



# IEC 61850 Based Bus Protection Applications

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# Introduction

- IEC 61850 standard has a significant impact on the development of a new generation protection solutions
- The paper analyzes conventional centralized and distributed bus differential protection schemes and compares them with IEC 61850 station and process bus based solutions.

# Introduction

- It describes their principles and discusses the benefits of the new bus protection schemes – improved flexibility, performance, safety and reduced cost.

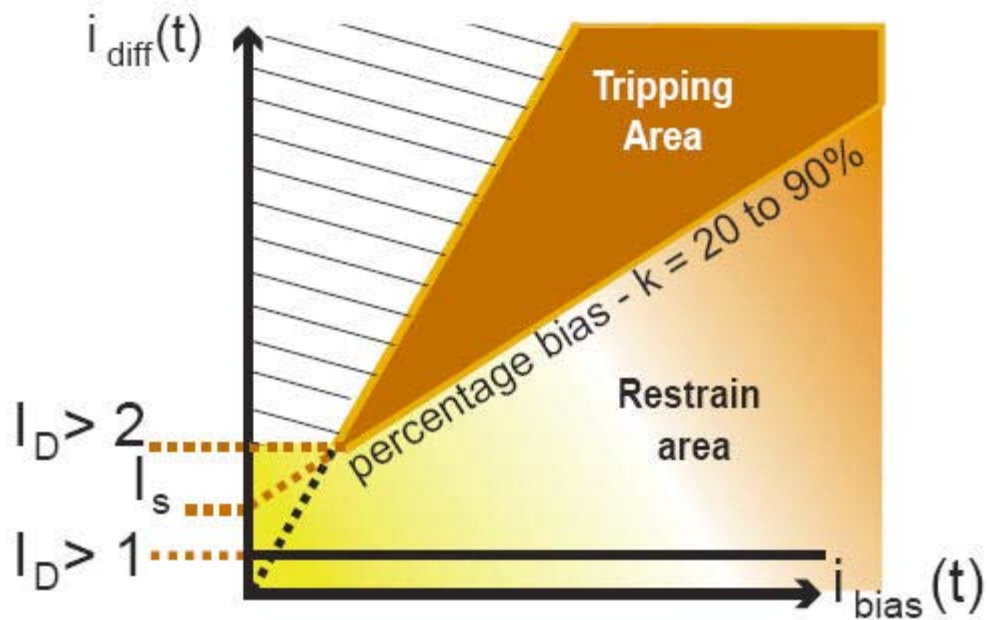
# Questions



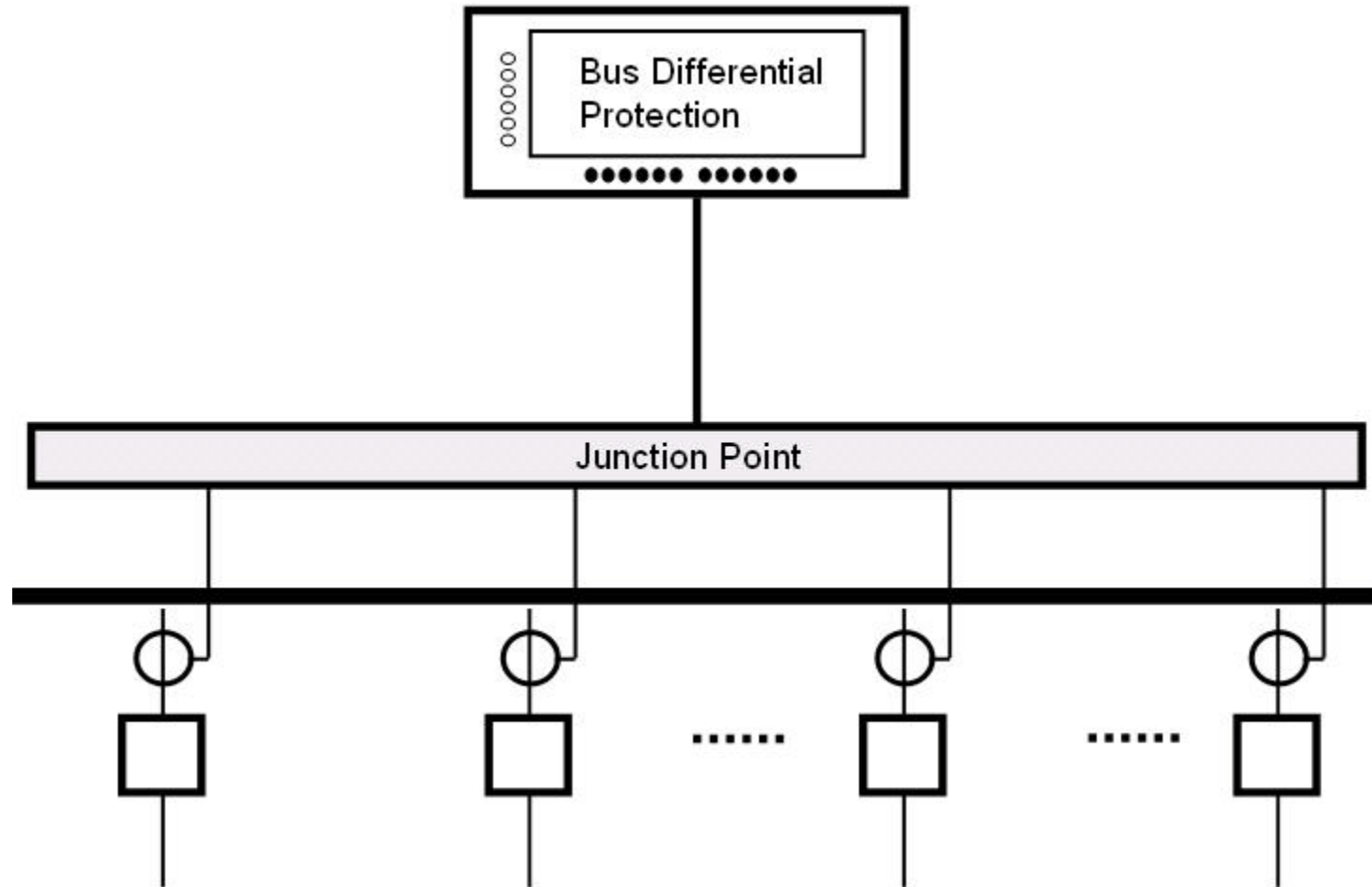
# Questions

- What do we need to do to protect a bus?
- What is the typical way of protecting a bus?
- What are the problems?
- How does IEC 61850 help us protect a bus?

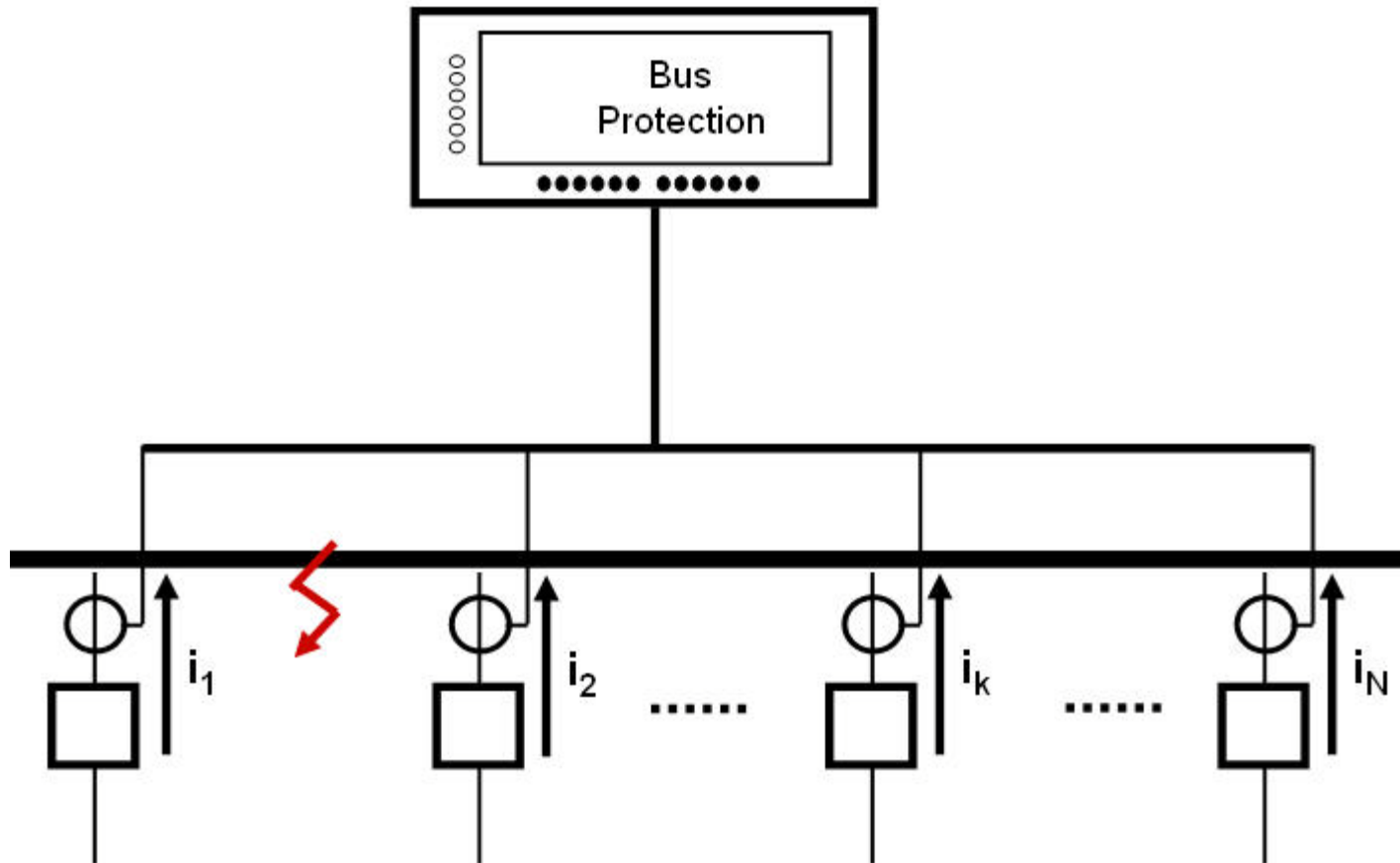
# Bus Differential Protection



# Conventional Bus Differential

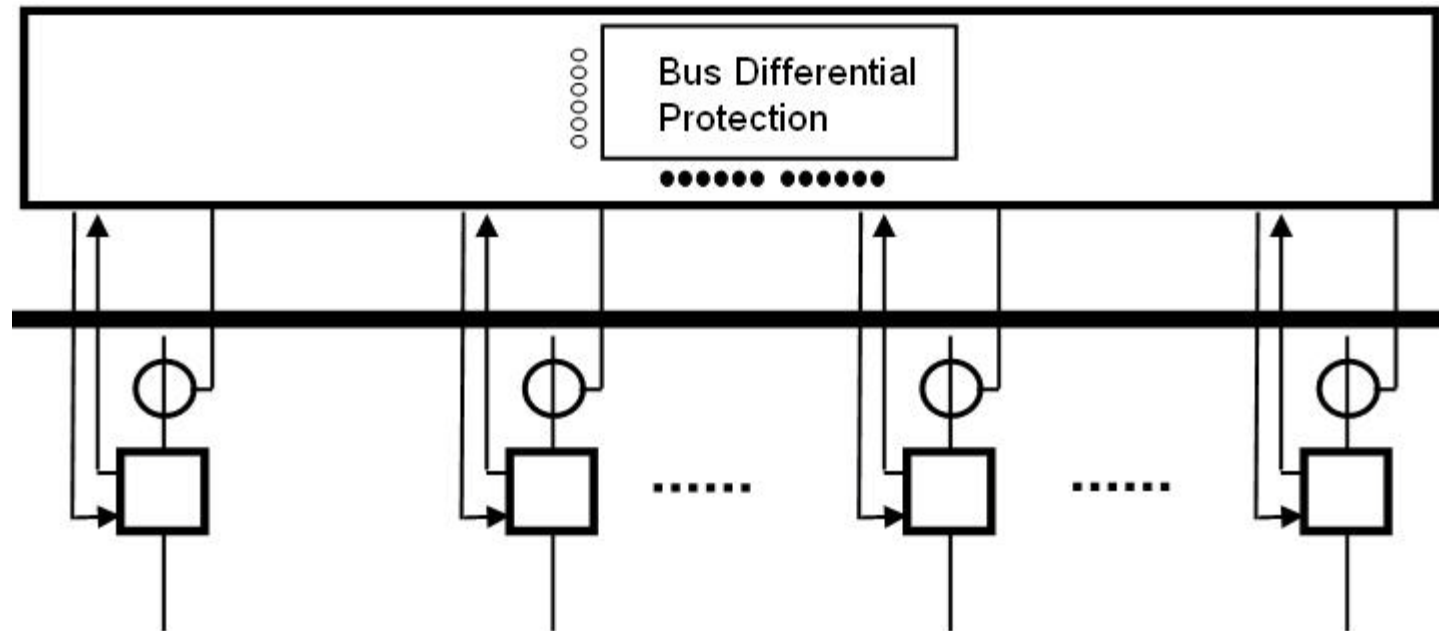


# Conventional Bus Differential

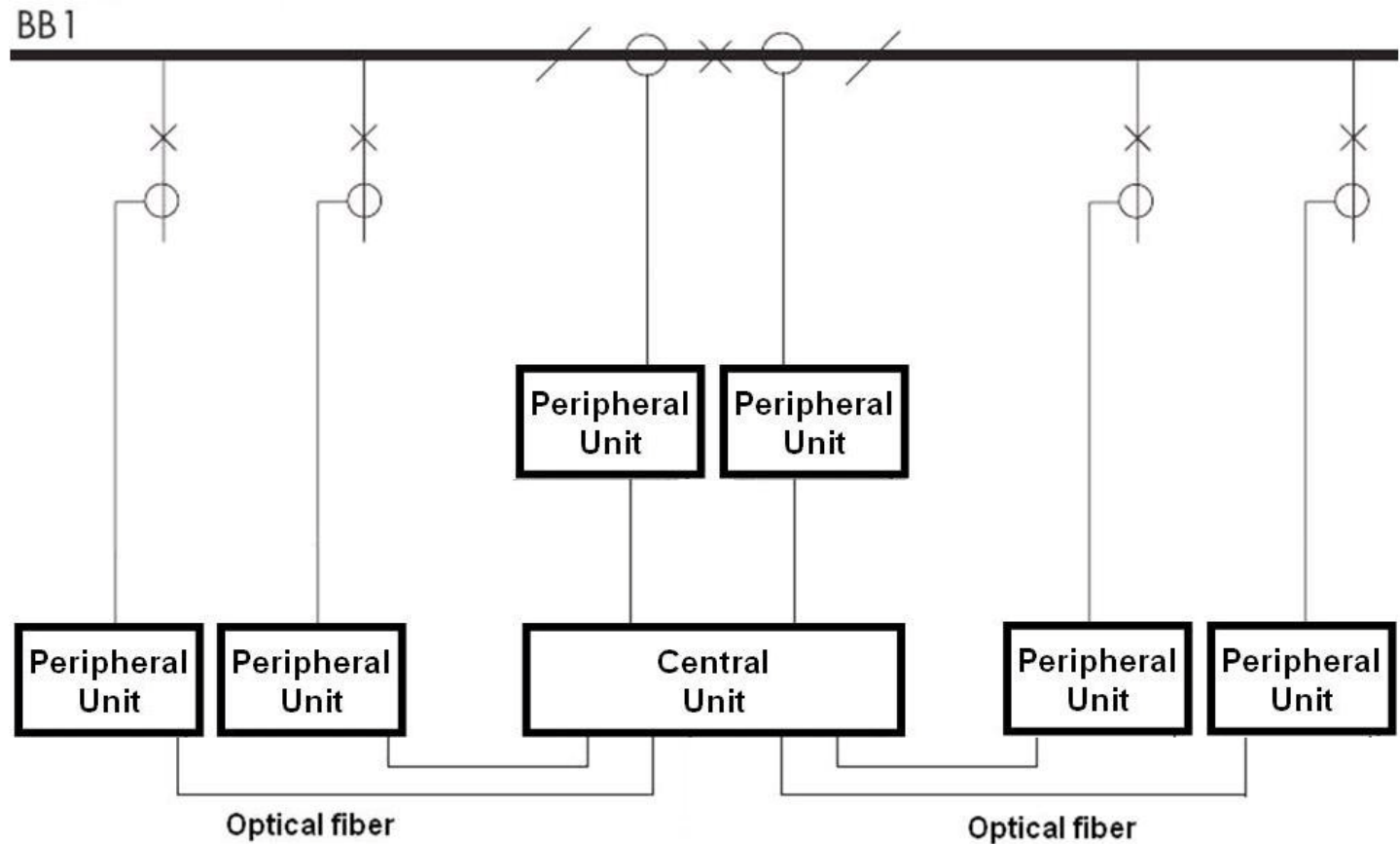




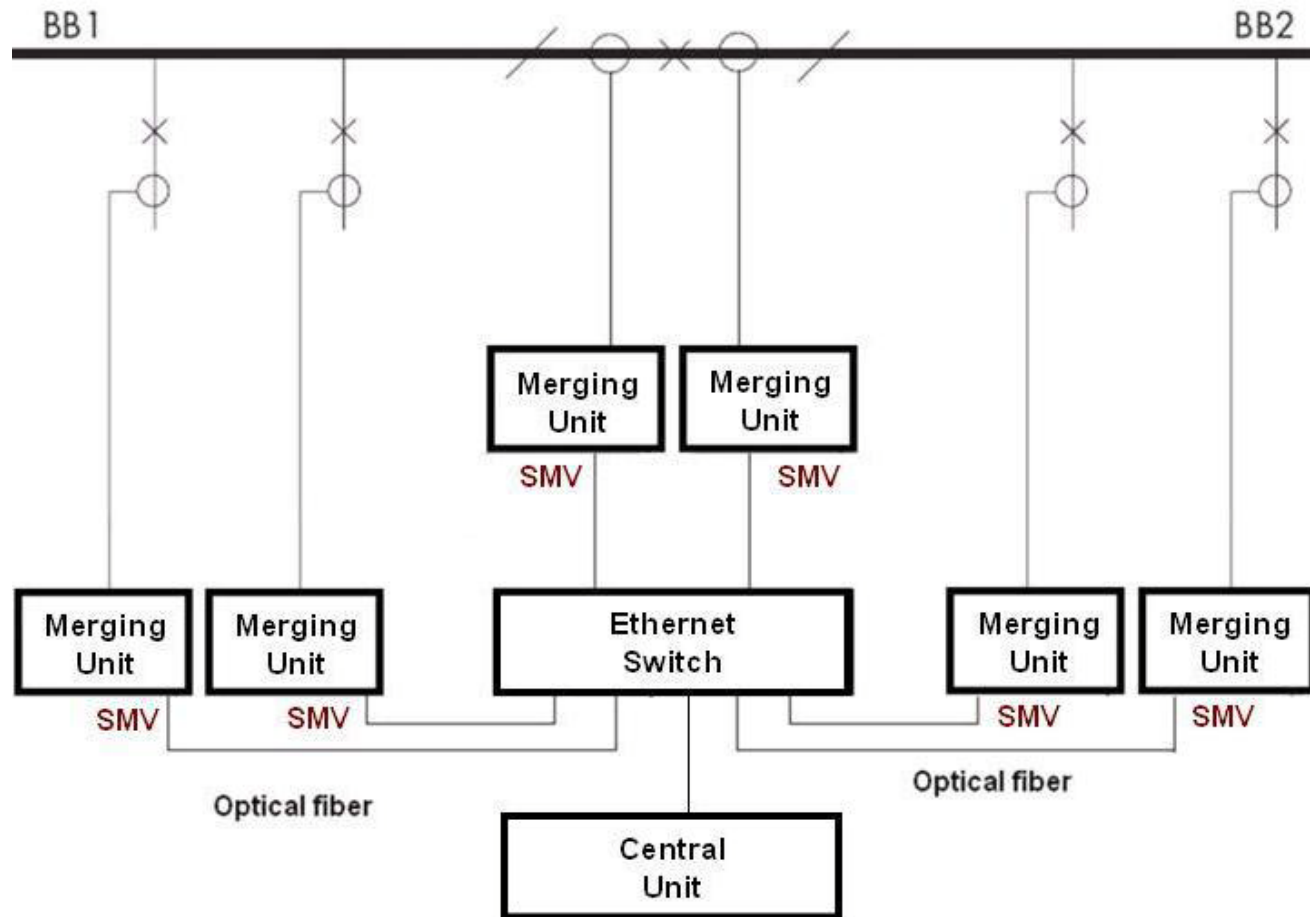
# Multiple Inputs



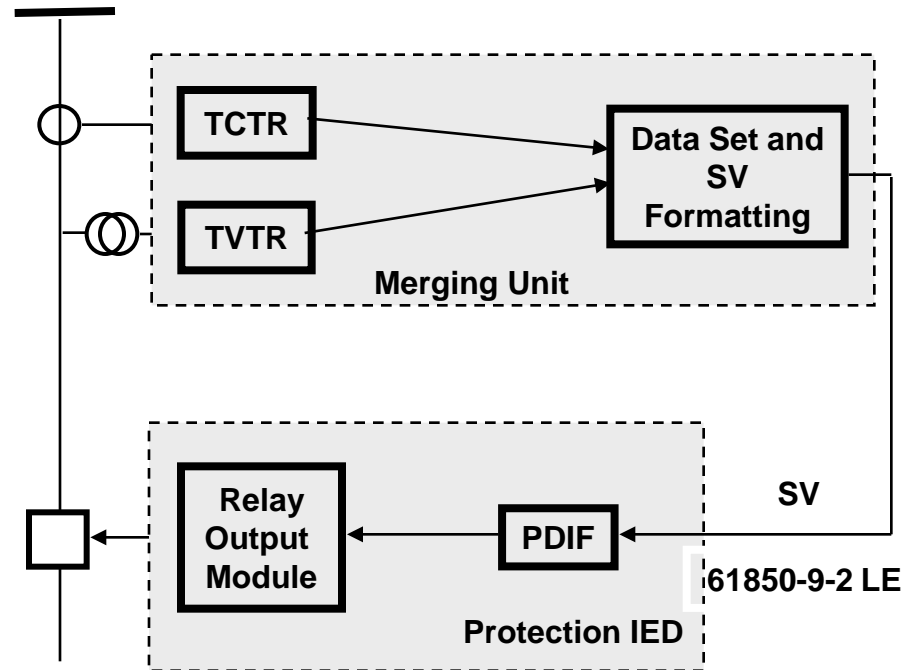
# Distributed Differential Protection



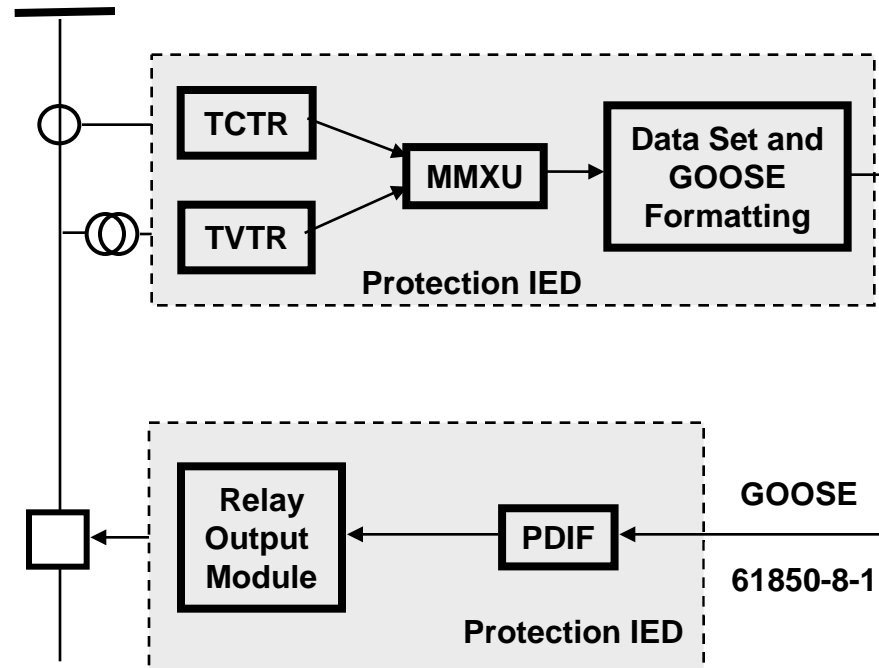
# IEC 61850 Process Bus Based



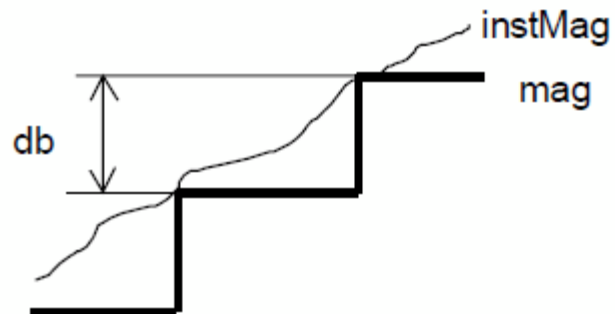
# Process Bus Applications



# Analog GOOSE Applications

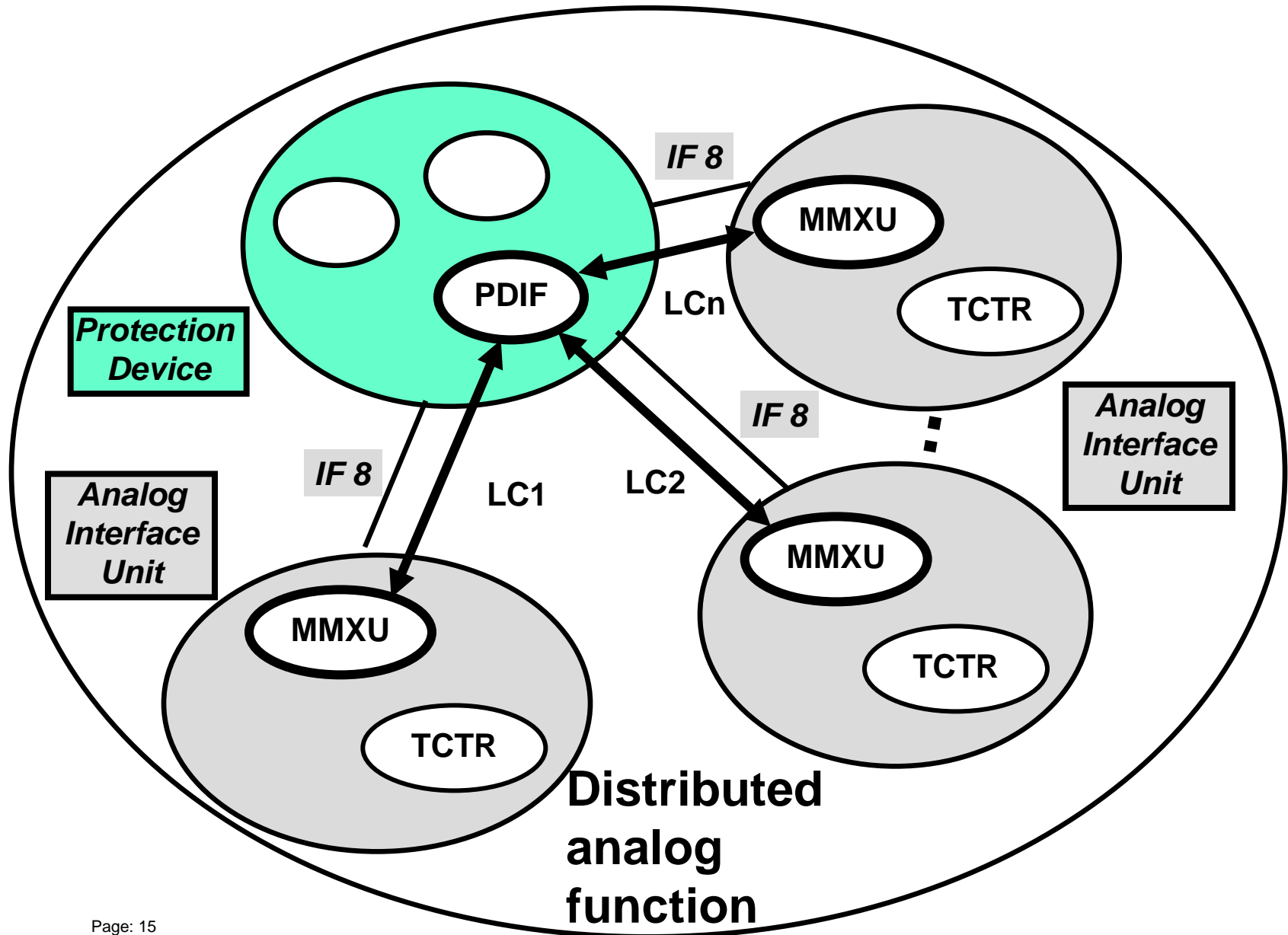


# Analog GOOSE Applications

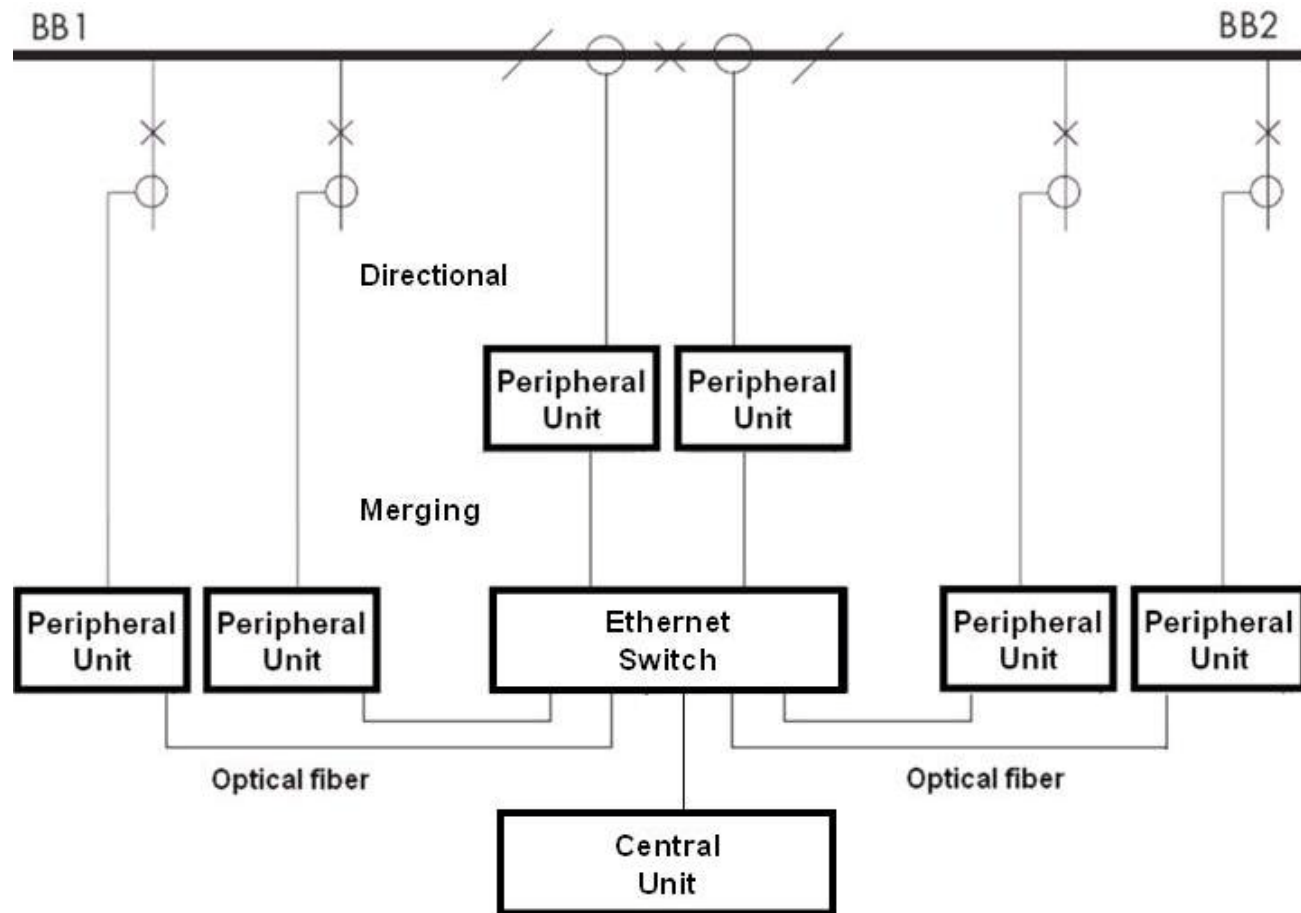


IEC 940/03

# Distributed Analog Functions

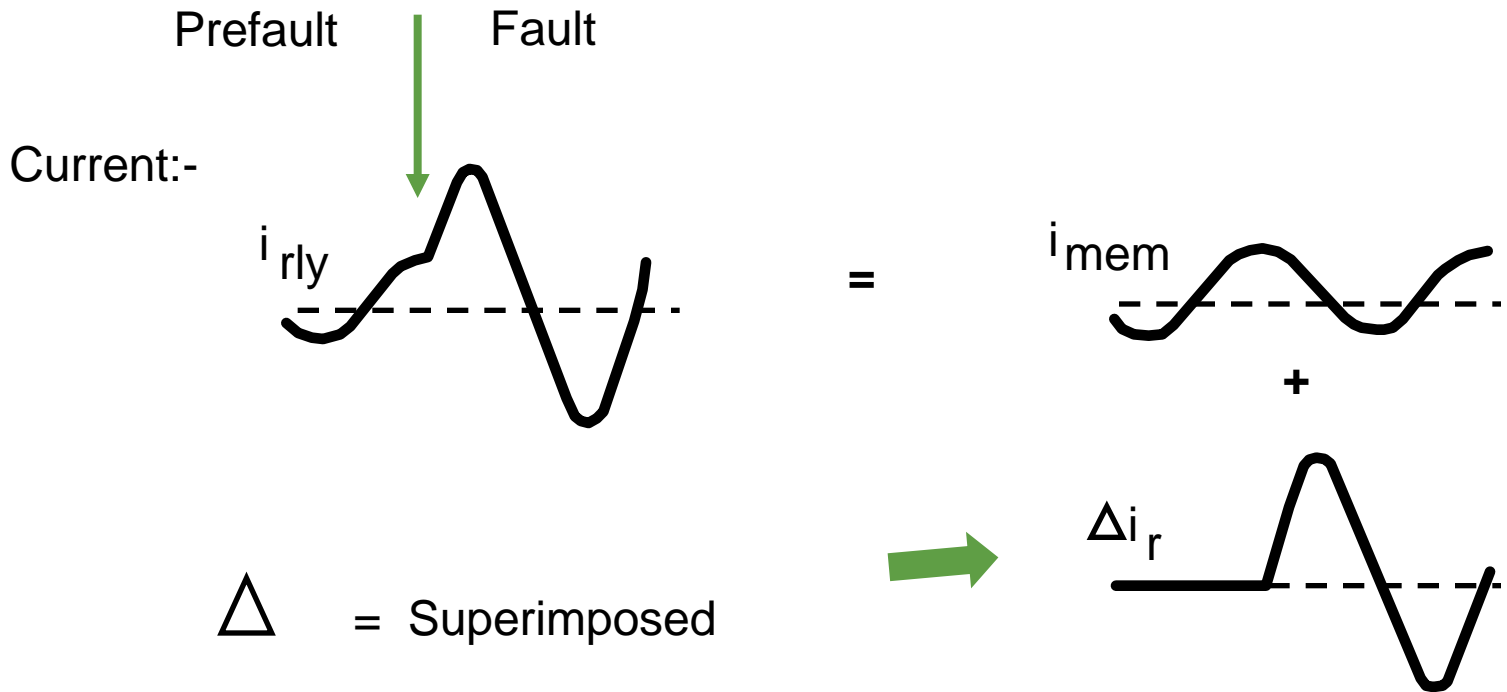


# IEC 61850 GOOSE Based

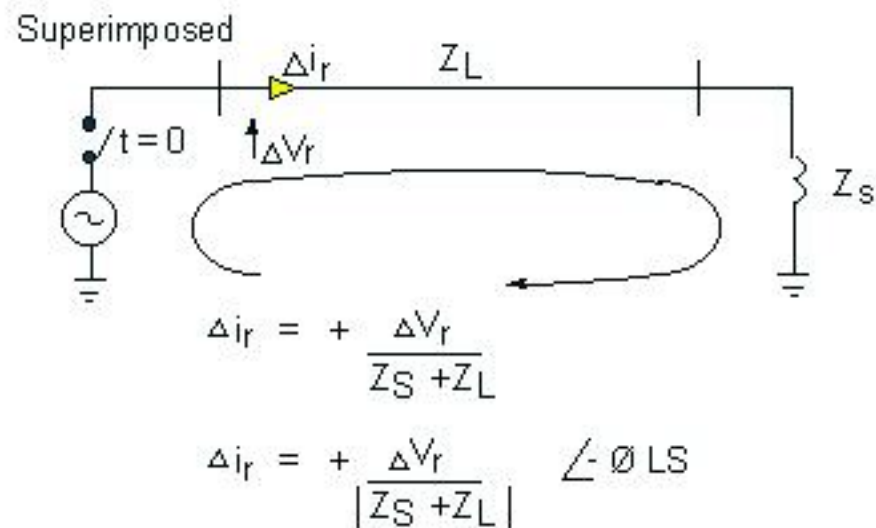
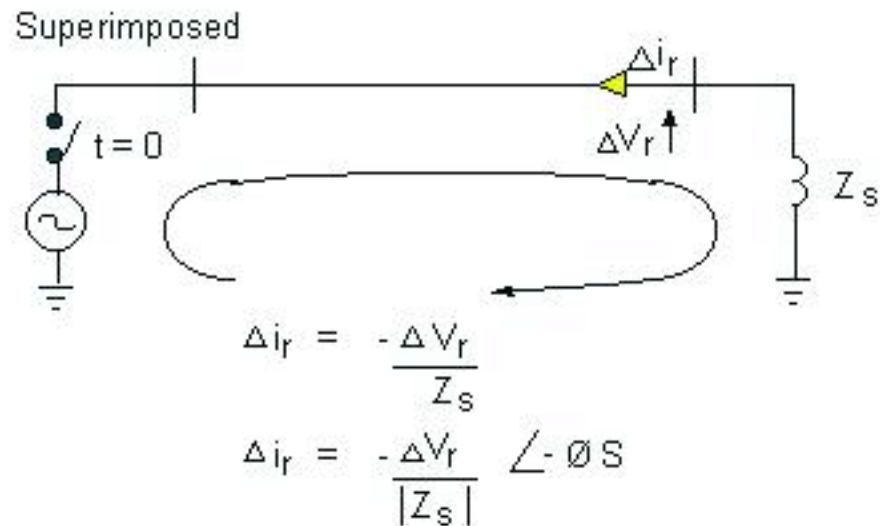




# GOOSE Applications



# Delta Directional Detection



# Transient Energy Directional Detection

$$S = \int U \cdot I \, dt$$

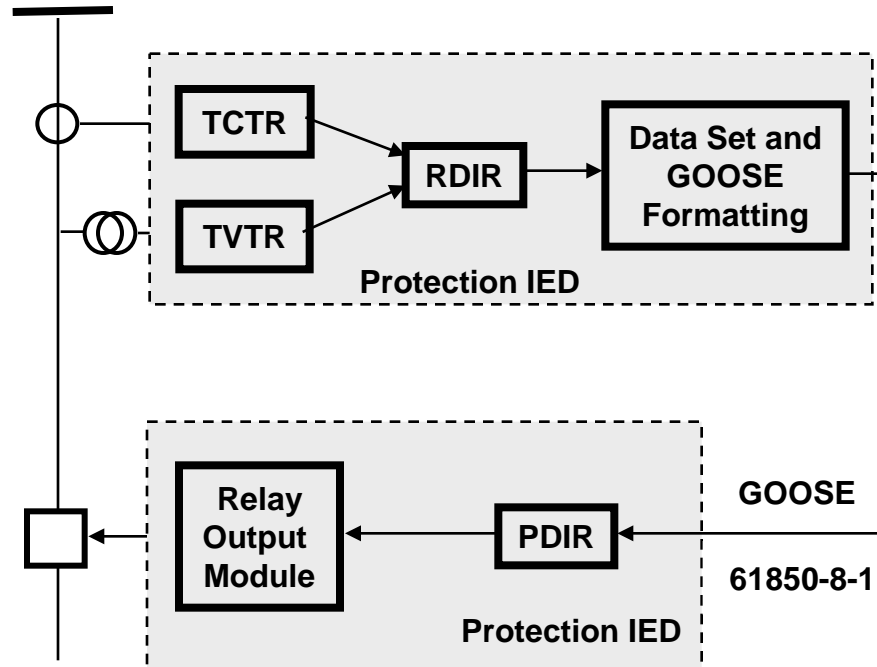
The three phase energy transition is given by

$$S = \int (\Delta U_a \cdot \Delta I_a + \Delta U_b \cdot \Delta I_b + \Delta U_c \cdot \Delta I_c) dt$$

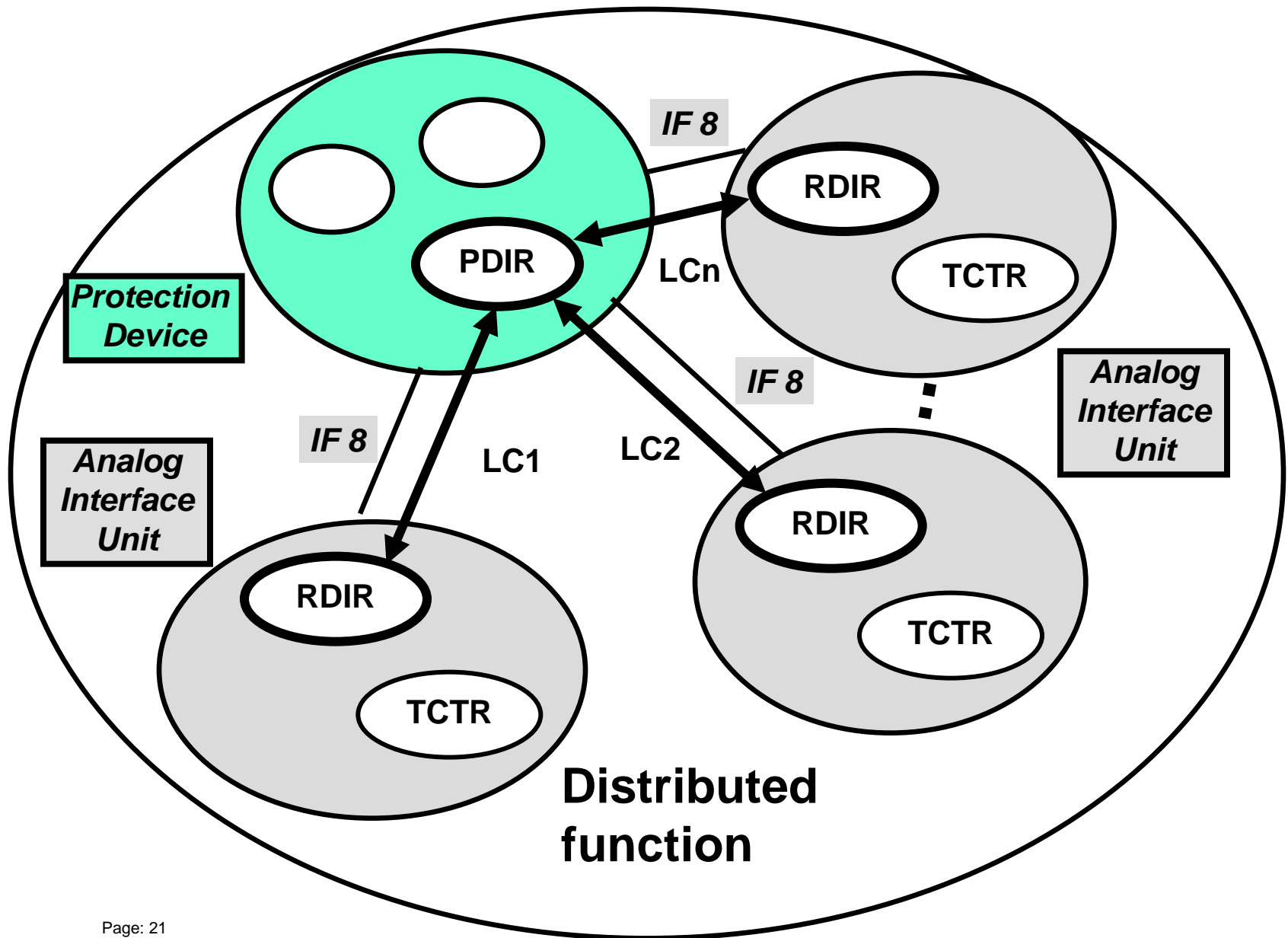
which is calculated in the relay as

$$S = \sum (\Delta U_{ai} \cdot \Delta I_{ai} + \Delta U_{bi} \cdot \Delta I_{bi} + \Delta U_{ci} \cdot \Delta I_{ci})$$

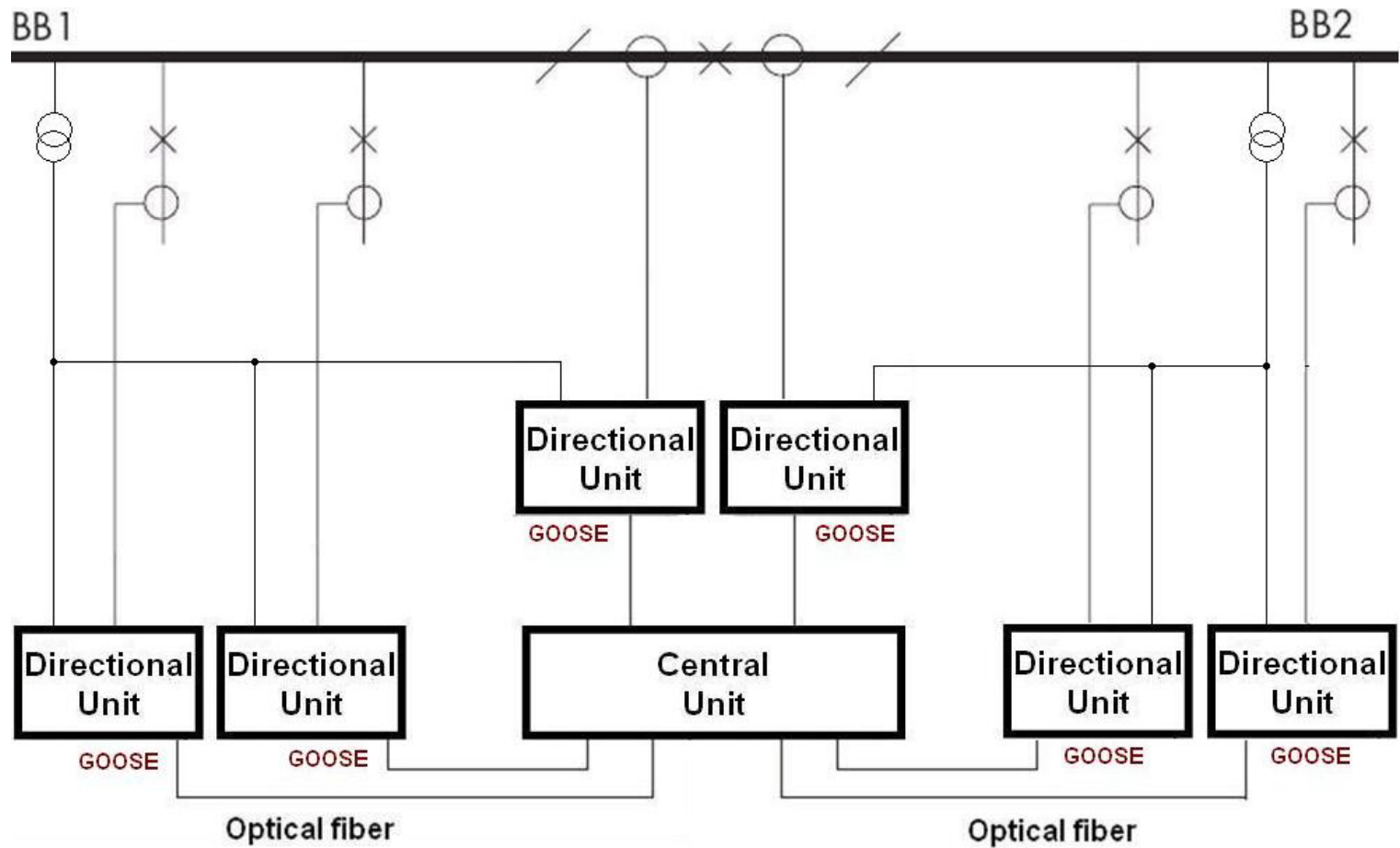
# Binary GOOSE Applications



# Directional Comparison Scheme



# IEC 61850 Directional Comparison



# Conclusions

- IEC 61850 has impact on bus protection design.
- Distributed bus protection systems based on the IEC 61850 offer significant advantages compared to conventional bus differential protection devices:
  - Reduced wiring, installation, maintenance and commissioning costs
  - Easy adaptation to changing bus configuration and practical elimination of CT saturation and open circuit.





