



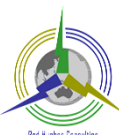
 Australia  
AP B5  
SEAPAC 2011  
1

## Experiences of IEC 61850 Engineering – Designing good systems the right way

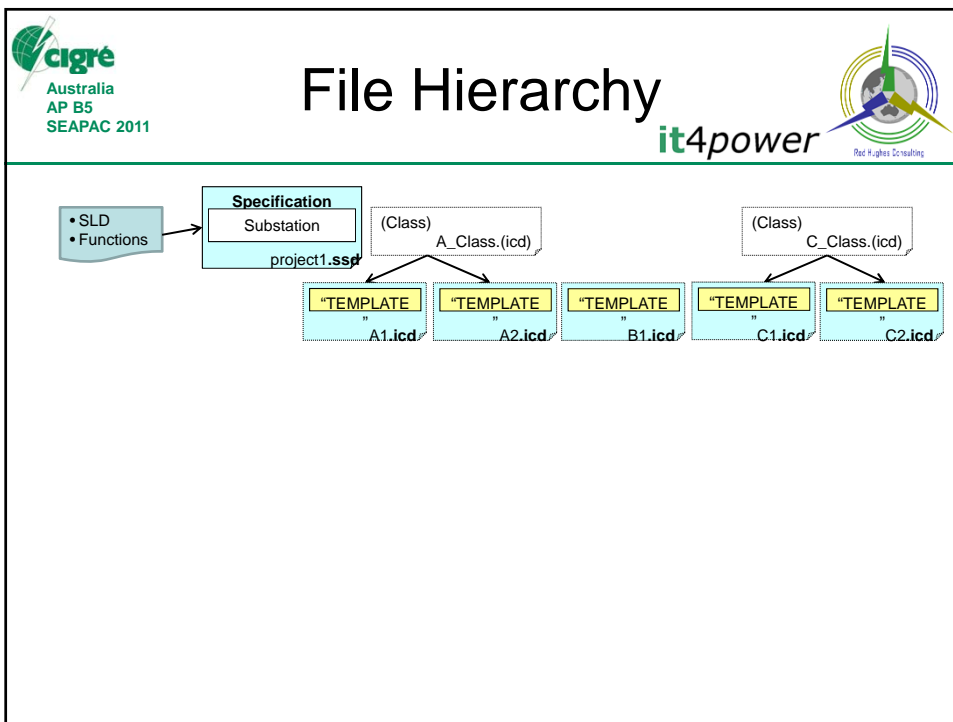
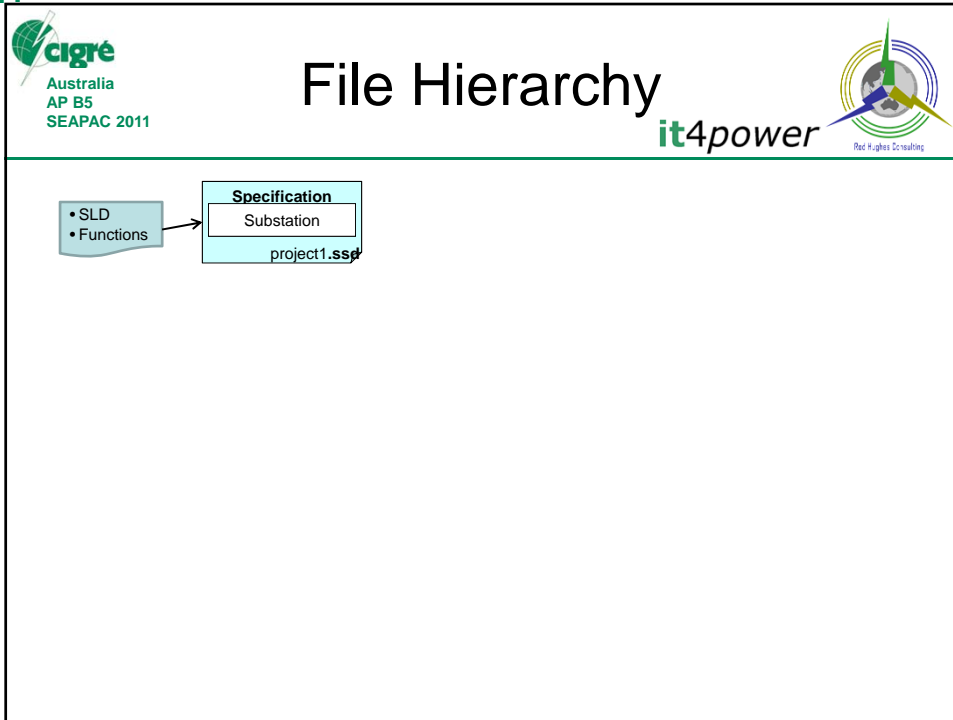
Author	Company	Email
Rod Hughes	Rod Hughes Consulting Pty Ltd	rg@rodhughesconsulting.com
Christoph Brunner	It4power LLC	christoph.brunner@it4power.com

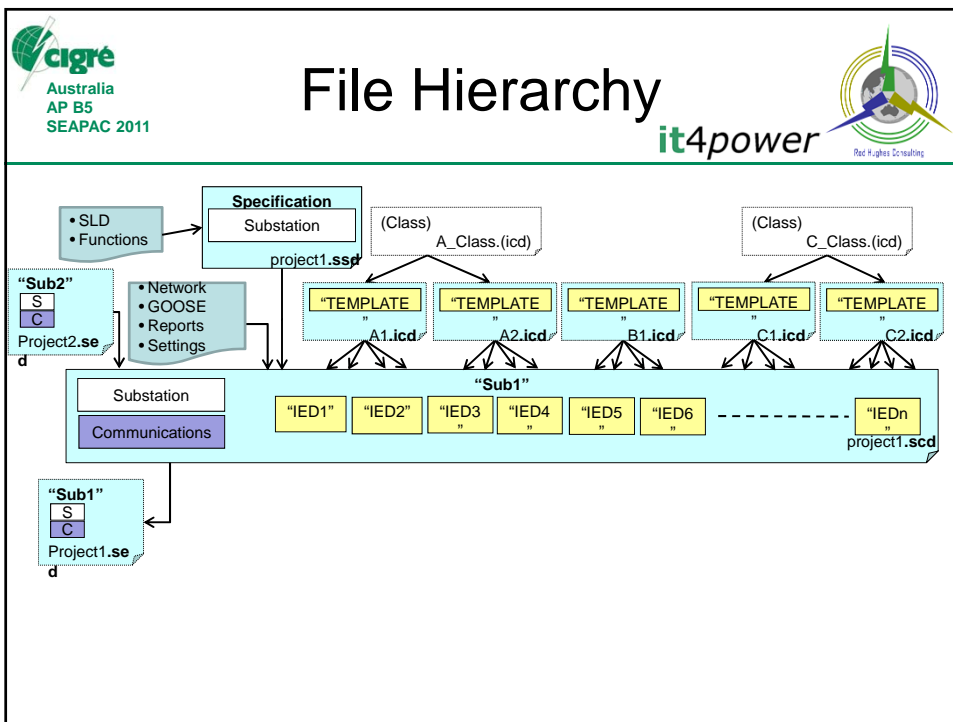
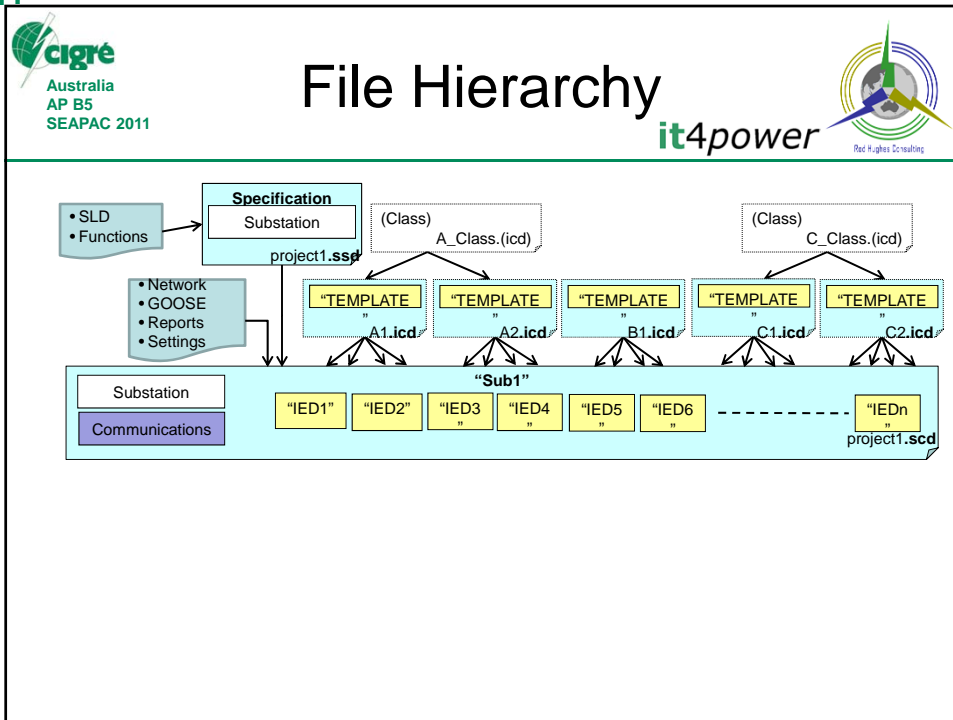
 Australia  
AP B5  
SEAPAC 2011  
2

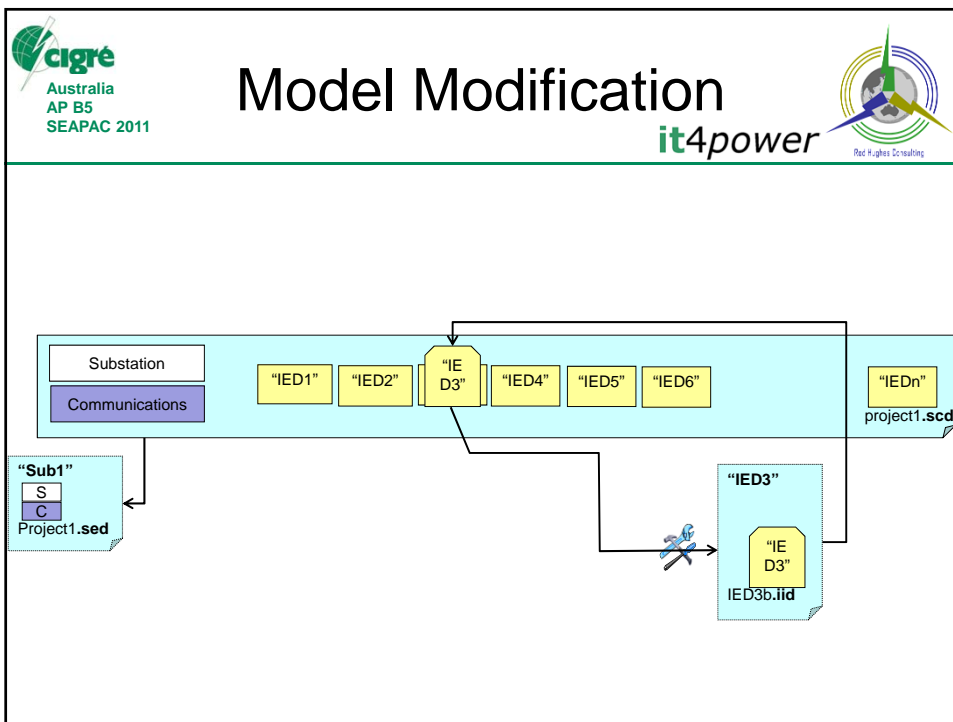
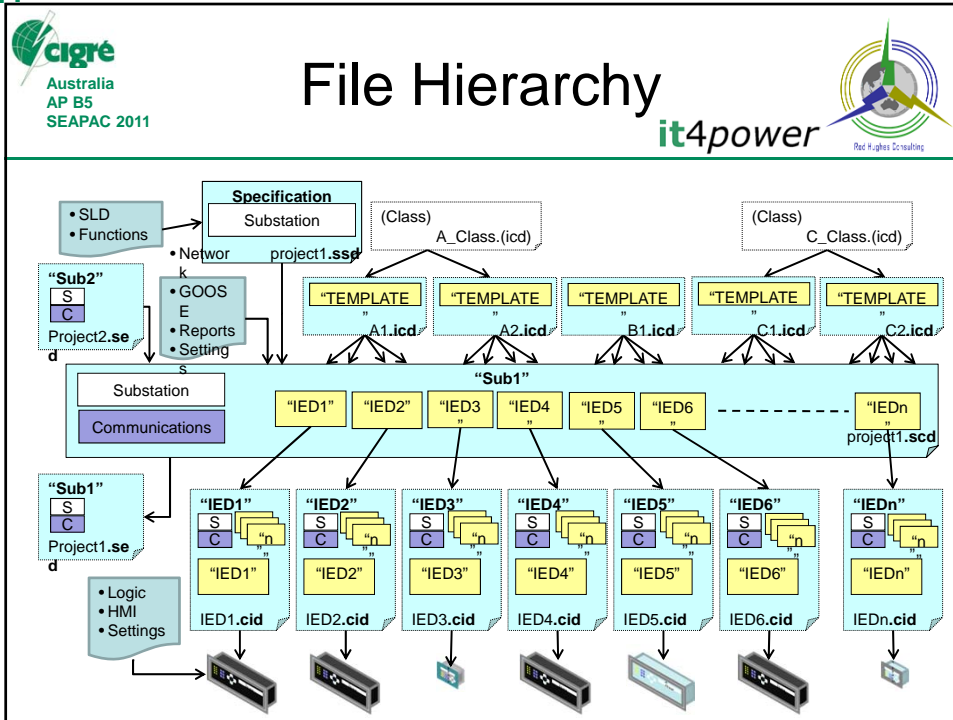
 

## A new type of spec

- System Overview and Architecture
- SAS Interfaces – external and internal
- SAS Functionality
- IEC Implementation Constraints
- System Security Provisions and Security Governance
- Engineering Processes, Documentation and Tools for the SAS Life Cycle
- Equipment Procurement Requirements
- Test, Operation and Maintenance Facilities and Procedures

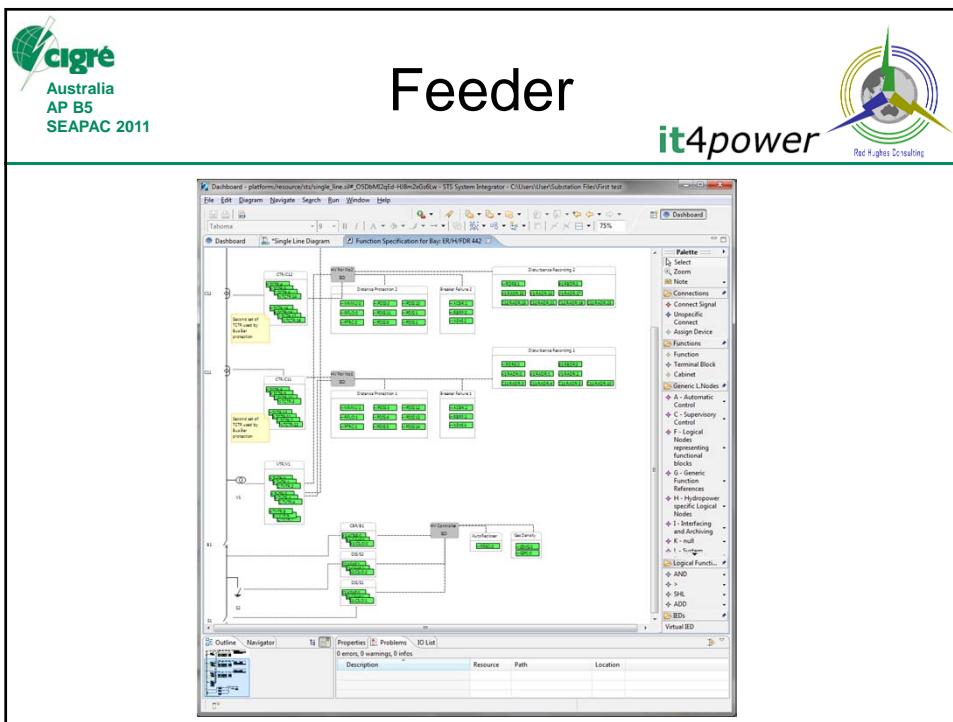
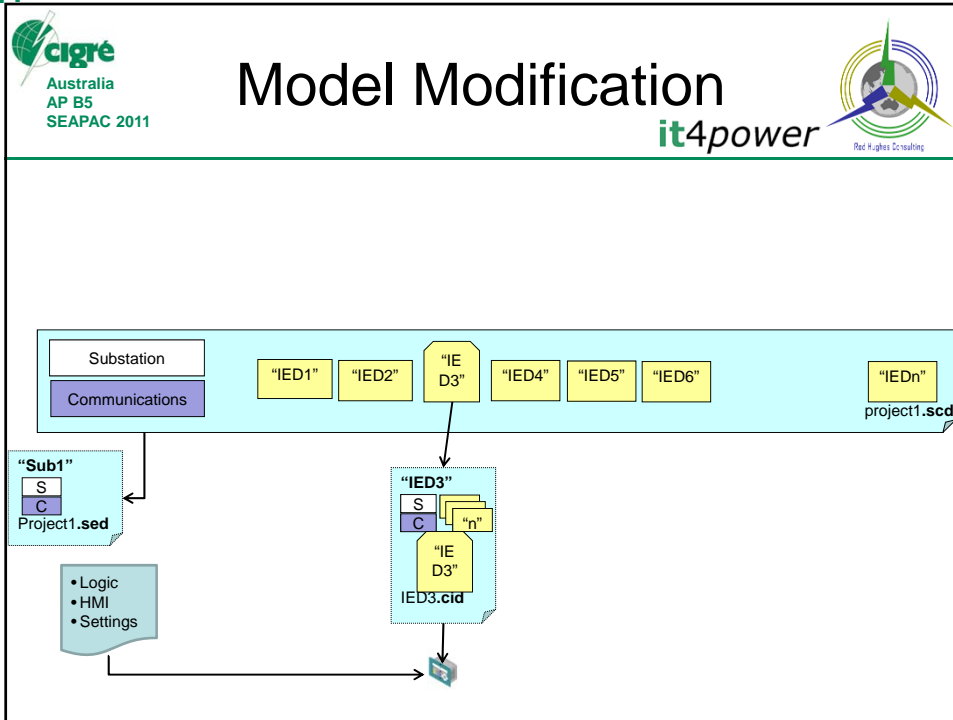









Australia  
AP B5  
SEAPAC 2011




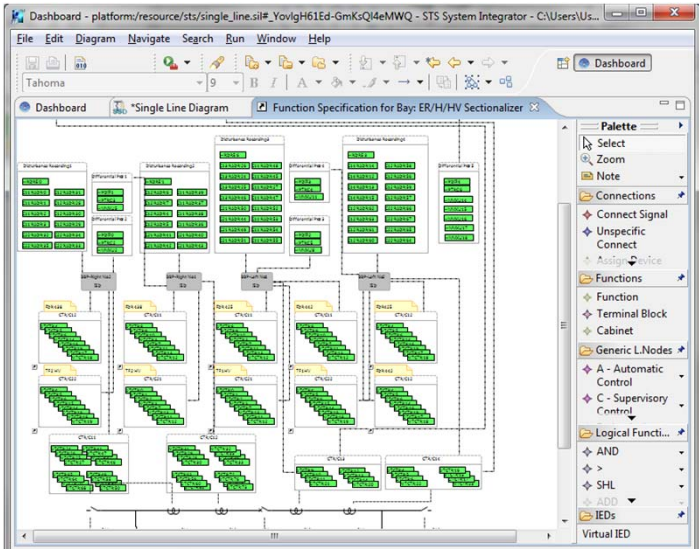



Australia  
AP B5  
SEAPAC 2011

 Australia  
AP B5  
SEAPAC 2011


# Bus Bar Protection

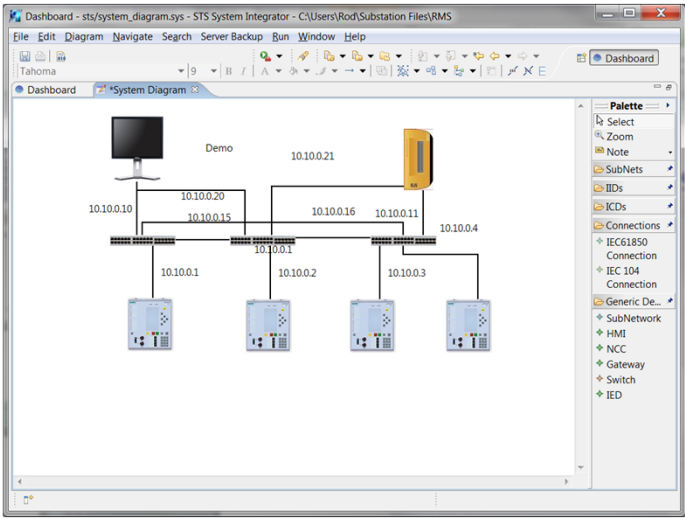
 Rod Hughes Consulting



 Australia  
AP B5  
SEAPAC 2011

# Network Engineering

 Rod Hughes Consulting



**cigré** Australia AP B5 SEAPAC 2011 13 **it4power** Red Hedges Consulting

## Some Issues (1)

- Modelling interpretation
- 3 zone, Ph-G & Ph-Ph distance relay requires how many PDIS?
  - One per zone
  - Two per zone

Status information		
Str	ACD	Start
Op	ACT	Operate
Controls		
OpCntRs	INC	Resettable operation counter
Settings		
PoRch	ASG	Polar reach is the diameter o
PhStr	ASG	Phase start value
GndStr	ASG	Ground start value
DirMnd	FNG	Directional mode


DataAttribute				
status				
general	BOOLEAN	ST	dchg	M
phsA	BOOLEAN	ST	dchg	O

**cigré** Australia AP B5 SEAPAC 2011 14 **it4power** Red Hedges Consulting


## Some Issues (2)

- How many TCTR are required per CT
  - Per CT
    - One
    - One per phase input to IED
    - One per phase plus neutral input
  - Per Physical device


Settings		
ARtg	ASG	Rated current
HzRtg	ASG	Rated frequency
Rat	ASG	Winding ratio of an external current transformer


 **Australia**  
**AP B5**  
**SEAPAC 2011**  
15

## Heirarchical Dependancy




- Remotely outside of the substation
  - Local at the substation HMI or operator laptop connected to the SAS LAN
    - Local at the bay panel through the bay controller
    - Local in the bay through a switch on the panel
      - Direct in the field (mechanical control on the switchgear mechanism)




 **Australia**  
**AP B5**  
**SEAPAC 2011**  
16


## Heirarchical Dependancy



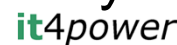

- Remotely outside of the substation
  - Local at the substation HMI or operator laptop connected to the SAS LAN
    - Local at the bay panel through the bay controller
    - Local in the bay through a switch on the panel
      - Direct in the field (mechanical control on the switchgear mechanism)



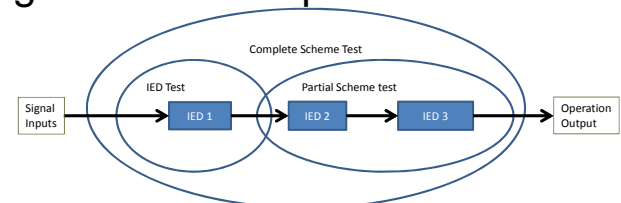



 Australia
   
 AP B5
   
 SEAPAC 2011
   
 17

# Human Interoperability





- Design for Test & Operation





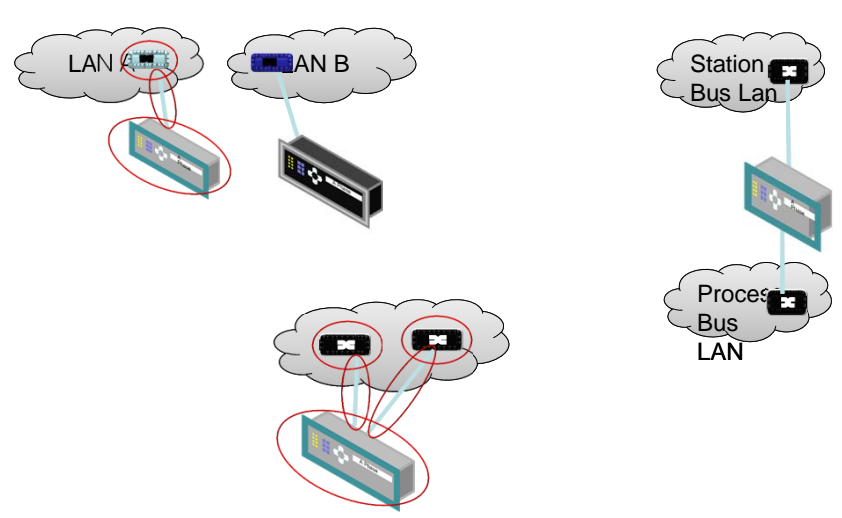
```

    graph LR
      SI[Signal Inputs] --> IED1[IED 1]
      IED1 --> IED2[IED 2]
      IED2 --> IED3[IED 3]
      IED3 --> OO[Operation Output]
      
      subgraph IED_Test [IED Test]
        IED1
        IED2
      end
      
      subgraph Partial_Scheme_test [Partial Scheme test]
        IED2
        IED3
      end
      
      subgraph Complete_Scheme_Test [Complete Scheme Test]
        IED1
        IED2
        IED3
      end
  
```


 Australia
   
 AP B5
   
 SEAPAC 2011
   
 18

# Testing – Impact of LAN



```

    graph TD
      LAN_A((LAN A)) --- S1[Switch]
      LAN_B((LAN B)) --- S1
      S1 --- S2[Switch]
      S2 --- Station_Bus_Lan((Station Bus Lan))
      Station_Bus_Lan --- S3[Switch]
      S3 --- Process_Bus_LAN((Process Bus LAN))
      
      subgraph Impact [Impact of LAN]
        LAN_A
        LAN_B
        Station_Bus_Lan
        Process_Bus_LAN
      end
  
```

