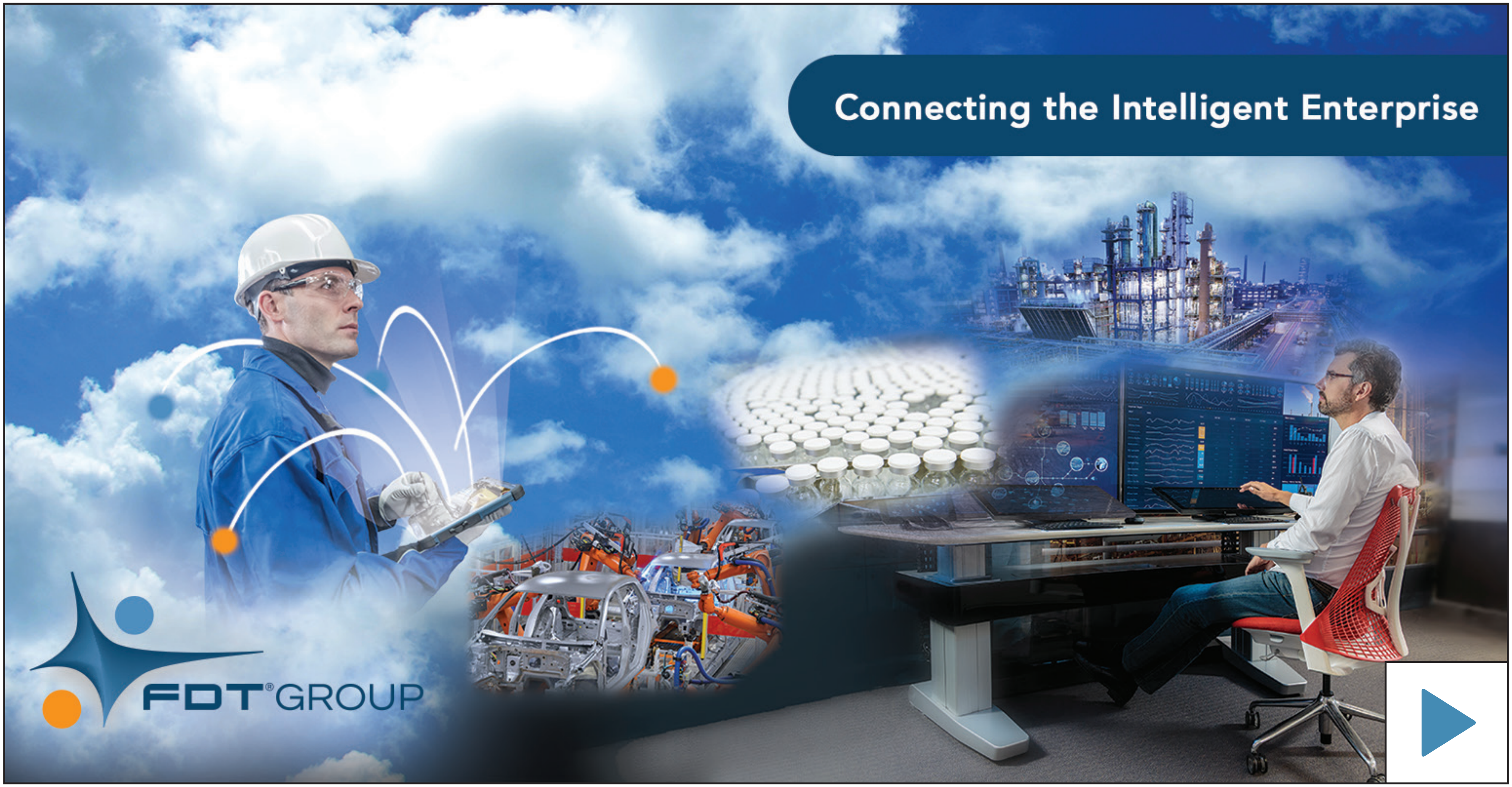

DEVICE INTEGRATION STRATEGIES

Connecting the Intelligent Enterprise

CONTENTS

What is FDT® Technology?

The FDT Group AISBL is an international non-profit corporation consisting of leading worldwide member companies active in industrial automation and manufacturing. The major purpose of the FDT Group is to provide an open standard for enterprise-wide network and asset integration, innovating the way automation architectures connect and communicate sensor to cloud for the process, hybrid and factory automation markets. FDT Technology benefits both manufacturers and end users, with advancements such as the Industrial Internet of Things (IIoT) and Industry 4.0 delivered out-of-the-box – enabling modernized asset integration and access to performance data for visualizing crucial operational problems. Around the world, end users, manufacturers, universities, and research organizations are working together to develop the technology; provide development tools, support, and training; coordinate field trials and demonstrations; and enable product interoperability.

FDT Technology is comprised of two primary software components—the FDT Device Type Manager (FDT/DTM™) the driver for an intelligent device, and the FDT Frame Application (FDT/FRAME™), which can be a stand-alone configuration application or embedded in engineering applications such as a DCS, PLC or asset management solution. DTMs developed by instrumentation suppliers provide a graphical interface to support configuration, diagnostics and troubleshooting of critical measurement devices and other assets. The FRAME Application provided by the system supplier, hosts DTMs used for management of all the devices on a wide variety of process and factory networks within a facility. Together, an FDT/FRAME and a collection of DTMs and/or other device drivers create an FDT-enabled application, which can be scaled from a small collection of devices to tens of thousands of devices controlled by a single FRAME throughout the automation communication pyramid.

FDT® GROUP

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Modernized FDT Logo Supports Leadership Role in IIoT/ Industrie 4.0

Expanded R&D Efforts focused on interoperability, security and mobility

Lee Lane, Chairman of Board of Directors, FDT Group

This issue of Device Integration Strategies welcomes you to the first public release of the modernized face of FDT® featuring a modular revision of the logo along with an enhanced website that sets the stage for FDT's vision for the new era of automation. Our new logo is a nod to our rich heritage but now projects our passion and determination to move forward into a leadership role in IIoT / Industrie 4.0.

When our Board of Directors approved the new look and feel of the FDT Group, it backed the strategic direction with the approval of our largest ever R&D funding tranche for a single year focused on enabling a FDT/IIoT architecture supporting mobility, on-the-wire security, and comprehensive interoperability through an ecosystem of automation vendors providing tomorrow's new adaptive manufacturing assets. The entire organization of nearly 200 volunteers is now aligning itself to this ambitious initiative.

Our modernized image accurately depicts the role we envision for the FDT platform of the future. With hundreds of thousands of installed FDT/FRAMEs™ (both stand-alone and embedded in major system supplier engineering systems) and tens of millions of FDT/DTM™ enabled devices in the current install base, FDT is the established standard for interoperability of intelligent devices. Additional, the adaptive backbone architecture supporting all common communication networks and many proprietary protocols allows the comprehensive integration model for both the process and factory market. It provides the flexibility needed in a single platform to seamlessly tunnel through a myriad of networks to transparently communicate with the end device.

Modernized FDT Logo Supports Leadership Role in IIoT/ Industrie 4.0

Expanded R&D Efforts focused on interoperability, security and mobility

Continued

This feature is one of the key architectural roles that FDT plays in enabling the next generation of industry.

Later this month, watch for the release of several updated annexes (networks) that will support the latest version of the FDT standard. Annexes include the release of the ODVA Common Industrial Protocol (CIP) annex, network adaptations of ODVA's media-independent CIP protocol including EtherNet/IP™, DeviceNet™, CompoNet™ and ControlNet.™ These updated annexes to the latest standard will allow new Frame Applications the advantage of network integration in stand-alone device management tools and other engineering systems.

Since 2011, the FDT Group and OPC Foundation have worked together on a technology initiative to provide greater access to critical information throughout the industrial enterprise. We are thrilled to publicly release the FDT/OPC UA annex. It will expand the FDT platform capability with enterprise wide access to this business intelligence. Our collaboration with the OPC Foundation to develop this off the shelf OPC UA capability within the Frame Application has been a model of industry cooperation. My thanks to Mr. Tom Burke of the OPC Foundation and our Managing Director, Glenn Schulz for providing the executive sponsorship to drive this partnership to a successful conclusion.

As significant as the OPC UA pairing is to the FDT platform, we are not stopping there. The FDT platform will now be further expanded to include support for mobile devices. This will include operating system agnostic support for standard browsers, fit for purpose apps, and general web services for any potential expansion. The prototyping for this phase of developments will begin in January.

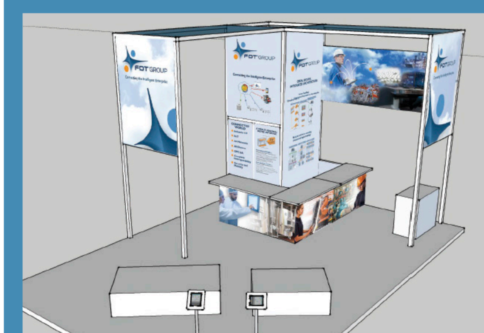
To facilitate our commitment to standardize sensor to cloud integration, the new FDT architecture will be deployable as a cloud, fog, local server, or standalone platform allowing it to scale to suit the needs of a single facility for the entire enterprise. We will be working with the various IIoT

Technology Tip

FDT Exhibits at SPS Drives

Come by and see the new FDT look!
Hall 2 Booth #550

Press Conference. Nov. 23 at 11:30



Modernized FDT Logo Supports Leadership Role in IIoT/ Industrie 4.0

Expanded R&D Efforts focused on interoperability, security and mobility

Continued

initiatives around the world to ensure that our new architecture supports their emerging requirements. Our commercial material will refer to this new platform as FITS™ - an initialism for the FDT Industrial Internet of Things Server.

With our mission set , we welcome you to visit us at the SPS IPC Drives Exhibition, Nov. 22-26, 2016; Hall 2, Booth 550 where we will be showcasing our new look and latest technology development for the entire industrial automation marketplace. We will be demonstrating complete interoperability with a FDT integrated hybrid application inclusive of multiple protocols, vendors and devices simulating a brewing and bottling application using control systems and components commonly found in a brewery.

We will also be demonstrating FDT/OPC UA device modeling, mobility and much more. Additionally, we will present our future strategy with a press conference at 11:30 on Nov. 23rd. Members of the FDT Group board, OPC Foundation President and Executive Director Thomas Burke, and ODVA President and Executive Director Katherine Voss will be there for exciting new announcements.

I invite other companies and organizations that are interested in participating in this fast-paced industry collaboration to join the FDT Group and bring your unique industry perspective and requirements to the table. In an open standards body, your scope of influence can range from technical committee participation to setting and driving the strategy at the Board level.

In closing, allow me to bid a fond farewell to our long time office manager, Katrien Peeters. In many ways, Katrien was the pulse of the FDT Group as she supported all facets of the FDT Group business operations over the past 10 years. I wish Katrien the best with her expanding family and future business ventures. We will announce a replacement in the near future. Meanwhile, please contact our Managing Director, Glenn Schulz, for any of your business office support needs.

FDT Press Conference at SPS IPC Drives Exhibition

Media briefing in Nuremberg, Germany, will address launch of fully integrated FDT/IIoT architecture

The FDT Group leadership team marks the organization's updated branding and mission for the industrial automation industry.

Established Standards Pave the Way for Industrie 4.0

FDT® and OPC UA pair to expand enterprise connectivity

The fourth industrial revolution intended to create "smart" plants and factories focuses on communications as implied in the German Reference Architecture Model for Industry 4.0 (RAMI4.0). As the industrial automation sector makes strides towards achieving the "Connected World", leading industry organizations are joining forces to leverage their respective technological strengths.

Since 2011, the FDT Group and OPC Foundation have worked together on a technology initiative to provide greater access to critical information throughout the industrial enterprise. OPC provides a uniform interface for many different client applications, whereas FDT® provides network/device configuration and access to devices.

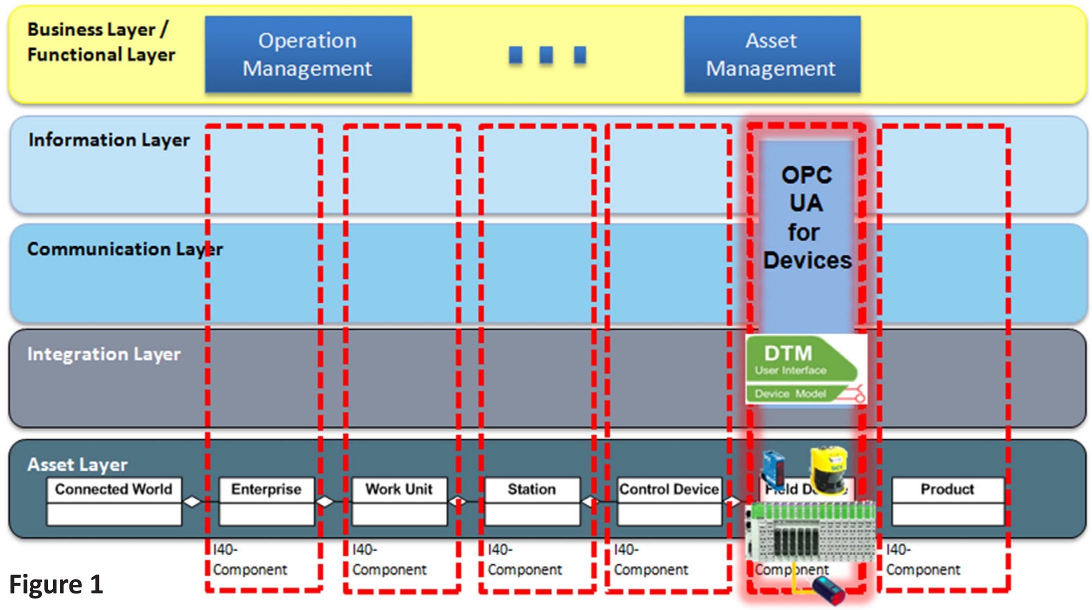


Figure 1

Together, FDT and OPC technologies simplify the transition to the next generation of connectivity for industrial facilities. Defined by an FDT-OPC UA device information model, the recently announced FDT/OPC Annex enhances the configuration of networks and devices, and gives the enterprise access to data without the complexity of protocol-specific handling.

History of collaboration

Technical collaboration between the FDT Group and OPC Foundation has been aimed at ensuring seamless online data exchange between automation systems, asset management systems, and other plant and enterprise systems and applications. As a result of this effort, automation end users will be able to utilize data and information models for the applications and devices supported by FDT and deploy OPC UA information modelling and corresponding services for robust application-to-device integration.

Figure 1 shows a simplified illustration of the two technologies arranged in the RAMI4.0 model. The provision of an OPC UA interface

Continued

Established Standards Pave the Way for Industrie 4.0

allows access to the device data from higher-level systems.

With release of the FDT/OPC Annex, sensor-to-cloud, enterprise-wide connectivity is granted with seamless data communications. The objective is a fully enabled Industrial Internet of Things (IIoT) architecture supporting mobility, on-the-wire security, and comprehensive interoperability. This solution will also be platform-independent and deployable in standalone, client/server or cloud architectures.

Working group uses cases

A joint working group of the FDT Group and OPC Foundation was established to determine the FDT/OPC UA interface specifications. This project envisioned a standard plug-in for the latest version of the FDT standard that would provide the necessary connectivity to enable data to be communicated throughout the enterprise using the OPC UA standard.

The following use cases have been defined for this purpose:

- Access to topology information
- Provision of device identification data
- Reading of device data (parameters and attributes)
- Access to device status
- Evaluation of device diagnostics

The respective FDT and OPC models provide the starting point for the

Continued
Established Standards Pave the Way for Industrie 4.0

specification. For FDT, information is provided by a Device Type Manager™ (DTM™). In addition to information about the DTM and device, device and process data are also described. The DTM's "Function Info" describes the features offered for the device (e.g., for configuration and diagnostics/maintenance). There may also be references to the device documentation such as manuals, certificates or device descriptions (See Fig. 2).

The "OPC UA for Devices" specification is the starting point for the OPC UA information model. This is an additional specification based on the basic OPC UA specifications like extension of base objects. It defines the device model, describing the device communication model and the model for device integration into a host.

The device model identifies the objects for a device. This includes device parameters, callable methods, information for device identification, supported communication protocols, etc. The device communication model specifies the objects required to describe a communication topology. These are the network (protocol type) and connection point (between device connection and network, network address) objects. The model for host integration describes the components that can be accessed in a server (host). The host has access to the automation system via any type of communication. An FDT-enabled system (e.g., PLC, DCS, asset management application, standalone engineering applications) is an example of such a host.

After identifying the corresponding objects in various models, the FDT/OPC working group prepared an illustration of the FDT information for the OPC UA objects. In some places, the device model has been expanded with OPC UA to take account of specific FDT information.

Once the specification was completed, prototyping was performed to check the defined use case models. The first step involved using a UA modelling tool to specify and test the data types. In the second step, an OPC UA server was implemented with FDT integration. A client was also created for the test. Figure 3 shows the architecture of the system.

The OPC UA server is part of the FDT/FRAME™-enabled system application. The information model for the OPC UA server is generated automatically within the FDT/FRAME Application data. The server can be accessed with any OPC UA client via a secure connection. The client is flexible and versatile, and can be integrated in other systems or run on a mobile device, depending on the intended application.

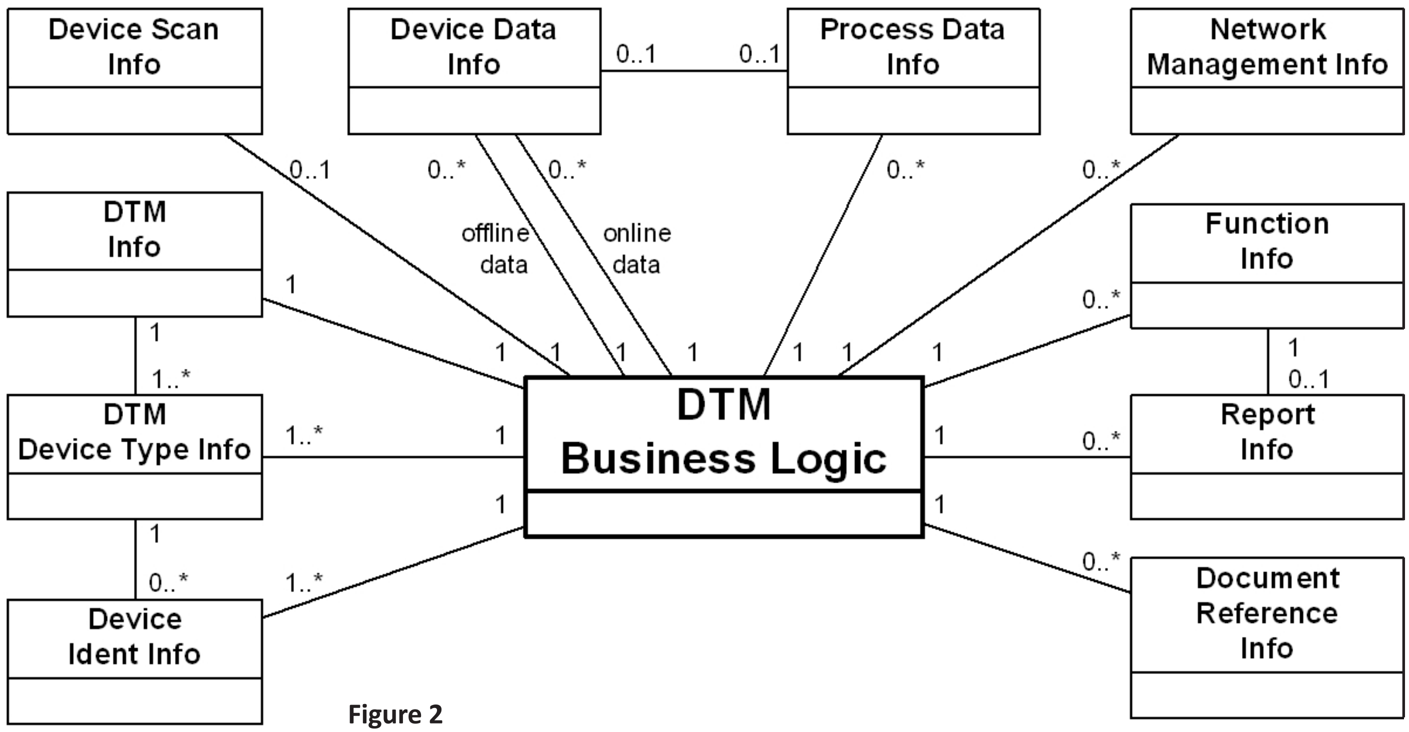


Figure 2

Summary and outlook

The strength and versatility built into the open FDT standard allows for backwards and forward adaption of technologies as they evolve to fit future automation needs across the process, hybrid and factory market spaces. FDT is the solution, unmatched in the industry today, offering a single system solution for device management for all communication protocols and networks, and allowing access to devices via ”tunnelling” throughout the bus hierarchies. Uniting FDT and OPC provides the ideal bridge to systems that demand data from these devices and opens the door to Industry 4.0.

With release of the FDT/OPC UA Annex this month, the FDT Group has taken an important step forward towards helping industrial end users realize the promise of IIoT and Industry 4.0 “Connecting the World.” Indeed, it is opening the door to enterprise-wide, sensor-to-cloud interoperability and enhanced lifecycle management throughout the industrial sector

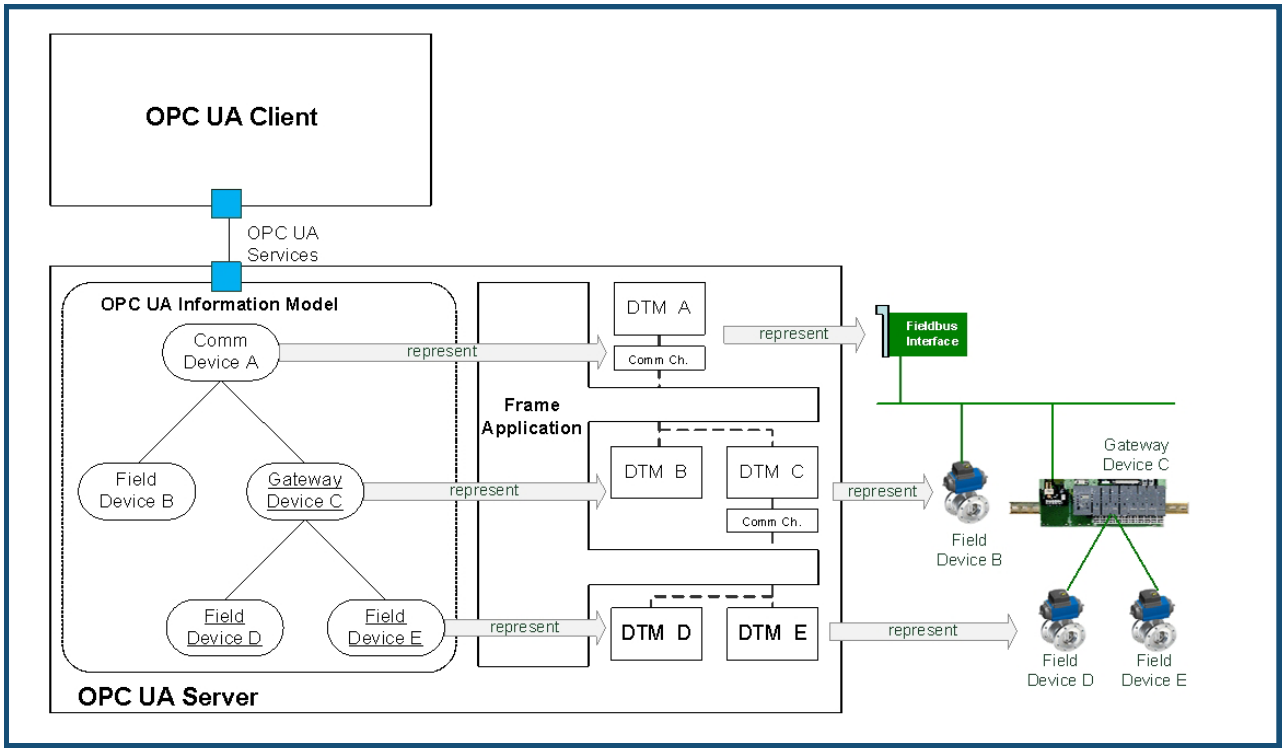


Figure 3

This article is part 7 of an 8 part series discussing FDT in Factory Automation. Below are the links to review the other published articles.

Article 1 – What Requirements in Factory Automation Does FDT Address?

Article 2 – Seamless Data Exchange Across All Network Layers and Protocols

Continued
Established Standards Pave the Way for Industrie 4.0

Article 3 – Advance Your PLC Configuration Method Saving Time Trimming Costs

Article 4 – New DTM Interface Simplifies PLC Programming

Article 5 – Fieldbus and Device Diagnostics

Article 6 – Simplifying Strategies for Effective DTM

Article 7 – With FDT and OPC UA Towards Industry 4.0

Article 8 – Look for the final article, ***Engineering, Configuration and Diagnosis of the Industrial Internet of Things with FDT*** in the next issue of Device Integration Strategies.

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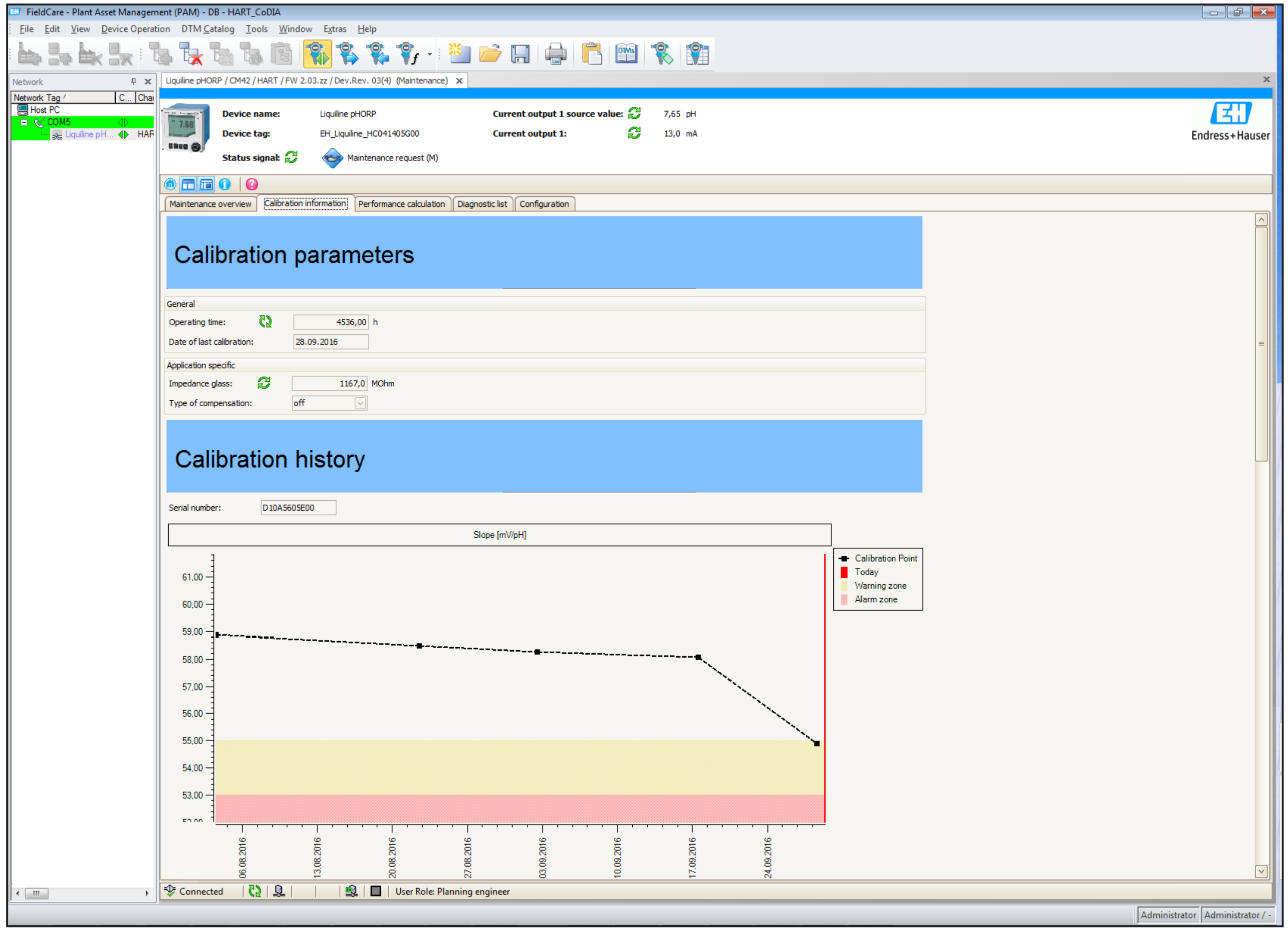
Analytical Field Device DTMs Enhance Maintenance

Heartbeat makes proactive maintenance trouble-free

Getting a fast and clear overview of the status of a measurement point using a remote workstation is the basis for effective maintenance. Heartbeat Technology is an Endress+Hauser tool that enables users to monitor and verify measurement points in process automation environments.

Heartbeat devices make it easy to measure performance and identify process trends so users can predict and plan their maintenance tasks. These benefits enable a transition from reactive to proactive maintenance.

Heartbeat Technology is now integrated in FDT/DTMs (Device Type Manager) for Endress+Hauser's analytical devices. The DTM for the Liquiline transmitter platform has been enhanced with a special maintenance



Endress+Hauser DTM with Liquiline Heartbeat and Maintenance view

view, which shows all the necessary service information at a glance. Structured with tabs for overview, calibration data, performance calculation and diagnostics give users the desired data without making them search for it in the broad DTM menu structure. Diagnostic and status relevant data are grouped together.

The calibration data tab shows the calibration results in a trend graph. This enables the service personnel to make qualified decisions for preventive maintenance tasks to reduce or combine trips to the field.

With Heartbeat, it is easier to find the optimal balance between process safety and maintenance cost savings. With experience over time, the maintenance strategy can be optimized to best fit the real requirements of the process. Users start with common maintenance intervals and adapt them to the individual requirements. In demanding processes, they can be shortened to ensure a safe operation. In other processes, the interval can be prolonged.

The performance calculation tab presents the results of the optimization, showing availability, mean time between failure and other key performance indicators as basis for the next optimization iteration.

In plants with many measuring points, it is difficult for the maintenance staff to detect the status and condition changes of all installed devices. Therefore, an important advantage of Heartbeat Technology is the integration of device status and secondary variables into the control system. This enables an automatic health monitoring of a huge number of devices.

Despite automatic monitoring and optimized maintenance plans, a regular verification of the measurement point is still required. This verification usually needs a lot of time-consuming paperwork since documentation of the work is essential. Heartbeat devices solve this problem by automatically generating verification reports that contain all module identification and test information. The report states a clear pass or fail result. Personnel does not need to detail interpretations or have special sensor knowledge. The verification procedure can be triggered remotely without process interruption over the fieldbus, and the report can be downloaded and stored with the DTM.

FDT Streamlines Device Management in Multi-Network Facilities with CODESYS

Device integration in PLC programming environments is simpler when FDT is used

Nuno Barral is Project Design Leader and Software Architect at Schneider Electric Automation.
Manfred Brill is Innovation & Technology Senior Manager at Schneider Electric Automation.

FDT Technology's roots in the industrial automation marketplace span the horizon for process, hybrid and factory automation – standardizing device integration and management for all common fieldbuses, regardless of manufacturer. This includes a common environment for accessing the most sophisticated device features. The technology enables configuration, operation and maintenance through a single, standardized user interface – regardless of supplier, device type/function or communication protocol.

So, what components and mechanisms are required to implement the FDT interface in a Programmable Logic Controller (PLC) programming environment such as CODESYS?

Due to the variety of fieldbuses found in factory automation, FDT technology is useful for standardized device management. That is because PLC programming systems common in this environment – such as CODESYS – can ensure significantly better device integration if FDT is employed.

A developer software tool, referred to as the FDT/FRAME™ Common Component, is available for developers looking to implement seamless asset integration in their PLCs for the factory automation marketplace. The FDT/FRAME Common Component software developer tool can be obtained by contacting the FDT Group

Figure 1

Continued

FDT Streamlines Device Management in Multi-Network Facilities with CODESYS

and is used as the base component to ensure complete asset integration within interface application offerings. Using it ensures that implementation conforms to the FDT specification and improves interoperability with many Device Type Managers™ (DTMs™).

The FDT/FRAME Common Component contains all of the interfaces required by the FDT specification to de-

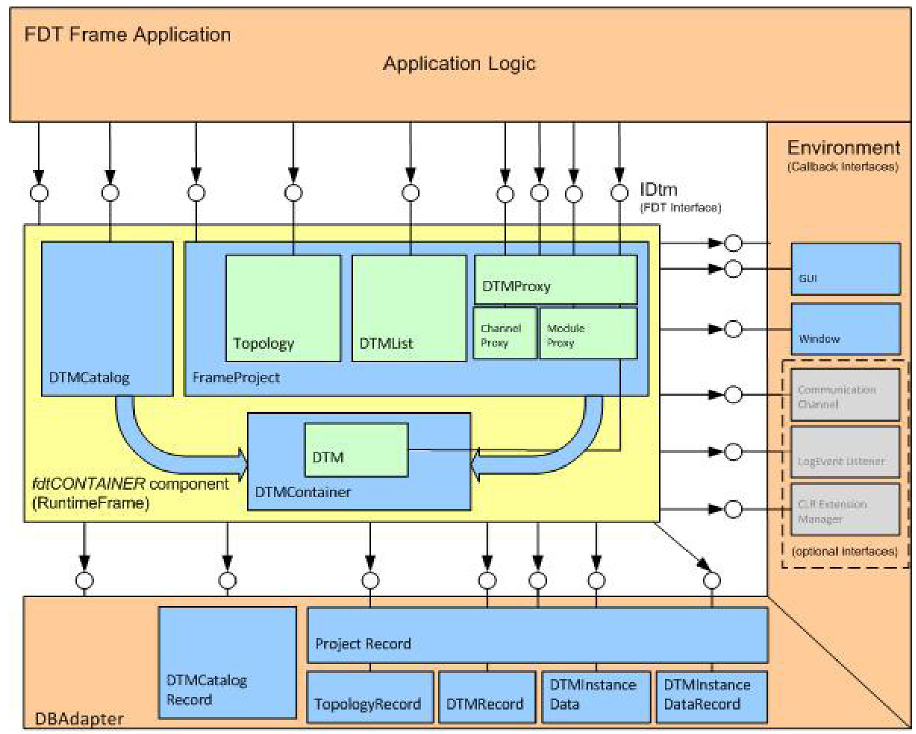


Figure 2

Continued

FDT Streamlines Device Management in Multi-Network Facilities with CODESYS

velop an FDT-enabled application. This kind of application can perform a wide range of functions such as a standalone tool for device configuration, a diagnostics tool or an asset management tool.

In Fig. 1, the outer FRAME Application represents the FDT application. This is where all the functions of each application are implemented. The inner part shows the base FRAME Common Component (also known as fdtCONTAINER component). Interfaces connecting the two elements are located between the application and base component. The direction of the arrows shows whether the interface calls up the base component or the application.

The database adapter (DBAdapter) can be seen in the lower part of the application. It forms the adaptation layer for the application-specific database. The functions shown in the database adapter (for example, "Project Record" or "DTMInstance Data") are placeholders for programming database access.

The base component itself contains functions for managing the DTMs (DTMCatalog) and the application project (FRAMEProject). The system topology, the associated DTMs (DTMList) and a proxy form part of the project. This proxy separates abstract online call-ups into individual FDT function call-ups – for example "go offline." The instantiated DTM itself runs in the DTMContainer component.

The CODESYS plug-in concept

CODESYS is a software suite for automation technology that is based on the IEC-61131-3 programming tool. The software makes it possible to integrate additional functions using custom-designed plug-ins such as new menus, editors, etc. The FDT base component is also embedded into the programming tool with this mechanism.

Fig. 2 provides a detail of the CODESYS architecture, including the FDT components. The project structure, as shown in CODESYS, should be considered in parallel to this (CODESYS device tree) architecture. The FDT Integration Plug-in contains the FDT base component for managing an FDT project with the associated DTMs.

The architecture in Fig. 2 shows integration using CANopen devices as an example. It is possible to use devices with and without DTMs. The CANopen Master is represented by a DTM used to configure the CANopen fieldbus. It is also the communication interface with the CANopen devices. The IFdtCommunication interface, used by a device DTM to exchange data with its slave (DTM for Slave 2), serves this purpose. The CANopen Master DTM converts the data from the device DTM into protocol-specific messages like CANopen and sends them to the device. The response from the device is processed in reverse order.

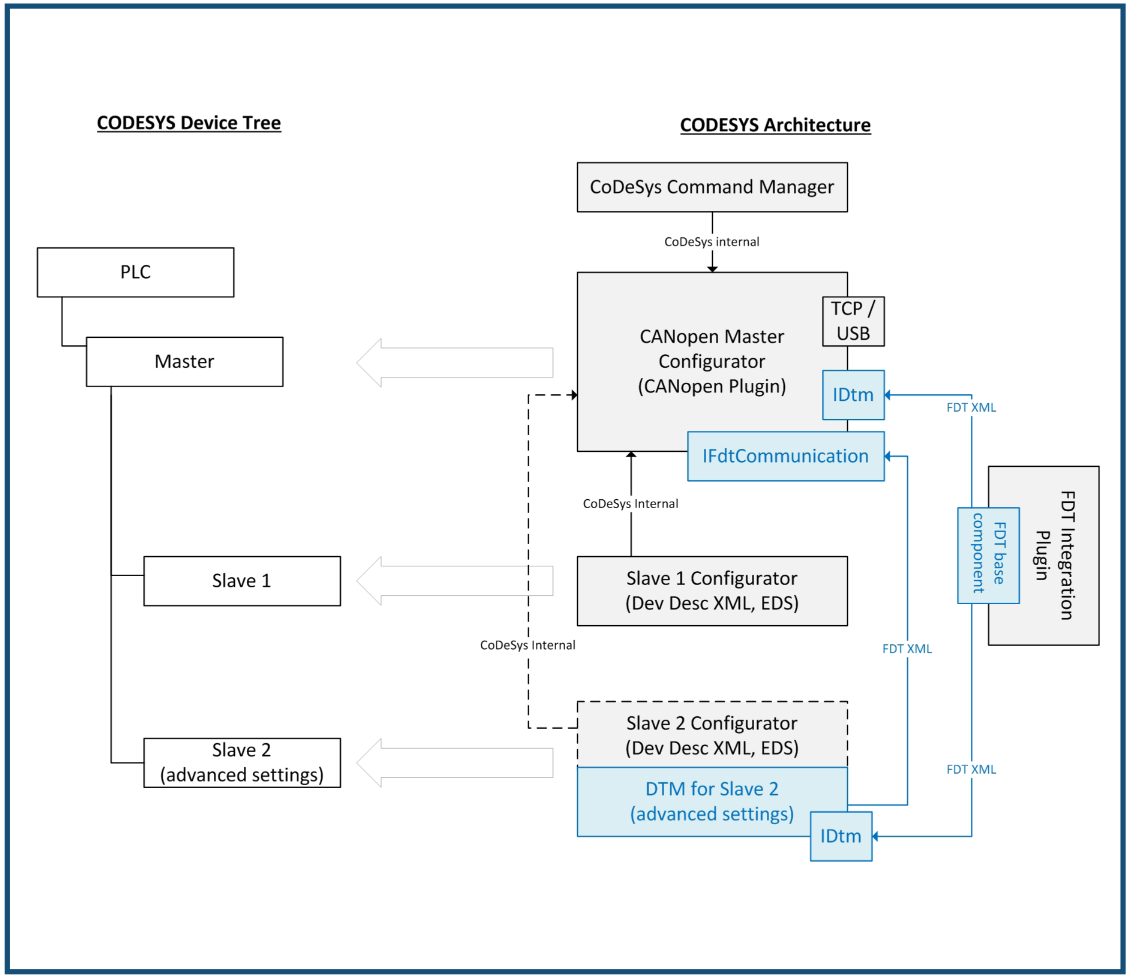


Figure 3

Device management

Device management makes it possible to mix simple components, which do not require an explicit DTM with devices with increased functionality and whose full scope of functions are enabled by the DTM. CODESYS contains a general XML Device Description (DD) for all devices as well as the associated fieldbus device file (for example, EDS for CANopen). The DD contains all the information related to the device, its parameters and communication options.

If a device with a DTM is used, the DTM is transferred from the DTM catalogue to the project, and the associated XML description is generated automatically. The system receives the required data via the interface DTM. In-

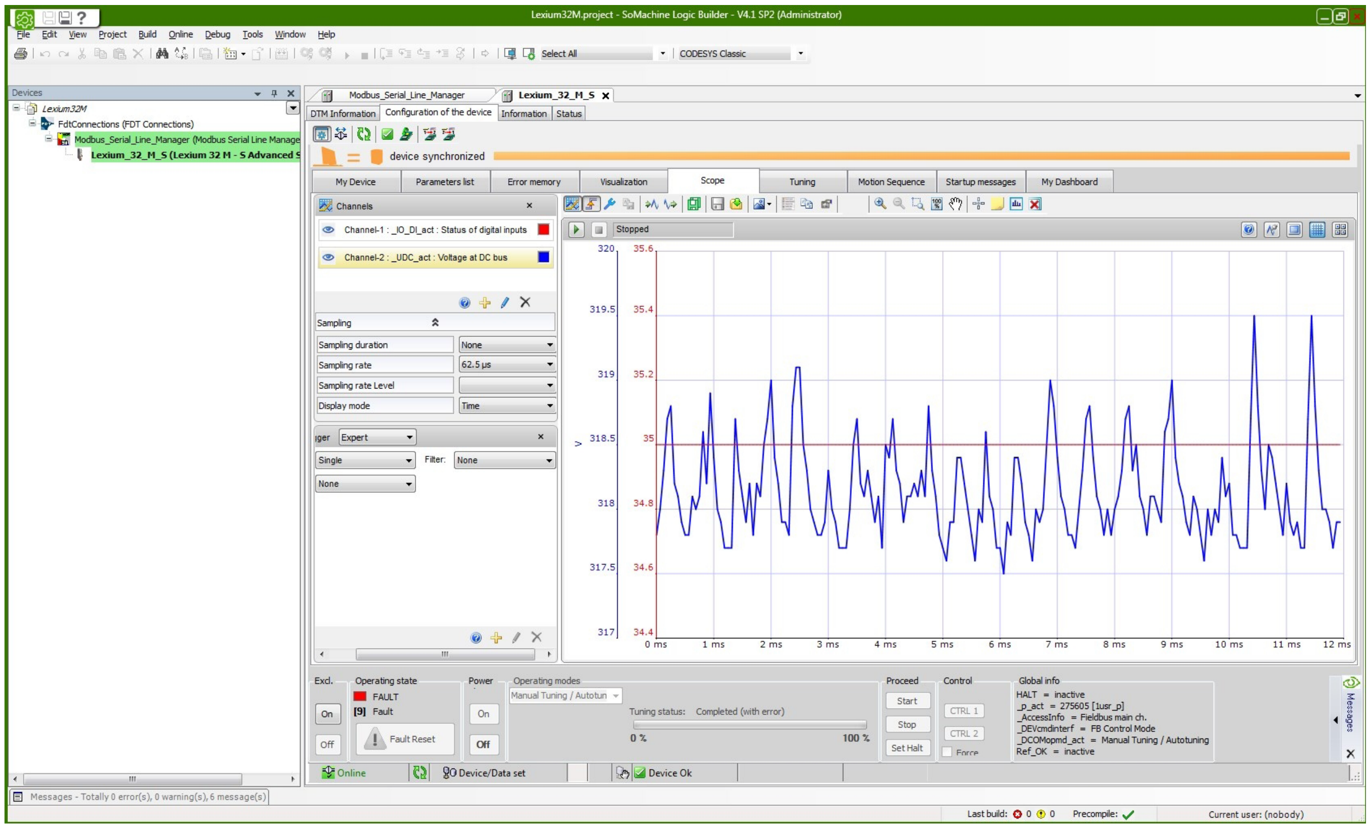


Figure 4

formation related to the manufacturer, device type and version data is made available in this way, as well as other information. Frequency converters are an example of a device with a wide range of functions. In this case, it is advantageous to provide each device range with a DTM that covers the entire range.

Fieldbus configuration

The CANopen Master Configurator enables convenient configuration of the fieldbus. This includes parameters for the fieldbus itself such as baud rate or heartbeat (monitoring time). This DTM assigns the device addresses (Node ID) and maps PDOs (ProcessDataObjects). The latter establishes the connection between the PDOs and the application objects in the object dictionary.

The Master Configurator exchanges data with the device DTMs via the interface DTM (SetParameters). It is notified when the device DTM changes data. The changes can be requested via the interface (GetParameters). After configuration is complete, the Master Configurator checks the consistency of the data in the CANopen system. The CANopen data is downloaded to the Master and the devices and used during runtime for starting up the system, setting the fieldbus parameters and exchanging data.

Generating process data

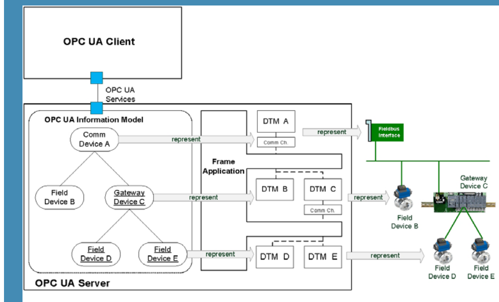
Process data is the data transferred between the PLC and the slaves during the fieldbus runtime. The description of the process data defined by means of the device DTMs is made available at a corresponding interface (process channels). In this case, the information from the Electronic Device Description (EDD) is not used, as it is insufficient for the intended purpose. This procedure is particularly helpful for modular devices with a variable configuration. The Process Data Objects (PDOs) are automatically generated for the process data. Existing variables can be assigned to the process data or redefined in the device DTM.

The PLC tool receives the variables from the device DTM and makes them available to the PLC program in a final step. This allows the variables to be used directly by the PLC programmer for further processing.

To summarize, using FDT Technology in CODESYS provides programmers with a wide range of options for device management. The functions and flexibility by far exceed what is possible using the usual description files (e.g., EDS, GSD). For instance, devices from different manufacturers can be integrated into one tool. Access to the devices is ensured beyond the scope of fieldbus hierarchies. With their graphical user interface, DTMs make accessing the relevant device simple and also offer device-specific diagnostics functions enabling rapid fault detection in the event of maintenance.

White Paper

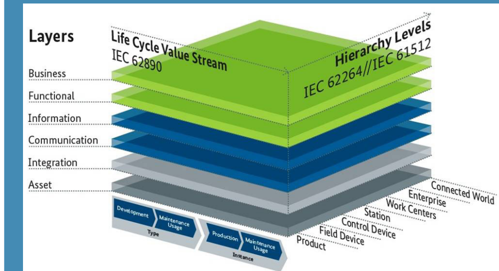
Field Device Management Based on FDT and OPC UA



Providing OPC UA services for device management and device integration may be considered as a strategic development towards support of remote configuration of devices (e.g. via the Internet), support of access by mobile platforms and support of integration into cyber physical systems.

This white paper discusses the approach for providing OPC UA for device management and integration, based on FDT Technology, the established and widely supported device integration solution for your platform.

FDT for the “Connected World”



The FDT standard is represented in the German Reference Architecture Model Industrie 4.0 (RAMI 4.0) as the device integration solution, and with the release of the FDT/OPC Annex, sensor-to-cloud, enterprise-wide connectivity is granted with seamless data communications.

Profibus Device Integration with FDT® 2.0

Thorsis Technologies supplies first certified communication and generic device DTMs for Profibus DP.

Join the FDT Group

FDT Technology continues to be at the forefront of industrial automation advancement, with a truly open and standardized architecture to address the critical needs of the 'Connected World' of the Industrial Internet of Things (IIoT) and Industry 4.0. FDT Group has a strategic vision focused on the "Connected World" enabling a FDT/IIoT architecture supporting mobility, on-the-wire security, and comprehensive interoperability through an ecosystem of automation vendors providing tomorrow's new adaptive manufacturing assets.

Join other leading companies in the FDT Group today. There are unique advantages for the entire industrial automation industry – end users, suppliers/developers, service providers, universities, and individuals.

For membership information, please visit www.fdtgroup.org

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