Dual Redundant Communications for DA System

The Israel Electric Corporation (IEC) implemented a Distribution Automation (DA) project for upgrading the control of their Medium Voltage (MV) grid at selected sections where weather and over-load related problems were likely to occur. The MV power grid operated by the IEC is over 16,000 km long, and primarily comprises of
11-33 kV range overhead lines. For this system Motorola supplied MOSCAD based Remote Terminal Units (RTUs) serving pole mounted Air-Break switches, SF-6 type Load Break Sectionalizers (LBS) and Internal Transformer Station switchgears (ITS). The system allows operator initiated Fault Isolation and System Restoration (FISR), and it may also perform an automatic process based on a built-in algorithm.

As of today, the IEC system contains hundreds of RTUs, which are controlled from five regional Distribution Control Centers (DCCs). The recently installed DCCs use the PC based Wizcon application software. Each DCC has an Application Programming Interface (API) and is connected to a TCP/IP Gateway and a Front Interface Unit (FIU). The system supports; Polling, Report by Exception and Contention type communication methods. This is very important since a large number of RTUs share the same RF channels.

Communications Protocol Considerations

Use of RF channels for DA systems is very convenient, however this media is often subject to natural interference caused by other radio units using the same channel. Utilizing a suitable communication protocol helps minimizing these limitations. Protocol buzzwords such as UCA, DNP 3.0, IEC 870, MODBUS, etc. are widely used by industry experts, however a layperson might be confused with technical details.

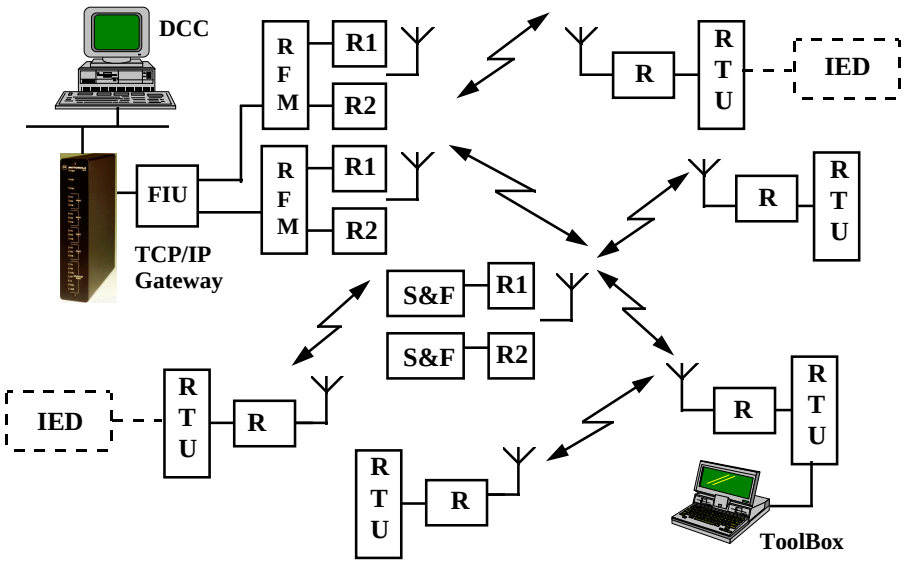
Modern SCADA systems are based on the Seven Layer concept, designed according to guidelines of the International Standards Organization (ISO) for Open Systems Interconnection (OSI). The advantage of the seven layers protocol suit is in separating the communications and application functionalities. By adopting this approach, the project integrator does not have to deal with functions such as RTU operation diagnostics, networking, communications error handling, confirming of the message integrity, etc. These are taken care of by the structure of the seven layer protocol, and as a result the programmer has to worry only about his application.

The IEC system utilizes the Motorola Data Link Communications (MDLC) protocol. The MDLC is an advanced seven layer protocol, and it reliably supports connection of multiple media (RF, Wireline, Fibre-optics, etc.) into an integrated communications scheme.

Dual RF Channel Communications

The IEC addressed their concerns related to possible RF interference and they decided to utilize a dual redundant communication. The system utilizes several pairs of conventional channels in the VHF band, and re-use these as topographical conditions allows (distances, hills, etc.). In case an RTU detects a long “channel busy” condition, or when a message was not acknowledged, it will automatically switch to the designated secondary channel.

After successfully completing the data transmission it initiated, the radio switches back to the default channel (see figure on next page for an illustration of communication links).



Summary

The IEC proceeds with expansion of their DA system, and plan to add thousands of remotely controlled sites. These include pole mounted SF-6 Load Break Switches, Internal Transformer Stations, remotely controlled Capacitor Banks, monitoring of Fault Detection devices, etc. All these report to five regional Distribution Control Centers located across the country. In addition to the DA system described above, the IEC took several other measures to improve reliability and service level of their MV power distribution system. From the feedback provided by their employees, the management learned that they have indeed benefited from implementing radio based remote control on their load break Sectionalizers switches. Implementing dual redundant communications in the critical sections of the system resulted in more reliable system operation, and increased customer satisfaction.