Basic considerations for IED interfaces

Technical Note

IED data profiles multiply substation reporting requirements; most IEDs do not discriminate between real–time and operational data

DNP3 accuracy and security greatly increase communications overhead

NTU–7500 RTUs combine traditional I/O functions with substation server capability

Virtual RTU technology segregates data by use or priority, streamlining communications

With the wide–scale implementation of DNP3 protocol in IEDs, direct communication from the SCADA master to the IED becomes possible. DNP3 is the first protocol with both sufficient security and deployment to make this a consideration. Two major technical concerns must be addressed before implementing a master–IED interface: IED data profile impact on the SCADA master; and IED and DNP3 impact on the SCADA communications system.

Impact of IED data profiles

Most IEDs on the market today have data profiles (databases) ranging in size from several hundred points to several thousand points. Perhaps ten percent of the total points are of any value to the system operator, yet when polled, most IEDs provide complete database reports. While a traditional substation database has about 200 points, a substation fully equipped with IEDs might have a database of 20,000 points. Setting up and maintaining substation databases of this magnitude in the SCADA master would be a massive task. Moreover, most of the data is of no value to real–time system operation.

For example, a relay may have 1200 points but only 20 with information that is critical to the system operator. If the relay has direct communication to the master and all the points are brought back, the master database becomes very unwieldy and communication traffic is very high. Some IEDs allow the user to configure which data points will be reported on a poll. But if the IED is configured to supply only real–time operational data, then data that might be of interest to relay engineers and others is locked in the IED. An engineer who needs to collect fault analysis data points will need to do it locally or set up an alternate communication path to retrieve this data.

Technical Note

The best solution is to have the feeder IEDs communicate to a database server in the substation. The server supplies real–time data under normal operating conditions and operational data following system emergency conditions. The emergency operational data can be retrieved by the SCADA master over the SCADA communication system and delivered to engineering or anyone else who may need the information.

DNP3 communications issues

DNP3 was designed to be very flexible, powerful, and secure. To meet these goals, DNP3 uses cyclic redundancy checks (CRCs). CRCs are mathematical values based on solving a polynomial equation using the bit values of the message structure as inputs. DNP3 calculates a CRC after every 16 message bytes to deliver an extremely accurate message in a noisy environment. Unfortunately, this continuous checking creates significant communications overhead.

If DNP3 is used to interface to a large number of IEDs, communication systems throughput would be consumed with overhead. The best solution to this congestion is a substation server with a large database.

Substation server solutions

Our NTU-7500 product family was designed to fill the role of substation host, operating as a client to collect data from directly connected I/O points and/or IEDs. An NTU-7500 series RTU can also operate as a server, communicating with one or more remote clients using *Virtual RTUs*™. *Virtual RTUs* are subsets of I/O points mapped from directly connected and IED points. For example, points critical to the system operator could be mapped to a "critical data" *Virtual RTU* that is scanned every poll by the master. Fault analysis data can be mapped to a "fault analysis" *Virtual RTU* which is polled on demand. The NTU-7500 series RTU can be configured to provide the data needed while making maximum use of the communication system.

Optional NTU-7500 application routines can provide fault detection and isolation using feeder IEDs (if they are properly equipped). The faulted feeder section can be isolated, while the non–faulted sections are restored. Other programmable logic routines may also be added.

ADVANCED CONTROL SYSTEMS

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