

# HSR and PRP Redundancy on RT Linux

## Part 1: Systems Overview

# Do you like...

Power that stays on?

Being able to buy things when you want them because they are available?

Transportation that is timely, efficient and safe?

# Markets with common roots

## Energy



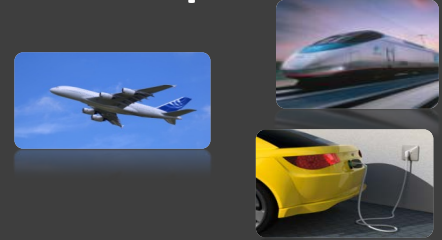
- Generation
- Transmission
- Distribution

## Factory



- Automation
- Production
- Monitoring

## Transportation



- Avionics
- Railway
- Automotive

RELIABILITY

ETHERNET PROTOCOLS

# Focus on Energy

## Energy



- Generation
- Transmission
- Distribution

## Factory



- Automation
- Production
- Monitoring

## Transportation

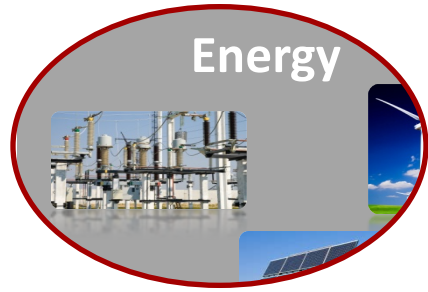


- Avionics
- Railway
- Automotive

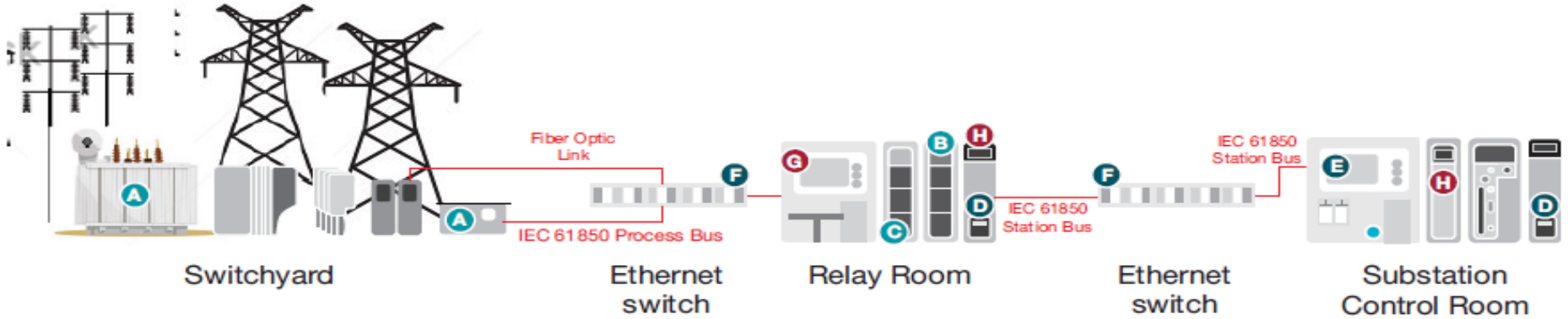
RELIABILITY

ETHERNET PROTOCOLS

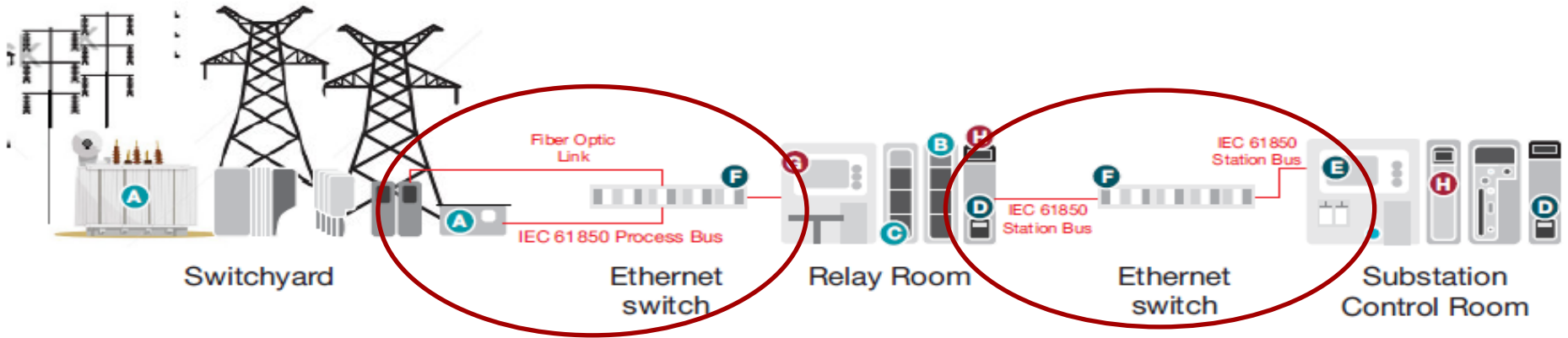
# Focus on Energy



# Substation Automation applications

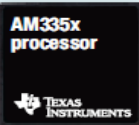
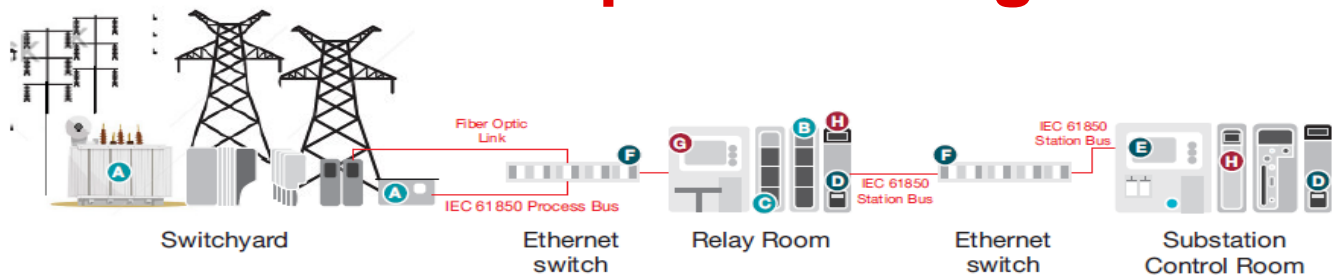


# Substation Automation applications



- Changing from no communication or serial protocols to Ethernet to connect more Intelligent Electronic Devices (IEDs)
- 2 primary buses: Process Bus and Station Bus
- Recommendations outlined in IEC61850

# Substation Automation portfolio alignment



- A** Data acquisition and merging unit (DTU, FTU)
- B** Substation bay controller
- C** RTU

#### Key features:

- Up to 1-GHz ARM® Cortex®-A8
- Low power (sub-1W)
- TI's ICSS-PRU programmable real-time core with support for HSR, PRP and industrial Ethernet protocols



- D** Protection relay and multifunction IED
- E** HMI
- F** Ethernet switch

#### Key features:

- Scalable dual- or single-core ARM Cortex-A15 for controls
- Dual- or single-core C66x DSP for real-time analytics
- Dual ARM Cortex-M4s
- TI's ICSS-PRU programmable real-time core with support for HSR, PRP and industrial Ethernet protocols



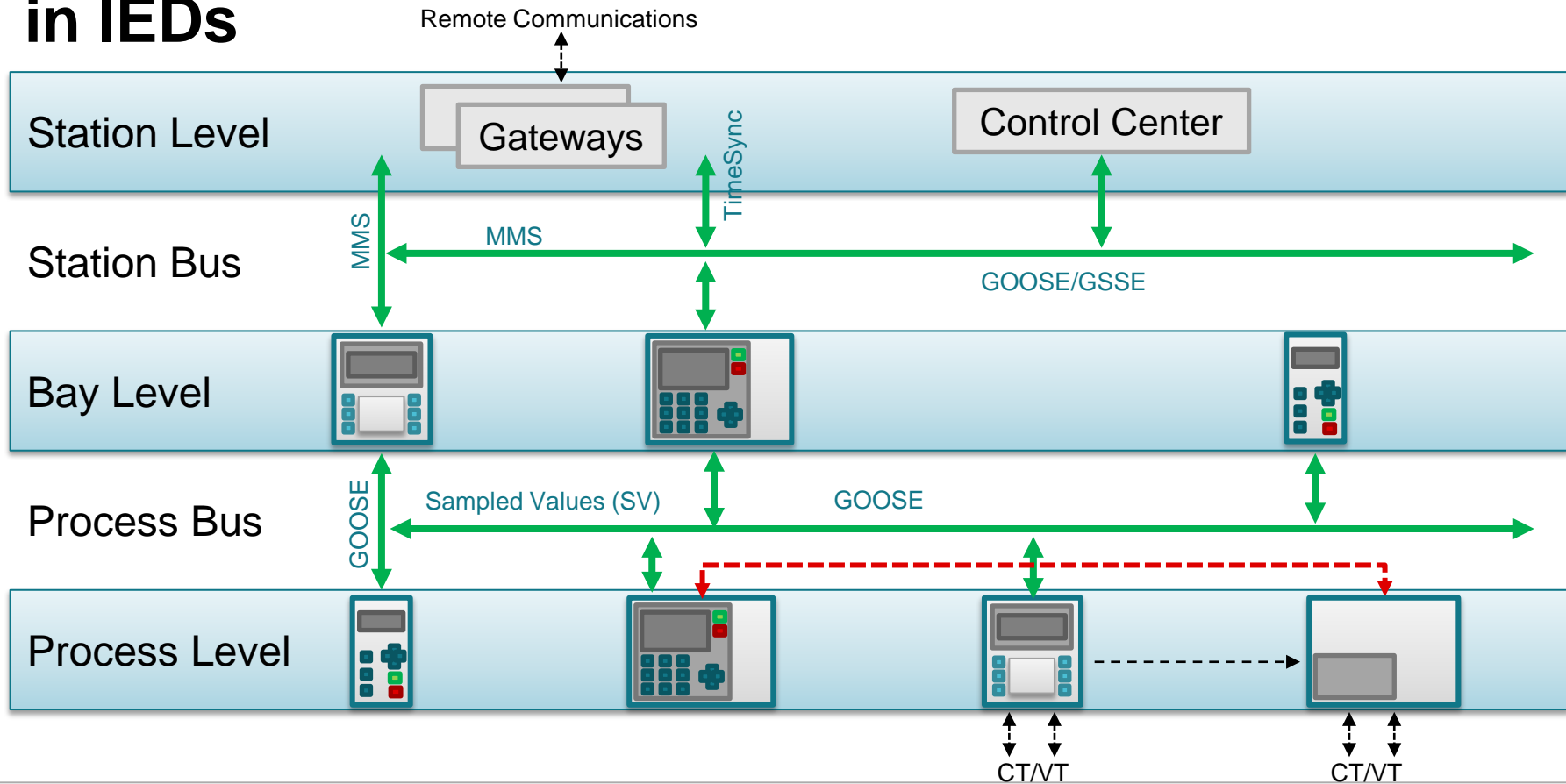
- G** Measuring and monitoring IEDs
- H** Phasor measurement

#### Key features:

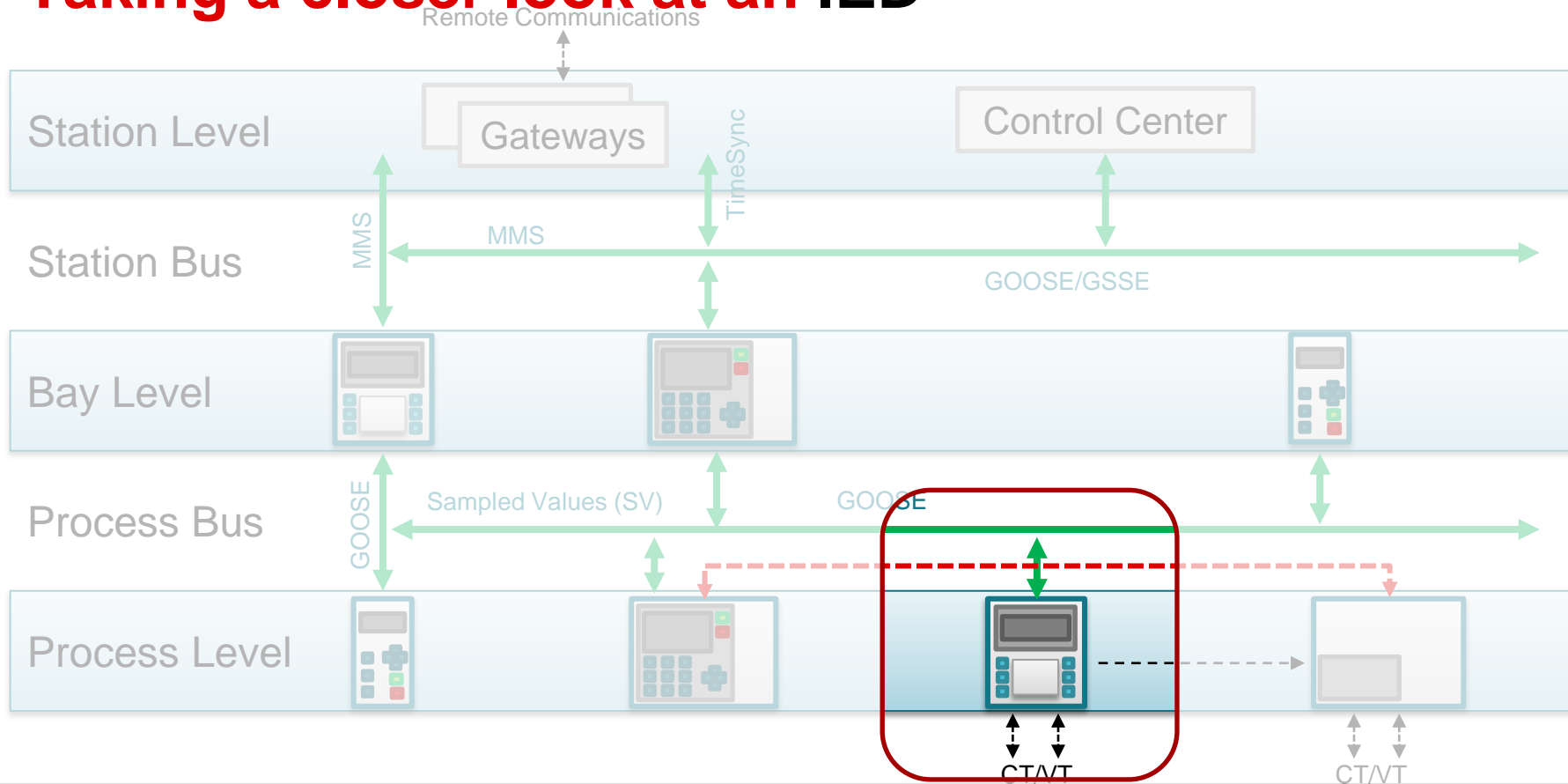
- Dual- or single-core fixed- and floating-point C66x DSP
- Power optimized for fanless operation
- Common signal processing libraries available



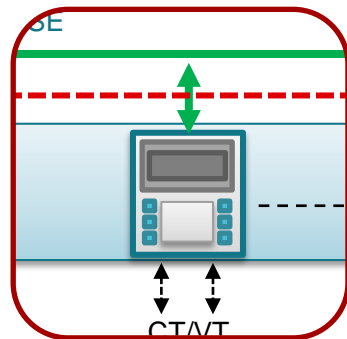
# Substation Automation System IEC61850 enabled in IEDs



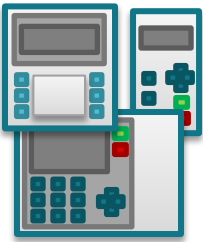
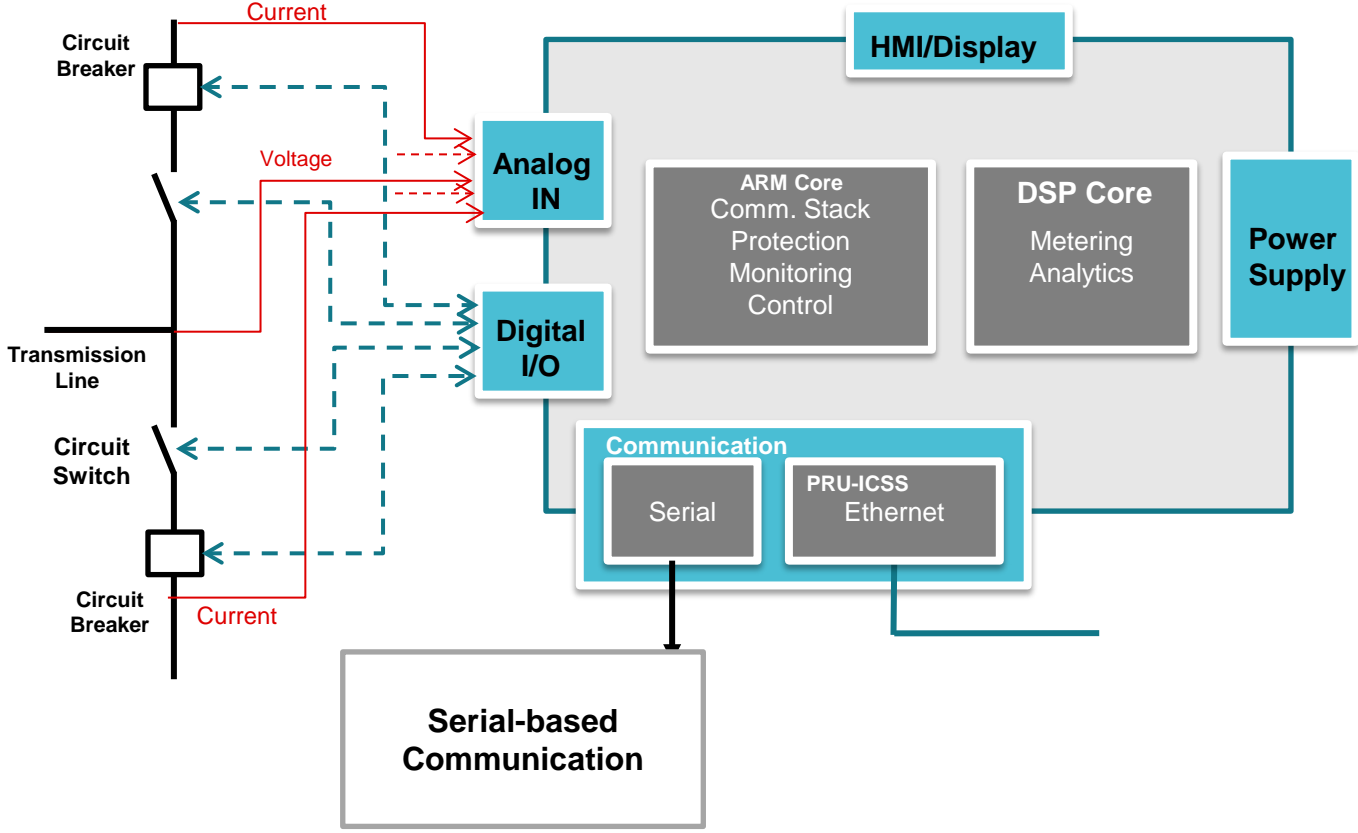
# Taking a closer look at an IED



# Taking a closer look at an IED



# IED block diagram



# Section summary

- Systems are changing to include more intelligence and communication
  - Grid Infrastructure, Factory Automation and Transportation are examples
- Communication is often based on Ethernet
- Substation Automation is one specific area well documented by IEC61850
- Processors and software with the correct support for communications (serial, Ethernet, etc.) are needed to spread intelligence through the grid and other systems with similar needs
- TI has a broad portfolio of processors and software to help meet the needs of these systems

# For more information

- HSR and PRP on RT Linux Training Series: <http://training.ti.com/hsr-prp-rt-linux-training-series>
- Sitara Processors Product Overview: <http://www.ti.com/sitara>
- AM571x Industrial Development Kit (IDK): <http://www.ti.com/tool/tmdxidek5718>
- AM572x Industrial Development Kit (IDK): <http://www.ti.com/tool/tmdxidek5728>
- Processor SDK Software Developer Guides:
  - Linux: [http://processors.wiki.ti.com/index.php/Processor\\_SDK\\_Linux\\_Software\\_Developer's\\_Guide](http://processors.wiki.ti.com/index.php/Processor_SDK_Linux_Software_Developer's_Guide)
  - RTOS: [http://processors.wiki.ti.com/index.php/Processor\\_SDK\\_RTOS\\_Software\\_Developer\\_Guide](http://processors.wiki.ti.com/index.php/Processor_SDK_RTOS_Software_Developer_Guide)
- PRP TI Design using TI-RTOS: <http://www.ti.com/tool/tidep0054>
- HSR TI Design using TI-RTOS: <http://www.ti.com/tool/tidep0053>
- For questions regarding topics covered in this training, visit the Sitara Processors support forum at the TI E2E Community website: [https://e2e.ti.com/support/arm/sitara\\_arm/f/791](https://e2e.ti.com/support/arm/sitara_arm/f/791)