

Digital Substations Challenges

B5 PS2

Question 2.01: What are the challenges in the development of digital substations and how to address the problems caused by the digitalization?

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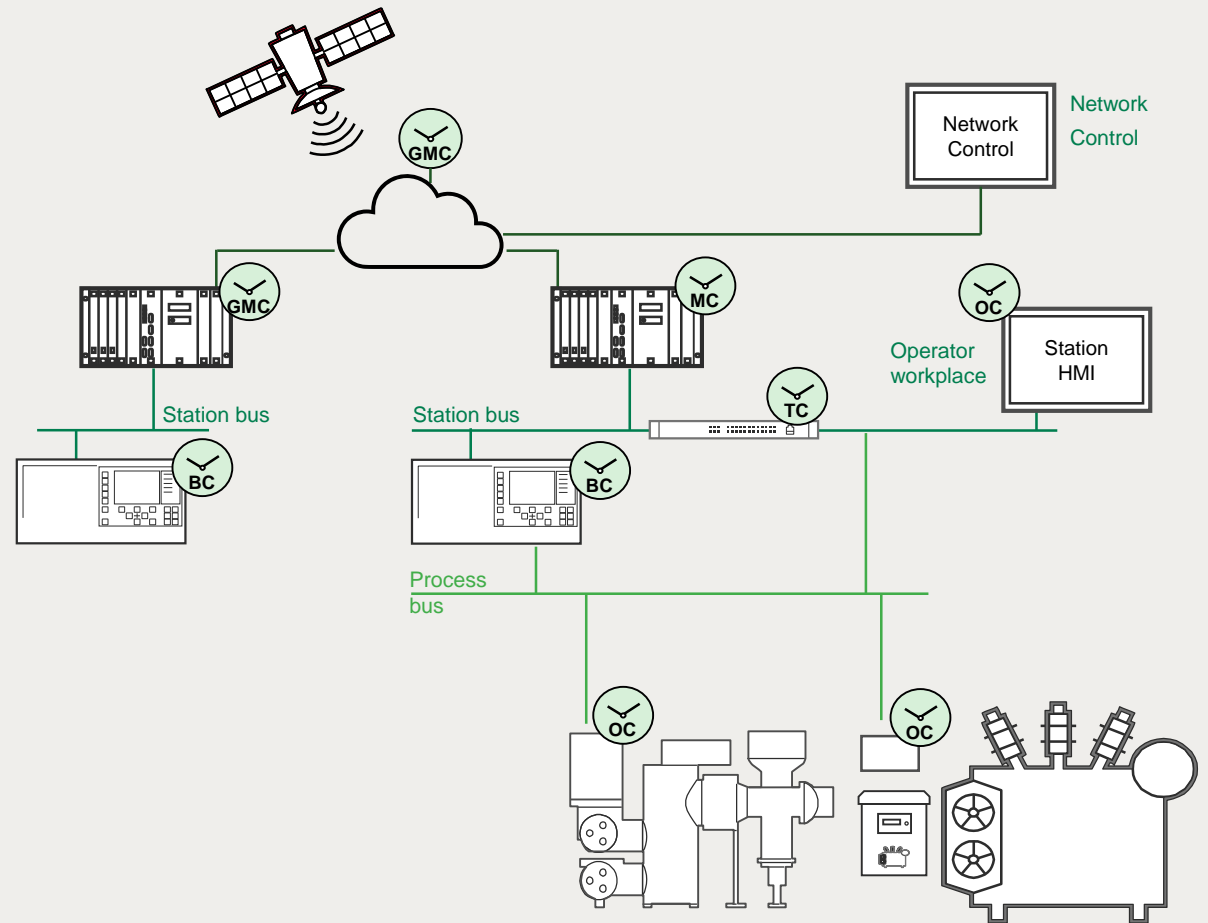
HITACHI
Inspire the Next

Two examples of challenge related to digital substations

1. Time synchronization
2. Documentation

Digital substations challenges – time synchronization

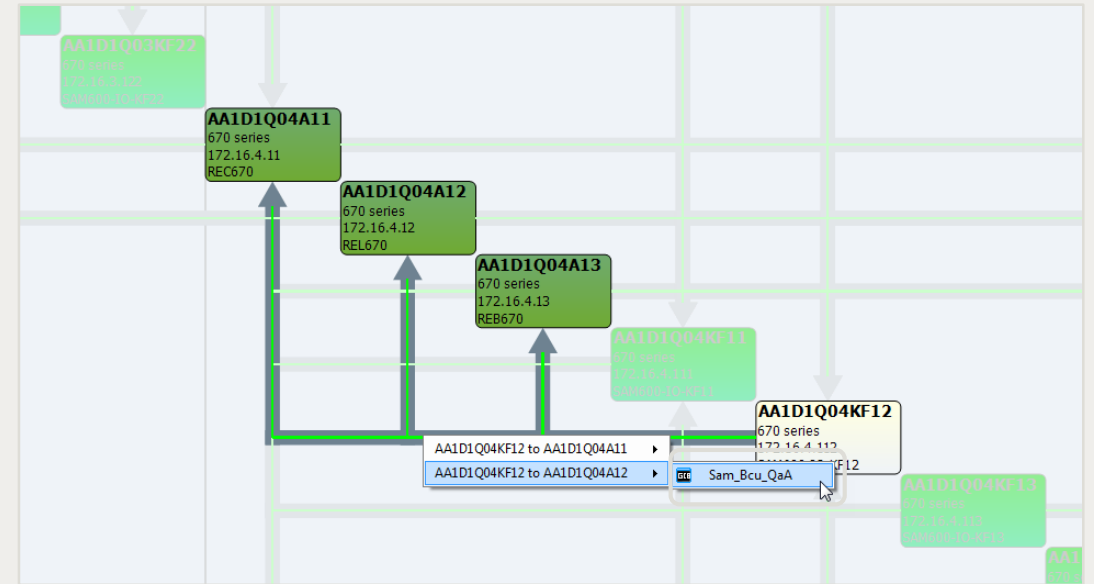
- Accuracy
 - IEC/IEEE 61850-9-3 precise time synchronization
 - IEC 61850-5 accuracy classes T4 (4 μ s) T5 (1 μ s)
- Interoperability and integration
 - IEEE 1588 profile as per IEC/IEEE 61850-9-3
- Robustness and availability
 - Multiple master clocks with different sources (GPS, utility WAN)
 - Master clock capable IEDs with BMCA
 - Link layer redundancy (HSR/PRP)
 - Graceful degradation of functions in IEDs in case of loss of time synchrony



Group Discussion Meeting

Digital substations challenges – documentation

- SCL based documentation
 - ✓ As built SCD file, the single source of truth
 - ✓ Rich of content, e.g., including substation section and topology
 - ! Requires tool support to interpret and represent
 - Human readable
 - ✓ List based documents, exported from system and IED configuration tools
 - ✓ Simple to read for non specialists, e.g., communication tables resembling today's wire connection lists
 - ! Limited content, risk to be out of date
- Both are required for documentation and maintenance



Source				Transmission		Destination	
IED	LD, LN, DO, DA	Dataset	Dataset description	Subnetwork	VLAN	IED	Access Point
Control IED AA3C1Q01KF1	XCBR1.Pos. StVal	InterIA	For distributed interlocking	AA3WF010	002	Control IED AA3C1Q01KF5	S1
Control IED AA3C1Q01KF1	XCBR1.Pos. StVal	InterIA	For distributed interlocking	AA3WF010	002	Control IED AA3C1Q01KF6	S1
Protection IED AA3C1Q02FN1	OC4PTOC1.Op. general	ProtA	For distributed protection	AA3WF020	003	Protection IED AA3C1Q01FN1	S1
...

Group Discussion Meeting