SOLUTION FOR DATA ACQUISITION AND UNMANNED SUBSTATIONS CONTROL

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1. An Overview of Operation Information System

1.1. Substation Control System and Operation Control Centres

To meet the need for the management and operation of the high-voltage system (110/220/500kV), transmission companies and power companies need to be equipped with an operation data collection and management system from the lowest level of the system, which is the level of substations.

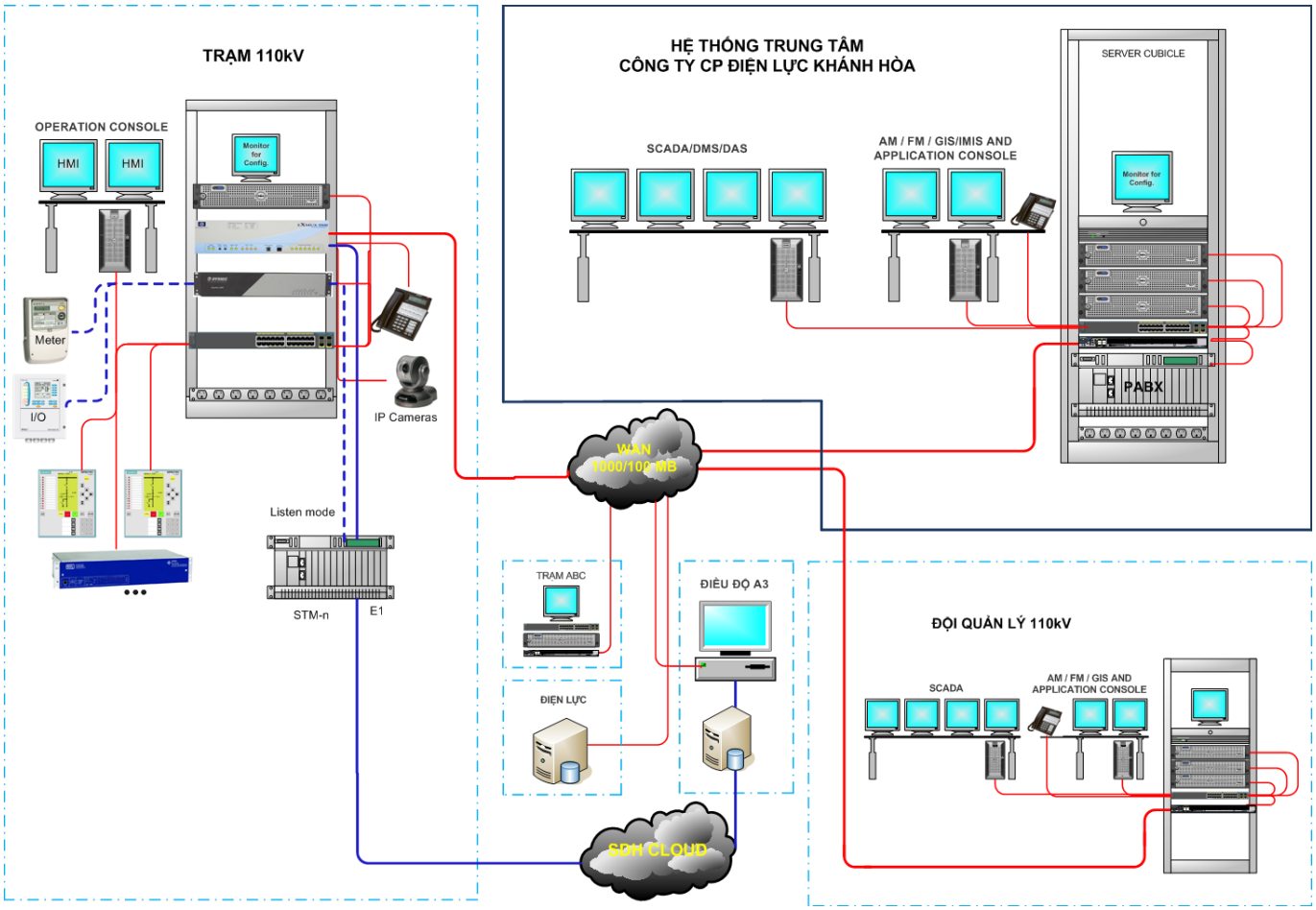

Figure 1-1: Overall Architecture of the Operation Data Collection and Management System

The overall architecture consists of:

- A substation automation system that collects information on the protection, control, and measurement of equipments as well as of power systems at high-voltage

substations. Data are to be collected through a direct connection with intelligent control, protection, and measuring devices (IEDs) using different types of protocols. This solution will allow for the elimination of the RTU, making it more convenient for later expansion and upgrade as there is no longer any need for RTU upgrade, thus reducing cost and time for the installation and testing stages. In the immediate future, we can utilize information from installed RTU by connecting to the RTU in listen mode or master mode.

- Central substations and operation management centres of 110kV management teams as well as MiniSCADA at regional dispatch centres.
- The main data link is over WAN using EVN's FO network and data transmission devices complying with IEC61850 standards, ensuring the transmission of protection and control data. Furthermore, for back-up data link, EVN's SDH network is used in cases the main network fails. In addition to operational data being transmitted, data from surveillance camera, voice and fax is also transmitted via these data link system.

1.2. @Station Data Exchange in the Overall Architecture

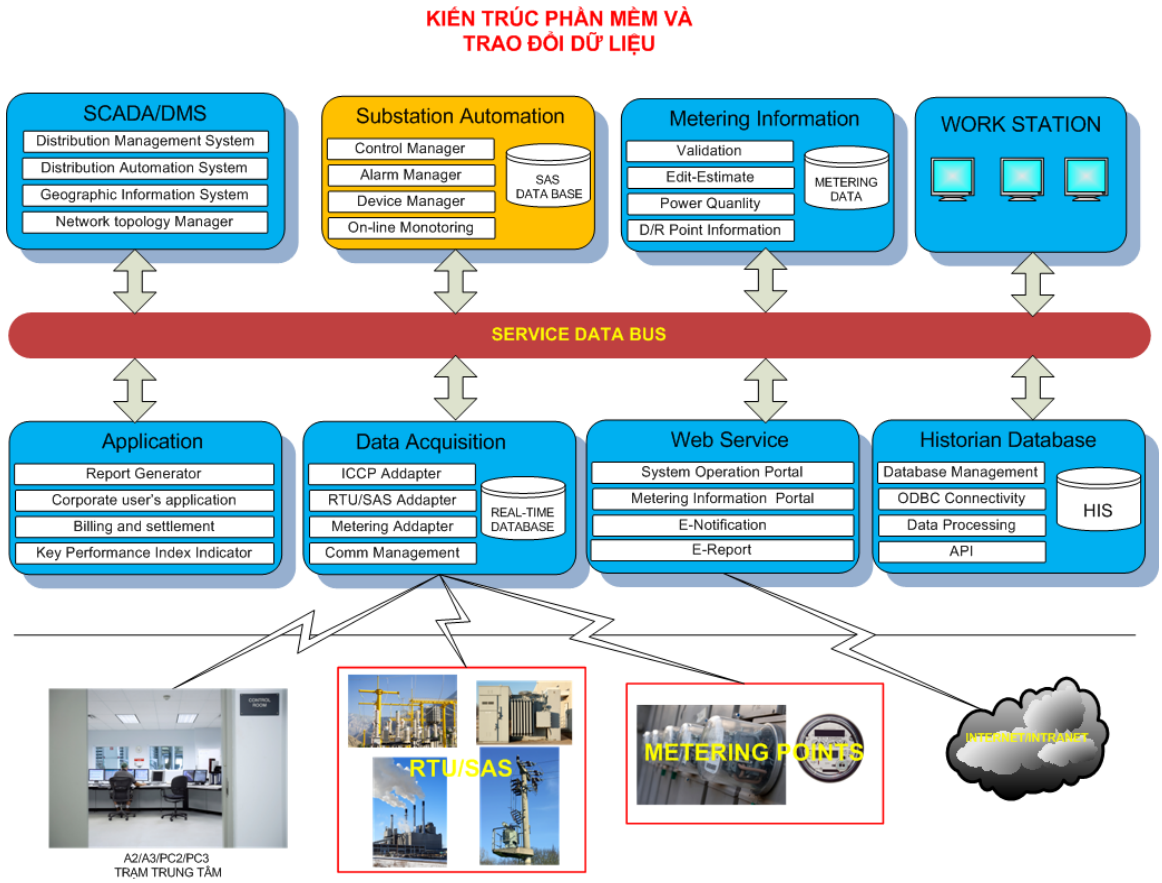

Figure 1-2: The Overall Information Transmission Architecture.

The main software modules of the software system include:

- Data collection module
- SCADA/DMS module
- Substation control module
- Metering data management module
- Historical data management module
- User application module
- Web-based information service module
- Human-machine interface module for working stations

With a structure that uses service data bus for the entire company and in meeting the needs of users registered externally, plug-in softwares can be developed to be easily integrated into the system. The process of information exchange with other systems or additional softwares can be done via standard interfaces or files such as: DDE, OPC, .CSV, .XML, and CIM.

The substation control module is a part of the integrated central system. This module can exchange and share information with other modules in specific applications and processes. This integrated structure allows users to easily access different types of data in performing their tasks. Moreover, with a system designed in this way, data can replace and complement each others in cases of failure of data acquisition equipment or communication.

2. Substation-level Data Collection and Processing System

2.1. Substation-level System Architecture

In order to utilize devices already installed and in consideration of the capability for connection to central systems for the remote control of unmanned substations, the overall architecture of the integrated monitoring and control system @Station, which is researched and developed by ATS (Applied Technical Systems Company Limited), is described in the below diagram.

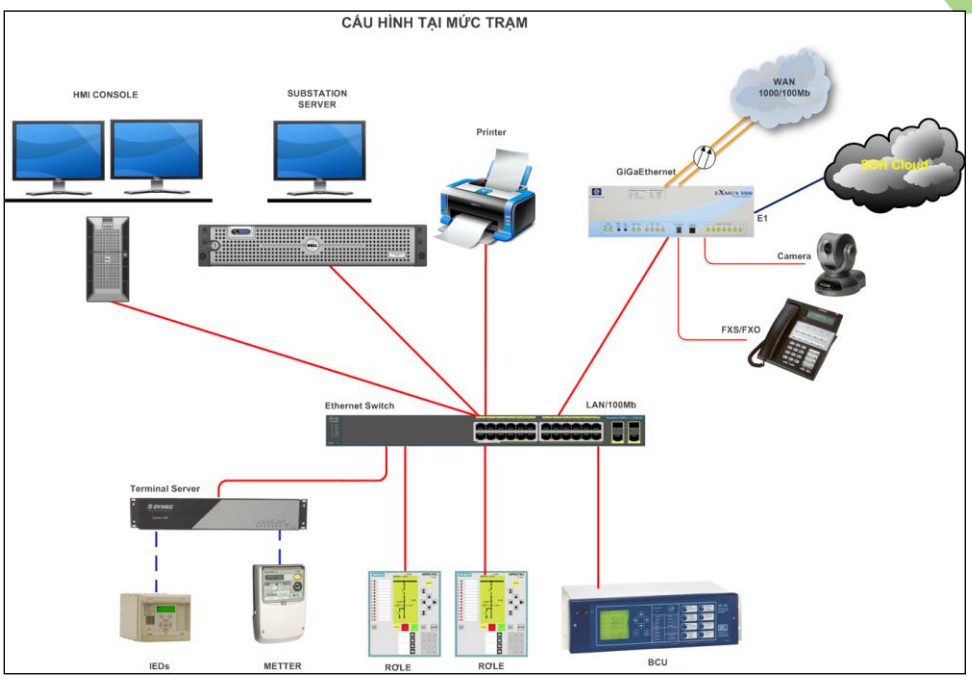

Figure 2-1: Communication Architecture at Substation Level

2.2. The key design attributes of the System:

- Open structure – allows different options for different phases of applications deployement in accordance with specific requirements within the structural limit. The systems complies with *de jour* standards, such as IEC, ISO, and IEEE, and *de factor* standards, such as DNP and Modbus.
- Maintenance capability – supports routine operation and local maintenance of components without requiring assistance from suppliers.
- Application Development Platform - provides a strong platform for the development of applications for device monitoring and control as well as data and information communication with internal management systems and external user applications.
- Future-Focused Strategy - the structure and functions of the software are designed in consideration of future technology trends and aim to resolve management problems of the future power industry.
- Integration Capability – has the ability to integrate in a flexbile manner new components, solutions and advanced applications (such as SCADA/EMS/DMS/AMI), ready to serve as a platform for future SmartGrid applications.

The significant feature of this system is its uniformity due to ATS's use of a 3-layer structure in processing data and applications for users on the basis of a high-speed information transmission system (100/1000Mb/s). Consequently, the process of control

at the Substation level and at the Centre level is absolutely the same. System operators in the centre, depending on their assigned tasks, will receive appropriate data and control authority as if they are working from the substation control room.

3. Information Transmission Architecture

Using the lastest technology in information transmission techniques and by evaluating the capability of the existing optic-fibre cable network of organizations within EVN, ATS has proposed a technical solution for the information transmission network, serving the management of the power system operation and business process.

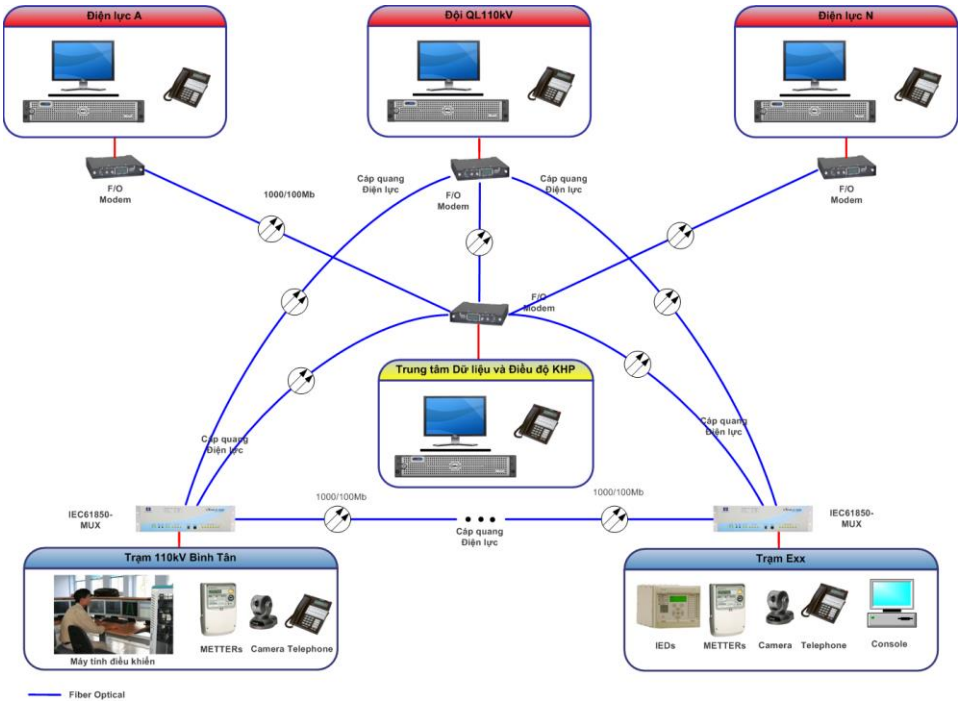

Figure 3-1: Overall Architecture of the Data Link System

In this information transmission system, substations, central stations, and control centres as well as SCADA/EMS/DMS/AMI systems of companies and dispatch centres are connected to a WAN network (1000/100Mb/s) via an optic-fibre system and operate as a main connection network. All equipments, working stations and user computers are connected to this network using the IP address system. Furthermore, services such as voice, hotline phone and E1 communication are also transmitted through TDMoIP.

The main equipments proposed are the equipments used for the transmission of information in substations and power systems. These equipments are designed in compliance with

IEC61850 and IEC 25 standards; their durability is in compliance with industrial standards for working environment temperature of up to +70^{o}C.

The application structure of JumboSwitch is shown in the below figure.

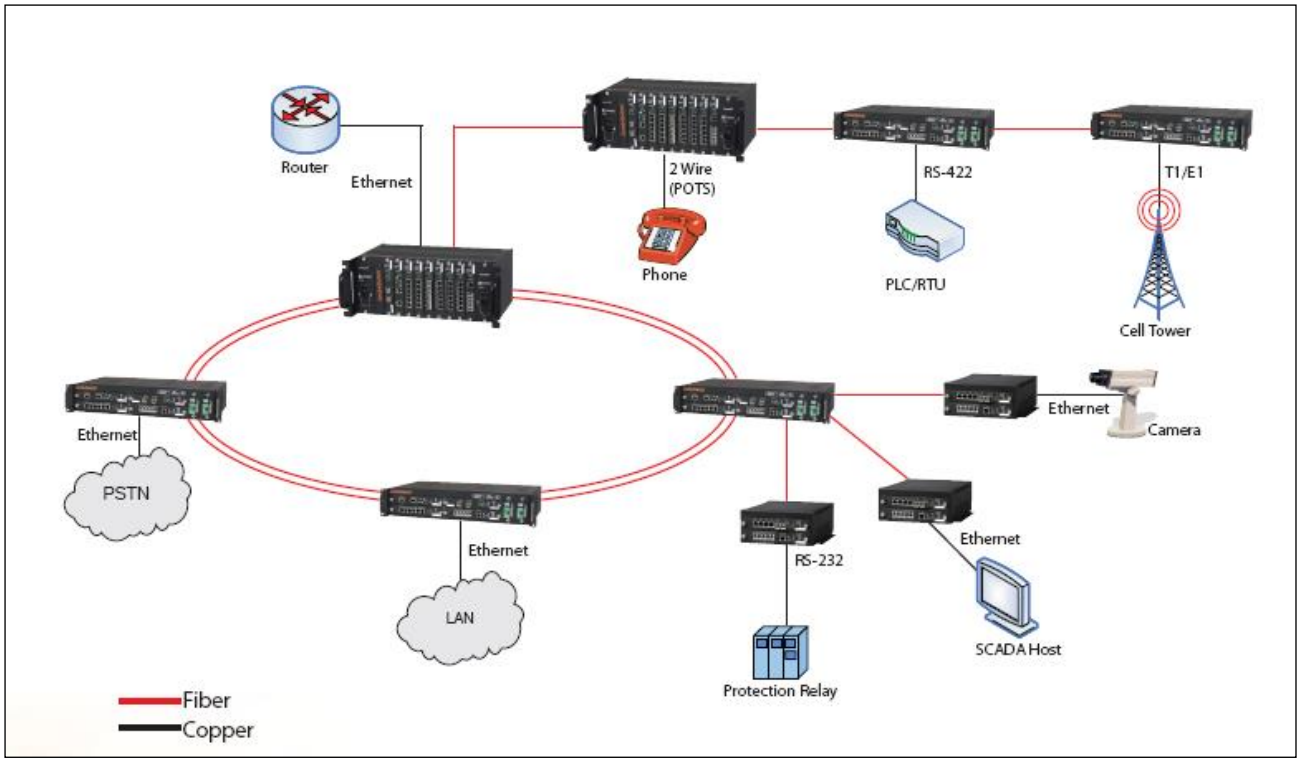

Figure 3-2: JumboSwitch Application Model

This is a WAN/LAN structure with multiple purposes and multiple services on the basis of IP with devices complying with industrial standards appropriate for the working environment of the current power system.

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