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Slide 1

Optimisation of CT/VT Arrangements and Improved Operational Response

Paper Reference
Paper No. 189__Rodney Hughes

Author	Company	Email	Presenter
Rodney Hughes	Rod Hughes Consulting Pty Ltd	rgh@rodhughesconsulting.com	✓
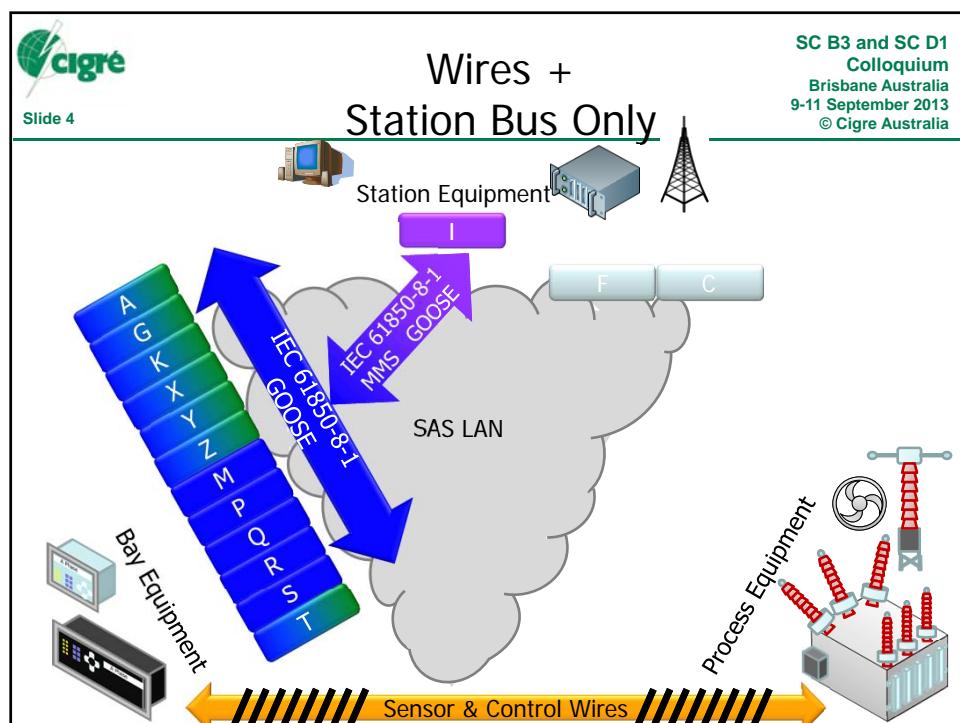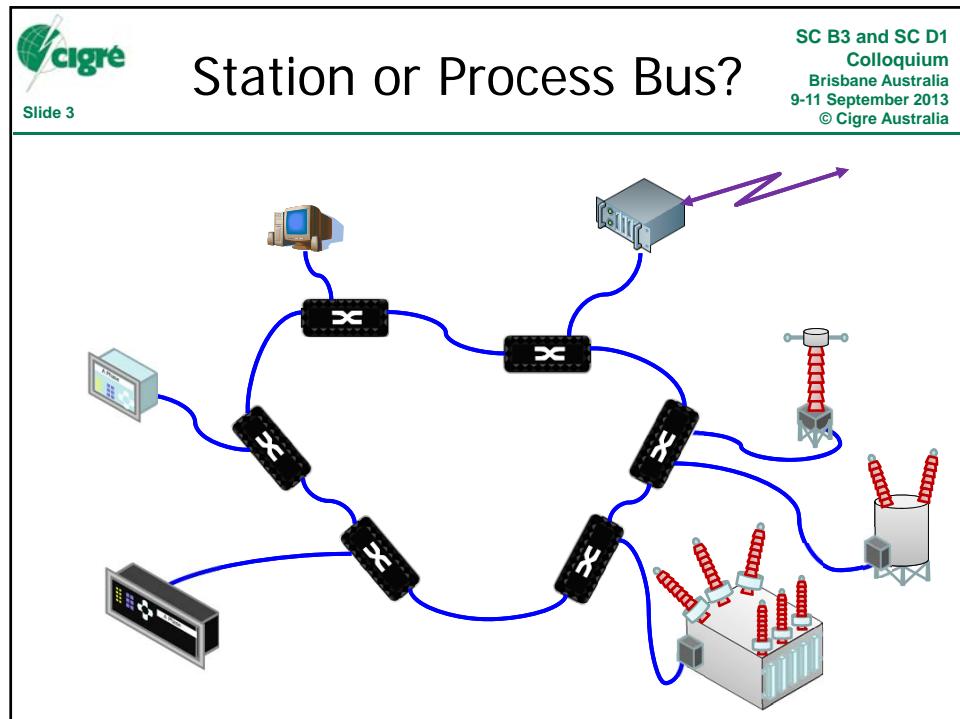
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Slide 2

Implementation Strategy
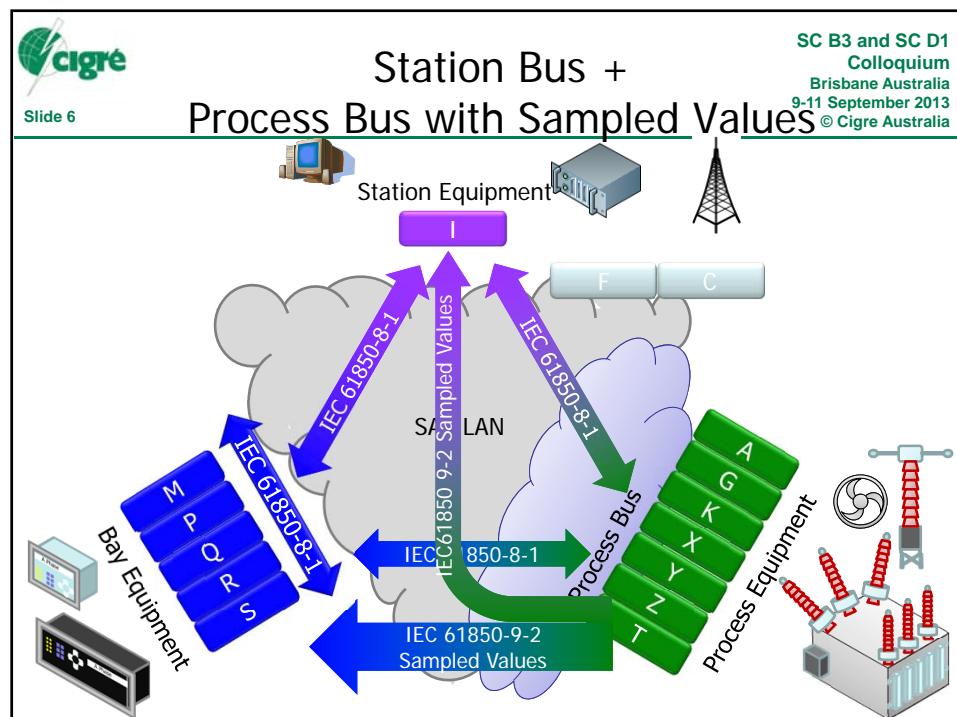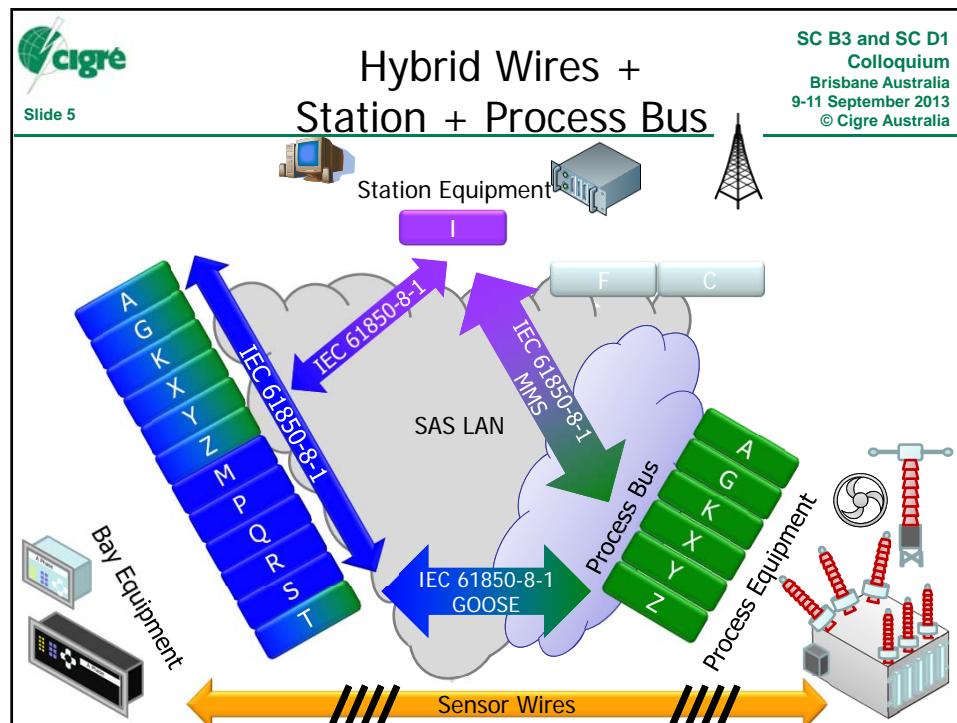
• "We are implementing IEC 61850 ...."

• "... but not Process Bus ...."

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Station or Process Bus?

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Slide 4

Wires +
Station Bus Only

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Station Equipment

IEC 61850-8-1
MMS GOOSE

IEC 61850-8-1
GOOSE

SAS LAN

Bay Equipment

Process Equipment

A
G
K
X
Y
Z
M
P
Q
R
S
T

I

F   C

Sensor & Control Wires

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AP B5
SEAPAC 2013

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T Group
IEC 61850-7-4 Ed 2
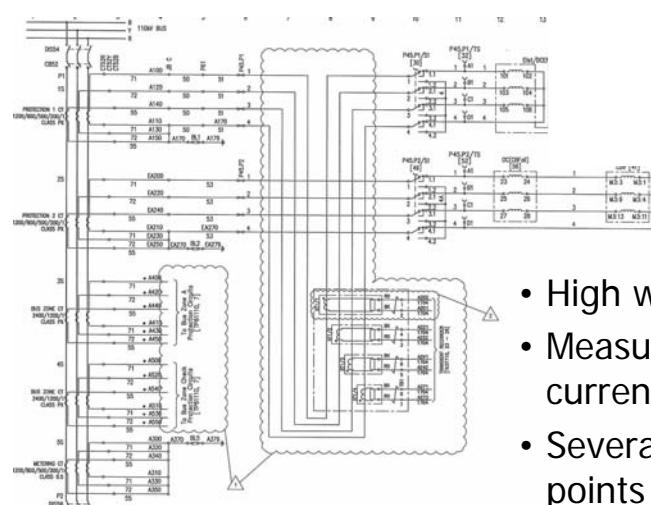
TANG	Angle
TAXD	Axial displacement
TCTR	**Current transformer**
TDST	Distance
TFLW	Liquid flow
TFRQ	Frequency
TGSN	Generic sensor
THUM	Humidity
TLEV	Level sensor
TLVL	Media level
TMGF	Magnetic field
TMVM	Movement sensor
TPOS	Position indicator
TPRS	Pressure sensor
TRTN	Rotation transmitter
TSND	Sound pressure sensor
TTMP	Temperature sensor
TTNS	Mechanical tension / stress
TVBR	Vibration sensor
TVTR	**Voltage transformer**
TWPH	Water acidity

Conventional CT circuit
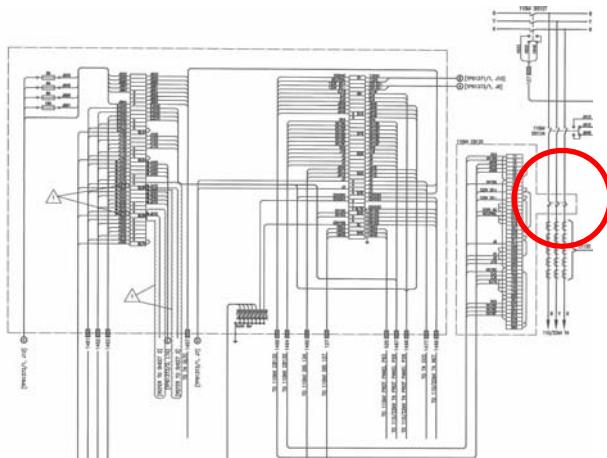
- High wire count
- Measure the same current several times
- Several isolation/test points

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Conventional Circuit Breaker Wiring

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- High complexity
- Measure the same status several times
- several isolation points for test access
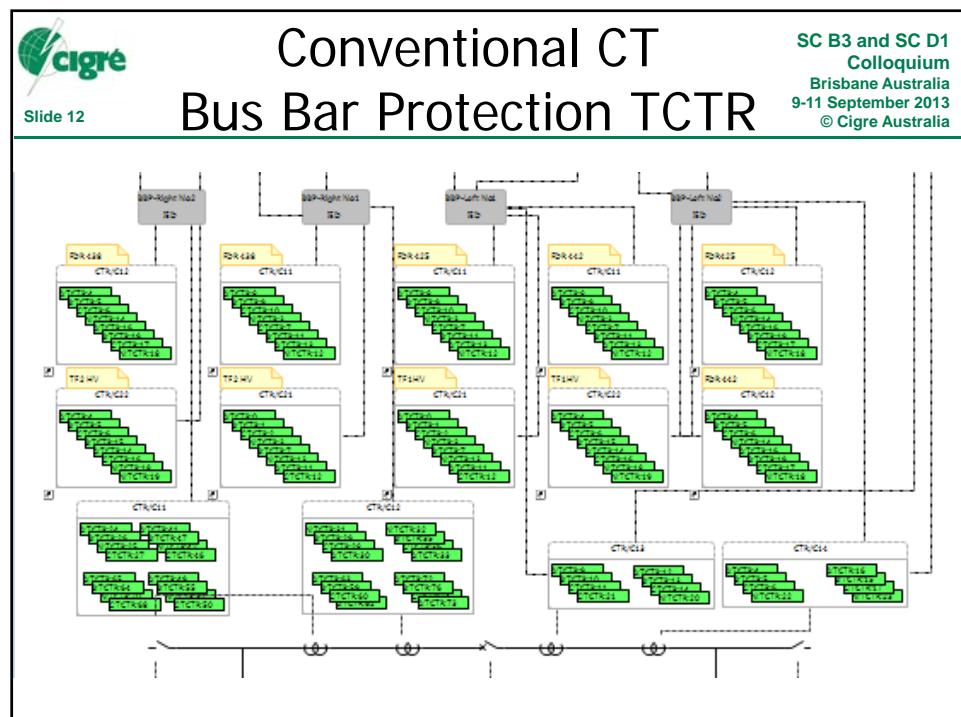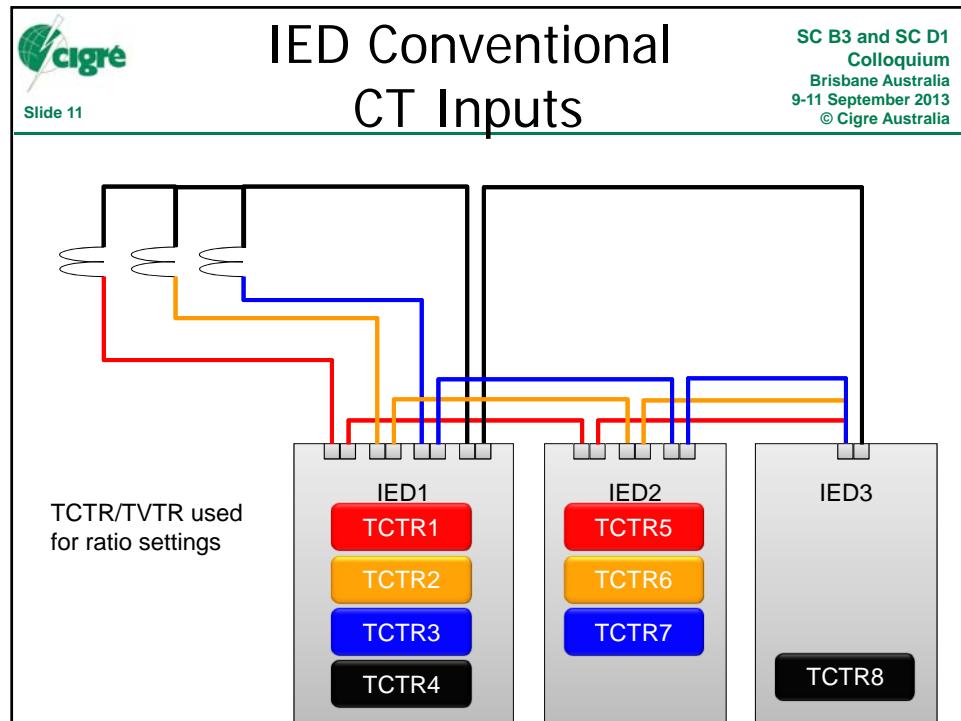
Logical Node TCTR

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- Source of Sampled Values
  - TCTR.AmpSv given as primary values
- Sensor Rating
  - TCTR.ARtg primary rating
  - TCTR.Rat only for external CT ratio

IED Conventional CT Inputs

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TCTR/TVTR used for ratio settings

IED1 — TCTR1, TCTR2, TCTR3, TCTR4
IED2 — TCTR5, TCTR6, TCTR7
IED3 — TCTR8

Conventional CT Bus Bar Protection TCTR

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New Systems

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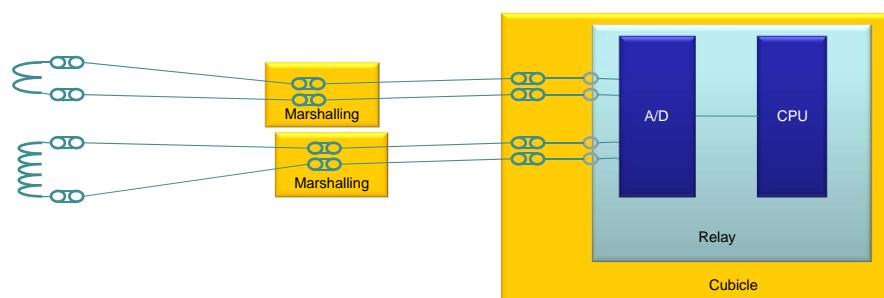
- Stand Alone Merging Units
  o Conventional 1A / 110V input, IEC 61850 9-2 output
- Low Power Instrument Transformers
  o Non-Conventional Instrument Transformers with IEC 61850 9-2 Merging Unit output
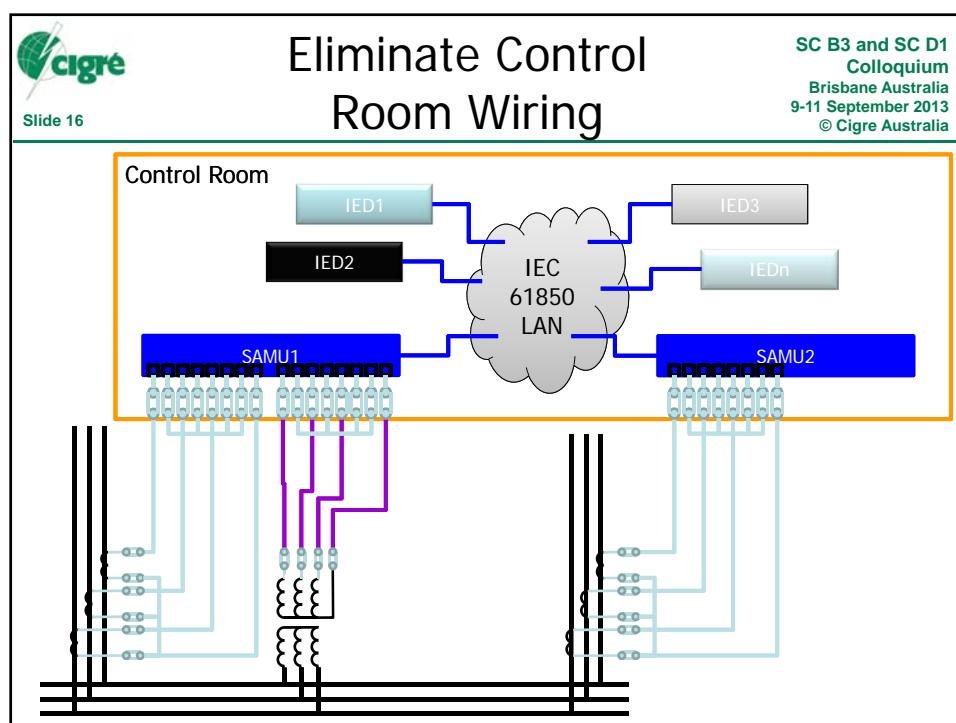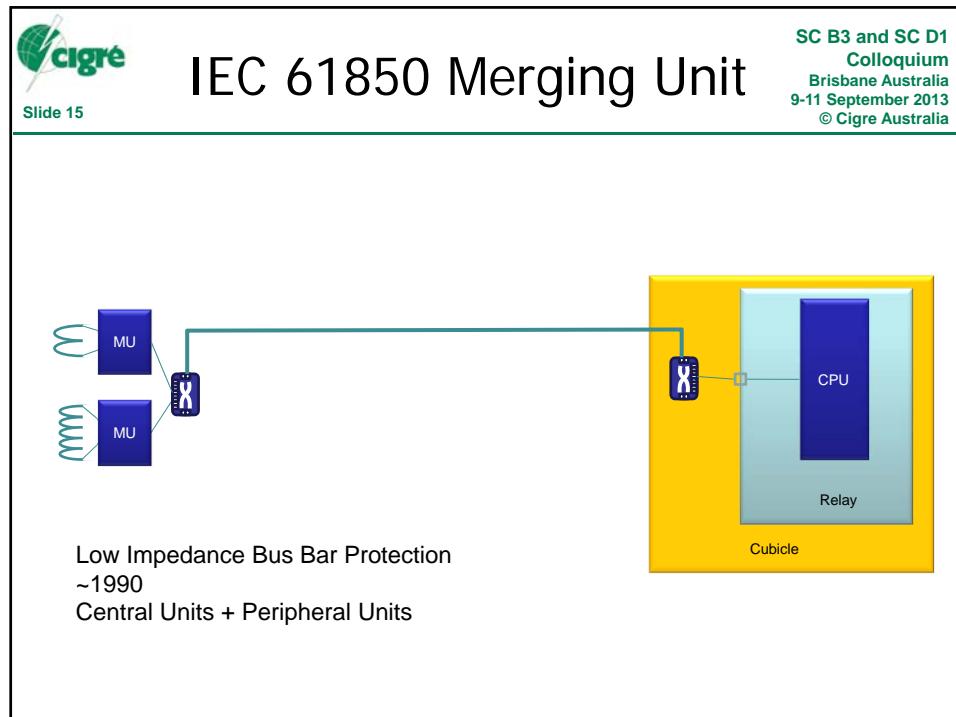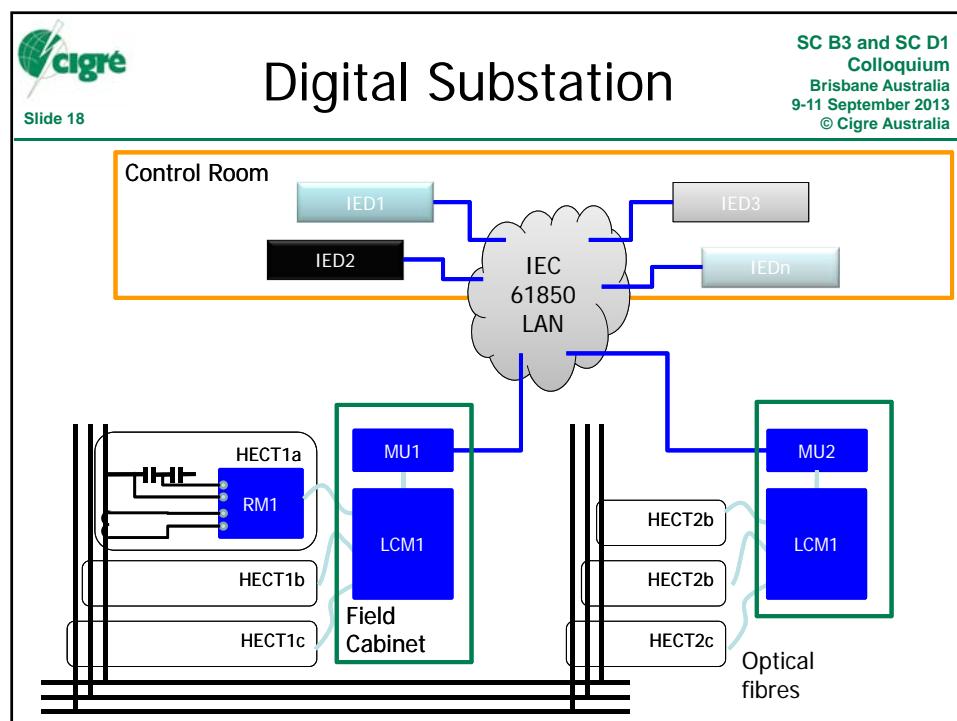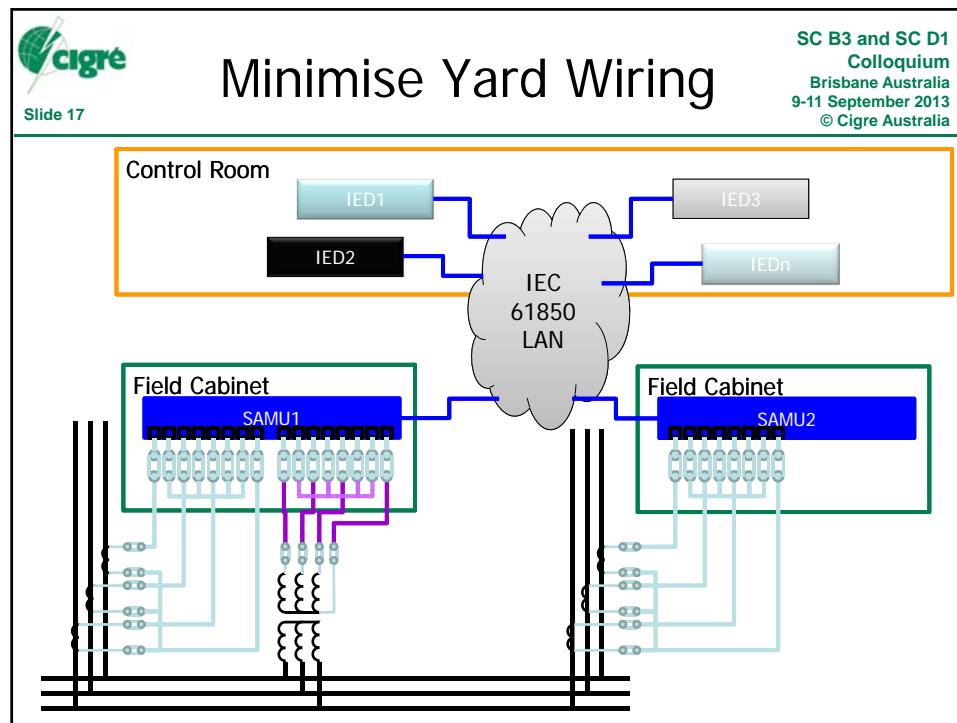
Conventional Sensor & Relay

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Marshalling

Marshalling

A/D   CPU

Relay

Cubicle

IEC 61850 Merging Unit

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MU

MU

CPU

Relay

Cubicle

Low Impedance Bus Bar Protection
~1990
Central Units + Peripheral Units

Eliminate Control Room Wiring

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Control Room

IED1

IED2

IED3

IEDn

IEC
61850
LAN

SAMU1

SAMU2

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Minimise Yard Wiring

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Control Room

IED1
IED2
IED3
IEDn

IEC 61850 LAN

Field Cabinet
SAMU1

Field Cabinet
SAMU2

Digital Substation

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Control Room

IED1
IED2
IED3
IEDn

IEC 61850 LAN

HECT1a
RM1
HECT1b
HECT1c

MU1
LCM1
Field Cabinet

MU2
LCM1

HECT2b
HECT2b
HECT2c

Optical fibres

1.5 CB Scheme (a) per Diameter

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- 2 off 4 x I, 4 x V
- 1 off 8 x I

CBs not shown
CT overlap not shown
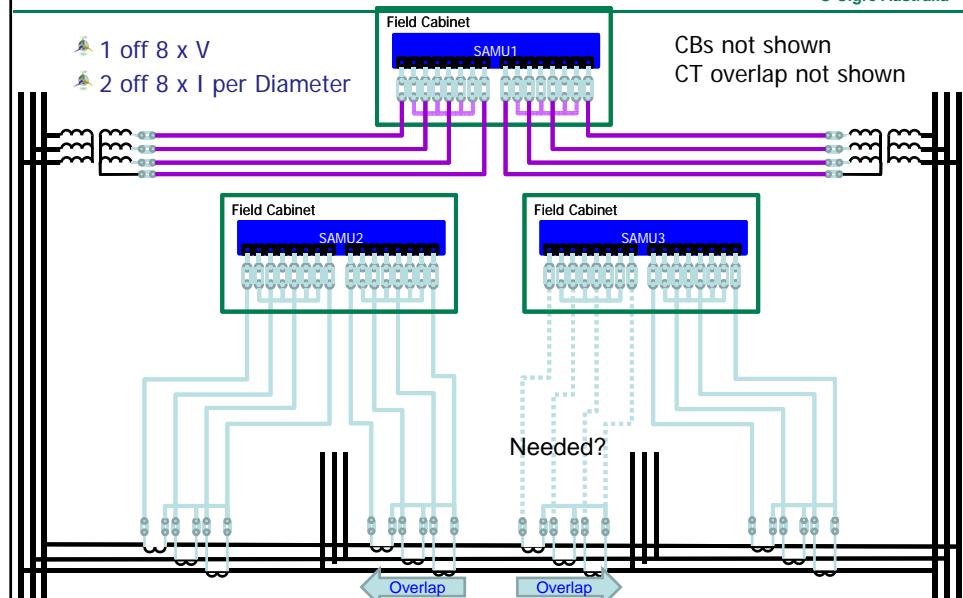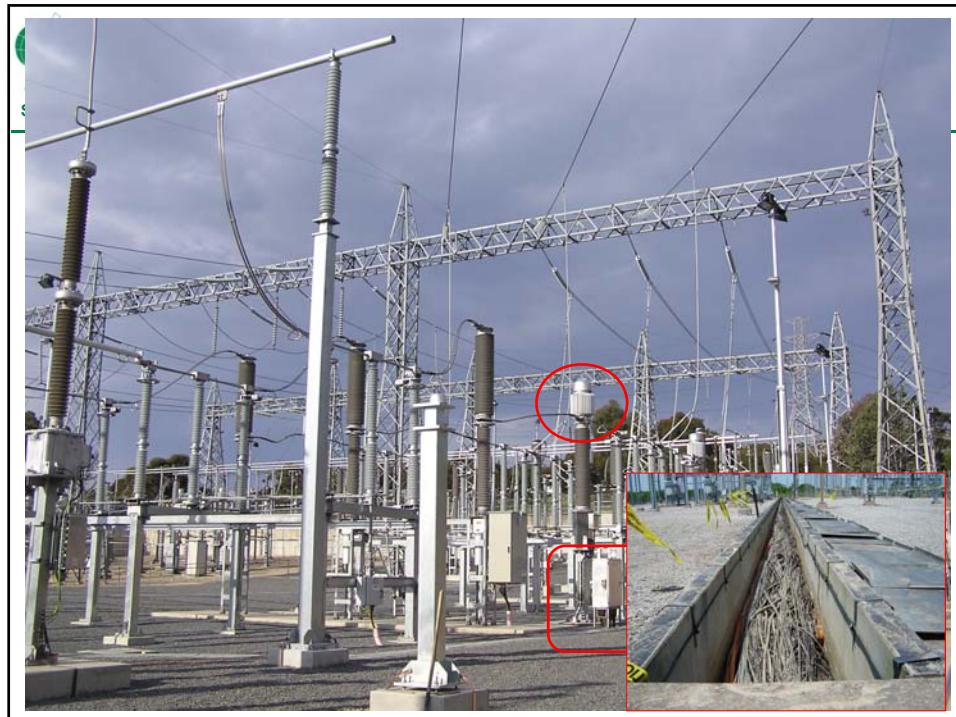
Field Cabinet — SAMU1
Field Cabinet — SAMU2
Field Cabinet — SAMU3

Needed?

Overlap   Overlap

1.5 CB Scheme (b)

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- 1 off 8 x V
- 2 off 8 x I per Diameter

Field Cabinet — SAMU1

CBs not shown
CT overlap not shown

Field Cabinet — SAMU2
Field Cabinet — SAMU3

Needed?

Overlap   Overlap

IEC 61850 Yard Wiring

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Direct bury
Ethernet cable

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Access any sub at "3am" in the morning

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- From home …
- which:
  - Substation?
    - vendor's IEDs are installed?
    - X system
    - Y system
    - Condition Monitoring
  - Condition Monitoring Server or HMI platform is used to control locally?
    - Vendor A, B … or Z HMI "standard"
    - Installed last year or 20 years ago
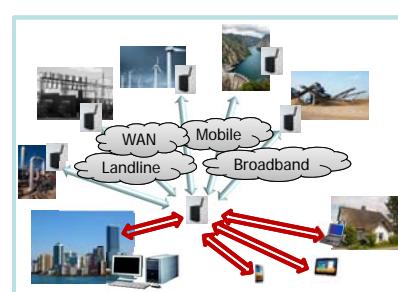
Solutions need to provide ….

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- Ability to
  - Access from any PC mobile device
    - Windows Remote Desktop
  - Secure VPN and access control
  - Connect to Central Unit
  - Select site
  - Remotely run software on local substation DCU
    - Virtual Machine for different platform requirements
    - Right software for right IEDs
  - Access current site specific files on site server
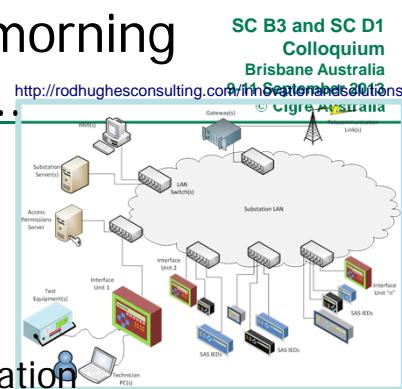
At 3 am in the morning need to ...

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http://rodhughesconsulting.com/innovationandsolutions

- From home:

- Gain access
  - o Physical Connection Authorisation
  - o Role Based Access Control
    - ▪ Specify and procedures for IEEE 1686
- Isolate a function
  - o in the right sequence for that Bay
  - o Independent of the SAS IEDs
  - o Independent of which vendor's IEDs
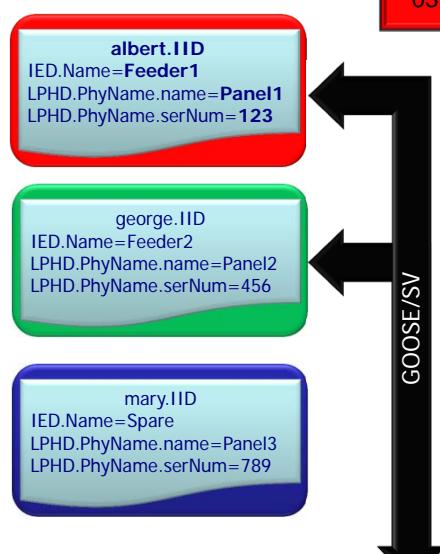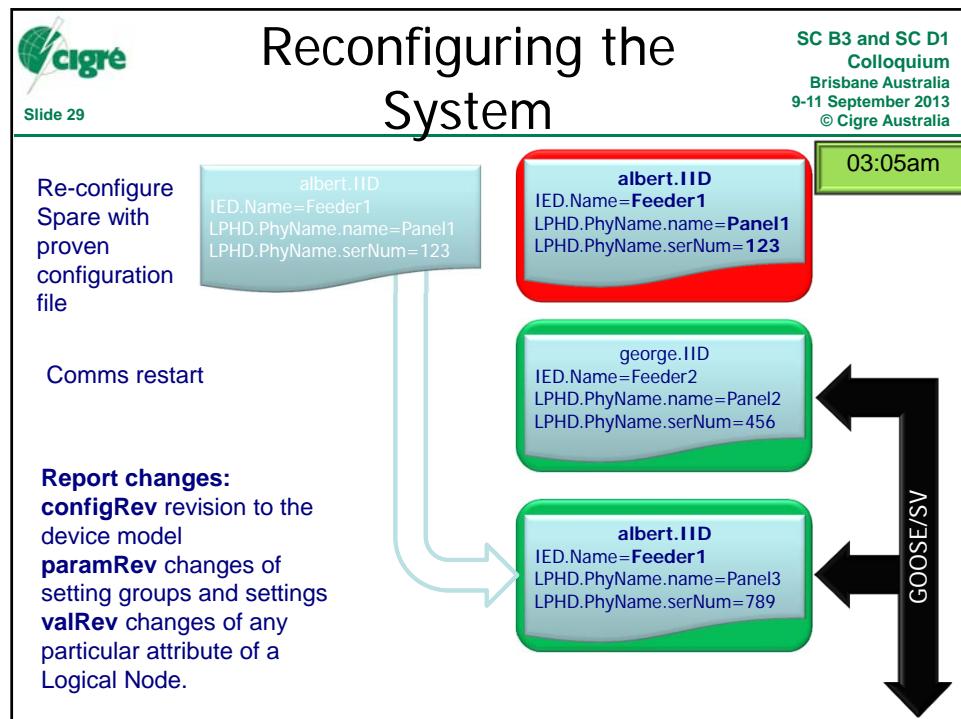
In Service System

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03:00am

- Two Feeder Panels
- One Spare Panel

- IEC 61850 System
- Top-Down Engineering
  - o SSD=>SCD=>CID/IID
- Process Bus
- Station Bus

albert.IID
IED.Name=**Feeder1**
LPHD.PhyName.name=**Panel1**
LPHD.PhyName.serNum=**123**

george.IID
IED.Name=Feeder2
LPHD.PhyName.name=Panel2
LPHD.PhyName.serNum=456

mary.IID
IED.Name=Spare
LPHD.PhyName.name=Panel3
LPHD.PhyName.serNum=789

GOOSE/SV

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Reconfiguring the System

03:05am

Re-configure Spare with proven configuration file

albert.IID
IED.Name=Feeder1
LPHD.PhyName.name=Panel1
LPHD.PhyName.serNum=123

albert.IID
IED.Name=**Feeder1**
LPHD.PhyName.name=**Panel1**
LPHD.PhyName.serNum=**123**

Comms restart

george.IID
IED.Name=Feeder2
LPHD.PhyName.name=Panel2
LPHD.PhyName.serNum=456

Report changes:
configRev revision to the device model
paramRev changes of setting groups and settings
valRev changes of any particular attribute of a Logical Node.

albert.IID
IED.Name=**Feeder1**
LPHD.PhyName.name=Panel3
LPHD.PhyName.serNum=789

GOOSE/SV

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Australia

- IEC 61850 and associated standards
- Automation & Control
- Protection design 11kV to 500kV
- Training
- Cyber Security
- Smart Grid and Smart Metering
- Telecommunications
- Substation LAN