Field Device Tool (FDT®) Technology for the Process Automation and Manufacturing Industries

An FDT Joint Interest Group White Paper

Fieldbus represents both an opportunity and a challenge for the automation industry

Digital fieldbus technologies offer tremendous potential benefits for the automation industry. Ideally, digital fieldbus communications should enable users to easily integrate all intelligent field devices and the wealth of information they contain into their control systems, while at the same time reducing costs for field installation.

However, since modern control systems can encompass such a broad range of devices (sensors, valves, actuators, analyzers, drives, PLCs, safety systems, etc.), and multiple fieldbusses and vendor toolsets are in effect, the effort required to configure, integrate, monitor, and support all these different types of devices can actually increase – rather than decrease – the burden on today's understaffed process and manufacturing plants. Today's multi-vendor, multi-protocol environment can also make it difficult to achieve an integrated, plant-wide information view.

Instead, what end users want is a standard interface that connects any automation system to any device, providing them with the freedom to choose the best device fit for their application, irrespective of supplier or communication protocol.

They want this "open" interface to access all the information available in intelligent field devices, even the most complex ones. The specialized applications should support the devices through all phases of their life cycle and support engineering, operation, monitoring, calibration, maintenance and diagnostics.

This information should be displayed on a standard graphical interface and the configuration method should be easy to learn and easy to use.

Finally, whatever the solution, it should evolve with the state of the art in communication and information technologies, so that the automation investment is protected in the future.

FDT technology builds upon and enhances existing fieldbus technology to enable users to achieve these benefits.

FDT technology helps to unlock the potential of fieldbus

FDT (Field Device Tool) technology standardizes the communication interface between field devices and systems. The key feature is its independence from the communication protocol and the software environment of either the device or the host system. FDT allows any device to be accessed from any host through any protocol.

Here’s how it works.

The device supplier develops a software driver called Device Type Manager (DTM) for each of its devices or group of devices. In general terms, DTMs can be compared with printer drivers, as we know them from our office PCs.
The DTM encapsulates all the device-specific data, functions and business rules such as the device structure, its communication capabilities, internal dependencies, and the Human Machine Interface (HMI) structure. The DTMs provide functions for accessing device parameters, configuring and operating the devices, and diagnosing problems. DTMs can range from a simple Graphical User Interface (GUI) for setting device parameters to a highly sophisticated application capable of performing complex real-time calculations for diagnosis and maintenance purposes.

By itself, a DTM is not executable software. It only comes to life in a FDT container program, or a “frame” application.

The system (host) environment has a FDT “container” that defines a set of interfaces between the hosting application and the “device drivers.” Frame applications can be device configuration tools, control system-engineering tools, operator consoles or asset management tools.

The frame application also contains the communication component to interface the host system with the specific fieldbus communication (one each for HART, PROFIBUS, FOUNDATION fieldbus, etc.).
The FDT container initiates the DTM and generally interfaces the device to the system engineering and operating environment.

FDT is based on Microsoft’s familiar COM and Active X technologies.

FDT uses XML for data exchange between Frame Application and DTMs. In this manner, it is possible to keep the FDT interfaces very generic and hide the fieldbus specific content in XML documents. This also allows easy extension of FDT to additional fieldbusses, just by adding the appropriate XML schemes.

FDT is highly scalable with a small set of mandatory interfaces, plus any number of optional interfaces. This enables FDT to be easily adapted to the needs of a special application or fieldbus. Each interface reflects certain functionality, such as configuration or display of measured values. This scalable approach enables individual DTMs to directly reflect the device capabilities
FDT supports nested DTM. This simplifies the building of complex communication hierarchies, which can be further expanded to encompass communication protocols not initially supported by the hosting configuration tool. The “nested communication” principle enables heterogeneous network topologies using different protocols.

Fig. 1 shows an example of an heterogeneous communication path between a device user interface (stand alone engineering tool, operator console, host engineering console) and a HART device over a PROFIBUS communication line. In this picture, DTM 3 represents both the user interface and the driver software (in this case, for a proprietary host environment). DTM 1 has an interface, which “understands” this proprietary protocol, converts it into PROFIBUS and sends it to the communication component in the FDT container program. The parameter is transmitted over PROFIBUS to the field device. When it reaches the field level, it follows the reverse path, with the I/O interface converting it from PROFIBUS into HART and sending it to the device.

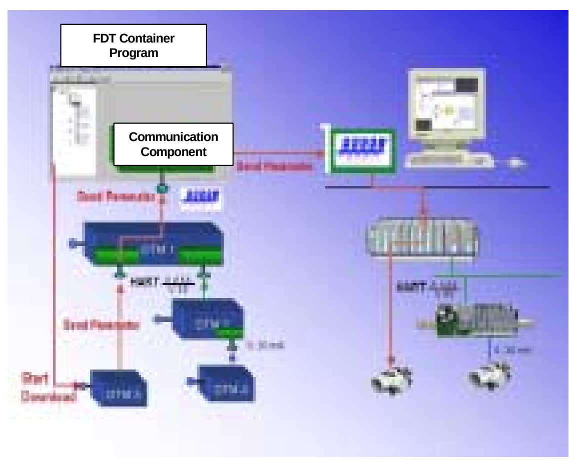

Fig. 1: Nested DTMs in a heterogeneous communication path

FDT is extendable by adding new interfaces for functional enhancements. As a result, future upward compatible extensions are possible without affecting existing solutions.

Component-oriented software has many advantages but also requires considerable effort to maintain the interfaces. This mandates an elaborate and "bulletproof" version management system.

FDT acknowledges this fact by using XML as the interface language. Data is exchanged between the DTM and FDT container program via XML documents. This results in lean software interfaces through which a lot of data can be transported. Instead of transferring fixed data types between components (in a pre-defined sequence), the transfer is accomplished through an XML document. In this manner, the client and the server only need to match the notation of their scalar types.

FDT leverages and expands existing Device Description (DD) languages

FDT technology complements and expands, existing device description languages. It does not replace but rather builds upon existing DDs. In particular, FDT expands the capabilities of DD for complex devices. Device Description languages have limitations in the graphical representation of the device at the user interface and allow only a limited integration of special features. FDT/DTM removes these limitations.

Existing DDs can be used to build DTMs.
The effort required to develop a DTM will depend on the complexity of the device. Simple DTMs can be easily built from existing DDs. Building DTMs for more complex devices requires greater effort. A number of companies offer tools, consulting services, expertise and other resources to support DTM development.

FDT technology has already been implemented and proven in process plants

FDT technology has already been implemented in plants on several continents. There are many installed references worldwide, including Germany, France, China, Korea, India, Mexico, Venezuela. An impressive reference for FDT is H505, a new chemical plant built by BASF (a world leading global chemical company) at their Ludwigshafen facility in Germany. In this plant, there are over 15,000 I/Os using HART protocol and devices from four different suppliers all integrated with FDT/DTM. The plant was commissioned in 2001.
Another large-scale application is the new Krupp-Thyssen coking plant at Schwelgern, Duisburg in Germany. This is the world largest coking plant and with 25.000 I/Os the largest FDT/DTM installation sofar. The plant will be fully operative in spring 2003.

The FDT Joint Interest Group of companies (FDT JIG)

The not-for-profit FDT JIG is a collaboration of international automation companies that support the proliferation of FDT/DTM technology. The group is open to all companies and organizations that wish to participate.

A number of FDT Joint Interest Group member companies demonstrated their FDT-compliant products and DTMs at a common exhibit at the HMI 2003 Hannover Show. These include ABB, Bartec, Endress + Hauser, Infoteam, Invensys, ifak system, Metso, M&M, Siemens and Vega.

Other companies that currently support FDT technology include, Buerkert, CEAG, Danfoss, ICS, Krohne, Sick A.G., Smar, Softing, Pepperl + Fuchs, Samson and Wika.

PNO has granted necessary rights to use the technology to the FDT JIG. PNO is the association of users of Profibus technology. FDT technology is available to all companies that wish to utilize it.

The mission of the FDT Group is to promote the acceptance and usage of FDT in the automation industry. This is clearly a long-term goal.

FDT has been tested and proven to work with HART and PROFIBUS. Products supporting these protocols are available from the FDT Joint Interest Group member companies.
A FDT prototype interface for FOUNDATION fieldbus was demonstrated at ISA 2002.

For more information on the technology and available products, please contact the representatives of the member companies at our booth at Hannover fair HMI 2003 and Achema 2003 or visit our web site at http://www.fdt-jig.org

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