FDT/DTM FRAMEWORK FOR NEW FIELD DEVICE TOOLS

TAKEUCHI Tetsuo [1]

We have developed FieldMate, a field device configuration software package offering a graphical interface and easy operation, by adopting FDT/DTM (Field Device Tool/Device Type Manager), a new open framework for field device tools. FDT defines the data exchange interface between field devices and each of the control systems, engineering tools and asset management system tools. A DTM is a software component that works on the framework and facilitates operation through a graphical interface. Many field device vendors including Yokogawa develop and provide DTMs which work on any control systems that have the same framework. FDT/DTM is becoming popular in not only the process automation industry but also the factory automation industry. This paper describes the characteristics of FDT/DTM and gives a technical overview.

INTRODUCTION

Many field devices are now being connected to process control systems through fieldbus communication. These field devices have intelligence, and so many settings and adjustments can be made through fieldbus communication. Conventionally, these operations have been done using dedicated terminals and host systems, but recently FDT/DTM-based software has become available that allows the work to be done through a Windows OS environment. Because FDT/DTM works as an open software execution environment for field devices, it can provide field device management software tools independent of a particular host system.

BACKGROUND OF FDT/DTM DEVELOPMENT

Field devices have gained intelligence along with the spread of digital communication. As the number of intelligent devices increases, the more complicated settings and adjustments needed to use the advanced functions in such devices have become required, and so some field device vendors now provide dedicated personal computers to supplement the dedicated terminals.

Along with the installation of intelligent devices in a plant, asset management systems have been introduced to collect and maintain information about field devices. In addition, these field devices have been made accessible from the host system in the plant as well as conventional dedicated terminals to make settings or adjustments. Though this host system uses the conventional EDDL (Electronic Device Description Language) technology, the vendor-supplied plug-in software must be used to make complicated settings or adjustments. However, this plug-in software must be created individually depending on the host system and imposes a significant workload on vendors.

The FDT Group has therefore proposed a software architecture where field devices can be set and adjusted in an open framework independent of a specific host system. This software architecture is called FDT (Field Device Tool) and allows the device setting software component called DTM (Device Type Manager) to operate on the FDT framework.
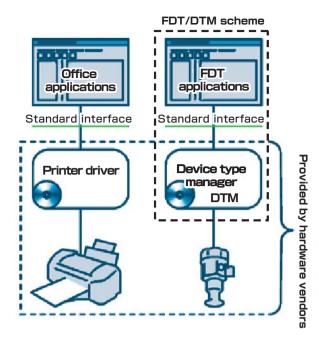
*1 YEA Singapore Development Centre R&D3

Figure 1 Comparison between Printer Driver and FDT

Figure 2 FDT Interface

FDT/DTM SPECIFICATIONS AND SOFTWARE CONFIGURATION

The FDT framework, which is called the FDT frame application, provides an environment for DTM operation. A software interface between this FDT frame application and DTM is called the FDT interface.

DTM contains two types of DTM: device DTM for field devices and communication DTM for field communication control. In addition, a gateway DTM is available to connect HART devices via the HART multiplexer or PROFIBUS and support communication between the devices.

As shown in Figure 1, the relation between the FDT frame application and DTM is similar to that between the Windows office application and printer driver. A dedicated printer driver is provided for each printer and a standard interface is available in each printer driver. The office applications can print data on any printer via this standard interface. In FDT, a DTM driver specific to a field device is provided and a standard interface is available in this driver. FDT frame applications such as the engineering system and asset management system can use the field devices via this FDT interface.

The FDT specification started to be prepared in 1998 by some conference members of the Zentralverband Elekrotechnikund Elekrinikindustrie (ZVEI). This specification has since been refined by the PROFIBUS working group and is now managed by a nonprofit organization, FDT Group AISBL, which consists of about 60 automation-related companies. In this organization, a technical committee consists of a specification working group, a test authentication working group and an interoperability project. The specification working group contains several teams responsible for maintainability, promotion activities for IEC, and
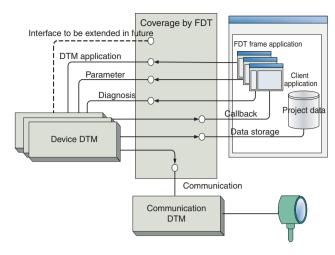
communication protocols, and it continues to contribute to specification improvement, new protocol support.

DTM employs the Microsoft Windows COM technology as the core and exchanges data between the FDT frame application and DTM in the XML document format. In addition, it employs Active X technology for the graphical user interface (GUI). In FDT, Active X control is displayed on the frame application and is connected to DTM for data exchange.

The EDDL-based host system employs a different GUI in each system. In contrast, FDT/DTM provides a GUI based on Active X, so the same GUI is available on each FDT frame application. In addition, FDT/DTM provides communication DTM to support various protocols for communication. When used in conjunction with a gateway DTM, it can support any communication topology involving complicated routes. Furthermore, FDT/DTM can also be used for protocols other than HART which is widely employed in the process control field, FOUNDATION™ fieldbus and PROFIBUS. At present, it can even be used for protocols such as DeviceNet, Interbus, AS-Interface and Modbus which are employed in the factory automation fields.

Device DTMs are classified into two types. One is a dedicated device DTM to support a specific field device and the other is a universal device DTM to apply for many field devices. The universal device DTM includes a generic DTM for supporting only the general parameters of each field device and a profile DTM, etc.

Though the dedicated device DTMs are provided by field device vendors, users could become confused in operation of DTMs if there are significant differences in GUIs among them. To avoid this, a DTM style guide has been prepared to define a certain standard.

Figure 2 depicts an FDT interface. In the FDT frame application, DTM-supplied GUI functions are run as Active X client applications and project data can be prepared to store such as DTM device parameter data there.

DTM and the FDT frame application cooperate with each other via the FDT interface. Each line in Figure 2 shows an interface.
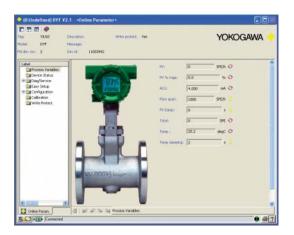
Figure 3 Device DTM Online Parameter Function GUI (Example)

Figure 4 Mass Flow Calculation Setup Operation Screen on the EJX910DTM

DEVICE DTM

The device DTM mainly provides the following GUI functions:
(1) Online parameter function
(2) Offline parameter function
(3) Process data monitor (observation) function
(4) Diagnosis function

The online parameter function directly communicates with a target field device to display or edit the parameters retained in the device. The parameters are classified into categories so that a desirable category can be selected via a tree view or tab to display the parameters of the category.

Adjustments such as device calibration can be made within this online parameter function; this function is used in the commissioning or maintenance phase.

The offline parameter function allows the parameters of a target field device to be manipulated in offline mode where no field device connection is required for communication. The parameters to be manipulated are not those within the device but the contents of internal memory called a data set. The data of a data set is saved in the project data of the FDT frame application as necessary. To achieve this, interfaces designed to save project data or read it are available in the engineering or maintenance phase.

The process data monitor (observation) function is used to check such as field device process data during commissioning or operation. Some DTMs can display process trend.

The diagnosis function displays the health status of a field device by using either the self-diagnosis function implemented in each device or the DTM diagnosis function.

Figure 3 shows an example of the GUI in the online parameter function. The device identification area in the upper part of the GUI lists the device tag names, model information, device ID numbers, etc. The menu tree view on the left lists device parameter categories for selection. The parameter manipulation area on the right lists the parameters belonging to the selected category. The user can check parameter values and edit them

here.

A print function for online or offline parameters is available in addition to GUI functions. A list of values of parameters over multiple GUI pages can be displayed on an Internet Explorer window as a printout image. When device settings are made on site, it is useful to be able to display setting data on the screen if a printer is not readily available. In this case, it is possible to save the displayed settings as a content file and then display it on-screen back at the office for data output via a printer.

Figure 4 shows a device DTM operation screen in our EJX910 multivariable pressure transmitter. This device concurrently measures three kinds of data: differential pressure, static pressure and temperature, and calculates and outputs the mass flow of a liquid or gas. To calculate the mass flow from these three factors, it is necessary to set many parameters such as the liquid's physical property data, orifice and nozzle shape. Especially in terms of physical property data, it is necessary to retrieve an enormous quantity of property data in the gas industry. Once this property data is stored in DTM, the user can decide the optimal mass flow calculation parameters required for a particular liquid by simply inputting the components of the liquid as instructed by the wizard and set it in the device. This function is available as an engineering tool as it is and can be used to easily change parameters for calculation not only when installing a device but also when patching during operation.

In addition, there is a simulation function to confirm that a desirable mass flow can be obtained from the specified parameters. This DTM can be used in all control systems equipped with the FDT frame applications.

FDT/DTM MERITS

The merits to end users are that DTM can be used in any process control system equipped with the FDT frame application function to set and adjust field devices. This means that the full lifecycle of each field device is covered, including device installation, commissioning, monitoring and diagnosis during operation and device maintenance. Because DTM can be

manipulated in the same manner on any frame application, it is not necessary to train the user even when the system is changed.

Furthermore, various protocols can be supported, so that devices using the new protocol can be added. And because DTM exists as a program, it is possible to provide functions based on advanced communication and information technologies.

The merits to device vendors are that the developed DTM software components can be used in all FDT frame applications and so it is not necessary to cope with various environments depending on the host system in use. In addition, DTM allows high-end user interfaces and advanced algorithms to be used, and so can be used together with field devices to provide users with various solutions. For example, it is possible not only to analyze diagnosis information read out from a field device but also to represent it as a 3D chart so that the user can readily grasp the problem.

CONCLUSION

To assist users, we have employed the FDT/DTM technology in FieldMate and PRM which are the core of Asset Excellence. In these applications, DTMs supplied from other field device vendors can be used to build a multi-vendor environment. As it is essential to maintain interoperability with devices from other hardware vendors, we will conduct interoperability tests for the devices and publish the results for users via our homepage.

Because the FDT/DTM technology can be used not only to build an open system independent of a specific vendor but also to implement various communication protocols and functions based on advanced technologies, it is highly popular with factory automation vendors as well as process automation vendors. This technology is expected to play a key role in automation applications in future. ◆

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