2 Industrial Ethernet Protocol Wars: Fieldbus Revisited

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2.1. Introduction

Industrial Ethernet continues its march to lower levels of the plant hierarchy as both standards organizations and automation suppliers address criticisms of its suitability for plant floor applications. While Ethernet is an international standard, IEEE 802.3 specifies only the physical and data link layers of the 7-layer network stack. TCP/IP adds the further but minimal guarantee that two devices can exchange data with one another. In the industrial automation space, however, the lack of standard application and user layers translates to ongoing headaches concerning which devices may connect to the network, how devices interoperate on the network, and what level of functionality is supported.

Ethernet’s rise in prominence comes after a protracted, decade-plus long battle to standardize the process Fieldbus certification, and now many fear that industrial Ethernet protocol standardization will result in “Son of Fieldbus.” Judging by today’s market profile, this fear of Fieldbus revisited is well founded. The only solace lies in availability of common physical and network/transport layers and the need to reconcile just three or four upper-level Ethernet protocols compared to the ten or more Fieldbus protocols (Fig.2.1). While the Fieldbus wars were fought all the way down to the level of competing network media or physical layers, availability of a common Ethernet TCP/IP stack has largely moved the protocol wars to the higher-level application or “user” layers. This upper-layer functionality represents the new battleground where the strategies of competing industrial Ethernet protocols such as EtherNet/IP, PROFINet, IDA, and Foundation Fieldbus diverge.

Both IAONA and OPC are stepping in as third parties to try and mitigate the potential for still another fieldbus war. After its initial founding as still another industrial Ethernet specifying body, IAONA has positioned itself as a neutral umbrella organization for the disparate industrial Ethernet factions. The OPC foundation, on the other hand, has announced its intention to extend the existing OPC DA (Data Access) specification to allow run-time interoperability across systems based on disparate industrial Ethernet networks.
2.2.1 Competition Moves to Upper Layers

User layer functionality such as common device profiles and their associated object models is supposed to ensure device interoperability and interchangeability. Common EtherNet/IP device profiles, for example, are designed to ensure that a replacement device is configured to produce or consume the same basic set of I/O data and exhibits the same network behavior as the original. This upper-layer functionality (Fig. 2.2) represents the new battleground where the strategies of competing industrial Ethernet protocols such as EtherNet/IP, PROFINet, IDA, and Foundation Fieldbus diverge.

The competitive landscape parts even further at the network configuration level. While each protocol specifies some configuration parameters, vendors augment this functionality with their own proprietary network configuration tools that often add incremental functionality to their own devices or systems versus those of competitors. As more and more of the industrial network is standardized in first the industry standard Ethernet TCP/IP protocol, then the higher-level industrial Ethernet protocol specifications, these vendor-specific network configuration tools and associated software assume even greater importance in control system selection.

When considering industrial Ethernet for control applications, varying interpretations of often-broad protocol specifications are leading some end users to implement homogenous vendor environments even when a common higher-level protocol is employed. This strategy stems from the bottom-line need for correct interpretation of control messages among plant floor devices and concern that devices from different vendors, even those supporting the same protocol, may not