Q PS3.4: What are other experiences to improve the specification, engineering, testing and maintenance to address the challenges in our industry?

Effort for interoperability verification of domestic device according to IEC 61850 in station bus and process bus

1. Introduction

Signal transmission in our substation monitoring and control system has been based on a protocol specific to Japanese electric power companies, but the system is expected to be generalized by changing to an international standard protocol, IEC 61850.

This paper presents a effort for interoperability verification of domestic device according to IEC 61850 in station bus and process bus in order to realize multi-vendor and cost reduction in the future. The verifications clarify many issues and make it possible to connect devices from different manufacturer's devices by unifying the configuration standards of each manufacturer's devices.

2. Overview of interoperability verification of communication device with IEC61850

Figure 1 shows the overview of interoperability verification of communication device with IEC61850. Table 1 and Tabe 2 show the verification items of station bus and process bus.

Interoperability testing of the station bus (red line) has been conducted in FY2020, and verification of the process bus (blue line) has been conducted in FY2021.

The tests concerning about connection and transmitting the information such as status of device are mainly conducted.
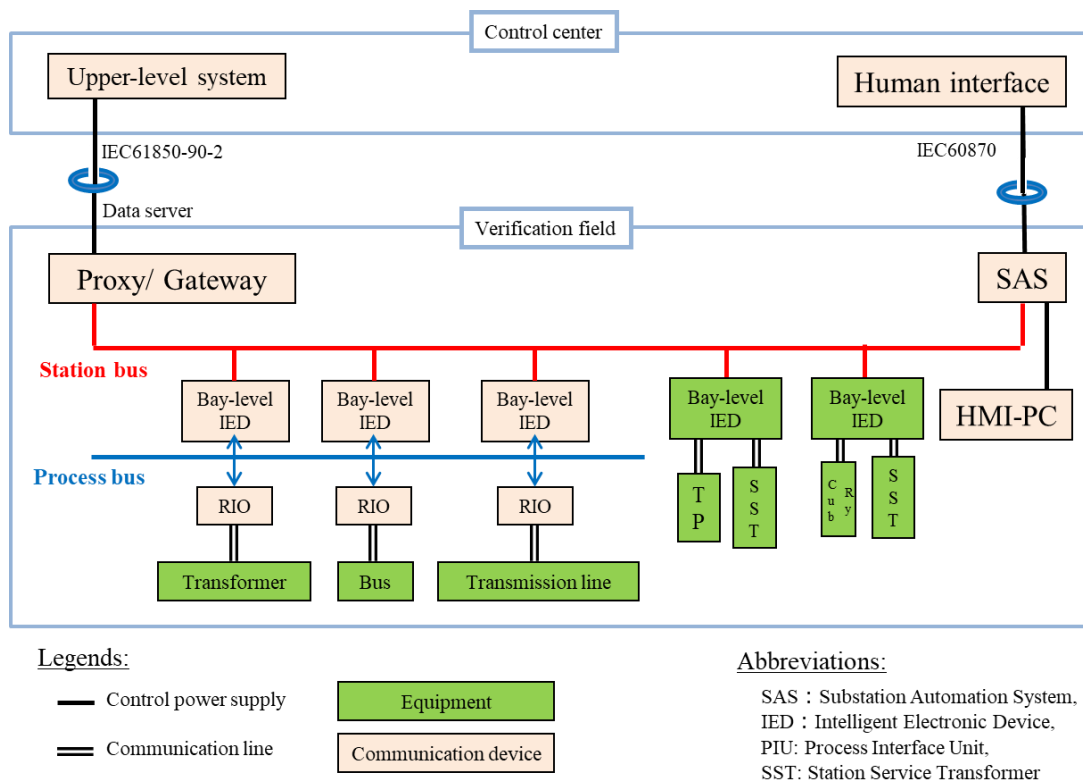

Figure 1 Overview of interoperability verification of communication device with IEC61850

Table 1 Verification items of station bus

No.	Verification items of station bus	Check
1	Initial Connection	✓
2	Time synchronization	✓
3	Status request/return	✓
4	Status indication/ failure indication request/ return	✓
5	Single status change	✓
6	Fixed-cycle measurement information	✓
7	Selective control / selective control return	✓
8	Buffer report confirmation	✓
9	Equipment abnormality	✓

Table 2 Verification items of process bus

No.	Verification items of process bus	Check
1	Initial Connection	✓
2	Status Request	✓
3	Status indication/failure indication	✓
4	Independent/responsive status change	✓
5	Measurement (scale over)	*1
6	TM monitoring information (fault meter)	*2
7	Selective control	✓
8	Monitoring timer	✓

Remarks :
1. Sampling value(SV) information of current and voltage for protection and control measured by the VT and CT is transmitted by metal cables because of accuracy.
2. TM information is treated from upper station bus in our system.

3. Result of the verification

Figure 2 and Figure 3 show the result of error items confirmed in interoperability testing of station bus and process bus, respectively. Differences in recognition between manufacturers can be corrected and realization of communication between devices of different manufacturer can be confirmed by changing settings and other measures.

Items that should be specified to ensure interoperability include unification or specification of units that cause scale over, response at power off, command holding time, and other items.
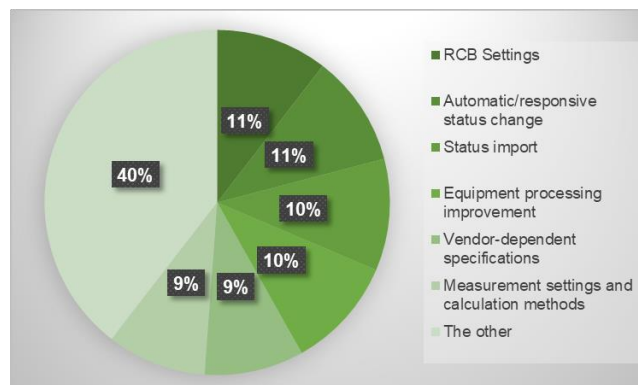

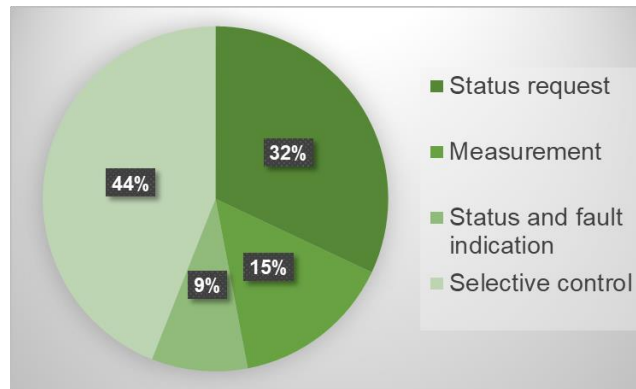Figure 2 Reuslt of error items confirmed in interoperability testing of station bus

Figure 3 Reuslt of error items confirmed in interoperability testing of process bus

4. Conclusions and future work

This verification clarifies many issues and makes it possible to connect with devices from different manufacturers by unifying the setting standards of each manufacturer's device. A digital substation, Chiba-Inzai Substation consisting of control systems from different manufacturers is scheduled to start operation in April 2024.

In the future, network redundancy and standardization with the manufacturers will be need to discuss and study in order to apply the system to actual substations. Future efforts will include verification of SV transmission for protection control and connection interoperability verification with upper-level systems.