

# An Open Platform for Rapid-Prototyping Protection and Control Schemes with IEC 61850

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# Using IEC 61850

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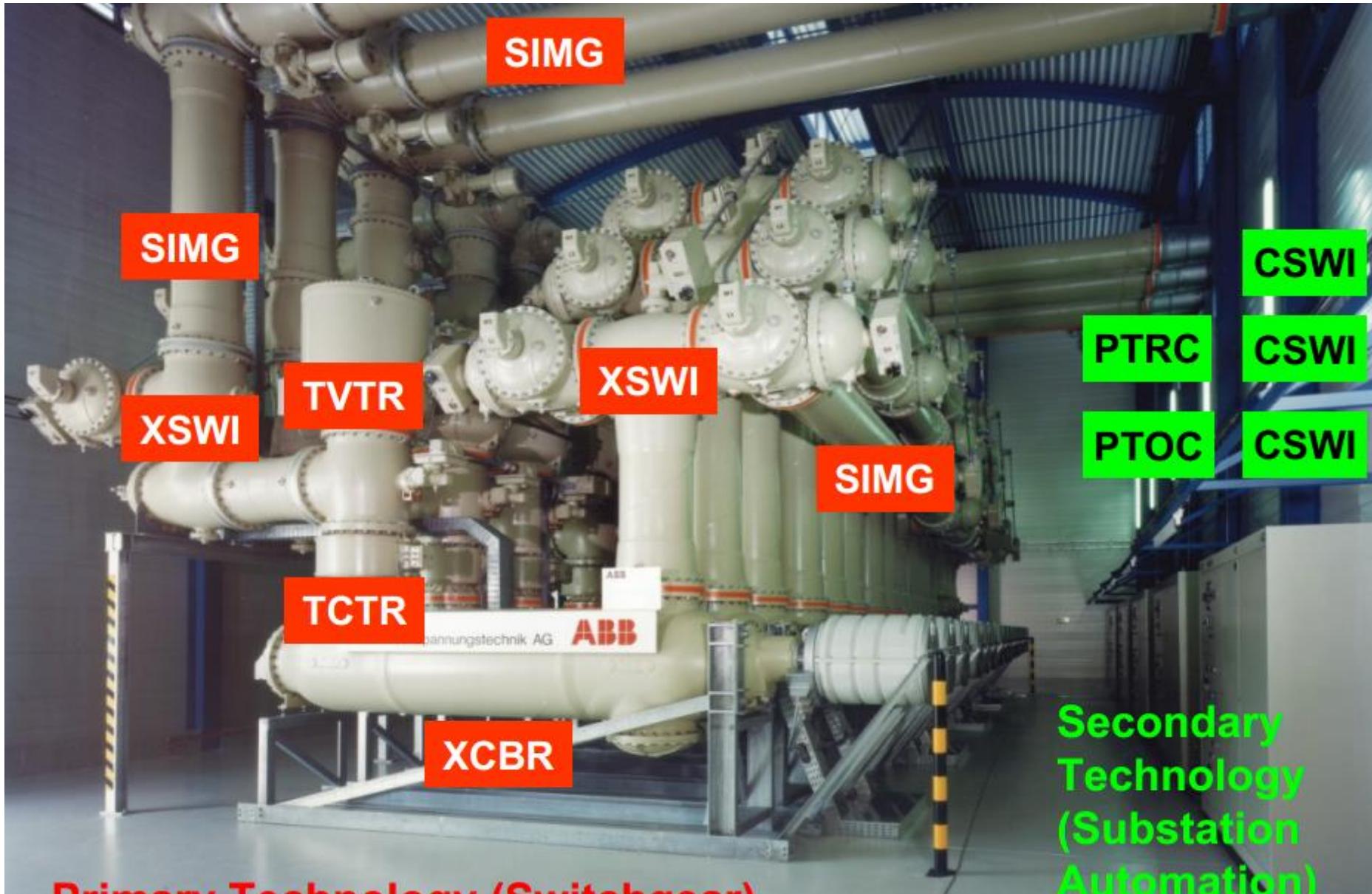
# Introduction

- What is IEC 61850?
- What problems are faced when using it?
- A solution for prototype systems
- Example applications
- Conclusions

# What is IEC 61850?

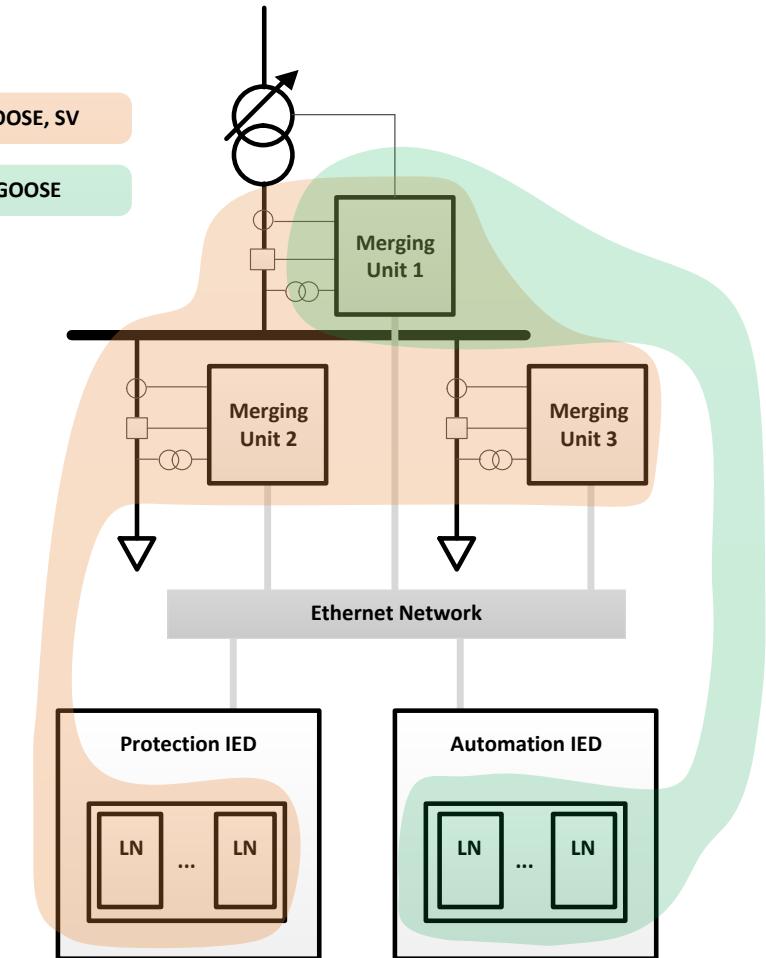
Using Ethernet communications for  
Protection, Automation, and Control

- Future-proofed for other technologies
  - Data model
  - Formal language
- Easier configuration  
Lower life-cycle cost  
Interoperability



# Communications in IEC 61850

- GOOSE
  - trip and status messages
  - multicast Ethernet
- Sampled Values (SV)
  - instantaneous sensor measurements
  - GPS time-sync'd
  - 4-15 kHz sampling
- Inter-substation comms becoming important



# Problems using IEC 61850

Part  
7-4

## Part 7-4

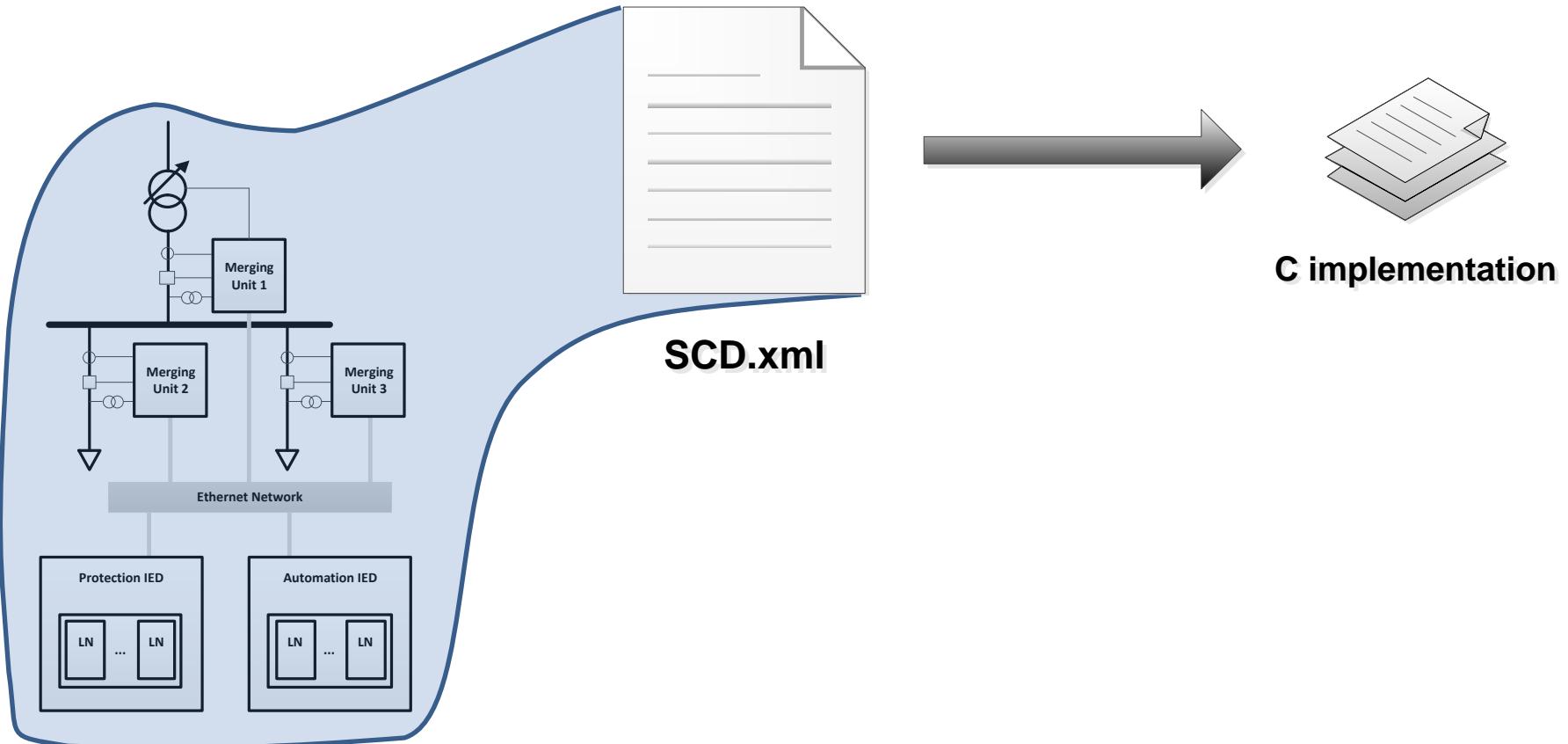
Common Logical Node class		
Attribute Name	Att. Type	Description
IPN-1	IEC	Network information class (see IEC 65800-7)
IPN-2		
Mandatory Logikal Node Information (Should be inherited by ALL LN's per CWD)		
Med	IEC	None
Me	IEC	Derived
Worth	IEC	-with
UnitPL	IEC	None - No
Detailed Logical Node Descriptions		
loc	PG	Local operation
ED-Object	IEC	Control object: test
obdShare	ANL	control object: share plots
opData	IEC	Operation data: rentals
opStat	IEC	Operation status
opConf	IEC	Operation configuration

## Part 7-2

**Part  
7-3**

Table 32 - Controllable double pain

# Code generation overview



# Code generation

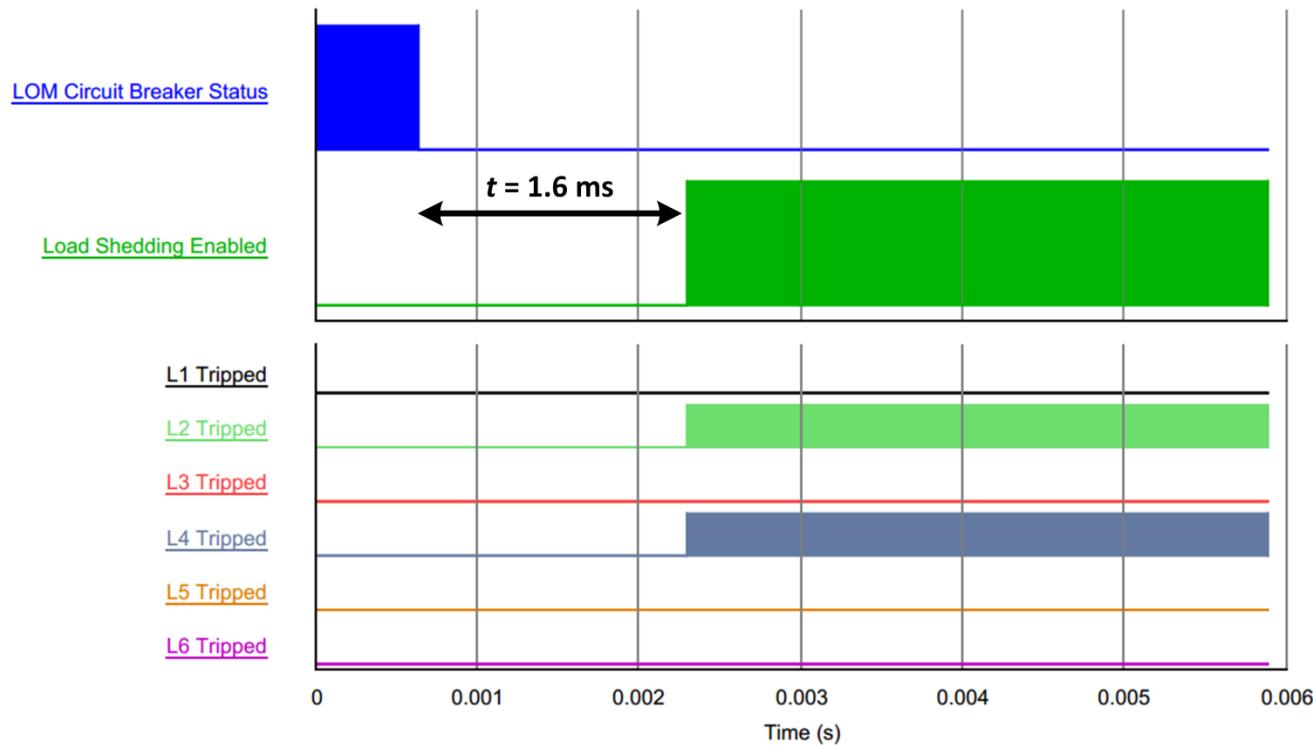
- Uses Eclipse Modeling Framework
  - “understands” the model behind SCL
  - automates XML parsing
  - helps with semantic validation of SCD file
- C code implements **GOOSE** and **SV**
- C code is tailored for each SCD file
  - very efficient at run-time
  - bespoke and correct

# Using the library

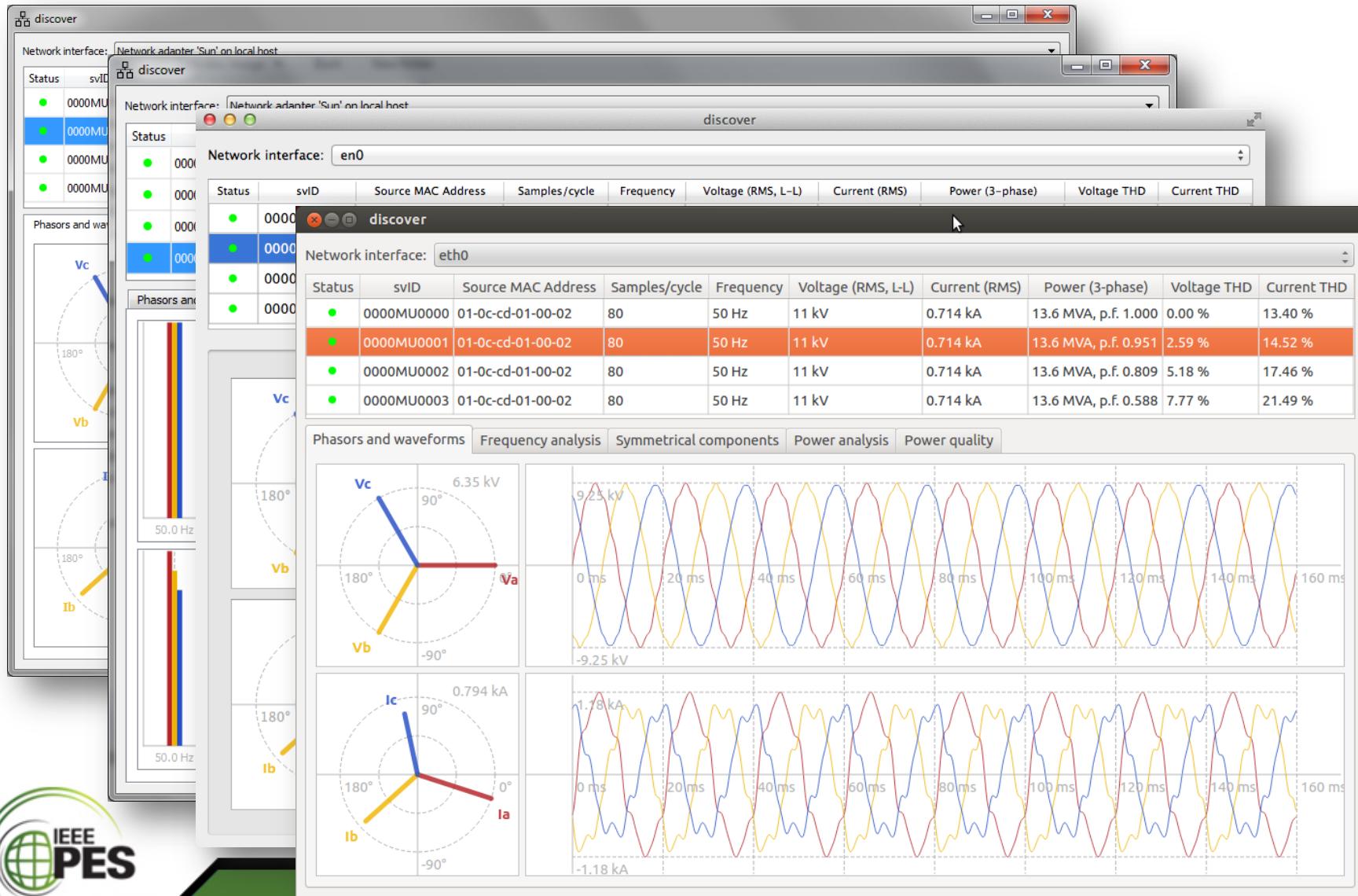
- Simple API
- Platform-independent
  - Windows, OS X, Linux
  - ARM, Raspberry Pi
- Can used from Python and Java
- Useful for rapid-prototyping protection, automation, and control schemes



# Example: Load Shedding



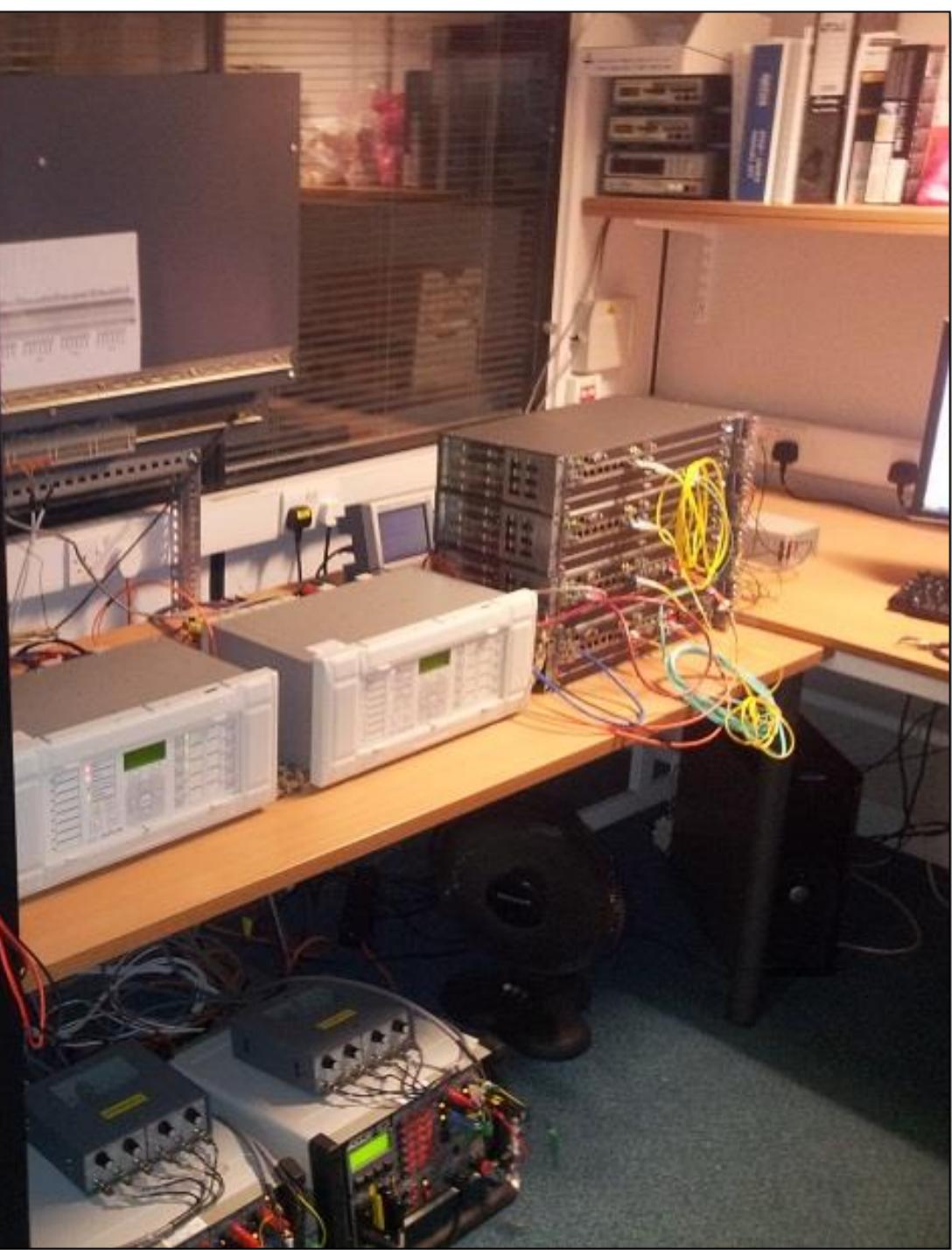
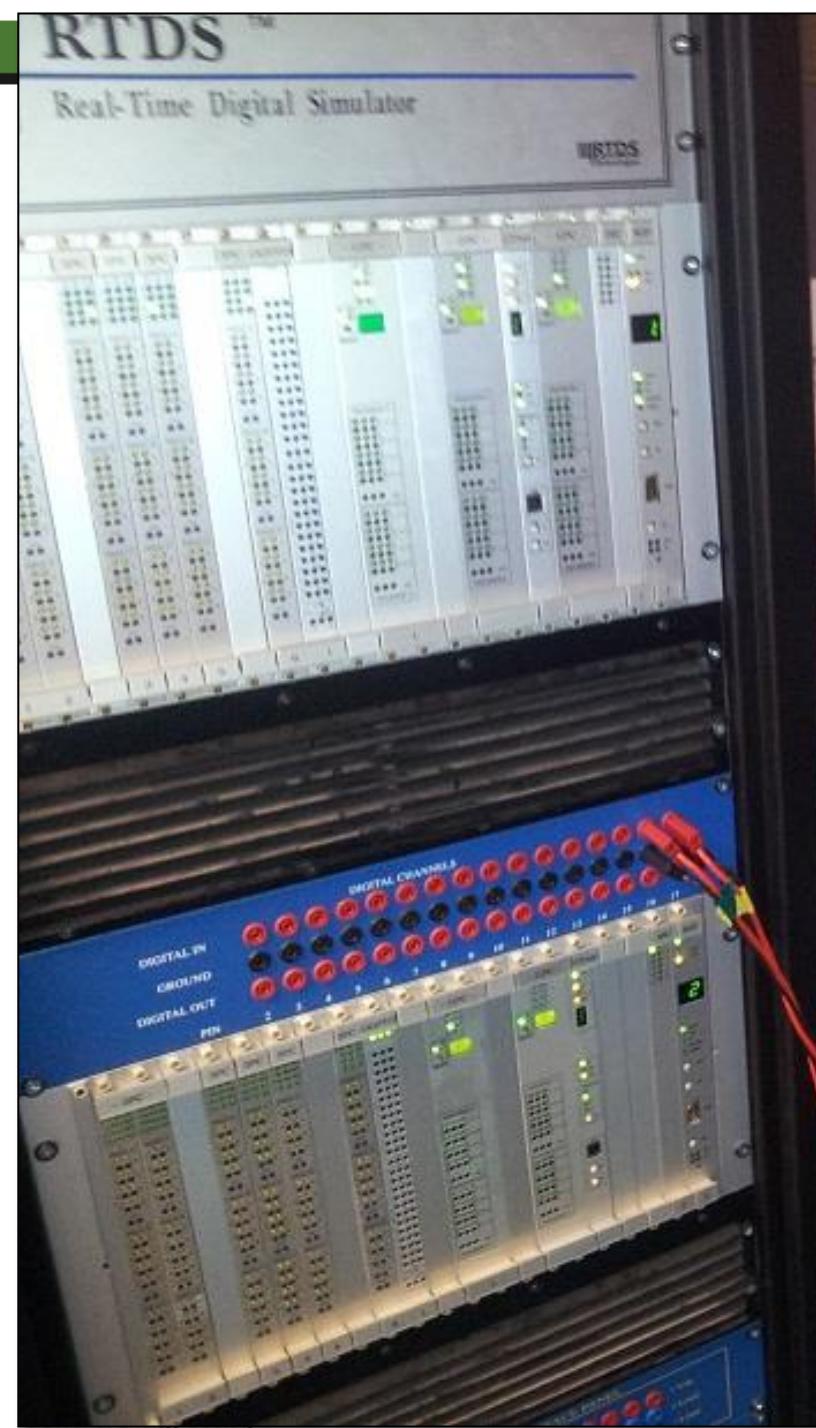
# Example: IEC 61850 “multimeter”



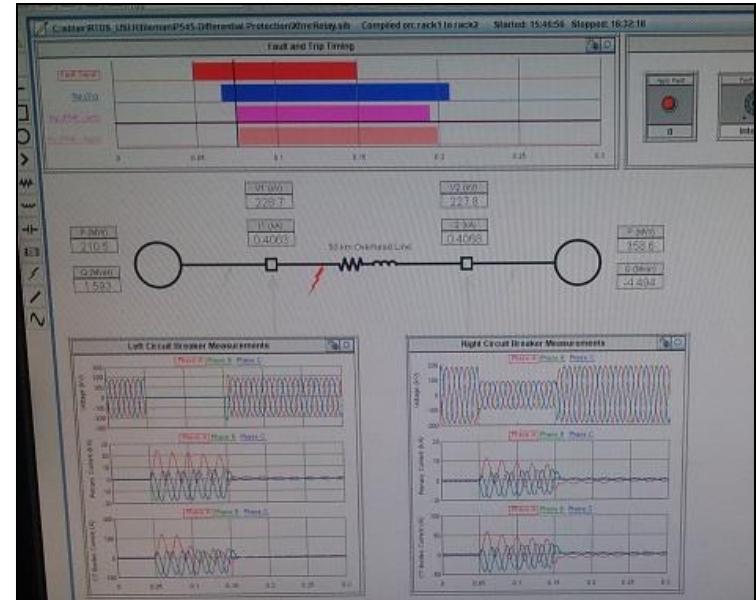
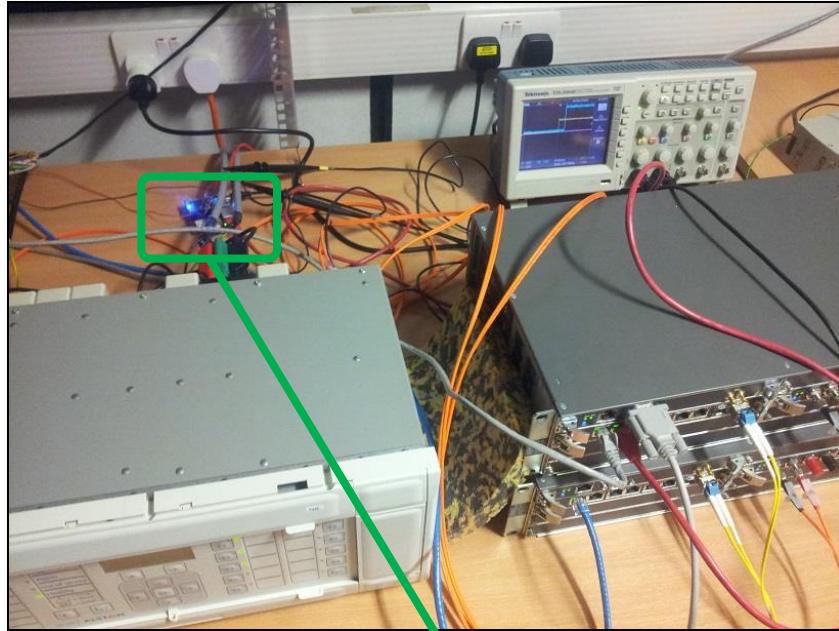
# RTDS™

Real-Time Digital Simulator

RTDS



# Example: SV over IP/MPLS



Microcontroller – subscribes to SV streams

# Other functions

- Protection testing
  - generate or replay SV streams
  - record GOOSE reactions
- Multi-IED simulation
  - one hardware platform
  - early verification of complex schemes
- Auto-generated protection logic
- Generate packet contents in comms simulator
- Visualisation and monitoring tools



# Other options

- libIEC61850
  - C implementation of MMS and GOOSE
  - <http://libiec61850.com/libiec61850/>
- OpenIEC61850
  - Java implementation of MMS
  - <http://openmuc.org/index.php?id=35>

# Conclusions

- IEC 61850 is complex and difficult to use
  - but necessary
- There's software to help
  - for prototyping protection and control schemes which require comms

<https://github.com/stevenblair/rapid61850>

<http://bit.ly/rapid61850>