Intelligent Distribution Automation Node (IDAN)

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Todays' challenges

With the large number of intelligent devices deployed in the distribution grid, several challenges need to be addressed in order to ensure grid reliability and to reduce operational costs. Monitoring and controlling a device as well as gathering other information needs to be efficient and automated for a SCADA engineer. Current devices in the distribution field are geographically deployed in different areas and are not necessarily connected to the utility communication network. Moreover, remote areas such as rural sections of a power line are not adjacent to a substation and their related devices need to be monitored and controlled.

Connecting these devices individually requires a large number of radios and increased data bandwidth. Without a network connection, a maintenance engineer must travel a long time to reach the site in order to investigate and fix issues when a problem occurs. This has impacts on operational expenses and response time for utilities. The problem becomes more relevant when manpower is reduced.

Using the Intelligent Distribution Automation Node (IDAN) solution proposed by Eaton to connect a group of IEDs from a given area to a communication network addresses the aforementioned challenges. The proposed solution can be also used in other applications such as Distributed Generation, Microgrids, Sensors and to connect large number of stations that do not have SCADA/RTU capabilities and where upgrading these stations is cost prohibitive.

The IDAN solution is based on reliable components to prevent or to reduce downtime and lower the risk
of penalties. The solution is easy to deploy thus reducing the related engineering cost compared to the cost of a substation upgrade.

The proposed solution

The main components making-up the IDAN are the following (refer to Figure 1):

- NEMA 4 Stainless enclosure
  - Protected by lock and monitored door alarm to prevent access by unauthorized personal (hazardous components)
  - Protected against environmental hazards such as water, dust…
- Eaton's substation-grade gateway, the SMP 4/DP:
  - Designed to operate in harsh environments and severe temperature conditions (-40 C°, +85 C°)
  - Supports most of communication protocols in the industry
  - Helps utility meeting NERC-CIP requirements with enhanced security features
- Cell Radio communication module to connect the IDAN to the Utility network through a secure VPN tunnel
- UPS, Batteries to ensure power autonomy and a wide variety of application-specific sensors
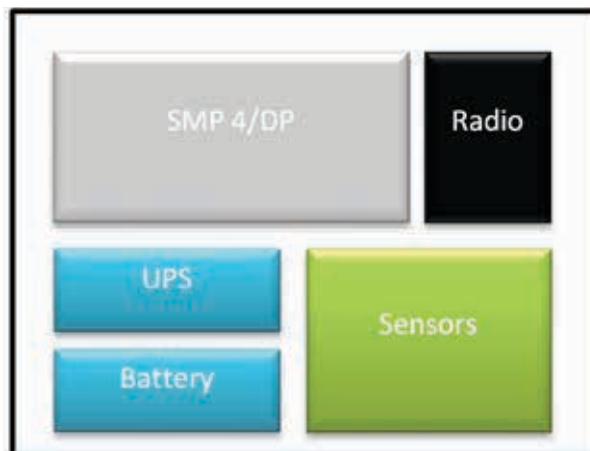

Figure 1. Overview of the Intelligent Distribution Automation Node architecture

Any device deployed in the field and located in a IDAN area, can be connected to SCADA as the SMP 4/DP supports more than 80 communication protocols. The SMP 4/DP is easily configurable using device templates and can be accessed and managed remotely by maintenance Engineers.

Communication to SCADA is performed through a dedicated VPN tunnel using TLS encryption thanks to the SMP 4/DP enhanced security features.

Using the SMP 4/DP tranparent connection (Passthrough) function, secure remote IED access allows maintenance Engineers to establish a secured connection to any device in the field and to change devices
settings using the related vendor maintenance tool.

Solution benefits

Figure 2 shows an example of an Intelligent Distribution Automation Node successfully deployed in the field.

Figure 2: An Intelligent Distribution Automation Node deployed in the field

The integration of the IDAN solution in the Distribution Grid (see Figure 3) offers several technical and operational benefits. The major ones are explained in the following sections.
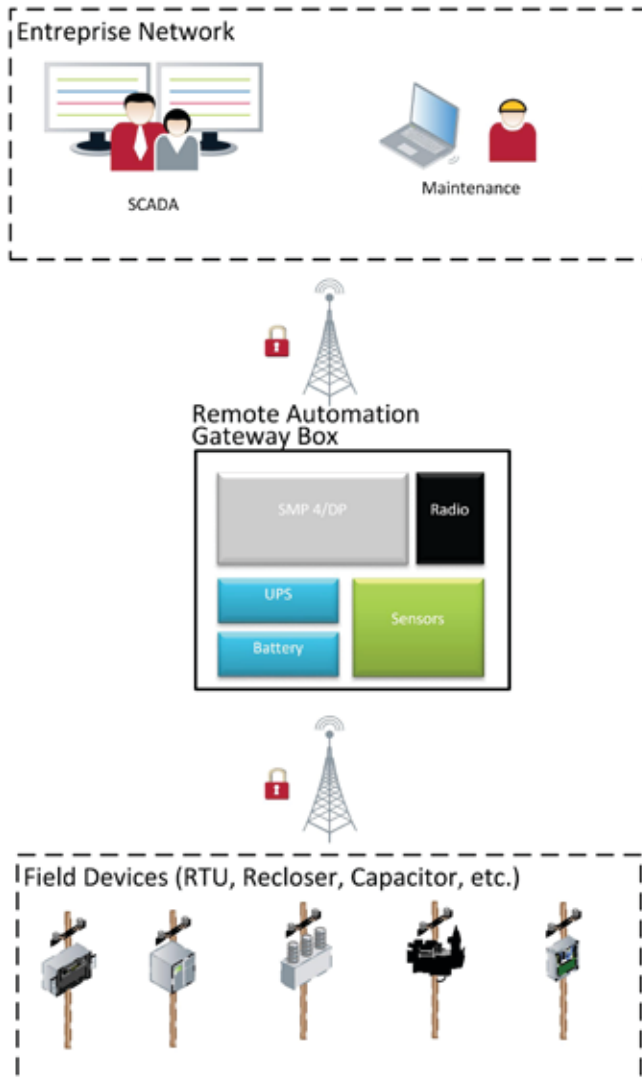

Figure 3. Integrating an Intelligent Distribution Automation Node in the distribution grid

Cost effectiveness

The IDAN solution is easily configurable. Using existing predefined device templates, the SMP 4/DP Gateway can be configured to integrate a set of devices deployed in a specific area. The Cell Modem can be also preconfigured with a secure and permanent connection to the Utility network. The system can be programmed, tested and packaged for field installation such that once powered in the field, the unit is ready to be polled by the utility head end. This makes the deployment of the IDAN simple and cost effective.

Furthermore, using the IDAN does not require any substation outage. This significantly reduces operational costs.

A traditional substation upgrade may cost around 250k$ whereas the proposed Intelligent Distribution Automation Node solution costs around 15k$ which is nearly 15 times less expensive.

Reliability

All components used in the IDAN are compliant with industry standards. The NEMA 4 enclosure allows using the solution in various climate conditions and prevents any possible damage to the equipment.

The IDAN solution is based on an extremely reliable and rugged substation grade gateway built on a real time operating system (RTOS) allowing the gateway to operate in a harsh environment. This substation gateway acts as a data concentrator and protocol conversion platform with a proven history in data acquisition and distribution automation applications. It is widely used in thousands of utility applications worldwide.

Cybersecurity

Connecting field devices to utility network must comply with Cybecsecurity guidelines. The IDAN solution offers a set of security features to help utilities meeting most cybersecurity requirements:

- A secure connection to the SCADA network can be established using a VPN tunnel.
- Changing field device settings using vendor maintenance tools becomes possible using the SMP 4/DP transparent connection (Passthrough) function. A transparent connection establishes an encrypted session between a maintenance computer and a field device connected to the SMP 4/DP.

Scalability and interoperability

Since the SMP 4/DP gateway supports more than 80 communication protocols, it is possible to integrate most field devices in the industry to the SCADA and perform real time status monitoring and control. It also allows retrieval of non-operational data such as sequence of events or oscillography for further analysis.

Getting assistance

If you have any questions regarding the performance, application, testing or repair of this or any other component of this Eaton product, do not hesitate to contact us. Our staff will be happy to assist you.

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