

IEC 61850

變電站現代化整合平台

Shenchyei Engineering Consultant Co. Ltd. 3th Aug ,2013
神捷工程顧問股份有限公司

簡報大綱



- IEC 61850變電站現代化整合平台
 - 變電所自動化的整合策略
 - 整合對像與架構
 - 主站的統一協定
 - 電力故障診斷策略
 - 校時策略
 - 變電站網路安全策略
 - IEC61850設備規格基準與KEMA 認證範例
 - Goose 應用
 - 符合過去、現在與未來的系統整合 (實例說明)
 - 整合應用

變電站自動化整合策略



整合對象與架構



◎ 整合對象

- ◎ 歸類 IED 且據備通訊能力(PM, Protection Relay, Sensors, RTU...etc) ，本類型佔既設變電站現場設備之絕大部分
- ◎ 歸類 IED 且據備IEC 61850 通訊協定
- ◎ 簡報以保護電驛(Protection IED) 為主

◎ IEC 61850 IED 整合架構

- ◎ 星狀 – 所有IED 都支持的架構 - 以星狀模式連結上station Bus
- ◎ 環狀(Ring) (自癒型) – 儘限縮在有發展的Vendor
- ◎ 星狀與環狀的優劣在此不另贅述

主站的統一協定



◎ IED 被整合後轉成統一的通訊協定

- ◎ 台電目前採 DNP 3.0 對主站電腦，未來 IEC 61850
- ◎ 中鋼/中油 → IEC 104
- ◎ 北捷重運量 → IEC 104
- ◎ 北捷中運量 → Modbus
- ◎ 一般工業 → 無律定

◎ 統一的通訊協定 IEC 61850 對主站

- ◎ 主站以點名映射方式(ICD file import) 系統的即時資料庫點，不易出錯且好管理。

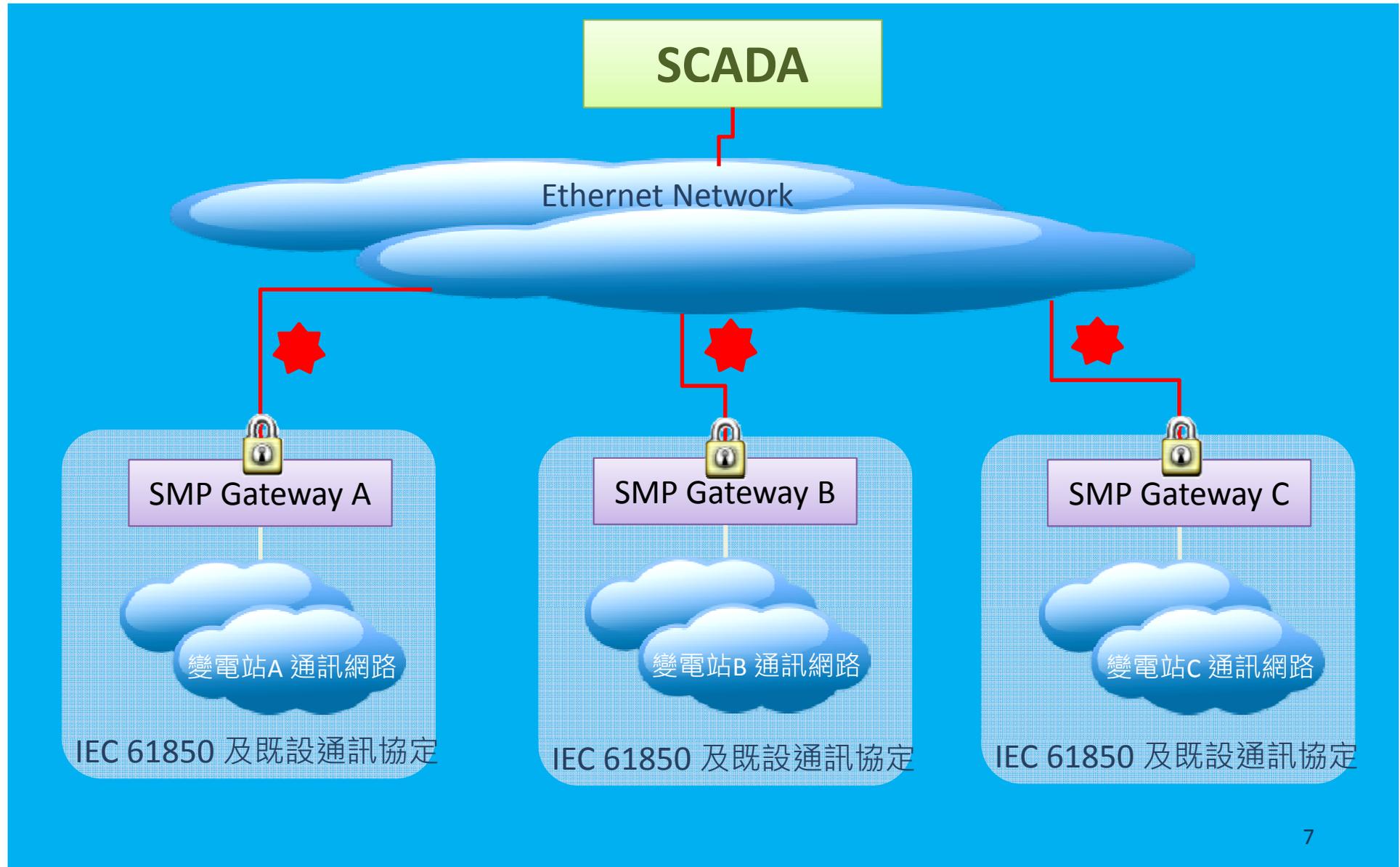
主站的統一協定



- ◎ 統一的通訊協定IEC 61850 對主站(續)
 - ◎ IEC 61850 點資訊帶有點品質點(QUALITY) ，主站可掌握IED端至主站端(End to End) 的通訊狀態 ，不用如 DNP 3.0 於在變電所 Gateway(Front-end/or RTU) ，必須增設通訊品質點。
 - ◎ 可實現 Goose Interlock (站內High speed, 跨站Low speed)
 - ◎ 所有的點資訊, 均帶有TimeTag(時間標籤, 單位至ms)
 - ◎ 非IEC61850的協定資料, 可轉換成IEC61850協定的資料上傳至中心, 並附加上點品質(QUALITY)及時間標籤(TimeTag)的特性。

主站的統一協定

IEC 61850 Server 標準點表規則



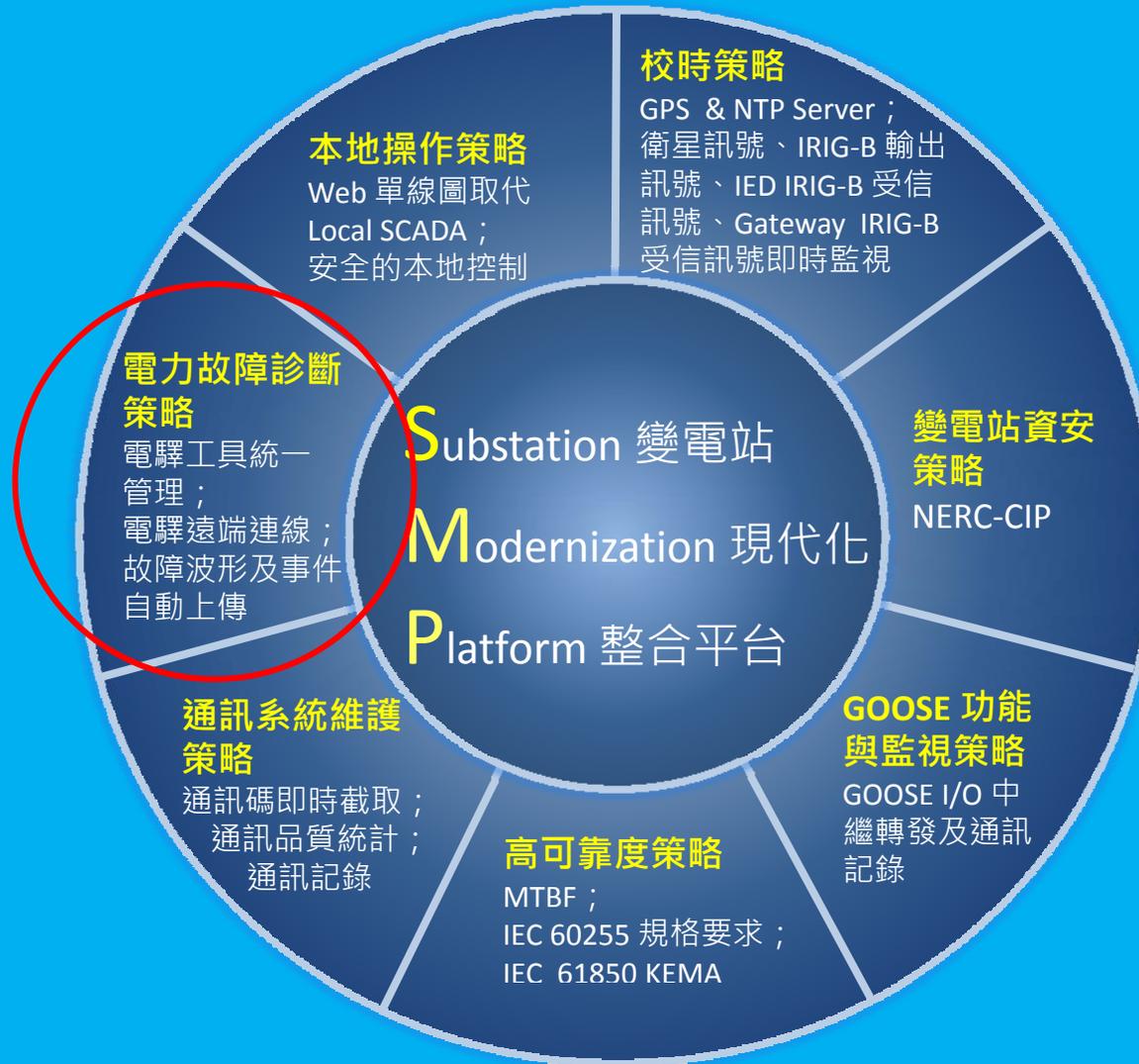
主站的統一協定

IEC 61850 Server 標準點表規則



IED	IED IF	PHA(50) in IED →GW	In GW Is T1	Convert To DNP Add	Convert To DNP value	Convert To 61850 Add	Convert To 61850 value
ABB w SPA	S/E	Fix adds	1/0	1	1/0+T1	PICO1	1/0+T1+Q1
SEL w ASCII	S	Fix adds	1/0	1	1/0+T1	PIOC1	1/0+T1+Q1
GE w Modbus	S	Fix adds	1/0	1	1/0+T1	PIOC1	1/0+T1+Q1
SEL w DNP	S/E	Flex adds	1/0+T	1	1/0+T	PICO1	1/0+T+Q1
GE w DNP	S/E	Flex adds	1/0+T	1	1/0+T	PIOC1	1/0+T+Q1
SEL w 61850	E	PICO1	1/0+T+Q	1	1/0+T	PIOC1	1/0+T+Q
GE w 61860	E	PIOC1	1/0+T+Q	1	1/0+T	PICO1	1/0+T+Q
ABB w 61850	E	PTOC1	1/0+T+Q	1	1/0+T	PICO1	1/0+T+Q
SIEMENS w 61850	E	PTOC6	1/0+T+Q	1	1/0+T	PIOC1	1/0+T+Q

電力故障診斷策略

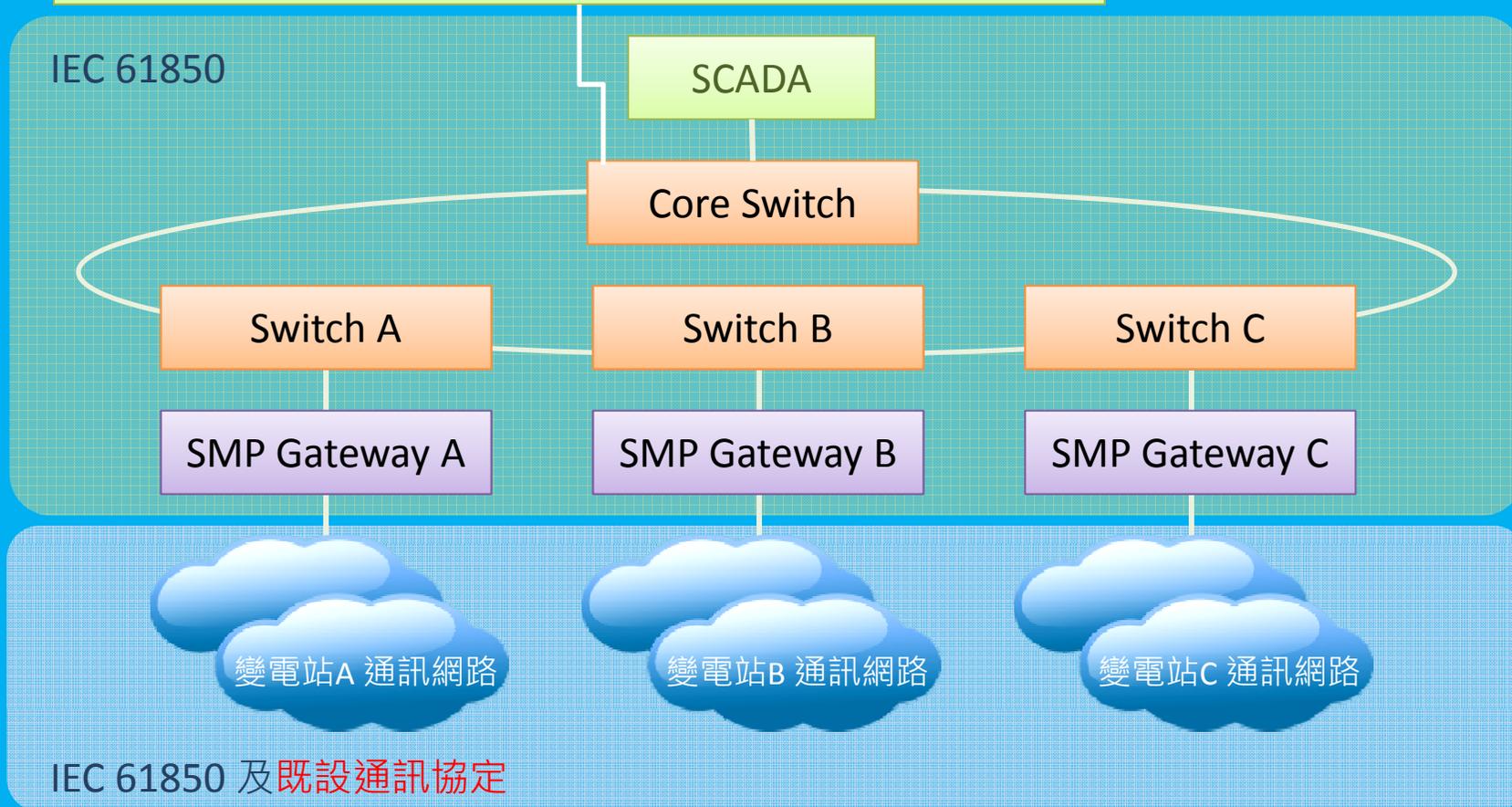


電力故障診斷策略



事故診斷平台

- (1) 各廠牌電驛工具統一遠端連線管理介面
- (2) 取得電驛資料即時顯示(如相序, 相角等)
- (3) IED故障波形及事件自動上傳
- (4) 校時狀態監視



IEC 61850 及既設通訊協定

電力故障診斷策略



電驛工具統一管理；電驛遠端連線；

- IED 的Service port 介面多樣，SMP 建立統一的虛擬通道平台；嵌入股電驛工具軟體並建立連線通道。

遠地

PC(SMP Pass through MANAGER +
電驛工具軟體)

變電站



IEC 61850
IED

IED4
IED

非IED 4 (或DNP
3.0 support)
IED

配電
IED

供電
IED

電力故障診斷策略



電驛遠端連線；故障波形及事件自動上傳

- IED Trigger 錄波，SMP自動將IED的錄波檔次抽載至PC端指定檔檔案夾(Folder)。

遠地

將電驛波型, 自動上傳至指定目錄區
並依SOE順序排列

:

PC

變電站

App of OSC file auto-retrieve

SMP

- (1) SEL電驛(311L,487B,387T,351,351A)
- (2) GE UR & SR(B90,L90,760,750)

IEC 61850
IED(Support FTP with OSC file)
- SIEMENS/GE

校時策略



校時策略



◎ 系統校時精確度非常重要

- ◎ IEC 61850 SCADA 讀取 IED 設備內部 SOE (Sequence of Event) ， 正確報告事件 (事故， 警報， 位置改變) 發生時間點， 解析度至毫秒 (ms) ， 清楚分辨並記錄事件發生的順序， 供事件分析及故障診斷；
- ◎ 保護電驛可於數毫秒之內對反應故障， 系統校時精準度大於 $\pm 10\text{ms}$ 時， 電力事件記錄先後順序會錯亂， SOE 功能失去意義， 故障診斷可能導致錯誤結論。
- ◎ 不使用 IEC 61850 Ed1 13 『SNTP Time Synchronization』， 採用 IRIG-B 替代

12: Enhanced SBO control	Select, With/Without, Cancel, Operate Command Termination	Time Activated Operate
13: Time sync	SNTP Time Synchronization	
14: File transfer	GetFile	SetFile

校時策略



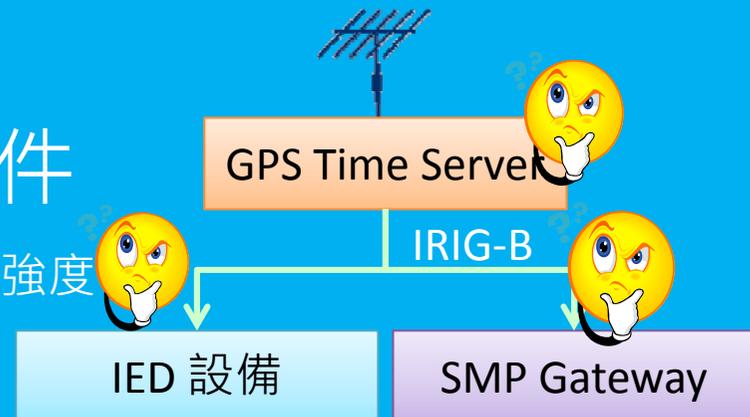
◎ IEEE 1588

- ◎ 目前IEC 61850 的規定是SNTP，但不能滿足校時需求，另支援IEEE 1588 的 IED Device 尚未普及。

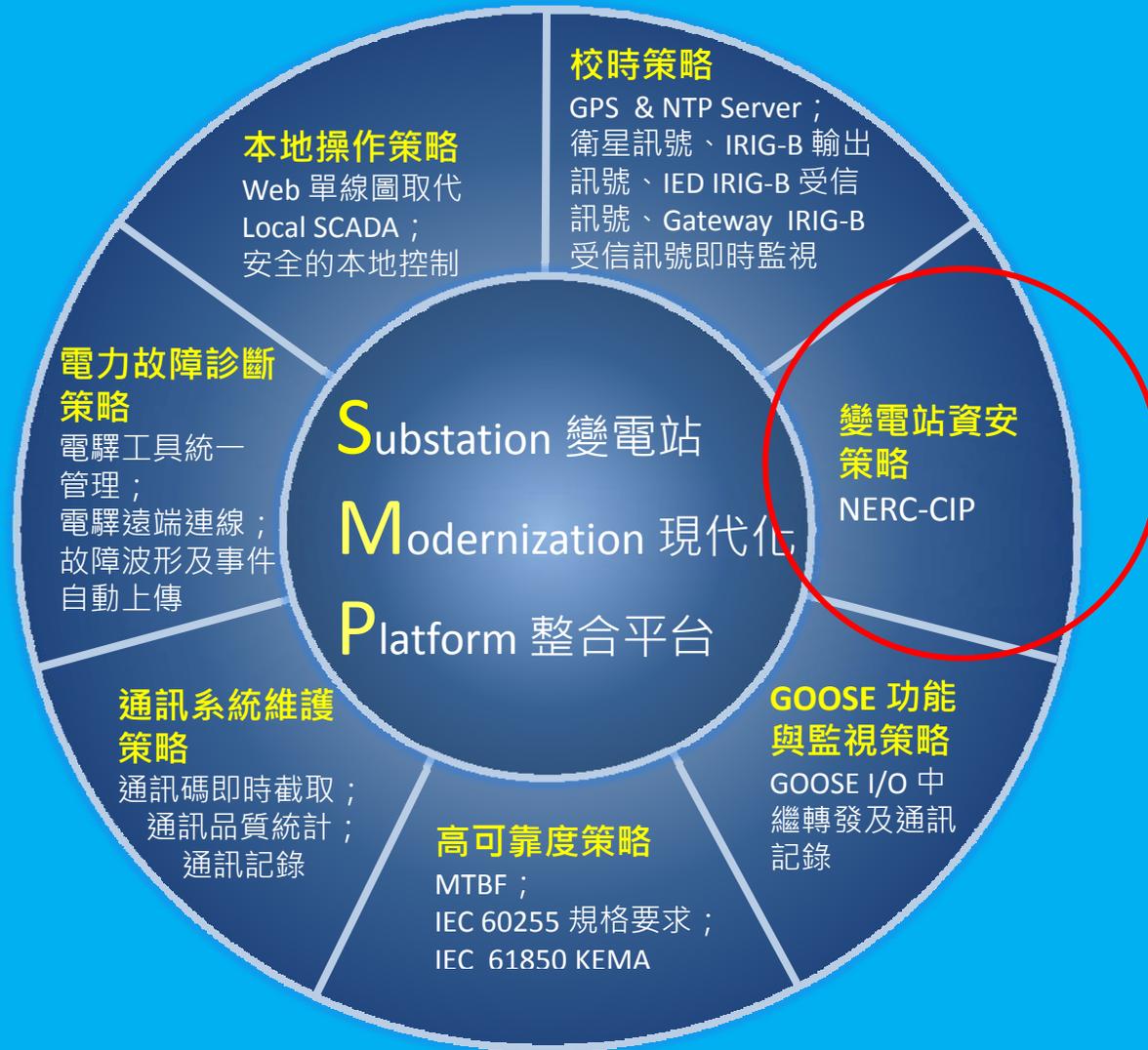
Protocol Time sync	SNTP Time sync	Modulated IRIG-B Time sync	Demodulated IRIG-B Time sync
~±500ms	~±100ms	~±10ms	~±1ms

◎ 完整系統校時需要三個條件

- ◎ 1. 即時遠端查看GPS 接收衛星訊號數量及強度
- ◎ 2. GPS 顯示已接受衛星的校時
- ◎ 3. IED 設備由通訊點回覆已收到 IRIG-B 校時狀態



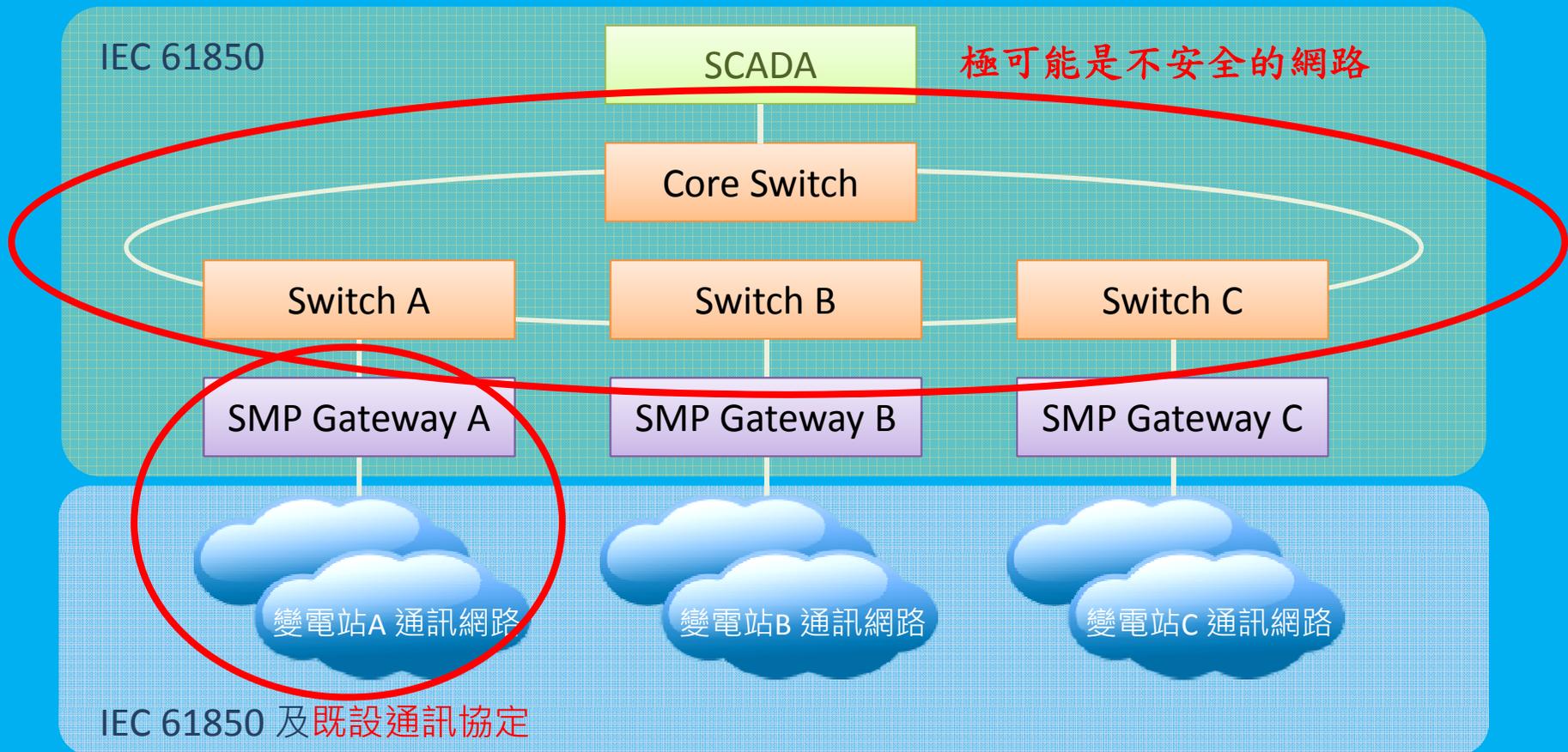
變電站資安策略



變電站資安策略



- ◎ 任一變電站通訊網路經 Gateway 與外部網路
- ◎ SCADA 經上層通訊與 Gateway 交換資料



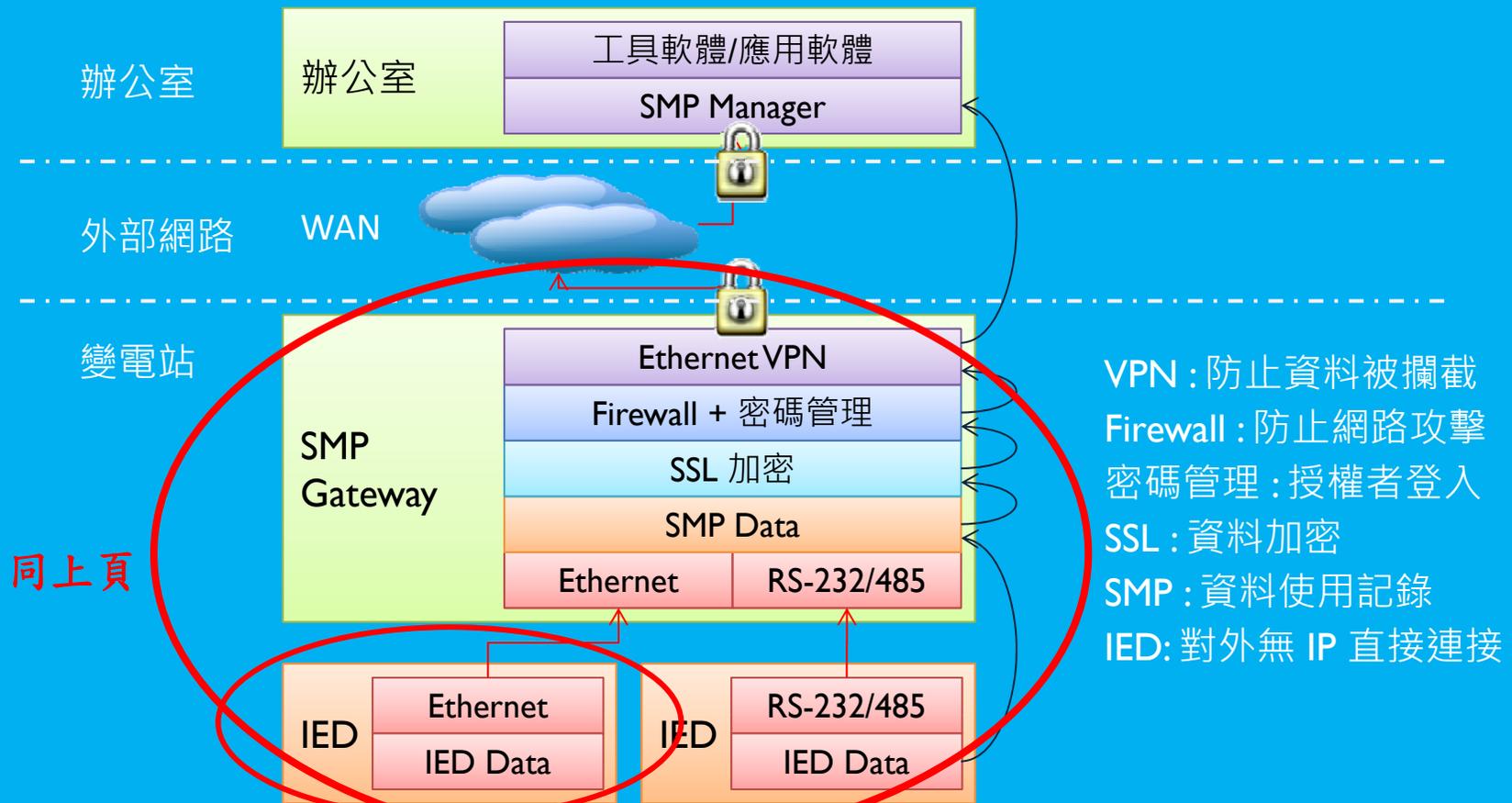
變電站資安策略



安全的網路通訊架構：**NERC-CIP**

North American Electric Reliability Corporation - Critical Infrastructure Protection

北美電力可靠度組織 – 關鍵基礎設施保護



同上頁

- VPN : 防止資料被攔截
- Firewall : 防止網路攻擊
- 密碼管理 : 授權者登入
- SSL : 資料加密
- SMP : 資料使用記錄
- IED: 對外無 IP 直接連接

IEC 61850設備規格基準與KEMA 認證範例



IEC 61850 設備規格基準



◎ 以 KEMA 認證 Register Table 為依據：

KEMA 網站可下載 所有KEMA 驗證過的設備

1. IEC 61850 Ed1 Client Systems

Apply to IEC 61850-8-1 Block : 1, 2, 5, 6, 12abcd, 13, 14

2. IEC 61850 Ed1 Server Devices

Apply to IEC 61850-8-1 Block : 1, 2, 5, 6, 9ab, 12xxxx, 13, 14

3. IEC 61850 Ethernet Switches

Apply to functional test IEC 61850-3 application depending on operation environment requirement

4. IEC 61850 Ed1 Sampled Value Publishers (Merging Units)

Apply to IEC 61850-9 Block : 10 , 11

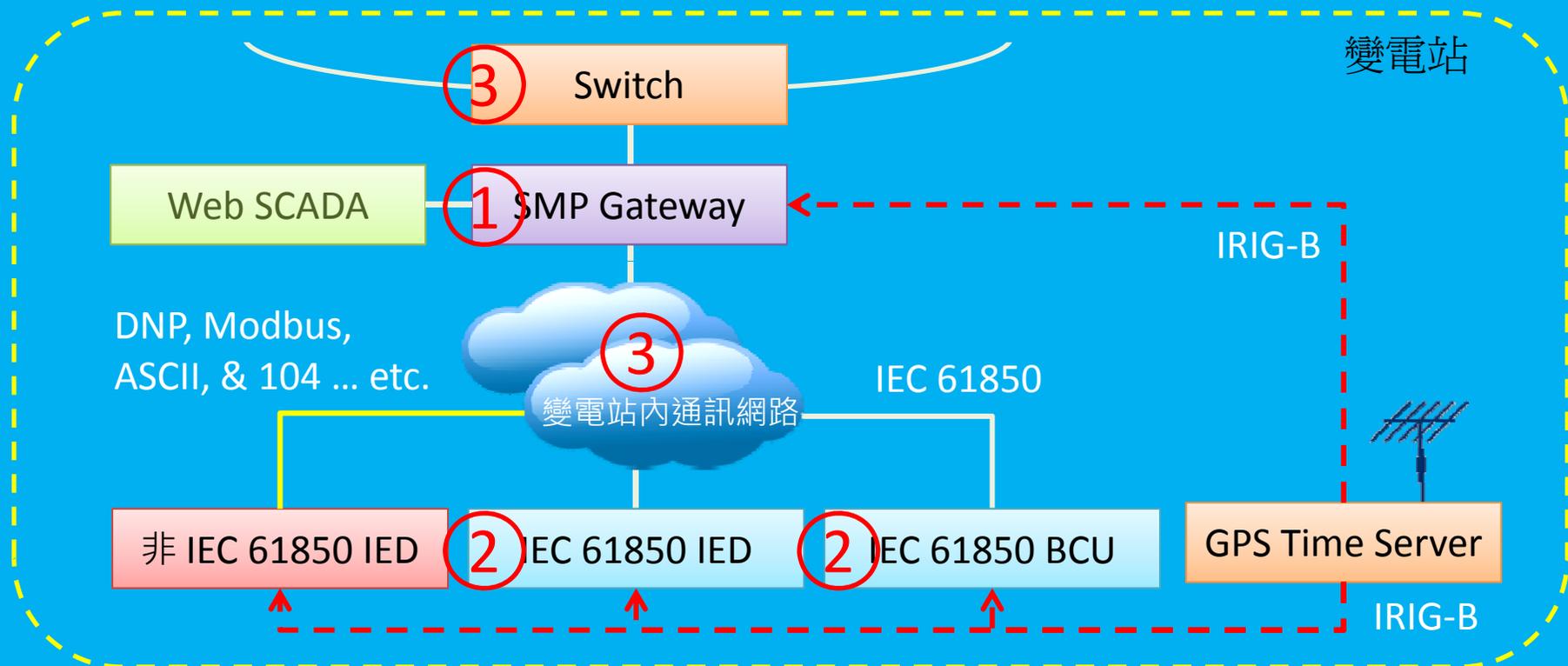
(發展中，少數KEMA 認證產品)

IEC 61850 設備規格基準



◎ 以 KEMA 認證 Register Table 為依據：

1. IEC 61850 Ed1 Client Systems
2. IEC 61850 Ed1 Server Devices
3. IEC 61850 Ethernet Switches



IEC 61850 KEMA 認證 Register Table





IEC 61850 Test Register

Test Register for

IEC 61850 Ed1 Client Systems
 IEC 61850 Ed1 Server Devices
 IEC 61850 Ed1 Sampled Value Publishers (Merging Units)
 IEC 61850 Ethernet Switches

Updated: February 6, 2013

Contact
 DNV KEMA Energy & Sustainability
 Protocol Competence & Test Centre
 P.O. box 9035, 6800 ET ARNHEM
 The Netherlands
 tel: +31 26 356 2025
 fax: +31 26 351 3683
 email: emea@dnvkema.com
<http://www.dnvkema.com/pcc>

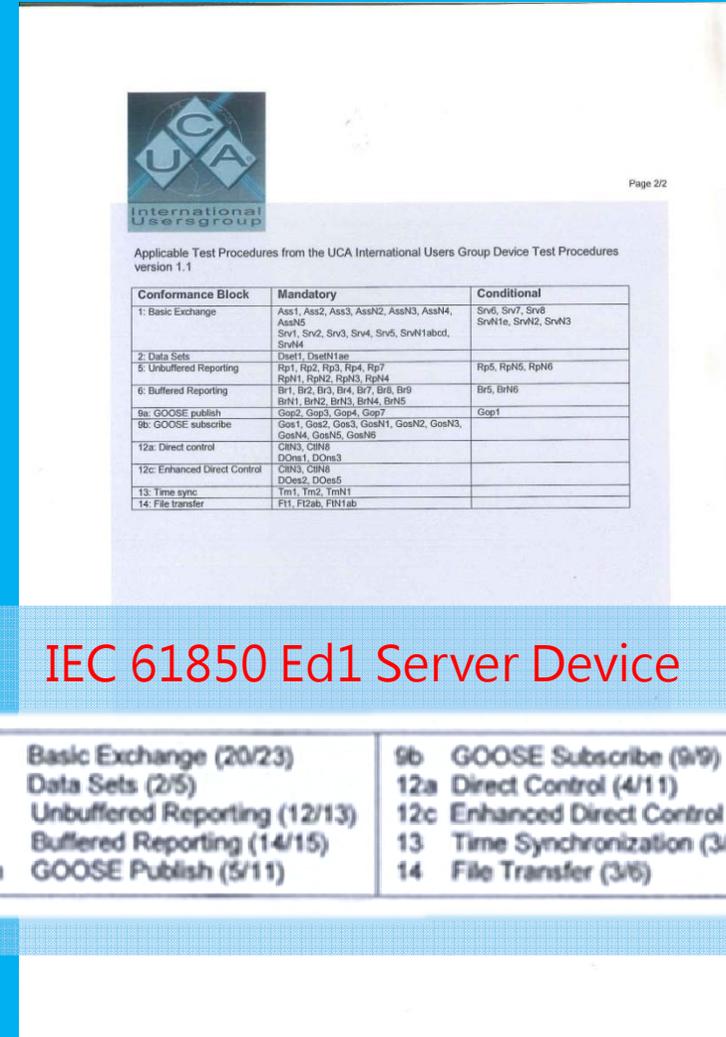
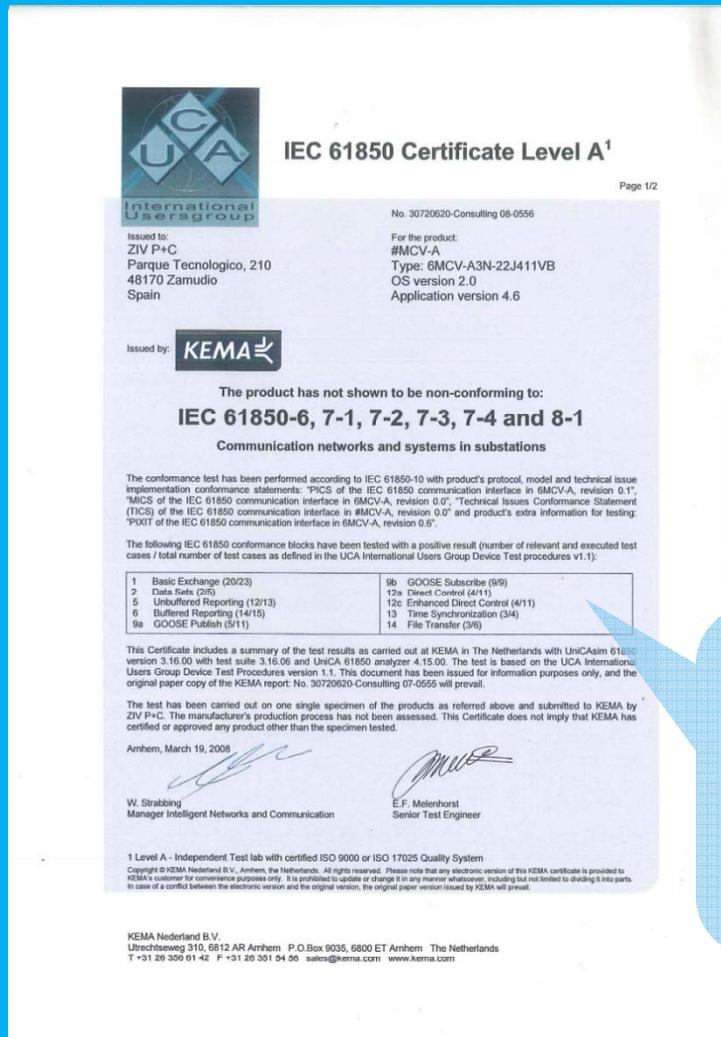


IEC 61850 Test Register

Annex A: Overview of ACSI services per conformance block for IEC 61850 Ed1 Server Devices

Conformance Block	Mandatory	Optional
1: Basic Exchange	Associate, Abort, Release GetServerDirectory, GetLogicalDeviceDirectory GetLogicalNodeDirectory (DATA) GetDataValues, GetDataDirectory, GetDataDefinition	GetAllDataValues SetDataValues
2: Data Set	GetLogicalNodeDirectory (DATA-SET) GetDataSetValues, GetDataSetDirectory	DataSetValues
2+: Data Set Definition	CreateDataSet, DeleteDataSet	
3: Substitution	SetDataValues, GetDataValues	
4: Setting Group	SelectActiveSG, GetSGValues	GetSGValues
4+: Setting Group Definition	SelectEditSG, GetSGValues, SetSGValues ConfirmEditSGValues	
5: Unbuffered Reporting	Report, GetURCBValues, SetURCBValues	
6: Buffered Reporting	Report, GetBRCBValues, SetBRCBValues	
7: Logging	GetLCBValues, GetLogicalNodeDirectory(LOG) QueryLogByTime or QueryLogAfter, GetLogStatusValues	SetLCBValues
8a: GSSE publish	SendGSSEMessage (publish)	GetGsCBValues SetGsCBValues
8b: GSSE subscribe	SendGSSEMessage (subscribe)	
8c: GSSE mngt	GetGsReference, GetGSSEDataOffset	
9a: GOOSE publish	SendGOOSEMessage (publish)	GetGoCBValues SetGoCBValues
9b: GOOSE subscribe	SendGOOSEMessage (subscribe)	
9c: GOOSE mngt	GetGoReference, GetGOOSEElementNumber	
10: Sampled values part 9-1 pub/sub	<no ACSI service associated>	
11: Sampled values part 9-2 pub/sub	SendUSVMessage or SendMSVMessage	GetxSVCBValues SetxSVCBValues
12a: Direct control	Operate	TimeActivatedOperate
12b: SBO control	Select, Cancel, Operate	TimeActivatedOperate
12c: Enhanced Direct Control	Operate CommandTermination	TimeActivatedOperate
12d: Enhanced SBO control	SelectWithValue, Cancel, Operate CommandTermination	TimeActivatedOperate
13: Time sync	SNTP Time Synchronization	
14: File transfer	GetFile GetFileAttributeValues	SetFile DeleteFile

IEC 61850 KEMA 認證範例



IEC 61850 Ed1 Server Device

1 Basic Exchange (20/23)	9b GOOSE Subscribe (9/9)
2 Data Sets (2/5)	12a Direct Control (4/11)
5 Unbuffered Reporting (12/13)	12c Enhanced Direct Control (4/11)
6 Buffered Reporting (14/15)	13 Time Synchronization (3/4)
9a GOOSE Publish (5/11)	14 File Transfer (3/6)

IEC 61850 KEMA 認證範例



IEC 61850 Certificate Level A¹

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No. 74104095-MOC/INC 13-1214

Issued to:
Cooper Power Systems
730 Commerciale Street, Suite 200
Saint-Jean-Christostome
Quebec, Canada

For the client system:
SMP 16 / CP-PM
Version 6.2C374104095

Issued by: **KEMA**

**The client system has not shown to be non-conforming to:
IEC 61850 First Edition Parts 6, 7-1, 7-2, 7-3, 7-4 and 8-1
Communication networks and systems in substations**

The conformance test has been performed according to IEC 61850-10 and UCA IUG Conformance Test Procedures for Client System with IEC 61850-8-1 interface, revision 1.1 with TPCL² version 1.2 with client system's protocol, model and technical issue implementation conformance statements: "Conformity Specification IEC 61850 Master Protocol, S1120-19-6, version 1". This document also includes the product's extra information for testing.

The following IEC 61850 conformance blocks have been tested with a positive result (number of relevant and executed test cases / total number of test cases):

1 Basic Exchange (18/22)	12a Direct Control (5/7)
2 Data Sets (7/9)	12b SBO Control (7/9)
5 Unbuffered Reporting (16/18)	12c Enhanced Direct Control (5/7)
6 Buffered Reporting (20/22)	12d Enhanced SBO Control (7/9)
	13 Time Synchronization (3/4)
	14 File Transfer (6/8)

This certificate includes a summary of the test results as carried out at KEMA in the Netherlands with UniCA Master IED Simulator version 3.26.1 and UniCA 61850 Analyzer version 4.25.0. This document has been issued for information purposes only, and the original paper copy of the KEMA report: No. 74104095-MOC/INC 13-1215 will prevail.

The test has been carried out on one single specimen of the client system as referred above and submitted to KEMA by Cooper Power Systems. The manufacturer's production process has not been assessed. This attestation does not imply that KEMA has approved any product other than the specimen tested.

Arnhem, February 25, 2013

M. Adriaens
Director Intelligent Networks & Communication

R. Schimmel
Certification Manager

¹ Level A - Independent test lab with certified ISO 9001 quality system
² TPCL - Test Procedure Change List

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KEMA Nederland B.V.
Utrechtseweg 310, 6812 AR Arnhem, P.O. Box 9035, 6800 ET Arnhem, The Netherlands
T +31 26 356 20 25 F +31 26 351 36 83 sales@kema.com www.kema.com

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Applicable Test Procedures from the UCA IUG Conformance Test Procedures for Client System with IEC 61850-8-1 interface, revision 1.1 with TPCL version 1.2

Conformance Block	Mandatory	Conditional
1: Basic Exchange	cAss1, cAss2, cAss3, cAss4, cAssN1, cAssN4, cAssN5, cAssN6	cAssN7, cSrv1, cSrv2, cSrv3, cSrv4, cSrv5, cSrvN1, cSrvN3, cSrvN5, cSrvN6
2: Data set		cDs1, cDs2, cDs3, cDs5, cDsN1a, cDsN1b, cDsN2
5: Unbuffered Reporting	cRp3, cRp4, cRp5, cRp8, cRp9, cRp10, cRpN2, cRpN3, cRpN7, cRpN9	cRp1, cRp2, cRp6, cRp7, cRpN1, cRpN4
6: Buffered Reporting	cBr3, cBr4, cBr5, cBr8, cBr9, cBr10, cBr11, cBr12, cBrN2, cBrN3, cBrN7, cBrN8, cBrN9	cBr1, cBr2, cBr6, cBr7, cBr13, cBrN1, cBrN4
12a: Direct control	cCt4, cCtN1 cDOes1, cDOes2	cCt2
12b: SBO control	cCt4, cCtN1 cSBOs1, cSBOs2, cSBOs3	cCt2, cSBOs4
12c: Enhanced Direct Control	cCt4, cCtN1 cDOes1, cDOes2	cCt2
12d: Enhanced SBO control	cCt4, cCtN1, cSBOs1, cSBOs2, cSBOs3	cCt2, cSBOs4
13: Time sync	cTm1	cTm2, cTmN1
14: Get File Transfer	cFt1, cFt2, cFt3, cFtN1, cFtN2	cFt5

IEC 61850 Ed1 Client System

1 Basic Exchange (18/22)	12a Direct Control (5/7)
2 Data Sets (7/9)	12b SBO Control (7/9)
5 Unbuffered Reporting (16/18)	12c Enhanced Direct Control (5/7)
6 Buffered Reporting (20/22)	12d Enhanced SBO Control (7/9)
	13 Time Synchronization (3/4)
	14 File Transfer (6/8)

IEC 61850 GOOSE 功能應用



IEC 61850 GOOSE 功能應用



- ◎ 變電站間 (Sub2Sub) ES operate security Goose interlocking for Project(2014)
- ◎ 81L load shedding application for Project (2014)
- ◎ CIGRE will release GOOSE application scheme as below in months :
 - ◎ Transmission Bus Protection: Directional Comparison Scheme
 - ◎ Transmission Line Protection: Inter-trip scheme
 - ◎ Transmission Line Protection: Breaker Failure Protection (RBRF)
 - ◎ Transmission Line Protection: Automatic reclosing (AR) for One Breaker (internal or external AR device)
 - ◎ Transmission Line Protection: Check Sync for One or Two Breakers
 - ◎ Breaker Control IED
 - ◎ Distribution Feeder: Breaker Failure Protection Scheme for One or Two Bus Sections (Shenchyei Lab : 2013~14)
 - ◎ Sympathetic Tripping or Blocking Scheme
 - ◎ Feeder Interlocking and Substation Interlocking (Project 2014)
 - ◎ Distribution bus protection (Shenchyei lab : 2013)
 - ◎ Substation Control Lockout or Control Uniqueness (Project 2014)
 - ◎ Under Frequency Load Shedding – UFLS (Project 2013~2104)

IEC 61850 GOOSE 功能應用



Applications for Protection Schemes Based On IEC 61850 Protocol

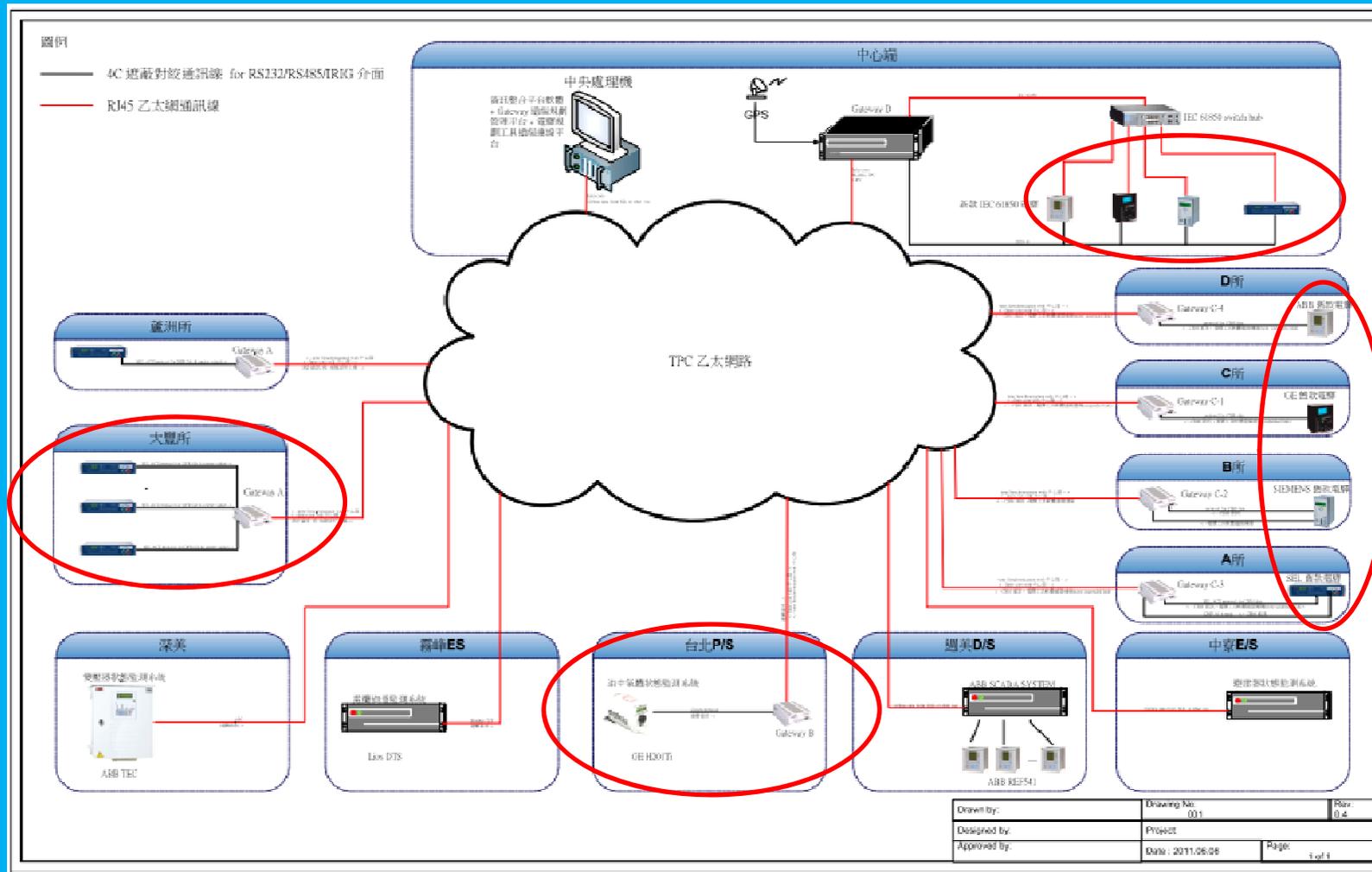
Working Group B5.36

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符合過去、現在及未來的系統整合 PROJECT 1



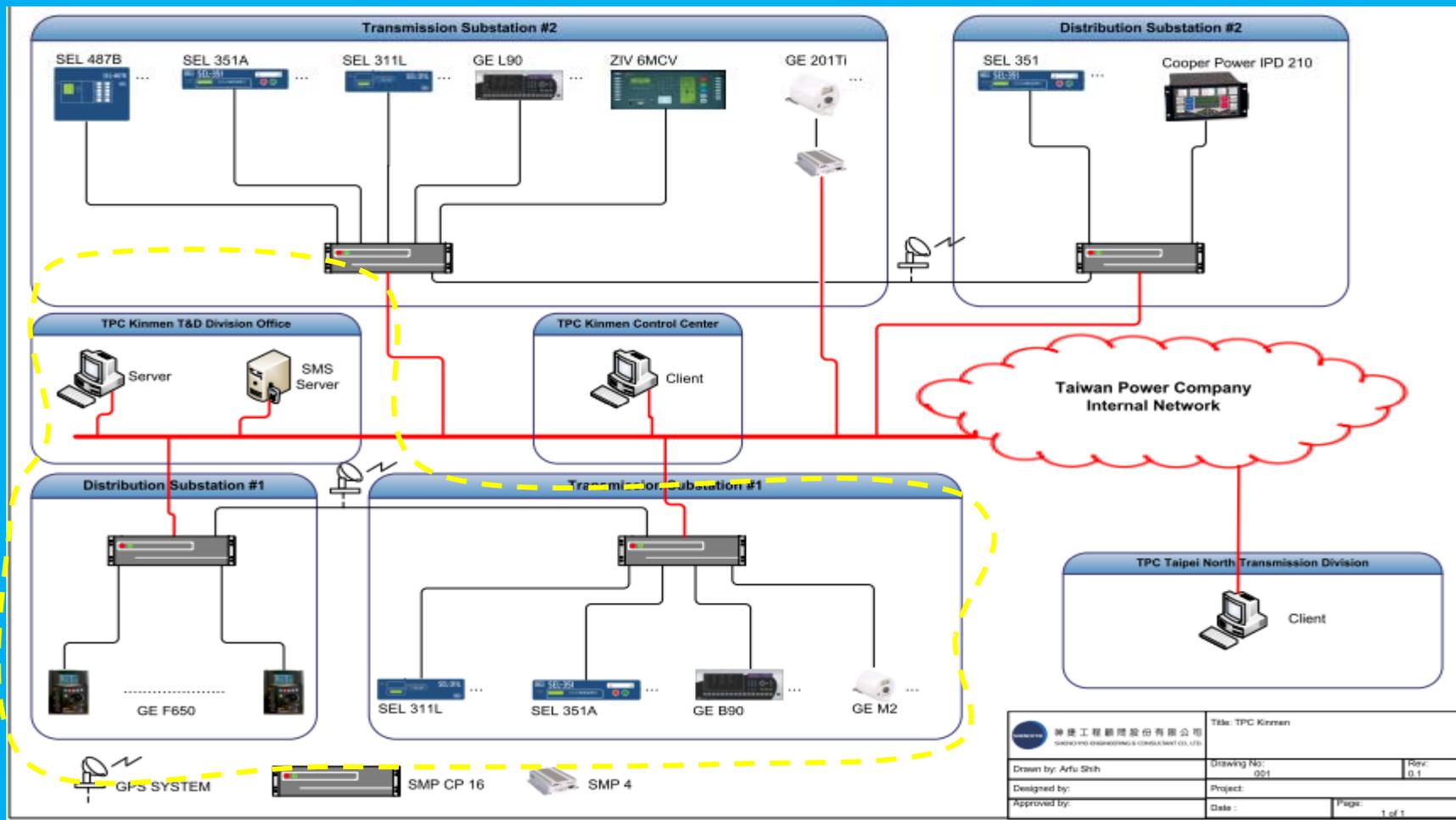
◎ TPRI複雜的整合實驗案



符合過去、現在與未來的系統整合 PROJECT 2



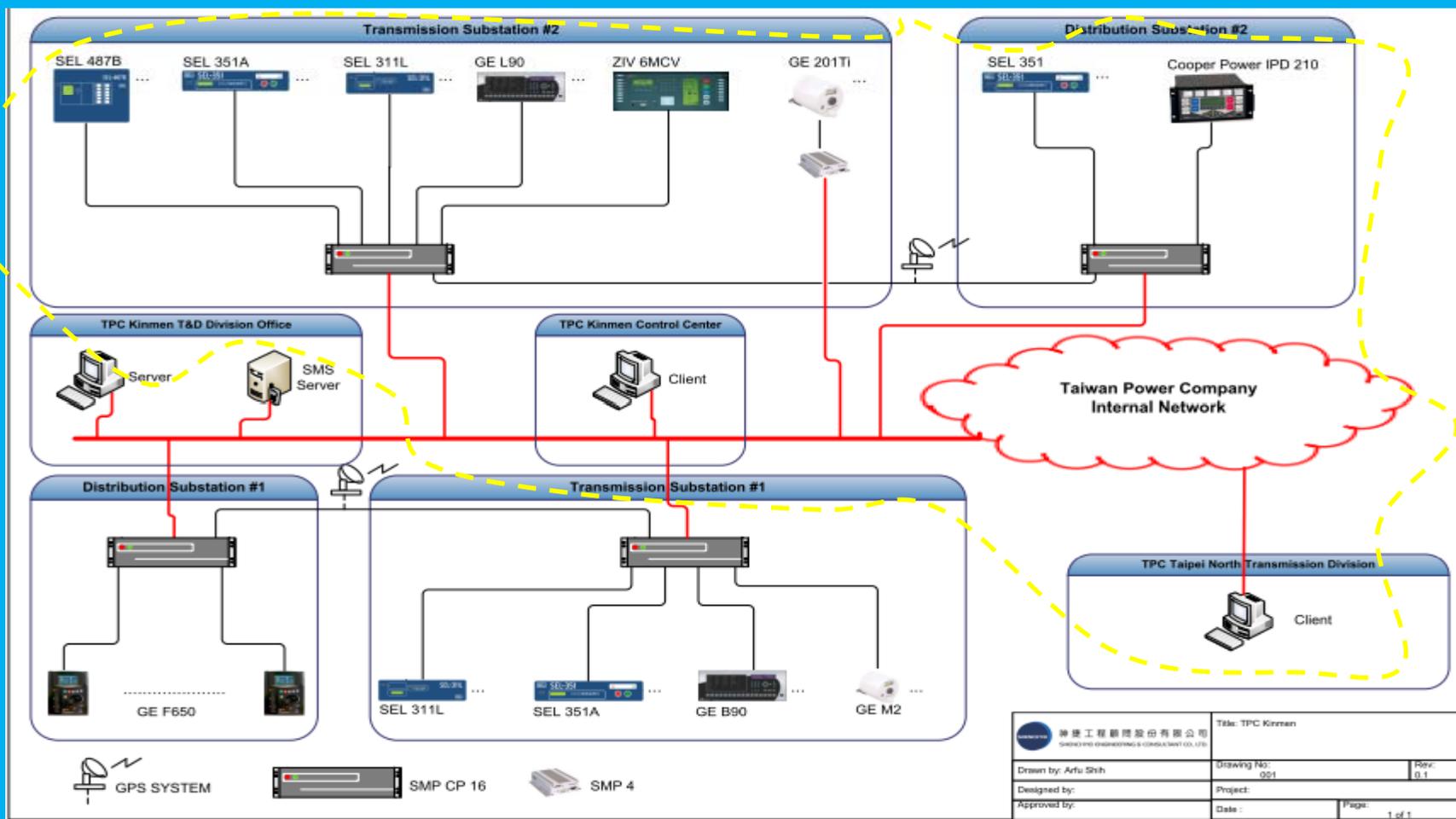
- ◎ 地點:金門鵲山整合全站電驛資訊及電驛工具至莒光辦公室及北供使用
- ◎ 整合電驛:F650*30, SEL311L*8, B90*3, SEL351A*2, GE M2*2



符合過去、現在與未來的系統整合 PROJECT 3



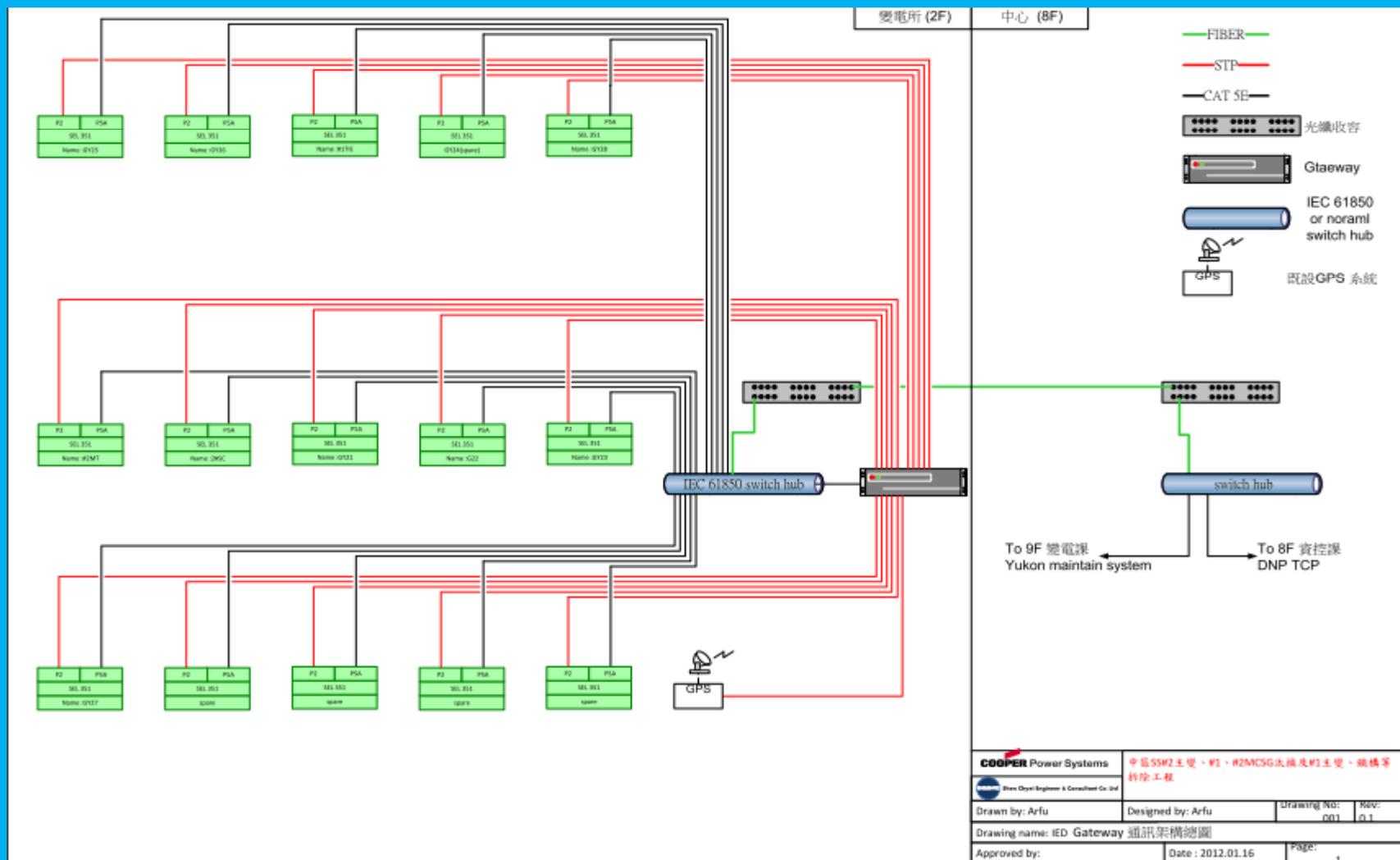
- ◎ 地點:金門莒光 整合全站電驛資訊, 電驛工具, 電驛故障波型自動上傳
- ◎ 整合電驛:SEL351*24, SEL487B*3,SEL311L*10, GE L90*4,GE 201TI*2



符合過去、現在與未來的系統整合 PROJECT 4



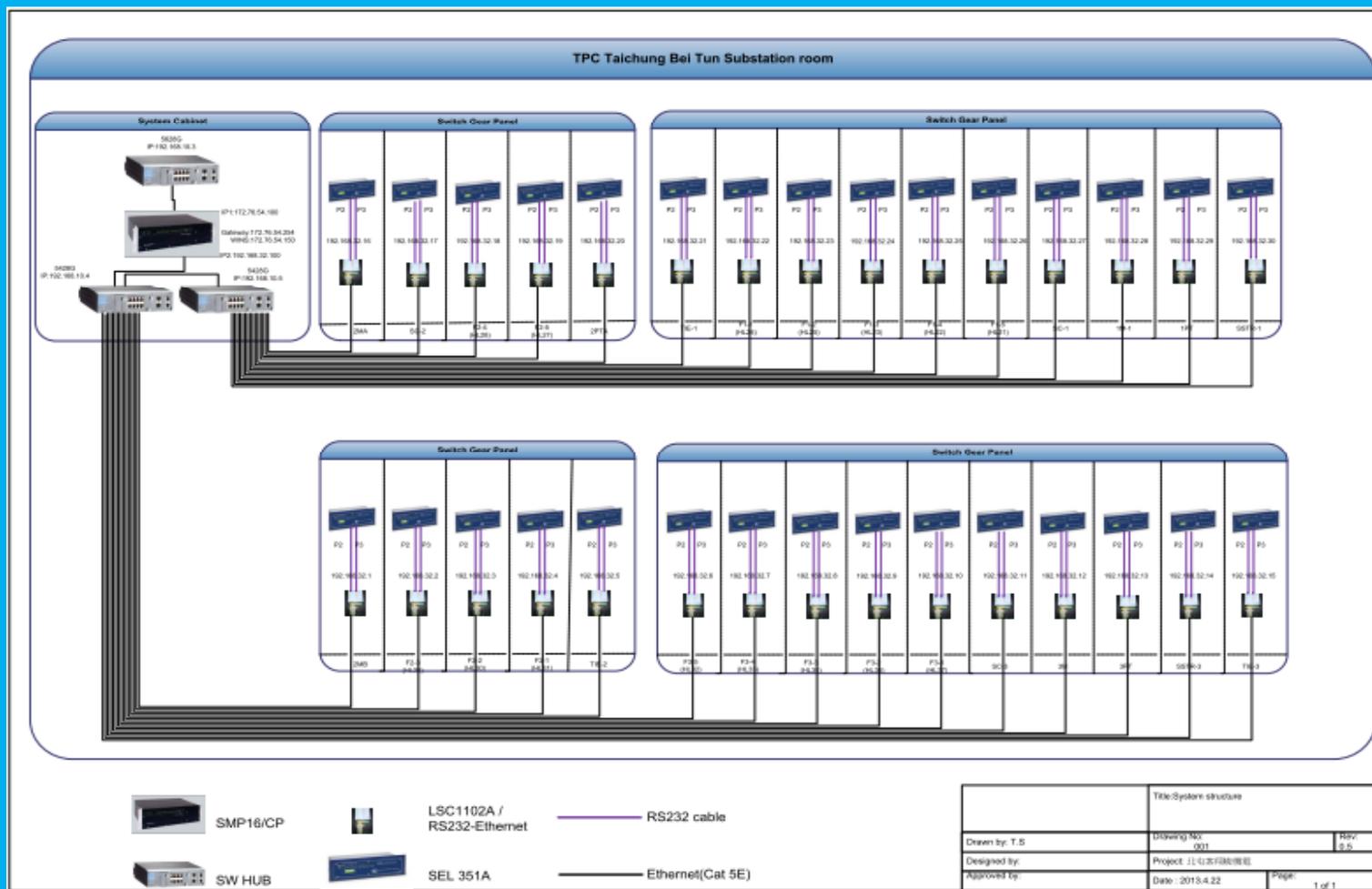
◎ 中區SS #2主變, 同時擷取15台SEL351的DNP, IEC61850資料, 整合成兩支DNP上傳



符合過去、現在與未來的系統整合 PROJECT 5

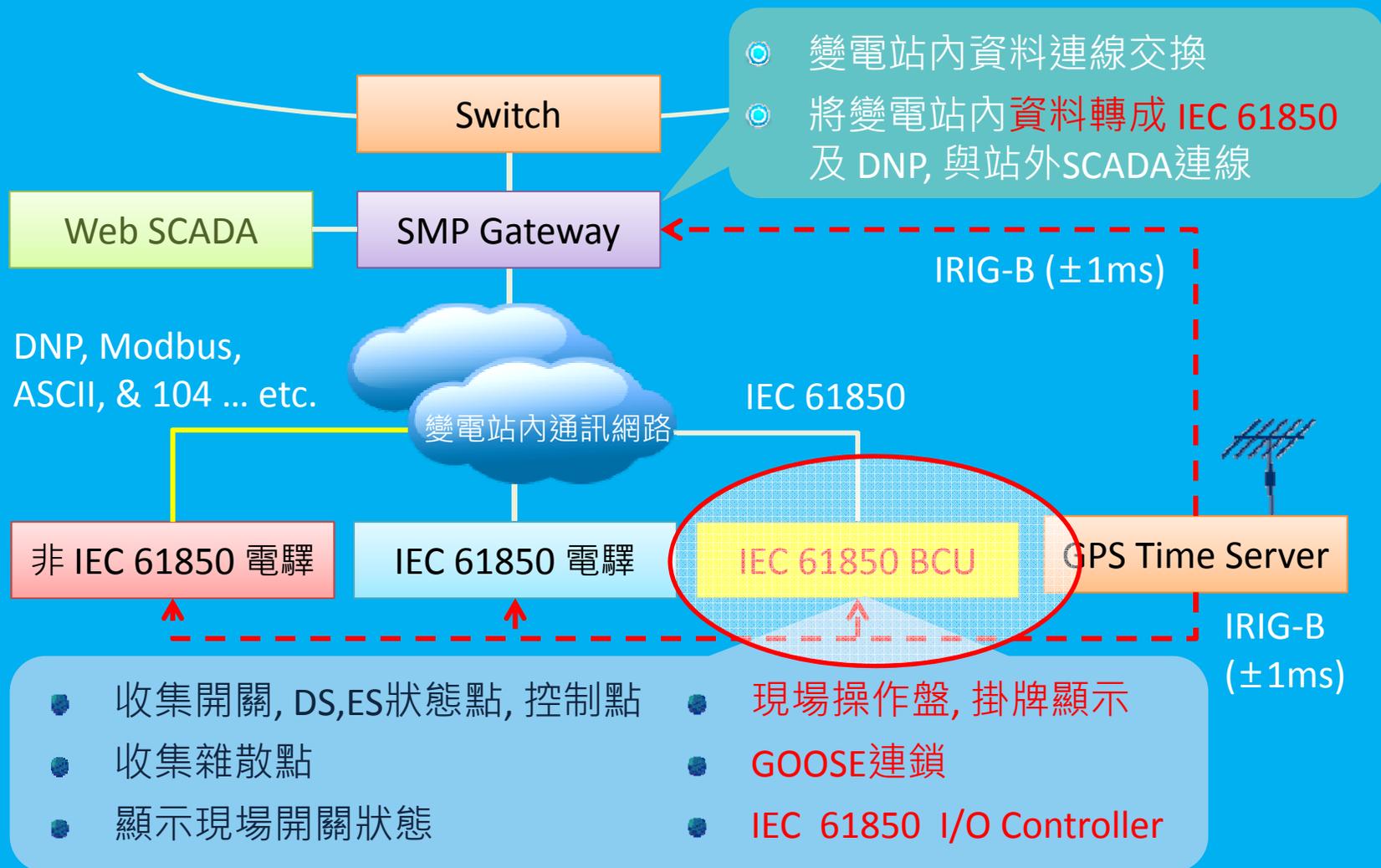


◎ 台中北屯, 擷取30台SEL351 ASCII資料, 同時轉換成DNP及IEC61850資料上傳



整合應用

IEC 61850 + 非IEC 61850 變電站實際架構



整合應用

IEC 61850 變電站實際架構



- ◎ 使用 Protection IED Goose Out (IEC 61850-8 Block 9a) ;
- ◎ 使用 Distribution Protection IED command (IEC 61850-8 Block 12) ;
- ◎ 不使用 Transmission Protection IED command (IEC 61850-8 Block 12) ;
- ◎ 不使用 IEC 61850-8 Block 13 『SNTP Time Synchronization』，採用 IRIG-B 替代；
- ◎ 變電所設置 IEC 61850 BCU (Bay Control Unit)，符合 IEC 61850-8-1 block 1, 2, 5, 6, 9ab, 12ac, 13, 14，以 command 與 Goose in/out 應用為主；
- ◎ 資訊安全遵循 NERC-CIP 規定，Pass-through IED native tool remote access 等應用均符合 NERC-CIP 要求，變電站資安管理非常重要。

整合應用

IEC 61850 變電站實際架構



- ◎ 輸電網路操作影響範圍廣泛，台電禁止設備經 Protection IED 遙控操作，Protection IED 單純做系統保護之用，故不使用 IEC 61850-8 Block 12 - Transmission Protection IED command ；
- ◎ IEEE 1588 『SNTP Time Synchronization』尚未成熟普及於 Protection IED，SNTP 不能滿足 SOE 時間精確度需求，故採用廣泛被 Protection IED 支援的 IRIG-B 校時策略。

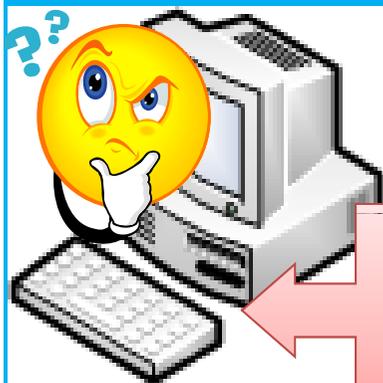
Protocol Time sync	SNTP Time sync	Modulated IRIG-B Time sync	Demodulated IRIG-B Time sync
~±500ms	~±100ms	~±10ms	~±1ms

整合應用

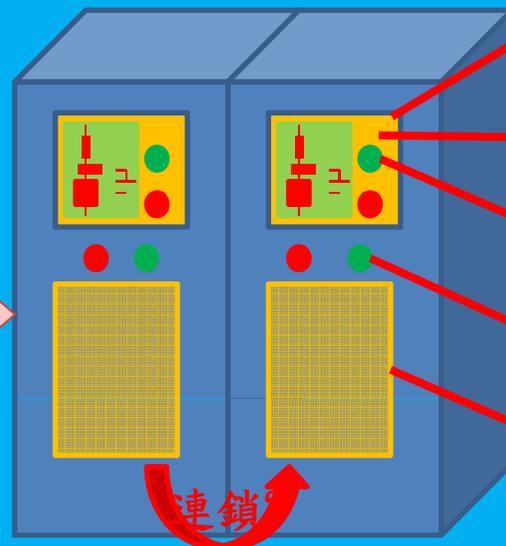
變電站實際架構-BCU 的導入



本地安全控制器 的發展概念 —— 變電站本地的操作類型-1



建置
Local
SCADA



高階保護電驛

LCD顯示單Bay畫面

開關操作鍵

狀態指示燈

開關本體

連鎖

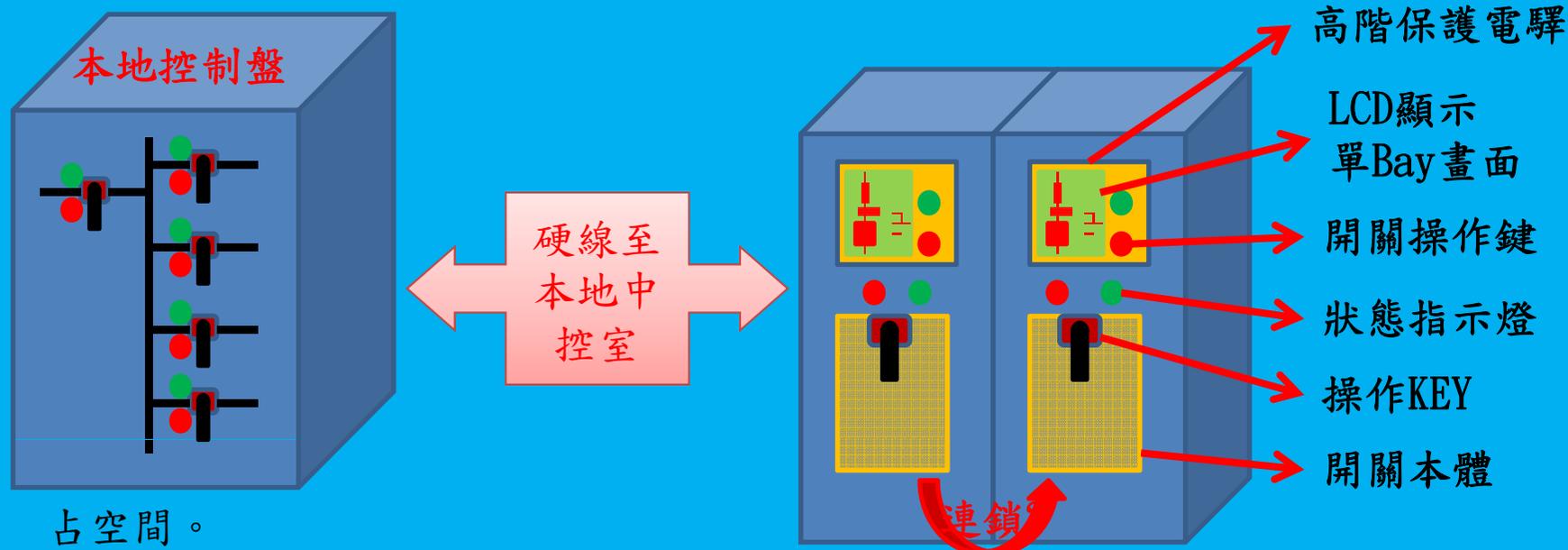
- 人員利用Local SCADA操作開關的投入與跳脫動作。
- 操作時已避免人身事故的風險。
- 端看Local SCADA 是否規劃互鎖機制。
- 多盤面(整體)之監視。
- 純軟體系統，妥善度沒保護電驛好。開關機程序較複雜，操程序也較複雜。
- 維修與備料較難掌握。

整合應用

變電站實際架構-BCU 的導入



本地安全控制器 的發展概念 —— 變電站本地的操作類型-2



- 占空間。
- 操作時已避免人身事故的風險。
- 端看本地控制盤是否規劃互鎖機制的顯示。
- 多盤面(整體)之監視。
- 純硬體設計，妥善度高。操作程序簡單。配線多，元件多。無自我診斷機制若元件毀損需人工察覺。
- 因為通常是設在本地控制室，硬線距離較遠。
- 人員利用本地控制盤操作開關的投入與跳脫動作。

整合應用

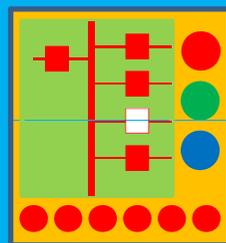
變電站實際架構-BCU 的導入



本地安全控制器 的發展概念 —— 變電站本地的操作類型-3



避免開關盤面
操作風險



本地安全控制器
監視與現場控制所有開關盤，
具備通訊(IEC61850)、操作紀錄及校時功能

整合應用

變電站實際架構--Web的導入



本地安全控制：於本地；避免開關盤面近距離的手動操作

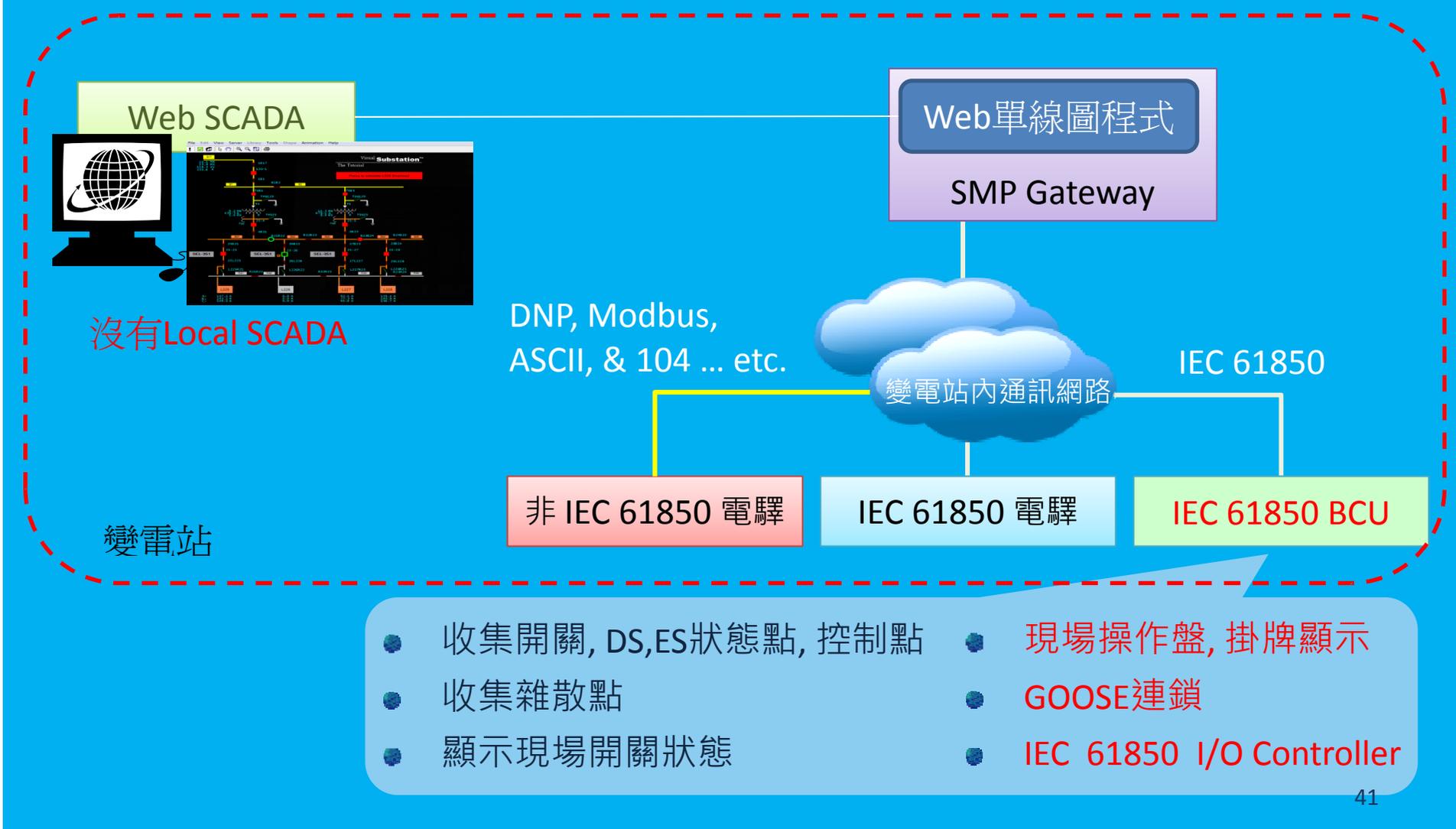


整合應用

變電站實際架構-Web 的導入



本地安全控制：於本地；避免開關盤面近距離的手動操作



結論



- ◎ 基礎於變電站現代化整合平台 (SMP) 發展的 IEC 61850 系統架構，能支援過去、現在與未來變電站自動化需求；
- ◎ 工程實例證明既設系統可成功整合於 IEC 61850 新建變電站自動化系統；
- ◎ 實際採行之 IEC 61850 系統發展整合流程，可順利使既設變電站自動化系統逐步汰換至 IEC 61850 系統，系統轉換期間不影響正常供電，系統升級衝擊減到最低。

討論



- ◎ 感謝聆聽；
- ◎ 敬請賜教。



六輸 LOCAL SCADA 問題與建議

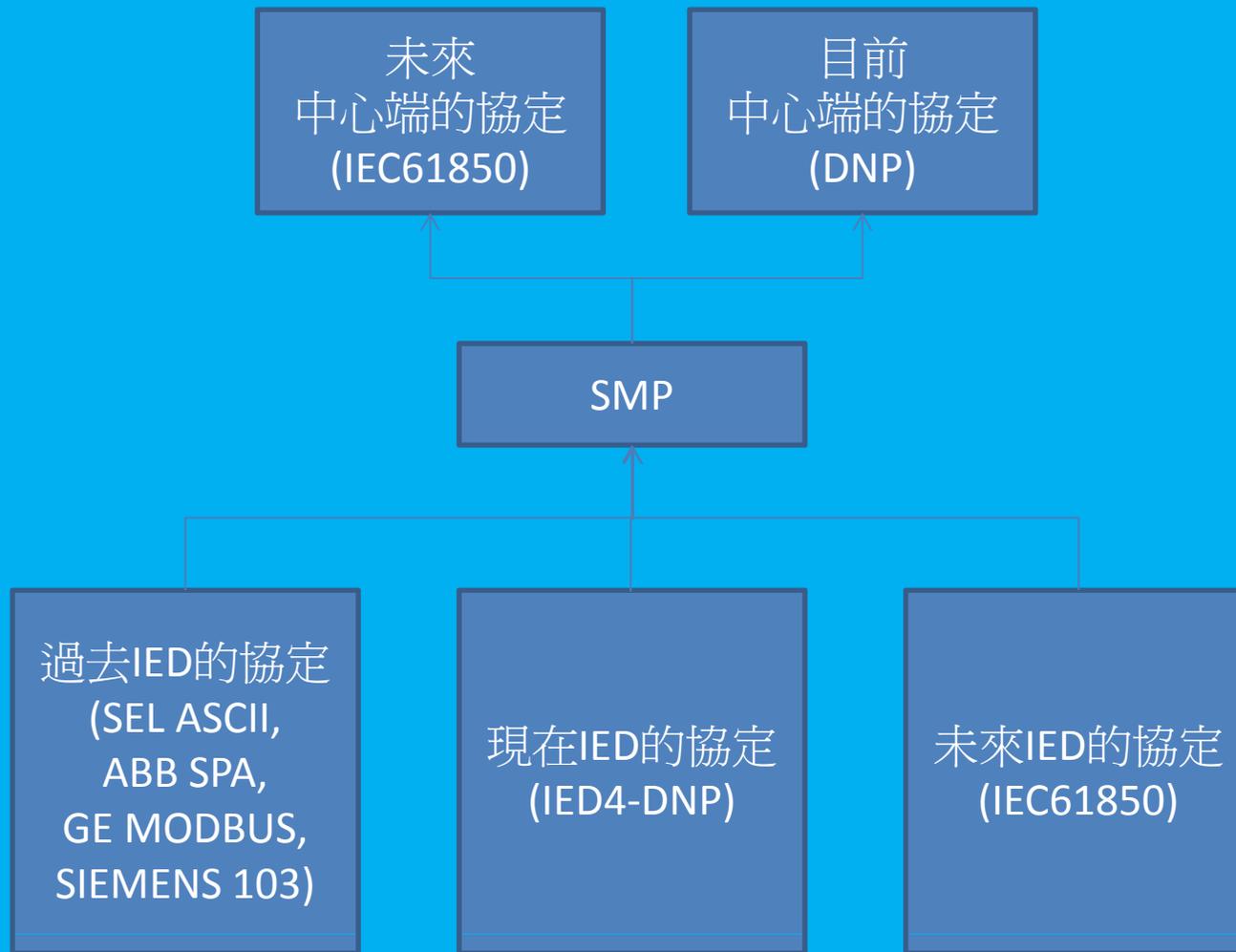
Shenchyei Engineering Consultant Co. Ltd. 3th Aug, 2013
神捷工程顧問股份有限公司

目前台電電力系統通訊整合的主要問題

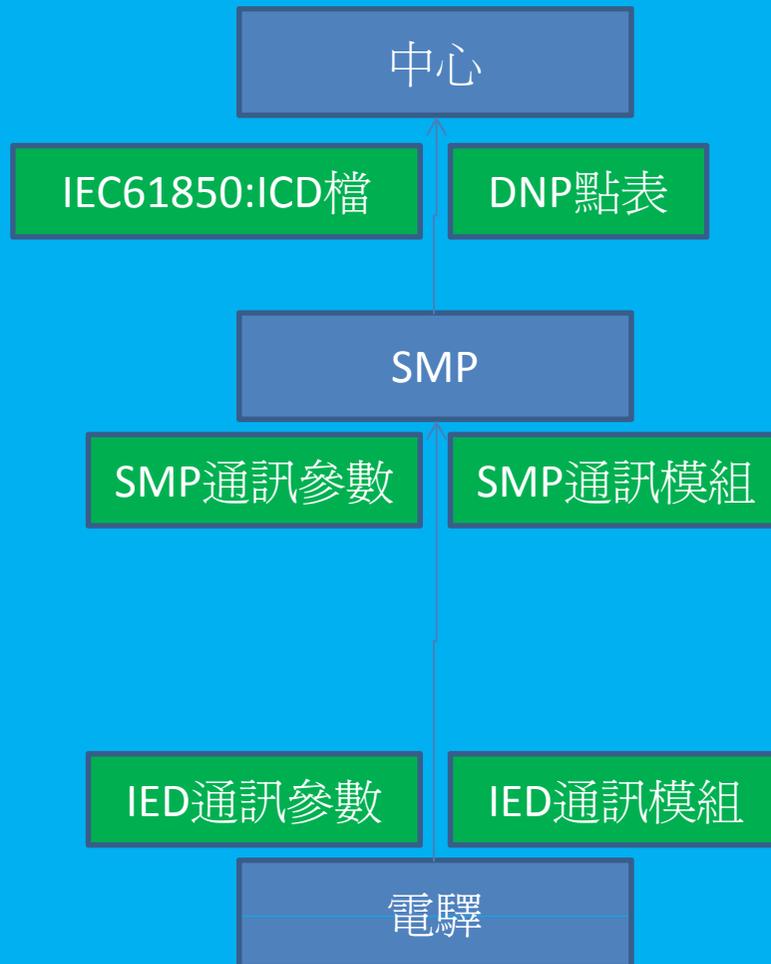


- 一、多廠牌電驛整合不易。
 - a、具備台電線上電驛，過去、現在、未來需使用的通訊協定。
 - b、建置各廠牌電驛的通訊模組化。
- 二、系統可靠度不足。
 - a、如何提高設備的可靠度。
 - b、環狀的網路系統。
- 三、系統複雜維護不易。
 - a、系統維護工具的提供。
 - b、系統維護平台的建置。

1-a、具備台電線上電驛，過去、現在與未來需使用的通訊協定



1-b 、建置各廠牌電驛的通訊模組化



目前SMP連線過的通訊模組

87L-SEL311L(ASCII)
87L-GE L90(DNP)
87B-SEL487B(ASCII)
87B-GE B90(DNP)
87T-SEL387(ASCII)
87T-SEL351(ASCII,DNP)
Feeder-SEL351A(ASCII)
Feeder-SEL351(ASCII,DNP,IEC61850)
Feeder-GE F650(DNP,IEC61850)
Feeder-SR760(MODBUS)
Feeder-ABB REF541(SPA)
Feeder-ABB RET630(IEC61850)
Feeder-Siemens 7SJ62(Modbus)
Feeder-Siemens 7SJ64(IEC61850)

總共約13個型號, 台電所使用電驛型號
應大部分都已連線完成

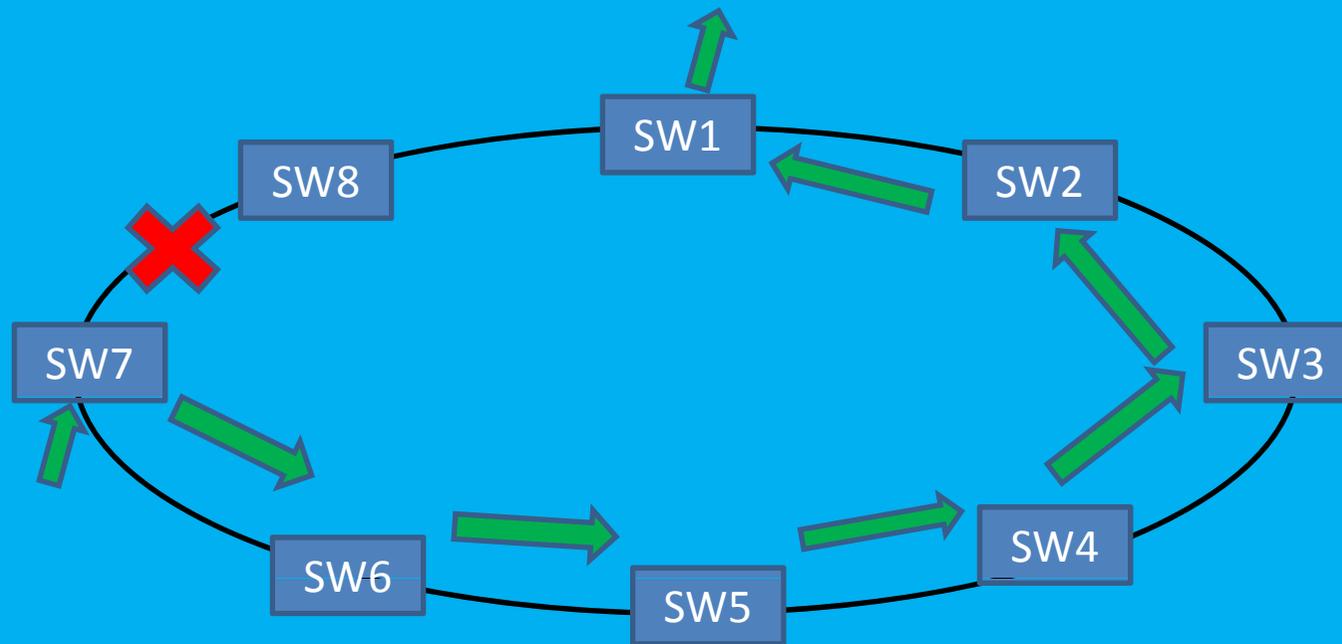
2-a 、如何提高設備的可靠度



- 1. 為軟體+硬體的專用設備
(經過原廠高度驗證測試)
(通訊軟體+PC的整合方式,未經過驗證)
- 2. 無開孔金屬外殼, 無風扇設計
(防塵, 防干擾, 無轉軸)
- 3. KEMA, IEC60255, MTBF.....
- 4. 可靠的電源模組

2-b 、環狀的網路系統

- 光纖網路主幹線形成環路，當其中一個節點產生斷線，系統依尋另外一條路徑將資料傳回中心，提高網路主幹的可靠度。



3-a 、系統維護工具的提供



- SMP提供了一個管理平台SMP Manager，具備以下功能：
- 1. 目前使用的SMP表列及連線狀態
- 2. Config及重啟功能
- 3. SMP_Connect提供多廠牌電驛工具連線管理介面
- 4. SMP_Log 使用記錄
- 5. SMP_Status 顯示所有連線與衛星校時的狀態及設定參數
通訊品質的統計紀錄
- 6. SMP_Trace 提供Data Scope的功能解析通訊碼
- 7. SMP_Web 提供單點測試介面與單線圖繪製功能
- 8. Security 提供密碼管理功能
- 9. Redundancy 備援設定

3-b 、系統維護平台的建置



1. 維護平台插上無線網路
2. 提供密碼授權予系統人員
3. 系統人員登入作業
4. 完成後移除網路

