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Implementing Automation Solutions for Mobile Substations

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Electric utilities worldwide are going through a process aimed at achieving higher operating reliability, lowering maintenance costs, deferring unnecessary investments, and reducing their overall operating costs. Substation Automation (SA) enables utilities to achieve these objectives even without allocation budgets for major refurbishing of the electric equipment.

High Voltage to Medium Voltage (HV/MV) electric substations are designed for manned operation or for remote control. Communication among these substations and a Distribution Management System (DMS) normally utilizes line or fiber optic network, as large amounts of data have to be transferred throughout the communications pipe. To allow remote control, these HV-MV substations implement Remote Terminal Units (RTUs), which are configured to handle up to 4000 points for a specific site. In these substations, the RTUs handle all the Input/Output (I/O) points connected to Potential Transformers (PT), Current Transformers (CT), various protection relays, temperature sensors, security sensors, etc. Implementation of remote control solutions, allows for better monitoring of loading conditions, alarm reporting, quick response to sudden events, voltage regulation on the MV level, performance of power factor correction, etc.

When a mobile HV/MV substation needs to be installed, communications connectivity is often not available at the site. Adding that substation RTU to the DMS system (which may utilize a different communications protocol), is also a complex and time consuming task.

Proposed Solution

The following description offers a practical solution that is suitable for temporary substations and emergency installations, making it extremely easy to add remote monitoring and control of the mobile substation to the DMS scheme. Motorola's MOSCAD based system allows a quick, low cost and simple-to-implement solution, which allows the use of almost any type of communications media including: VHF, UHF, Conventional, Motorola Trunked radio, MPT 1327 infrastructures and Spread Spectrum radio.

At the DMS control center, expanding the definition of an existing substation installation (i.e. adding more I/Os for monitoring and control) is a relatively simple task compared to defining a new substation with another (new) type of RTU, and another communications protocol.

As shown in Figure 1, the idea is to install two standard MOSCAD RTUs, one at the mobile substation, and another in the control room of a nearby permanent substation. Communications among these RTUs (the data flows in both direction utilizing RTU-to-RTU link) can involve one or more communications media, which are integrated into a single communications scheme, linking the two sites.

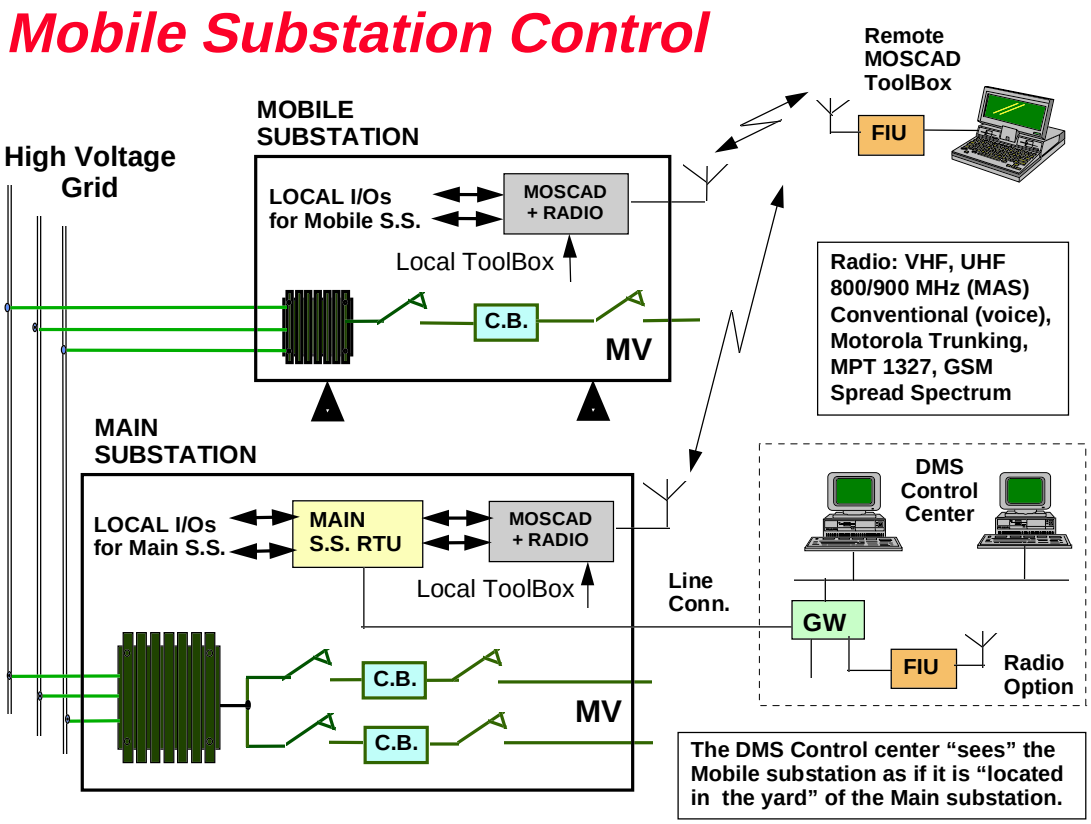

Figure 1. Mobile substation control

According to the proposed concept, all Digital Input (DI) values to the MOSCAD RTU (at the mobile substation) are transferred via radio to the Digital Output (DO) of the MOSCAD RTU at the main substation location. Here each DO from the MOSCAD RTU is fed to the DI of the main substation RTU. Similarly, all DO commands at the main substation RTU (intended to control the mobile substation) are fed to the DIs of the MOSCAD RTU, transferred to the MOSCAD RTU at the mobile substation, and appear as DOs, aimed to control devices at the mobile substation.

In practice, what we have here, is "mirroring" of all DI values at the mobile substation RTU to DIs at the main substation RTU and all DO commands from the main substation RTUs to DOs at the mobile substation RTU. The program in the MOSCAD RTU is fixed, and is suitable for any substation RTU configuration, regardless if some of the DI or DO connections are utilized or not. Alternatively, if an RF link can be established, the MOSCAD RTU at the mobile substation can directly communicate with the DMS control center using the available media.

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