RECENT DEVELOPMENTS IN INDUSTRIAL COMMUNICATIONS SYSTEMS AND PROGRAMMING STANDARDS AND THEIR IMPACT ON CONTROL SYSTEM ARCHITECTURE

Andrew Verwer and Vasilios Lakkas,

Abstract

Fieldbus technology has been in use in the manufacturing and process industries for control and monitoring for over 15 years. The benefits of fieldbus over conventional (point-to-point) connection are clear and well known. Recently, significant developments have occurred in fieldbus technologies that have made them applicable to a far wider range of applications including: high reliability and redundant control systems; safety-critical systems; highly deterministic high-speed real-time control; distributed control and intelligent sensors/actuators. Ethernet and Information Technology (IT) standards are widely used at the higher levels of the control system hierarchy, however these technologies cannot generally meet the determinism requirements of real-time control. Ethernet is however beginning to be used at the lower levels of the control system and in field-mounted devices.

Another development that has occurred is the way that standard control system programming languages are being used in a diverse range of control system devices. The standardisation of these languages means that control system software is now transportable across different manufacturer’s devices and between different types of device. For example: drives and servos, Programmable Logic Controllers (PLCs), distributed controllers, instruments, actuators, Human-Machine Interfaces (HMIs) etc. are all able to be programmed in a uniform and well-structured way.

This paper examines the recent developments and trends in industrial communications, fieldbus technology and programming methodologies. It shows how these developments have influenced, and will influence in the future, control system architecture. The paper gives a brief survey of fieldbus development to the present and examines how fieldbus is beginning to be used in new areas, such as safety critical applications and high-speed multi-axis servo control (robotics). The impact of open control system programming standards (IEC61131-3 and IEC1499) is also examined. The paper then looks at developments in Industrial Ethernet and in particular PROFINet. The paper shows how PROFINet, which uses standard Ethernet communications, is being used for high-speed deterministic control along-side standard TCP/IP communications. PROFINet also provides a simple path for integrating Ethernet with existing fieldbus systems, providing a simple uniform way to integrate horizontally between different fieldbusses and vertically with Supervisory Control and Data Acquisition (SCADA) systems and IT systems.

The above changes are influencing the architecture of control systems, data acquisition systems and safety systems. The benefits of integration of these diverse systems and the improvements in system engineering/software engineering are presented. Real applications are examined where fieldbus, Ethernet and open programming standards are being applied to a range of control, data acquisition and safety related applications.