

CANopen and FDT

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Abstract
The FDT technology was introduced in process automation ten years ago. Now, more and more supporters in factory automation are embracing it. The technology allows the integrated management of devices from different vendors connected to different field-busses. This article gives an overview on the technology, and describes how it can be used in CANopen environments. It will explain the different types of DTMs (Device Type Manager), and the usage of CANopen-EDS.

End-users are demanding a single engineering environment to manage, commission, and configure any field device, from any device manufacturer, and connected to any communication technology. They want the flexibility to select any supplier's product and not be restricted to a specific vendor. End-users need an "open" technology that preserves the investments made in the field and changes of the installed base has to be avoided. They demand a technology that enables them to make use of any field device without restrictions.

They want to be able to select the best device fit for their application and access all the powerful native features of modern devices, without restriction imposed by the integration to a specific system. End-users need an open technology that preserves the investments made in installed field devices. Replacement or costly upgrades of the installed base have to be avoided. Seamless data exchange from devices to asset management applications is also required by end users.

Vendors do not want to adapt their software to different engineering environments. There shall be a single component supporting the capabilities of the device, which interoperates with many host-systems.

Broadly speaking, the FDT system can be compared to the printer driver system known from office applications. The printer is delivered with the corresponding driver. That driver implements standardized interfaces so that any office

application can make use of it. In FDT, the hardware (the field device in this case) is delivered with a driver called Device Type Manager (DTM), which has the standardized FDT interface. This allows any FDT-enabled application (so-called FDT Frame Application) to use it. FDT specifies these standardized software interfaces. They were defined in a general way, so that it is possible to design engineering environments that could manage any device from any manufacturer using an arbitrary field bus protocol as required by end users (Figure 1).

The device vendor provides the interfaces for the DTM, including communication capabilities to the device itself but also to other DTMs. The Device Type Manager of a device from one vendor is thus able to

interact with the Device Type Manager of a device from another vendor. This allows connecting products of different vendors, to have greater flexibility. It is possible to select the device best fitting the demands of the application, independent from vendor or communication protocol.

A change of the current installed base is not required. The existing network of buses, communication devices and field devices can be mapped to the FDT engineering system. The only thing needed is the Device Type Manager component representing the devices in the FDT Frame Application.

FDT is not limited to a predefined set of description semantics or graphic elements. Anything that can be done with software is possible inside the DTM. ▽

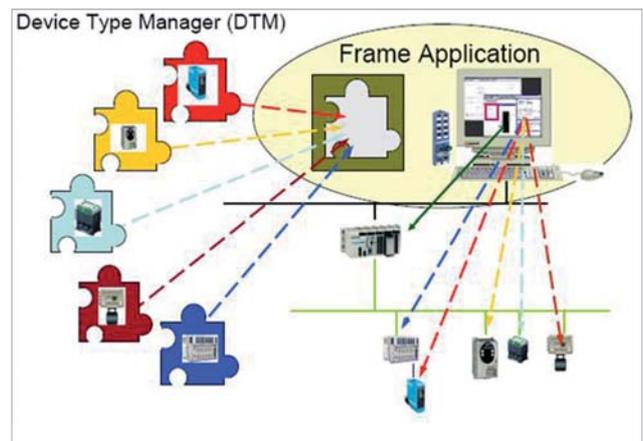


Figure 1: DTMs from different vendors can run in one FDT Frame Application

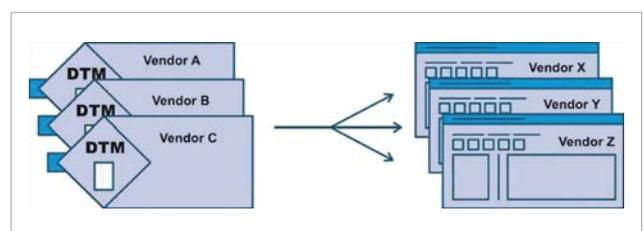
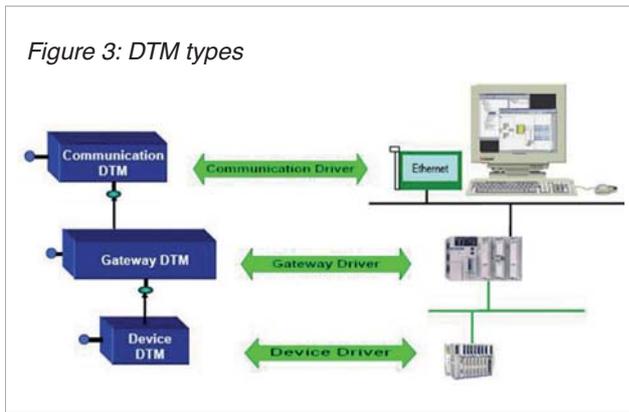


Figure 2: Any DTM can run in any FDT Frame Application

Figure 3: DTM types



This allows device vendors to implement any functionality they find useful for their customers and makes it easier for automation suppliers to evolve their software with the state of the art in communication and information technology. Investments in automation are protected well into the future.

Automation suppliers no longer have to worry about integration problems. Development costs due to diverse environments in host systems and field devices, which used to require customized interfaces for every combination, cease to exist. Resources can be invested in specialized, differentiated features that bring benefits to the end user.

FDT provides standard interfaces, which means that the DTM can be used either in automation systems or stand-alone asset management tools. The Device Type Manager is unique for each device type and needs to be built only once, thereby protecting vendors' investments (Figure 2). Its content is inaccessible to third parties and the vendor's know-how is protected.

A FDT Frame Application could be any tool, which provides the FDT interfaces to host a DTM. Examples of such tools are:

- ◆ Configuration tools to configure devices and system components
- ◆ Commissioning tools to set up devices in the field and download device-specific data

- ◆ Programming tools for PLCs
- ◆ Diagnostic tools to analyze device and system errors
- ◆ Asset Management tools to manage all the devices and components of a plant

In respect to FDT the Frame Application is responsible for the following tasks:

- ◆ Managing the catalog of installed DTMs
- ◆ Engineering of Topology
- ◆ Managing the lifecycle of a DTM
- ◆ Hosting the DTM User Interface
- ◆ Ensuring data persistence
- ◆ Printing documentation
- ◆ Managing Users
- ◆ Managing the audit trail
- ◆ ... and more depending on the application type

The Device Type Manager

The Device Type Manager (DTM) is a software component developed by the device manufacturer containing device-specific application software. It encapsulates device-specific data, functions, and business rules. The DTM is typically supplied with the device. It is not a stand-alone tool. The DTM always needs a FDT Frame Application to run.

There are different types of DTMs. Figure 3 shows an example of a network topology and the equivalent structure of DTMs in the engineering tool. The DTM type depends

on the device type the DTM represents. The access to the network, where the engineering tool is connected to is provided by a Communication DTM. This DTM allows the access to the network in a standard way.

A Gateway-DTM is responsible for the transformation of the protocol data from one network to the other. A Device-DTM represents the field device with all its capabilities.

A specific PLC tool Interface annex supports a deeper integration of FDT into PLC programming tools. With this interface it is possible to map process data communication technology independent to PLC variables.

The FDT Group has implemented a certification process for FDT products. Vendors can certify their DTMs and Frame Applications in seven accredited test sites around the world.

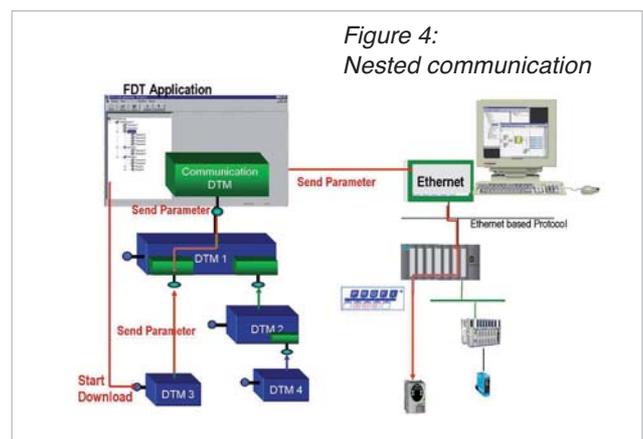
The FDT technology is the only one, which supports the integration of different vendor tools into one engineering environment and uses it with different field buses. This means the user can manage all the different field devices from a central engineering application and in a common and standardized way. This reduces the cost over the complete life-cycle of its plant. Due to the ability to cross network hierarchies in a heterogeneous network environment (called nested communication), it is possible to access a device at ▶

FDT Group

The FDT Group promotes the FDT technology. The data exchange between the FDT components is based on XML. Members of the international FDT Group have developed annexes for different communication technologies, where the services are selected and their XML format is described:

- ◆ CANopen
 - ◆ CC-Link
 - ◆ CIP Networks (DeviceNet, EtherNet/IP and CompoNet)
 - ◆ Foundation Fieldbus
 - ◆ HART
 - ◆ Interbus
 - ◆ IO-Link
 - ◆ Modbus SL and TCP
 - ◆ Profibus DP/PA
 - ◆ Profinet
 - ◆ Sercos III
- For Ethercat is an annex under construction.

Figure 4: Nested communication



any level of the automation pyramid from a central point (Figure 4). With this ability it is possible to manage CANopen devices located at lower levels from higher levels of the automation pyramid (e.g. configuration, diagnosis) with no need ac-

cess the device at its location. With FDT the administration of a complete plant is simplified and managed in a consistent way, it is possible to provide the automatic mapping of PDOs and there is no need to handle EDS file. The use of DTMs offers

much more flexibility for device management than static device descriptions (e.g. GUI, dynamic data management). Figure 7 shows an example from a Drives DTM of Schneider Electric configuring a closed-loop control.

References
 FDT Specification V1.2.1, FDT Group (www.fdtgroup.org)
 FDT Annex for CANopen V1.0, FDT Group, July 2009
 FDT Technical Description, FDT Group, April 2007
 FDT Applications for Drives, Jürgen Fieß at FDT FA Forum, September 2011

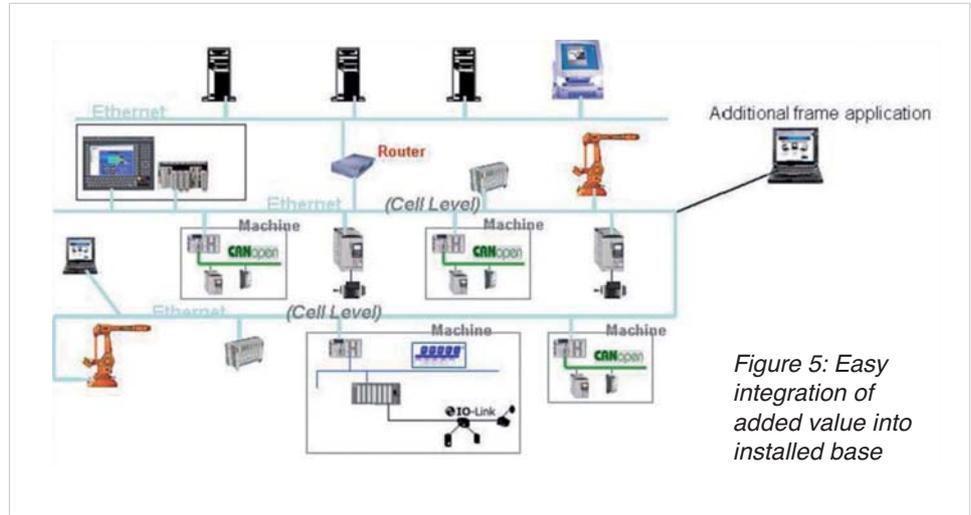


Figure 5: Easy integration of added value into installed base

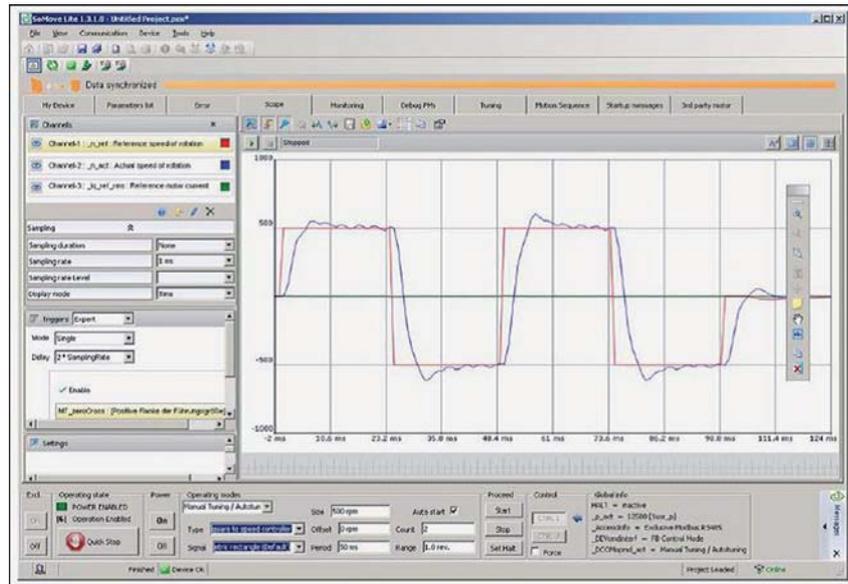


Figure 6: Capabilities using a DTM

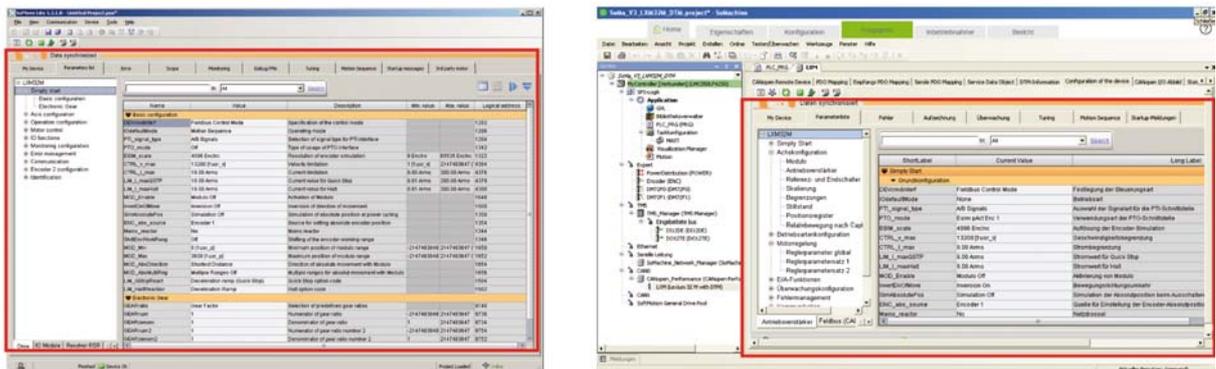


Figure 7: Lexium Drive DTM in the stand-alone and the PLC programming tool

Furthermore the FDT technology allows the end user to add additional applications in the installed base without changing the installed devices and networks. Figure 5 shows such an example where an additional frame application is added to the installed base, which could be used e.g. for diagnostic, asset management or predictive maintenance activities.

At Schneider Electric CANopen DTMs are used in different tools in the same manner. The tools provide a FDT interface (called FDT container), which allows running DTMs in a integrated way. There is e.g. a stand-alone tool called SoMove to configure single drives in a one-to-one connection. The same DTM can be used in a PLC programming tool. The use of the FDT technology helps to present the devices in different tools in a consistent manner. The red frame in Figure 7 shows the same Lexium Drive DTM in the two different tools.

FDT evolution

Today the FDT specification version 1.2.1 is used in the implementations. The FDT Group is currently finalizing the next step in the evolution of the technology. The version 2.0 will be released in April at the Hannover fair. The new version will be based on .NET und having a lot of improvements. The object model is simplified, the number of interfaces is reduced and performance aspects are taken into account. Beside this some new features are included which are important for tools used in factory automation. It is know possible to manage a physical topology (e.g. networks) aside the logical topology from version 1. It is also assured that the new specification guarantees backward compatibility that means the use of DTMs of version 1 and 2 in the same environment. ◀

Summary

The FDT Technology fulfills the needs of the end-user. It is the only technology, which allows the integration of field-device tools into one application, the so-called FDT Frame Application. With such an application the end user is able to manage its field devices in a consistent manner. Such a solution reduces its cost over the whole life cycle of a plant. As the technology is communication technology independent it offers a real value in our heterogeneous fieldbus world. CANopen is part of this world and can easily be used within an FDT Frame Application even if it is applied in a plant with other field buses. FDT can also be an enabler for improvements in existing plants (e.g. asset management, preventive maintenance) without the need to change the installed base. The FDT technology is standardized at IEC since July 2009 (IEC 62453) and was released as GB/T standard in China last November.



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