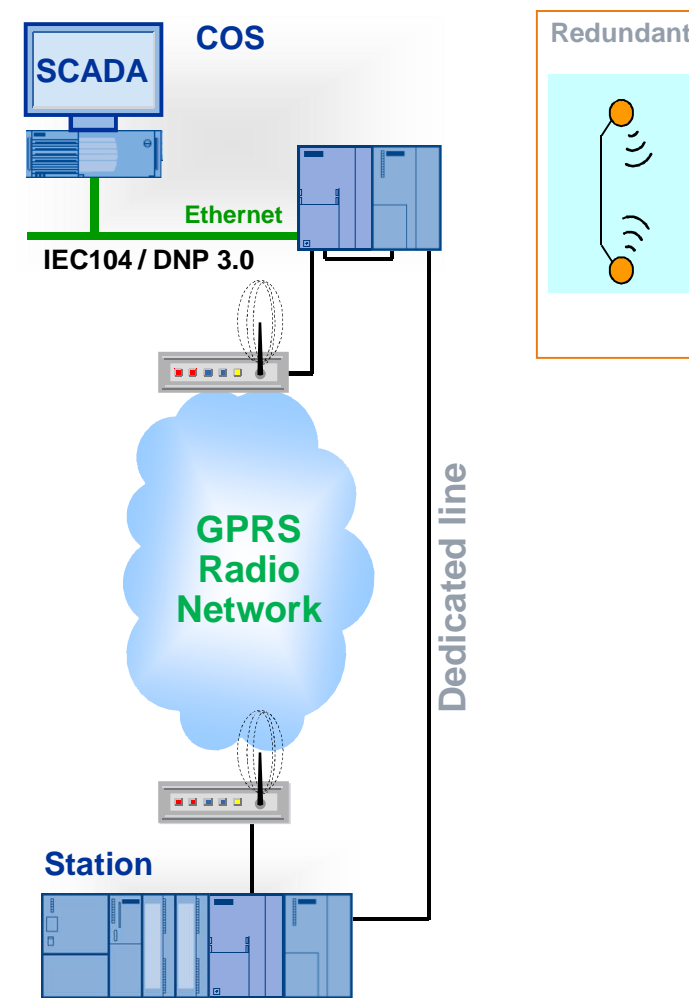
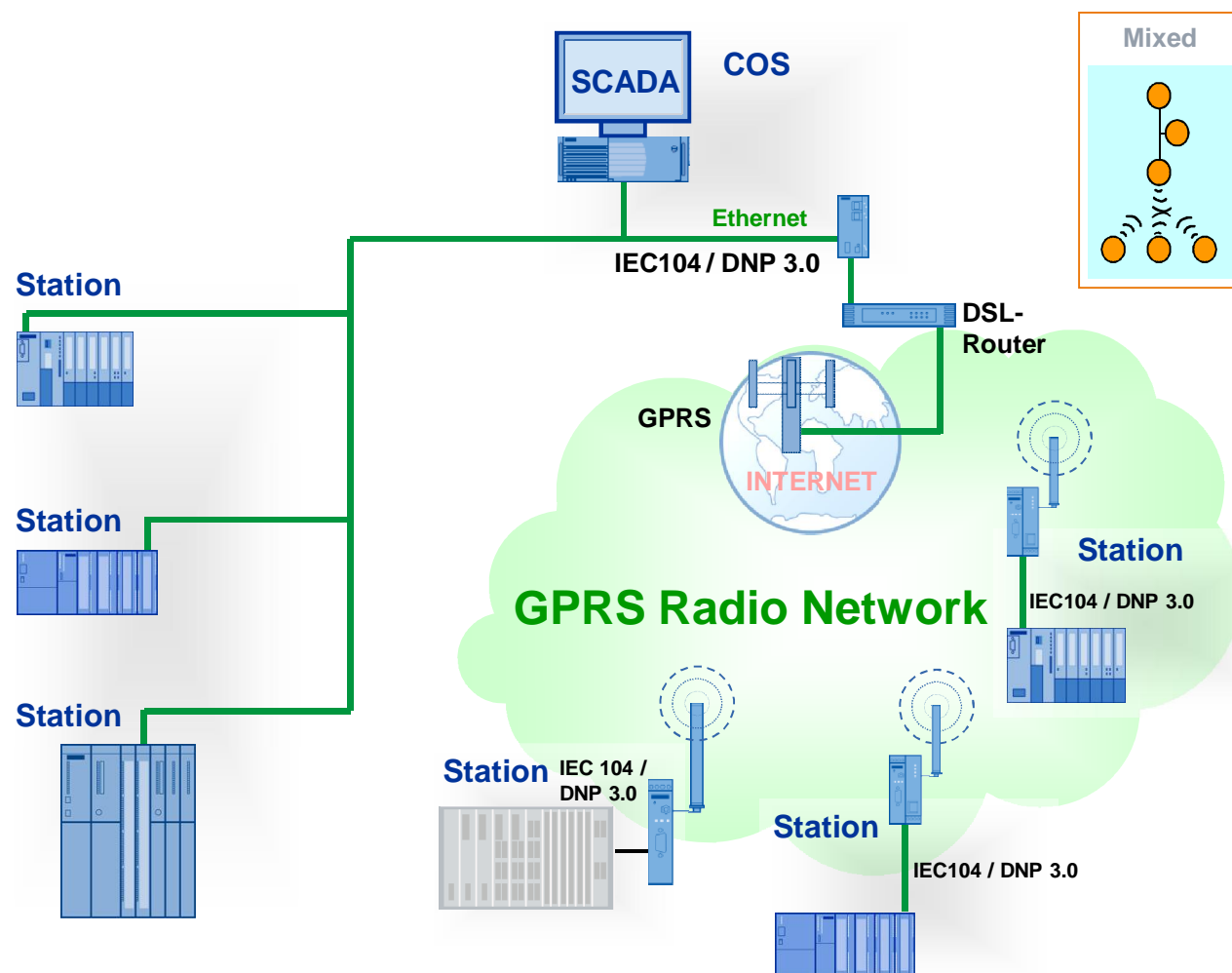
What is DNP 3.0?

- ❑ DNP3 – Distributed Network Protocol version 3
- ❑ SCADA protocol for low bandwidth telecontrol application
- ❑ Can use serial link as well as IP link
- ❑ Data types organized in data object groups
- ❑ Different classes (0 – static data, 1,2 and 3 – event data)
- ❑ Conformity levels 1 -5 (from simple to clever device)
- ❑ Device profile – list with supported DNP feature





Telecontrol Network structures



Telecontrol

Cyclic and event-driven communication

❑ Polling

-> cyclic querying of data from the remote station

❑ Cyclic communication

-> cyclic transfer of data from the remote station to the master station

❑ Event-driven communication

-> events occur spontaneously and are transferred unsolicited, in other words, data is only transferred if it has changed

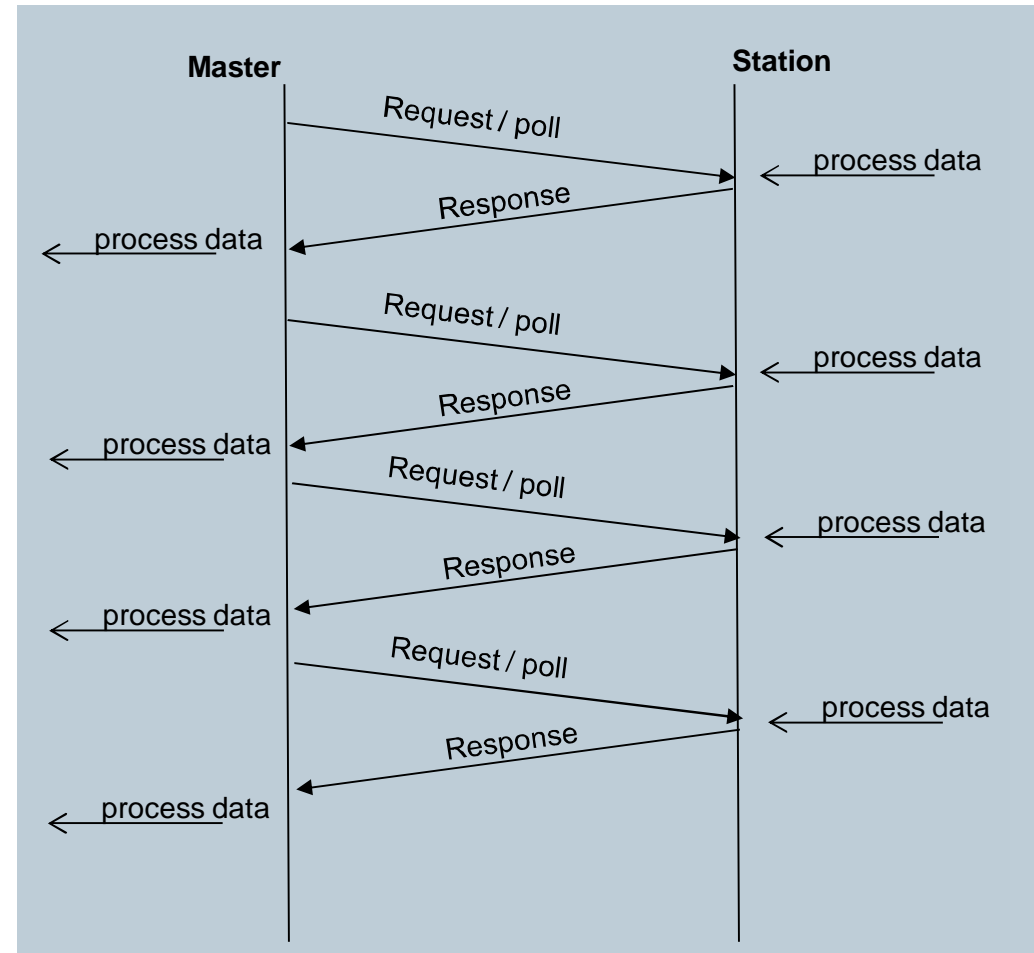
-> ***most efficient type of data transmission***

-> with serial variants if a full duplex/collision-free medium exists

Telecontrol

Data acquisition with polling

Data acquisition by polling is used in process control systems (SCADA) that operate with asymmetric data transmission procedures (half duplex or medium not collision-free) to update the master station with the actual statuses of the process variables in the substations. The master station initiates the queries with sequential polling of the substations. Substations can only transfer when they have been polled.

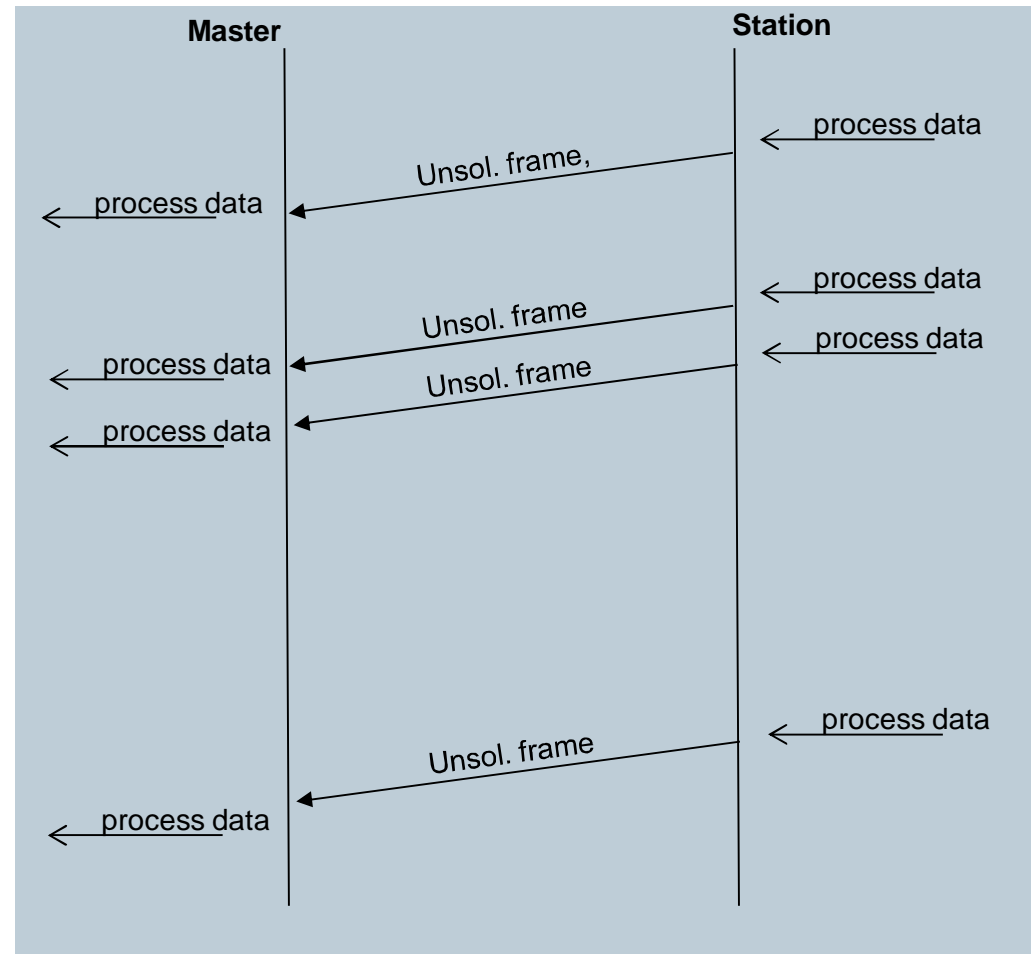


Telecontrol

Data acquisition in spontaneous (unsolicited) mode - event-driven

In systems with symmetric transmission (full duplex or collision-free), events are transmitted.

This method is used to speed up the transmission of events. It is also normally a more efficient method of transferring data

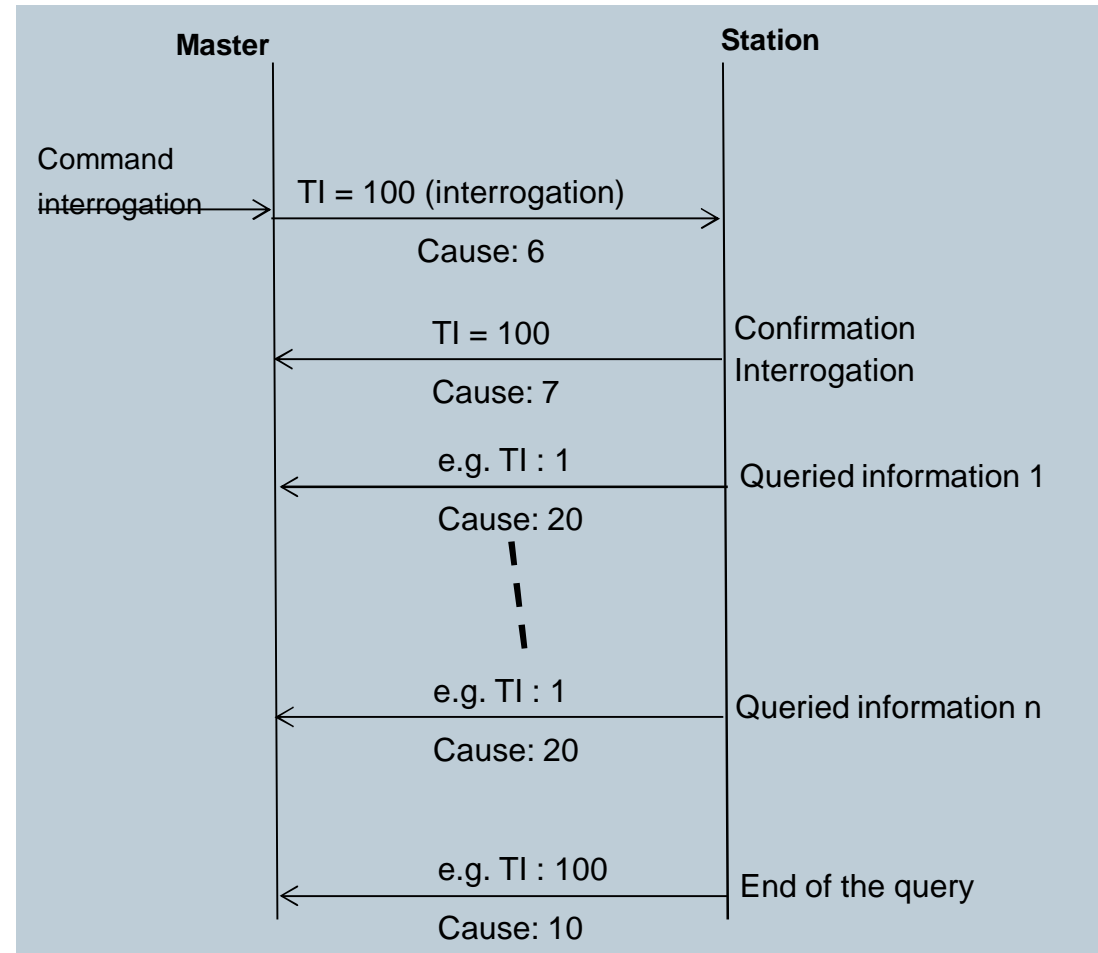


Telecontrol

Interrogation (update process image)

Interrogation

- ☐ Is used to update the master station.
- ☐ Interrogation means that the master station requests the station to transfer the actual values of all its process variables (IEC objects)
- ☐ Interrogation is, for example, triggered
 - After initialization of the master station or substation (station startup)
 - After detection of loss of data
 - Elimination of a disruption in transmission

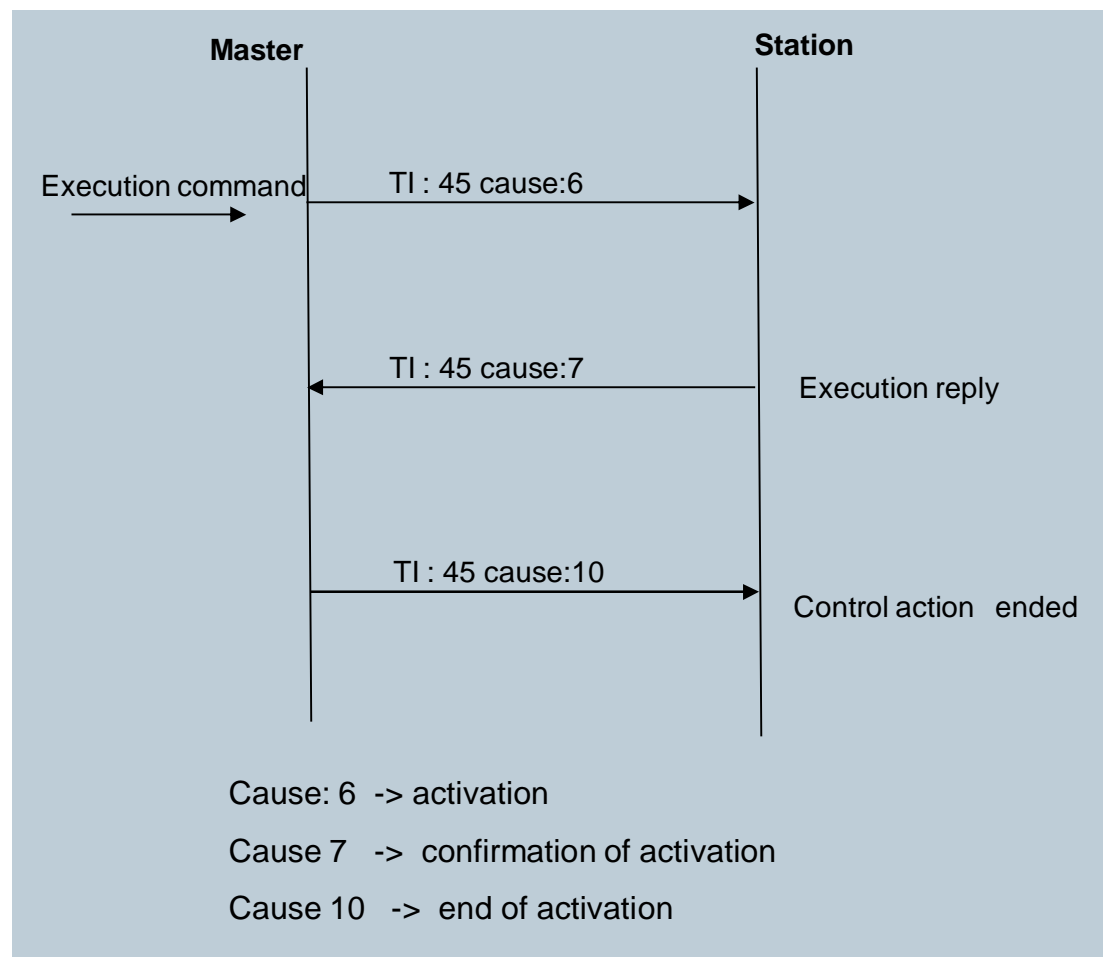


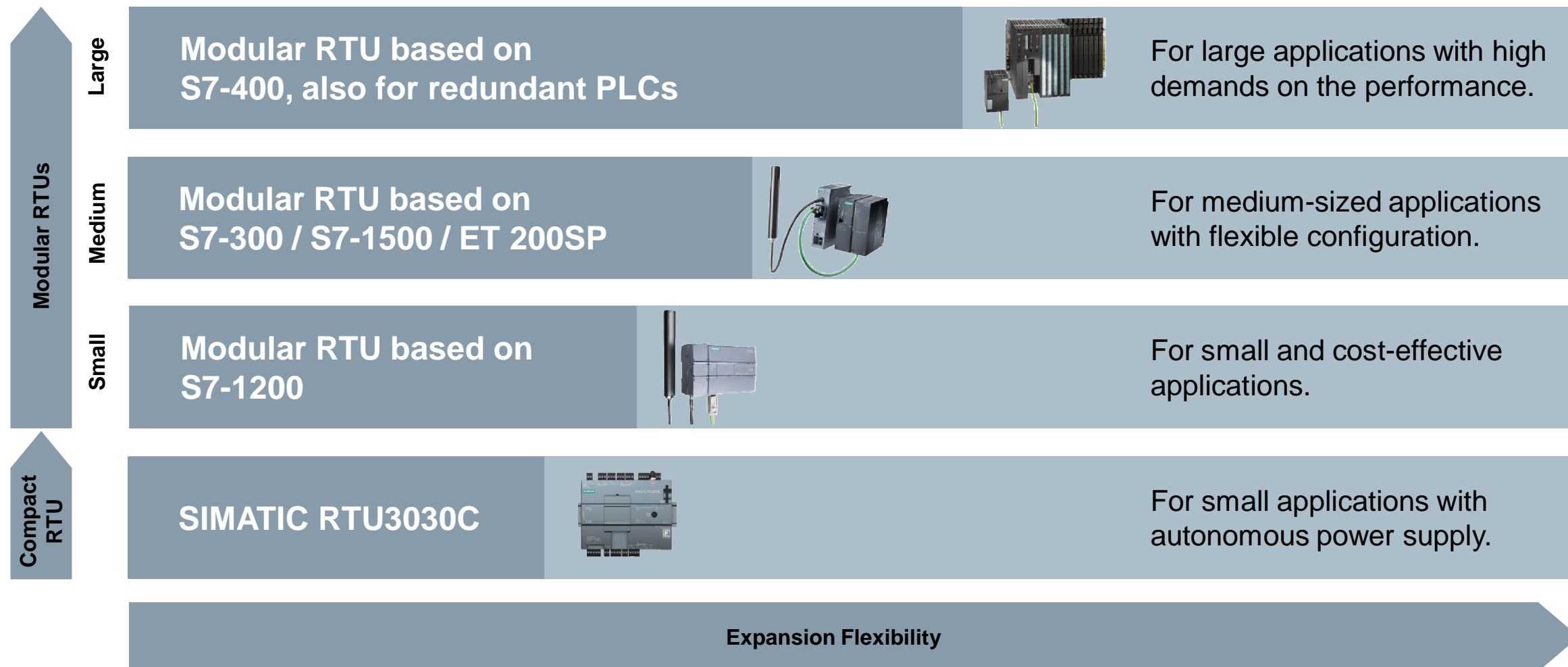
Telecontrol

Example of command transmission

Command / setpoint command

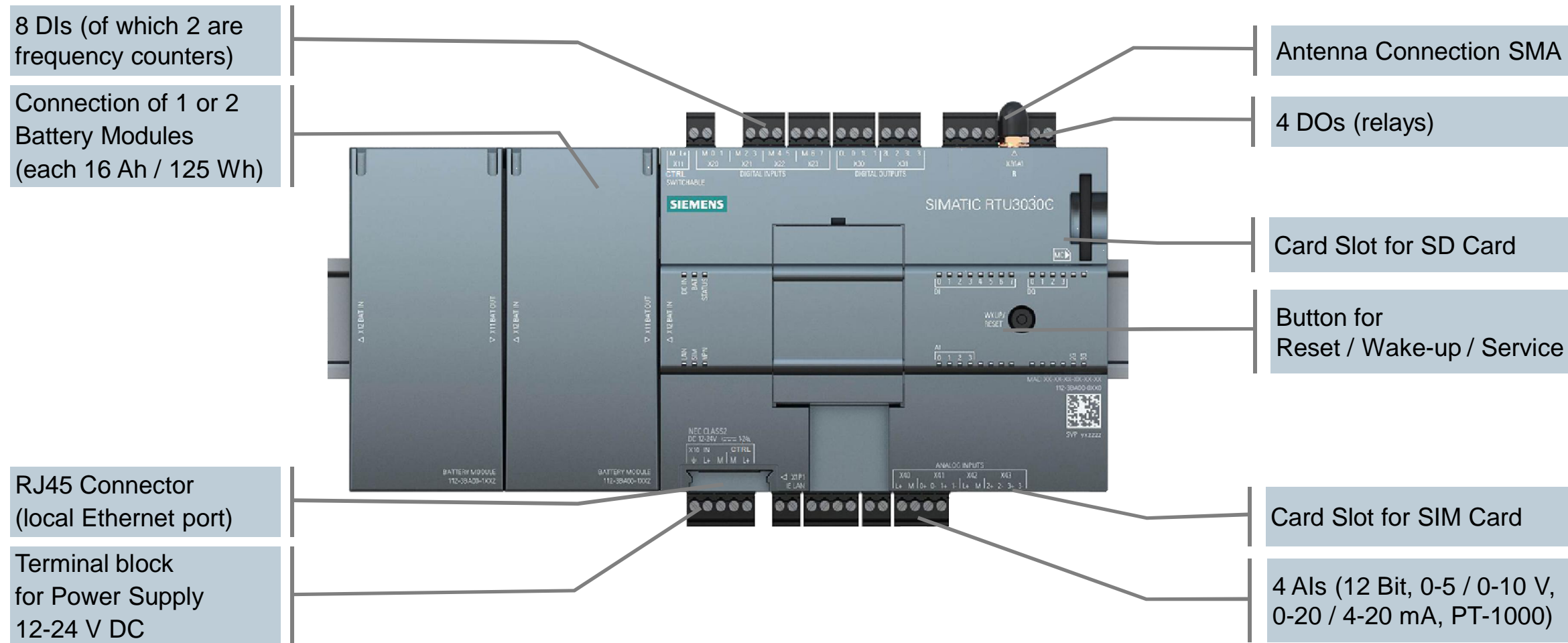
- ☐ Commands and setpoints can be transmitted in different ways
- ☐ Simple transmission
- ☐ Select before operate





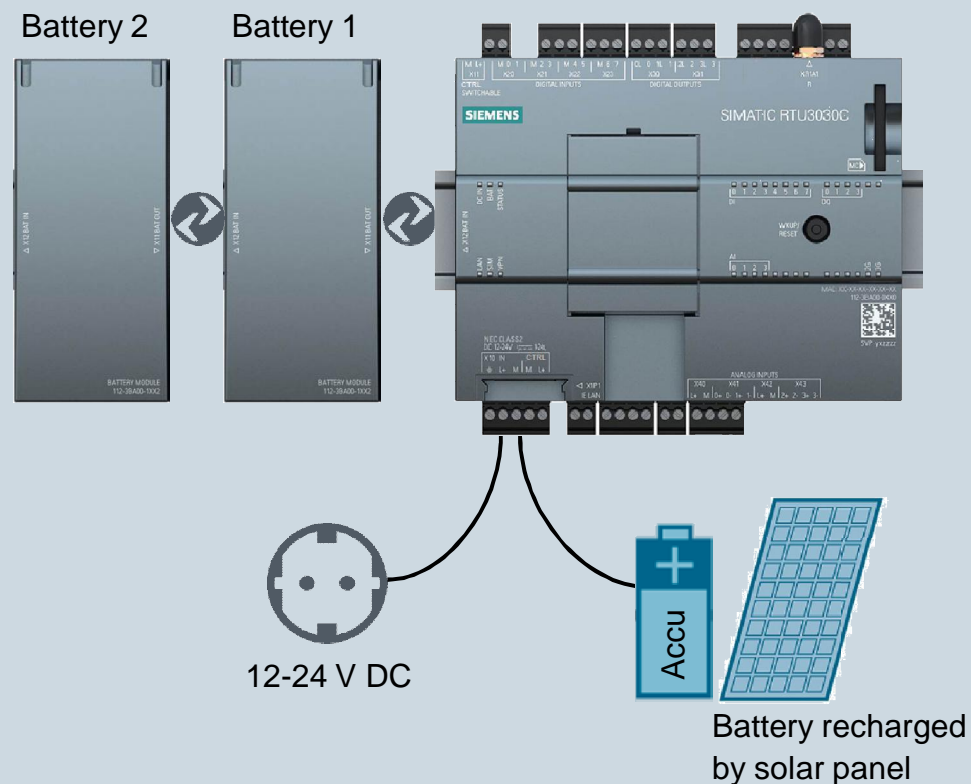
SIMATIC RTU3030C

Layout



SIMATIC RTU3030C

Power Source Options



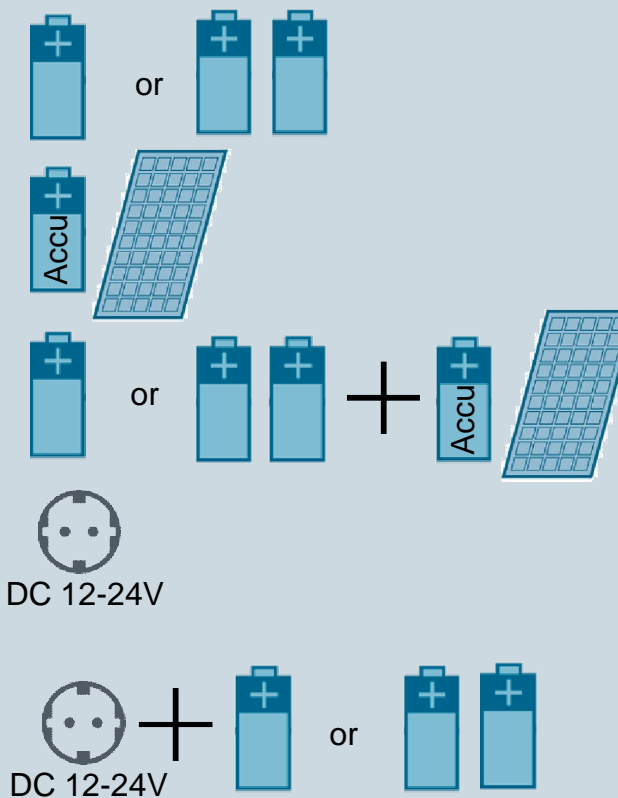
Pure battery operation with 1 or 2 batteries

Pure rechargeable battery operation with solar panel

Mixed battery + rechargeable battery operation

Plugged into standard power outlet

Plugged into standard power outlet, battery operation as backup



SIMATIC RTU3030C Highlights

Security mechanisms

- OpenVPN tunnel
- Encrypted e-mail

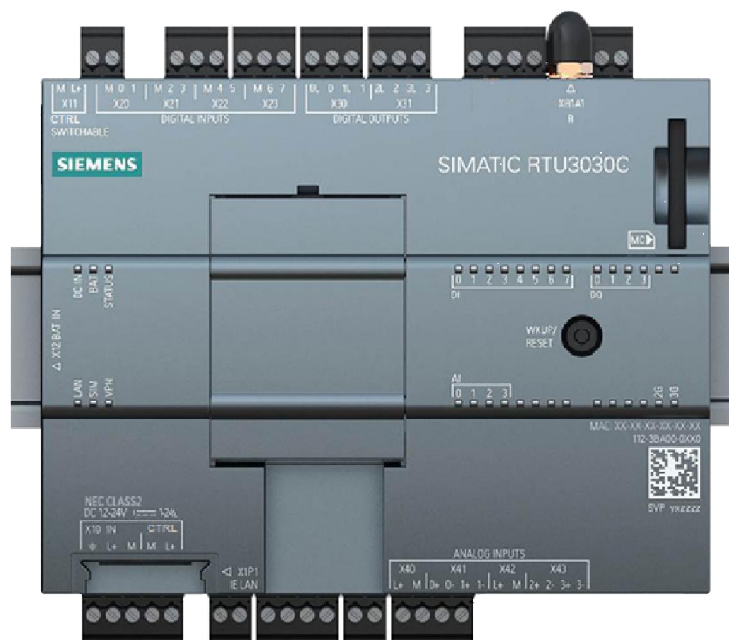
Web Server for configuration and diagnostics

Remote reading and setting of I/Os

Data logging on memory card

Wake-up through SMS or phone call

High degree of protection with IP68 external enclosure



Remote communication via cellular radio (2G / 3G)

Communication

- SMS or e-mail
- Event- or time-controlled
- Telecontrol protocols: TeleControl Basic, DNP3, IEC 60870-5-104

Time Synchronization via

- NTP
- Telecontrol protocol
- Cellular network

Expanded temperature range -40 to +70 °C

SIMATIC RTU3030C

Functions (1)

Low-Power operation in three operating modes:

- Sleep mode: all inputs and communication functions are turned off, outputs retain their last state.
- Update mode: inputs and outputs are active and can be scanned.
- Communication mode: cellular connection and communication with the control center are active.

Modes of communication:

- Event-controlled alerting via SMS or e-mail
- Logging of historical data with time stamping
- Telecontrol communication with a control center via various telecontrol protocols: TeleControl Basic, DNP3, IEC60870-5-104
- Wake-up from control center via SMS or phone call
- Time synchronization via NTP server, telecontrol protocol, or cellular radio provider
- Time buffering in case of power supply failure
- Configuration, firmware update, and teleservice access via Web browser



SIMATIC RTU3030C

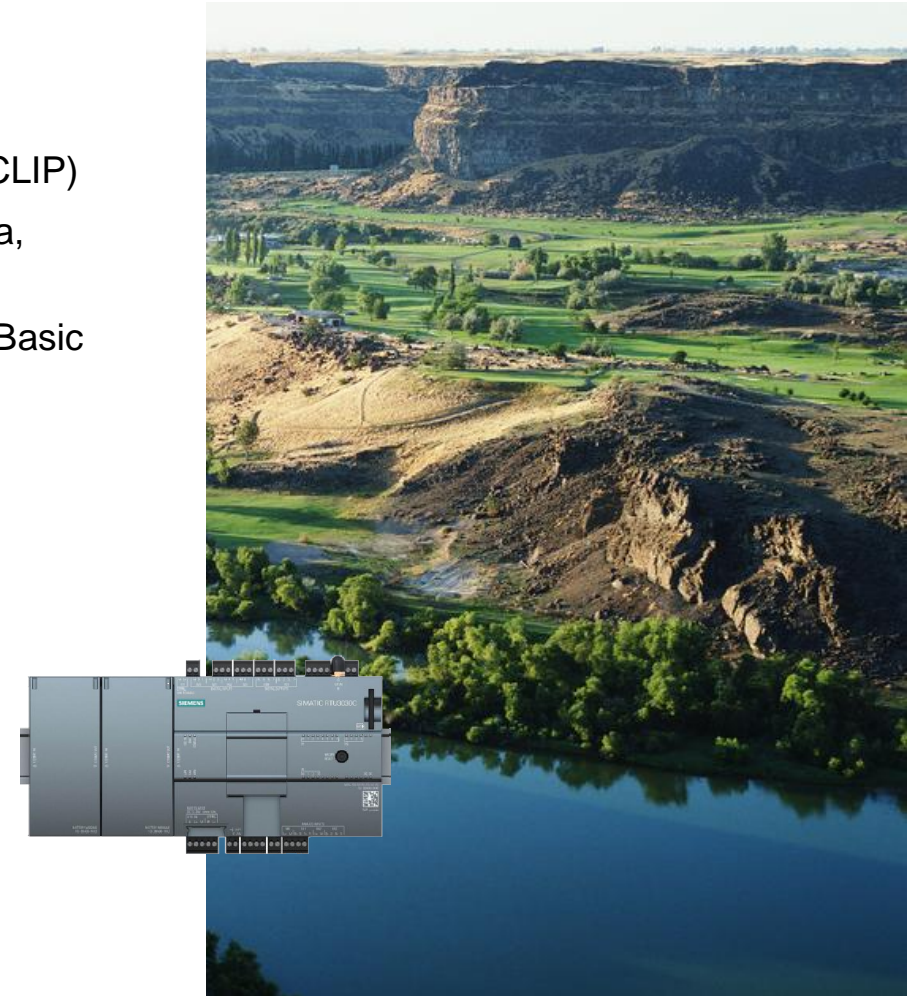
Functions (2)

Security:

- Access to Web interface protected by user name and password
- Approval of up to 20 phone numbers for incoming teleservice connection requests (CLIP)
- Authorization of up to 20 e-mail addresses and phone numbers for the receipt of data, messages, and alarms
- Communication via OpenVPN tunnel or via secure tunnel of the TeleControl Server Basic
- Encrypted e-mail sending

Diagnostics:

- History buffer can be saved on memory card
- Display of the current LED indicators in the Web-based management
- All diagnostic information can also be retrieved via the Web server of the RTU3030C



SIMATIC RTU3030C

Use Case 1: Monitoring of Measuring Stations

Task

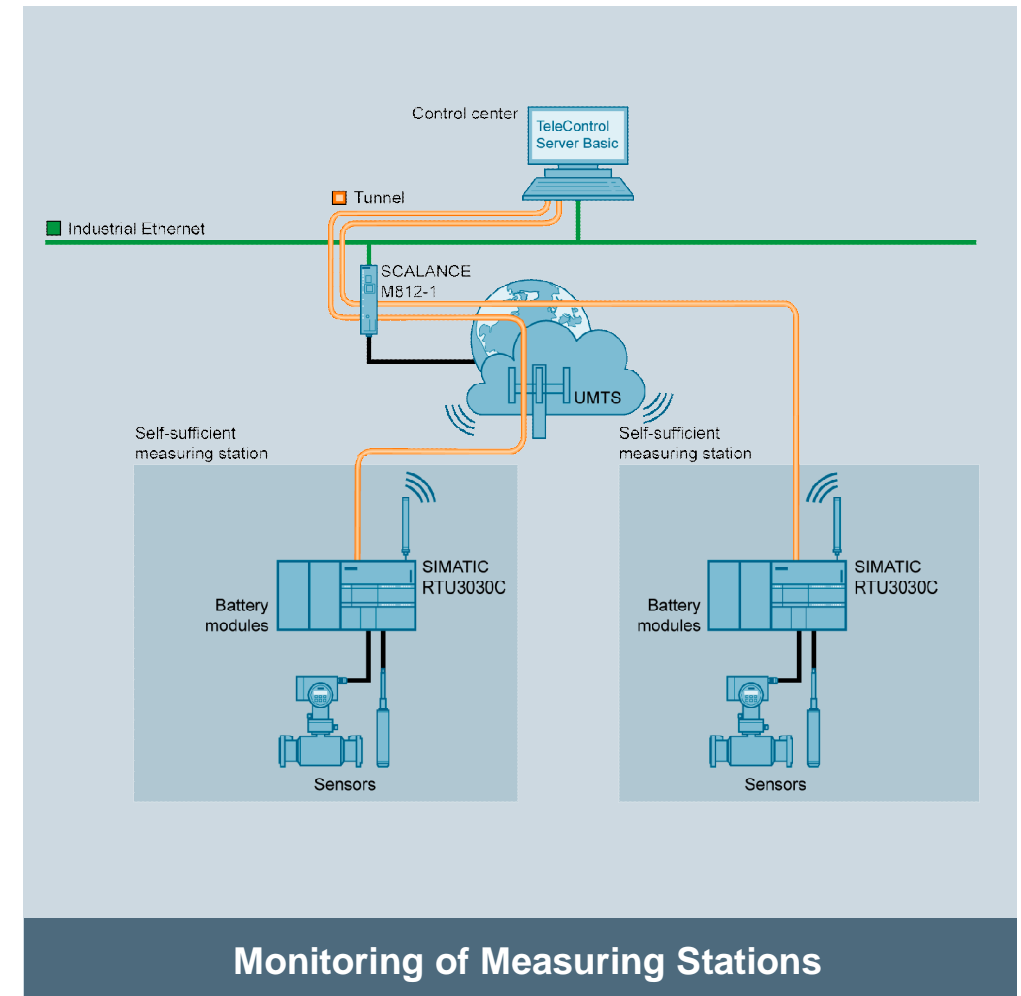
Monitoring of measuring stations at remote locations without connection to the power grid. If specified threshold values are exceeded, an alarm is to be sent.

Solution

The RTU3030C is operated without an external power supply and sends data to a control center via a telecontrol protocol. Power is, for example, provided by batteries. Should extraordinary events defined by the user occur (e.g., exceeding of threshold values), alarms / warnings / fault messages are sent with high priority to the control center or selected personnel by e-mail or SMS.

Benefit

Deployment location is not dependent on power grid availability. Reduction of the time and money required to monitor widely spread plants. Option of quickly responding to faults in the wide area network.



SIMATIC RTU3030C

Use Case 2: Retrieval of the latest status by the Control Center

Task

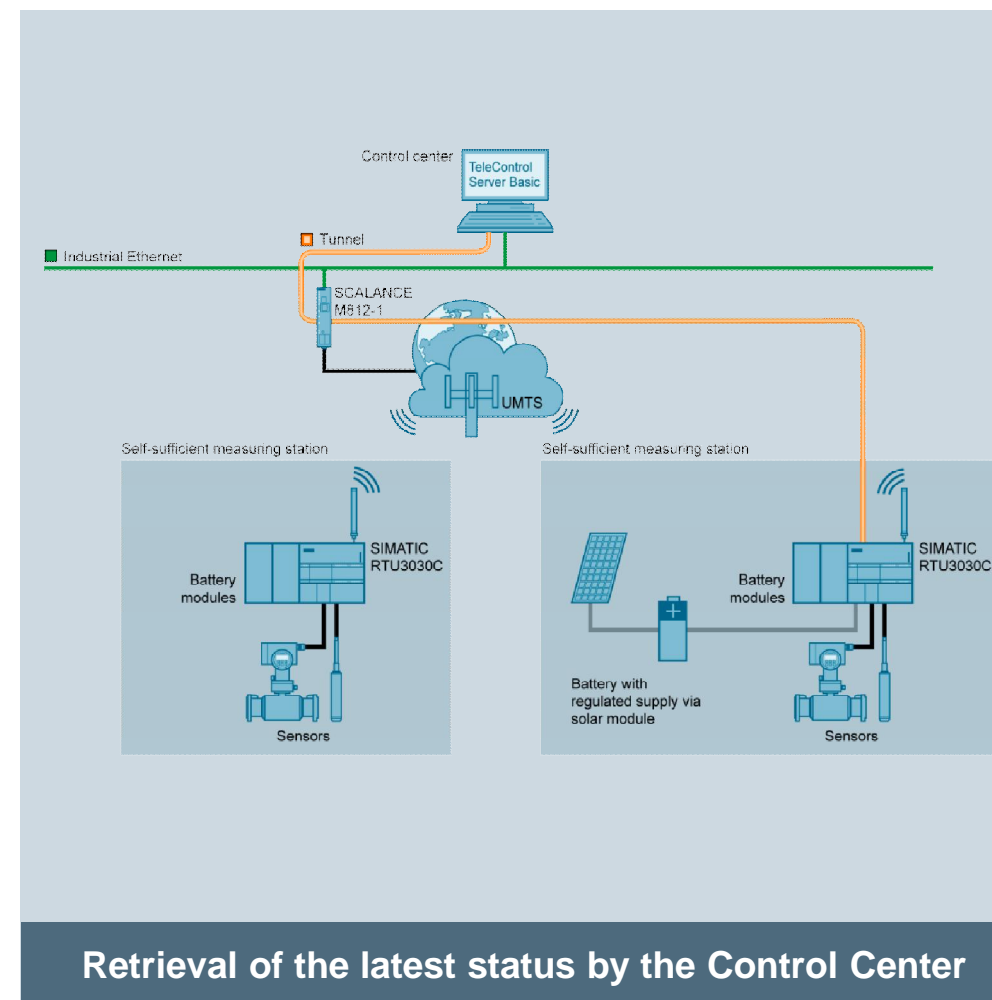
Control center requires current data from remote measuring stations. No connection to the power grid available on-site.

Solution

The RTU3030C is operated without an external power supply. A service engineer in the control center sends a SMS to wake the RTU up. At the next specified time defined via parametering, the RTU establishes a connection to the control center and automatically transmits the data buffered in the RTU3030C via a secured connection.

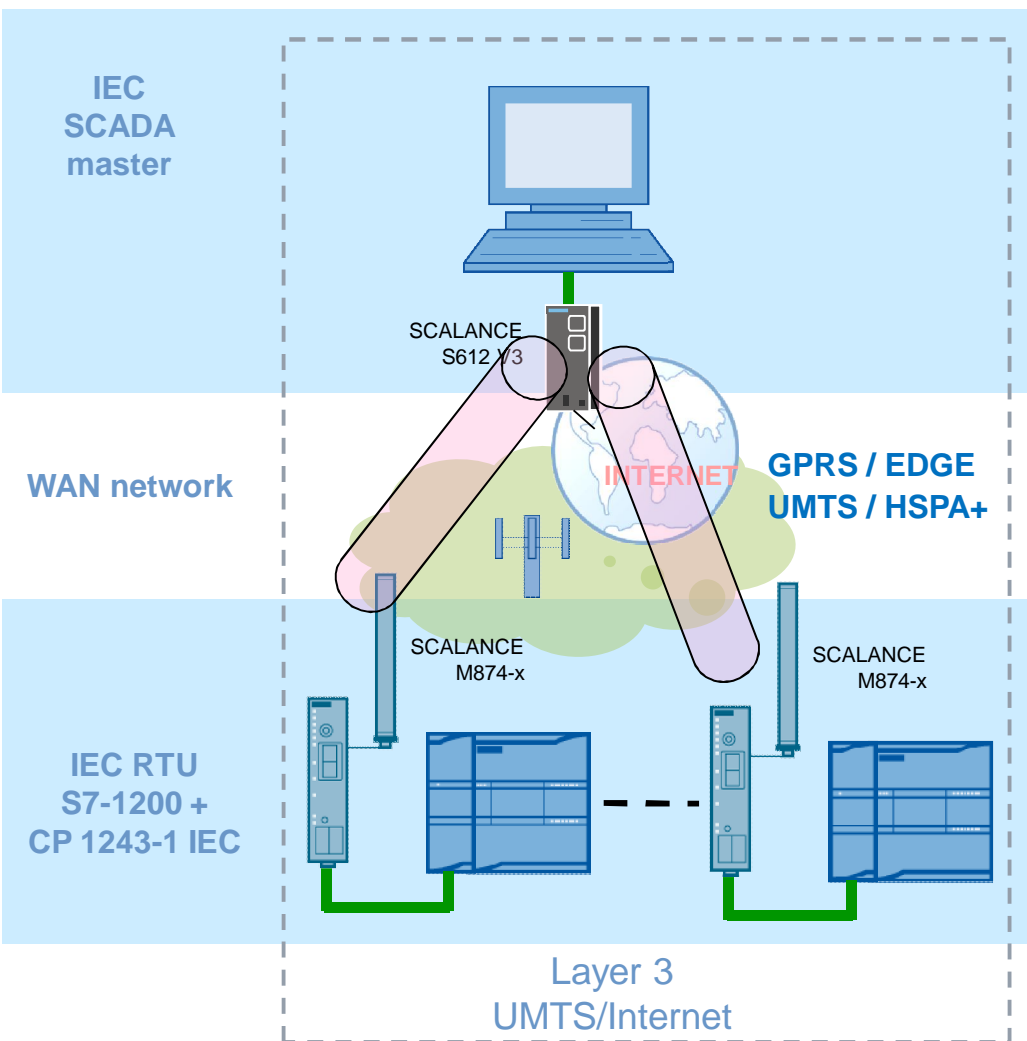
Benefit

Deployment location is not dependent on power grid availability. Quick availability of current data without incurring travel expenditures.



SIEMENS Solutions

Application example – Water treatment via GPRS/UMTS



Use case

- Water treatment
- No private network infrastructure available
- GPRS/UMTS coverage
- S7-1200 RTU with CP1243-1 IEC
- SCALANCE M GPRS/UMTS router as network access
- IEC master based on WinCC Telecontrol

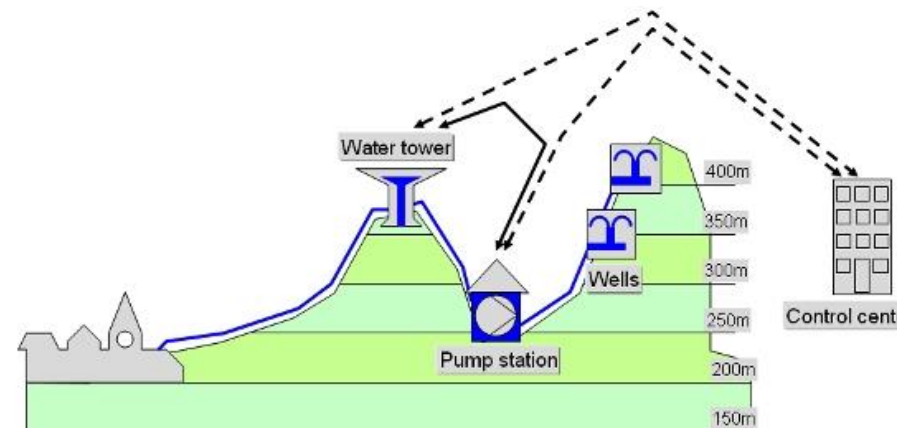
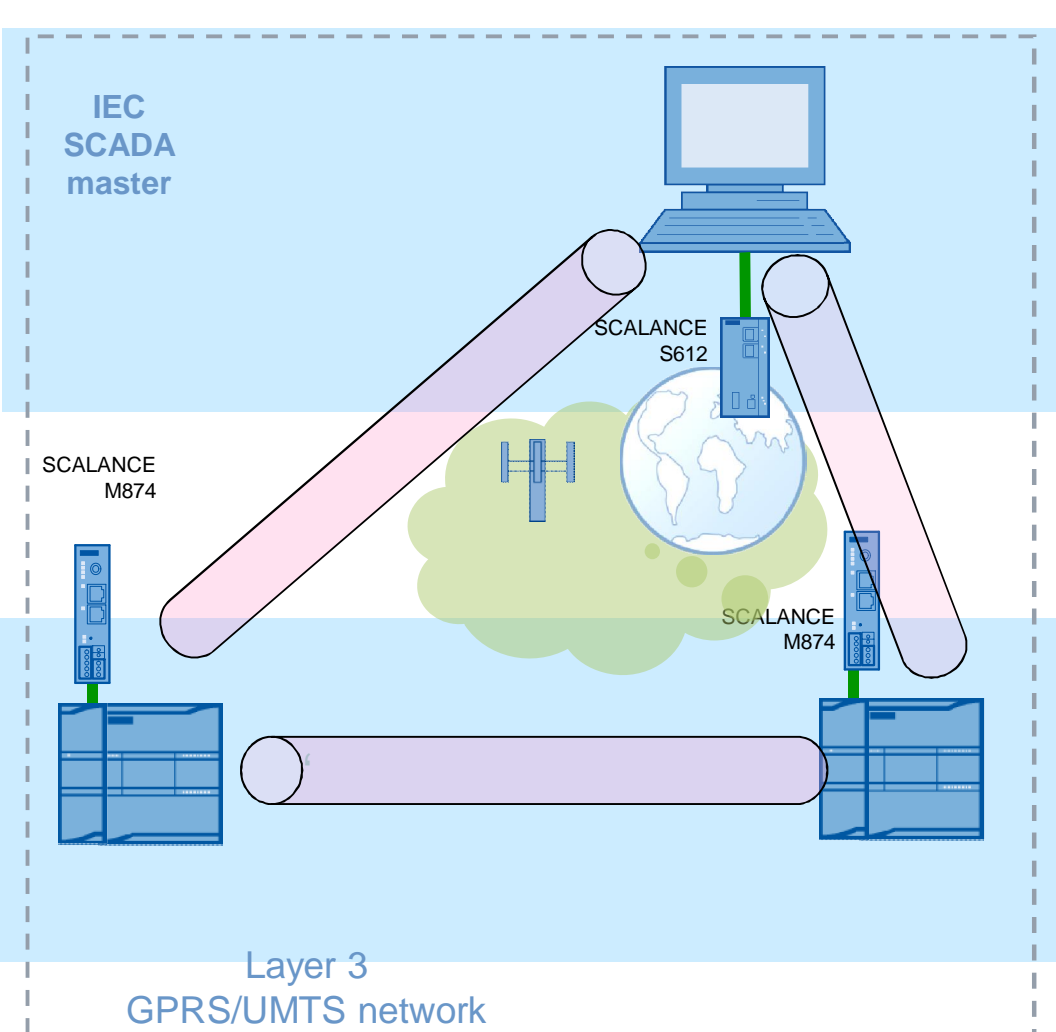


Application

Water treatment with pump stations spread over the whole city. SCALANCE M Mobile routers establish secure VPN tunnel with central control site to connect IEC RTU with SCADA Master via UMTS/GPRS.

SIEMENS Solutions

Pump station and reservoir using public GPRS/UMTS network infrastructure



Use case

- Water distribution
- RTUs monitored by SCADA Master
- Pump station and water tower control each other directly
- Public mobile network available

Application

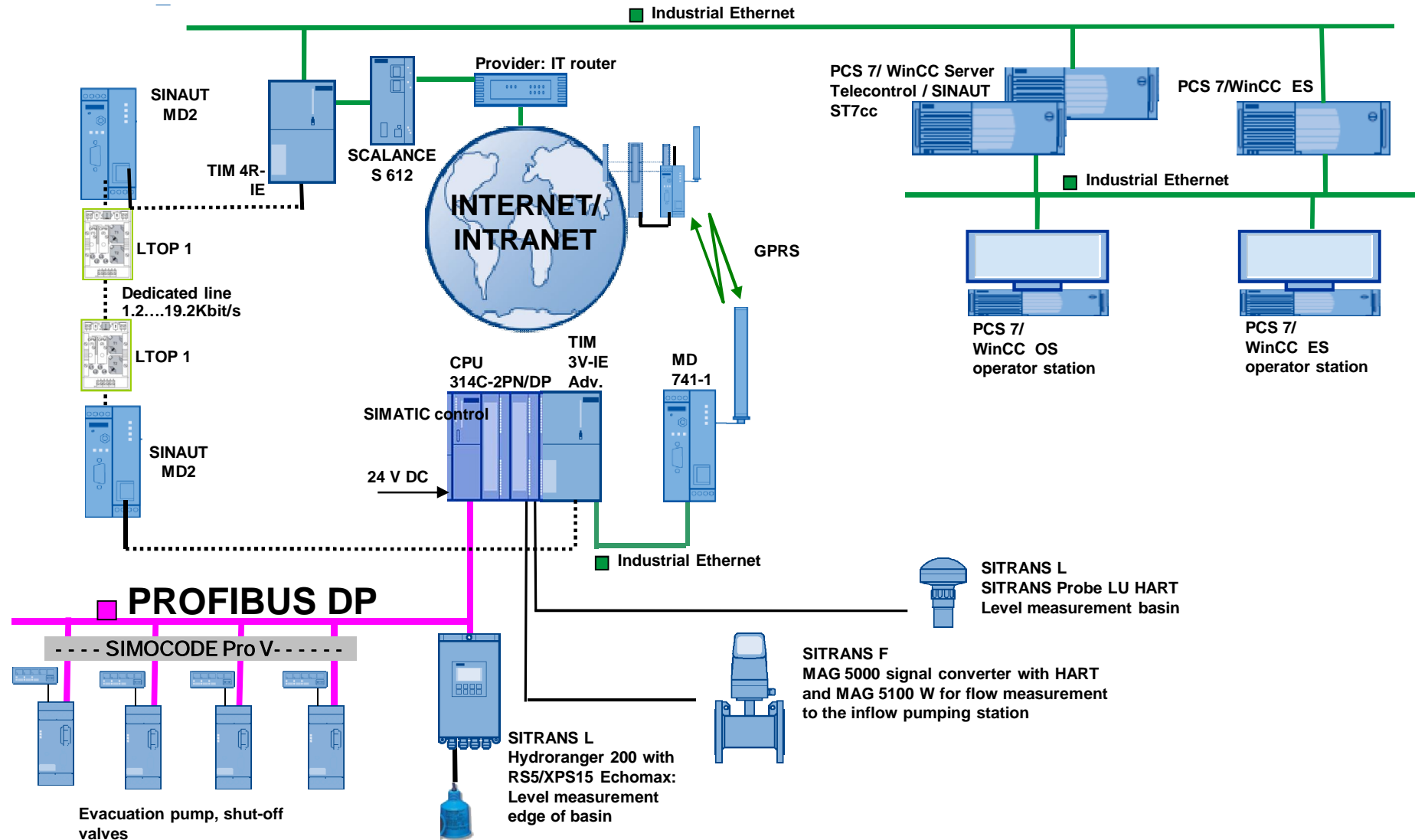
Water tower, pump station and well RTUs are connected via IEC protocol with SCADA master to be monitored and controlled. Water tower and Pump station need to control each other directly. This can be also done IEC104/DNP 3.0.

Both IEC 104 or DNP 3.0 communication via secure IPSec or OpenVPN tunnel established by SCALANCE M874 and SCALANCE S613. To establish the VPN tunnel between mobile router M874 it needs peer to peer support of the provider

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Complete wastewater management

SIEMENS





Obrigado!

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