

# Continuous Automated Analysis of Protection Scheme Communications Leads to Improved Reliability and Performance

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## Monitoring Application Data

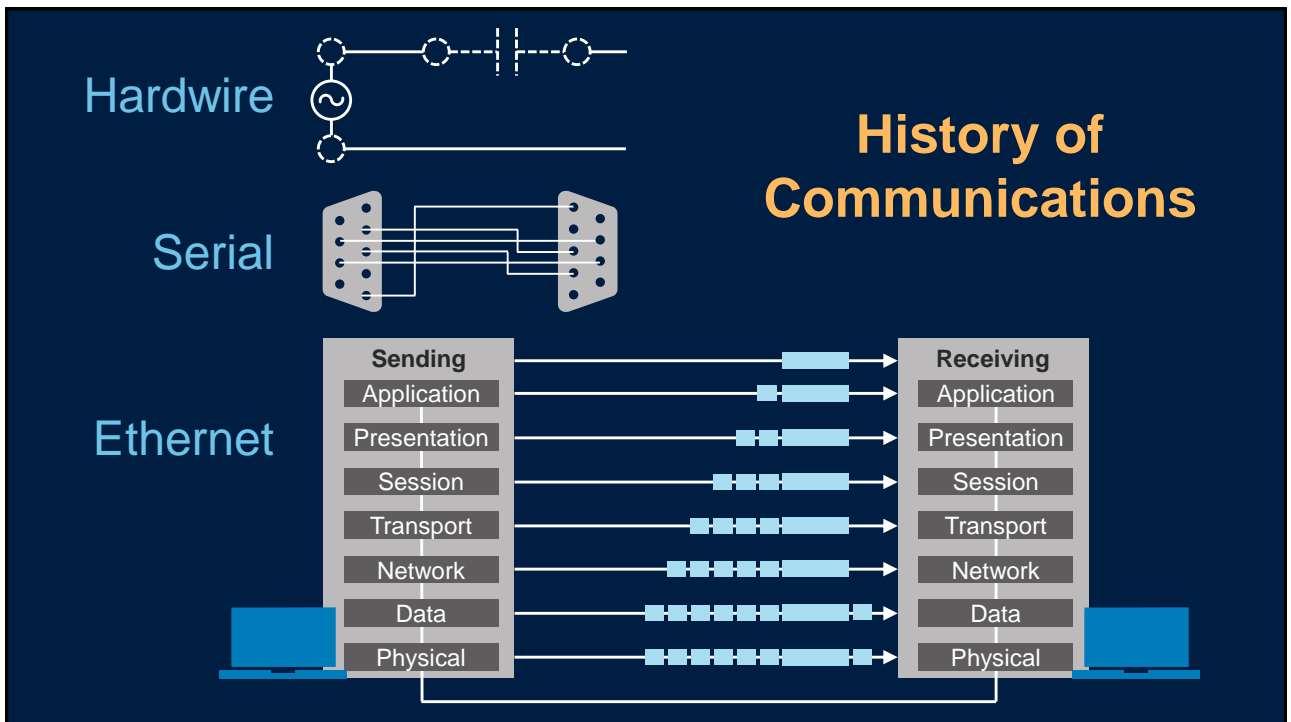
Analyzing How Information Moves Between Devices

- Speed
- Consistency
- Reliability



## Benefits of Monitoring

- Reduction in time it takes to analyze communications-assisted protection scheme performance
- Historical performance records
- Continuous performance monitoring



# Monitoring Communications

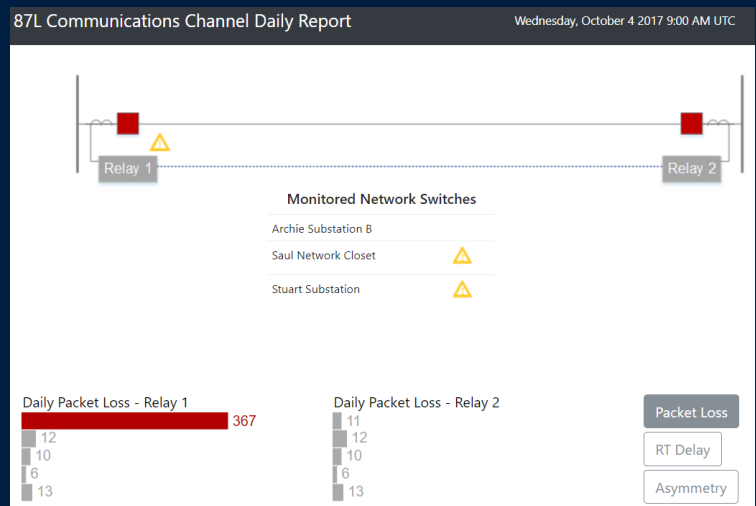
## Serial

- Few statistics
- Built-in determinism
- One-to-one connections

## Ethernet

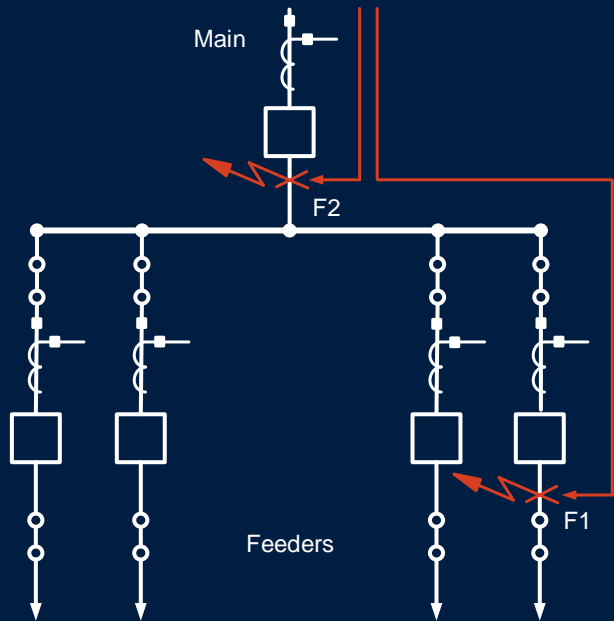
- Many statistics
- One-to-many connections
- Better delivery guarantee

## Applications That Benefit From Application Data Monitoring 87L Schemes



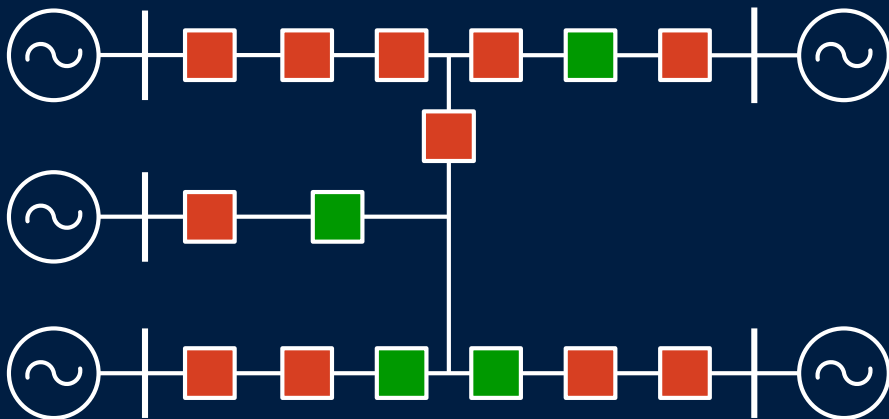
# Applications That Benefit From Application Data Monitoring

## Fast Bus Tripping Schemes

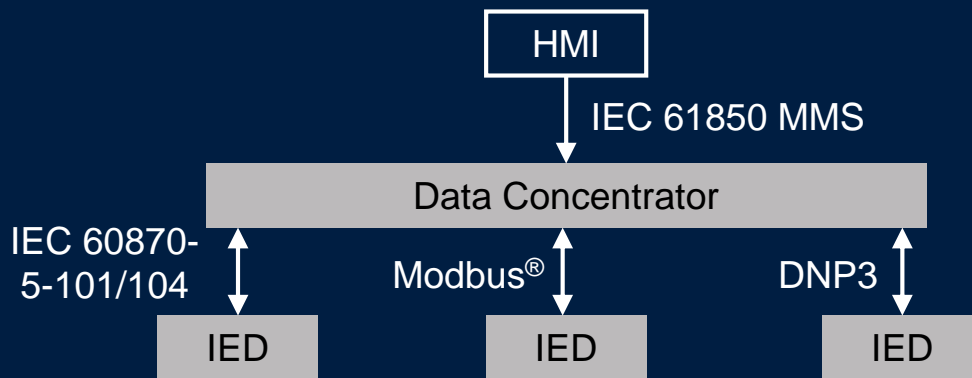


# Applications That Benefit From Application Data Monitoring

## Restoration Schemes

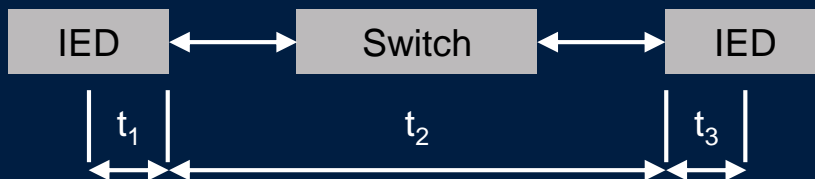


# Applications That Benefit From Application Data Monitoring SCADA and HMI

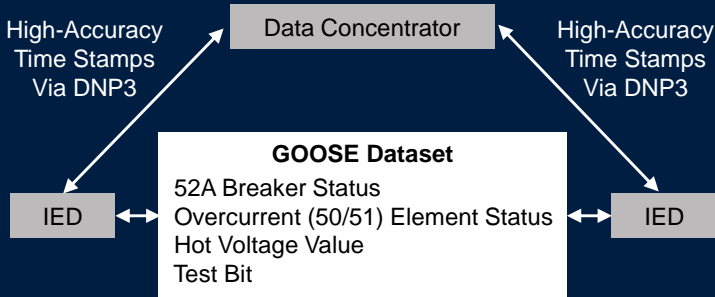


## Monitoring Application Data

- $t_1$  = Device logic engine to network
- $t_2$  = Device to device, on network
- $t_3$  = Network to device logic engine



# Configure Time Delta Monitoring



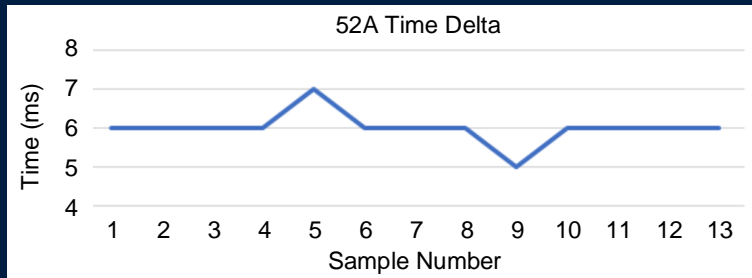
```

2  VAR
3     timeDelta_1 : fb_timeDelta;
4     timeDelta_2 : fb_timeDelta;
5  END VAR

```

The code block shows the configuration of two variables, timeDelta\_1 and timeDelta\_2, both of type fb\_timeDelta. Below the code are two ladder logic diagrams. The first diagram, labeled 'timeDelta\_1' with a '1' in a box, shows a normally open contact for 'IED\_1\_DNP.BI\_52A' and a normally open contact for 'IED\_2\_DNP.BI\_52A' in series with a coil for 'fb\_timeDelta'. The second diagram, labeled 'timeDelta\_1' with a '0' in a box, shows a normally open contact for 'IED\_1\_DNP.BI\_52A' and a normally open contact for 'IED\_2\_DNP.BI\_52A' in series with a coil for 'fb\_timeDelta'. Both diagrams also show a 'LogTime' coil.

# Keeping Track of Performance Over Time



tag_name	message	t_value
52A time delta(ms)	6	11/14/2017 23:40:26.000
52A time delta(ms)	6	11/14/2017 23:41:47.000
52A time delta(ms)	6	11/15/2017 11:40:32.000
52A time delta(ms)	6	11/15/2017 12:15:17.000
52A time delta(ms)	7	11/15/2017 12:45:36.000
52A time delta(ms)	6	11/15/2017 12:57:01.000

## Implementing Monitoring Solutions

### Good

- Collect information
- Calculate time delta
- Store calculations in log file

## Implementing Monitoring Solutions

### Better

- Compare time calculation against known value to create potential alarms
  - HMI
  - SCADA
  - Email
  - Text
- Determine statistics of time calculations

## Implementing Monitoring Solutions Best

- Custom HTML- or SVG-formatted report
- Graphical display of information
- Trends over time
- Highlighted anomalies

## Advantages of Performance Monitoring

- Reduction in analysis time
- Historical performance records
- Continuous performance monitoring

tag_name	message	t_value
52A time delta(ms)	6	11/14/2017 23:40:26.000
52A time delta(ms)	6	11/14/2017 23:41:47.000
52A time delta(ms)	6	11/15/2017 11:40:32.000
52A time delta(ms)	6	11/15/2017 12:15:17.000
52A time delta(ms)	7	11/15/2017 12:45:36.000
52A time delta(ms)	6	11/15/2017 12:57:01.000
52A time delta(ms)	6	11/16/2017 15:02:31 PM



**Questions?**