



# FDT UE Migration Enables Smart Manufacturing

END USERS, SYSTEM AND DEVICES SUPPLIERS  
ADVANCE MODERN MANUFACTURING  
INITIATIVES WITH FIELD TO CLOUD INTELLIGENT  
DEVICE MANAGEMENT



Integrating Tomorrow's Technology

# Contents



Abstract.....	2
Introduction.....	3
Universal Device Integration Standard for Modern Industrial Markets .....	5
FDT UE Provides Seamless Communication for Systems and Devices .....	7
Customer Use Cases: Mobility, Security, DTM Repository .....	8
Protect Your Investment: FDT UE Offers Backwards Compatibility For Easy Migration.....	12
Common Components Toolkits: Key to Interoperability and Reduced Time to Market.....	16
Scalability Benefits: End Users, System and Device Suppliers.....	18
Conclusion .....	21

# Abstract

Industry-driven feedback has been the basis for the growth of FDT technology since the release of the original single-user desktop approach, Version 1.2 specification in 2001. The latest version of the standard, FDT Unified Environment (UE), or FDT 3.0, has evolved to a distributed, multi-user, client/server approach. It offers a robust combination of features, including improved security, faster performance, ease of use, and investment protection. These advancements underscore FDT's transformation as a complete, standardized platform enabling field-to-cloud, enterprise-wide connectivity for the new era of automation.

The FDT 3.0 / Unified Environment (UE) Industrial Internet of Things (IIoT) Ecosystem, consisting of FDT hosting environments (Server and Desktop) and DTMs, delivers universal device integration and a data-centric platform to mobilize the industrial workforce with modern and diverse deployment options, including cloud, enterprise, edge, on-premise, and desktop environments.



# Introduction

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To meet the demands of advanced manufacturing, companies are looking at new technologies to optimize processes and equip people for higher performance and efficiency. Modern technologies highlighted in IIoT strategies already are helping forward-thinking end users, system and device suppliers reap the benefits of smart manufacturing.

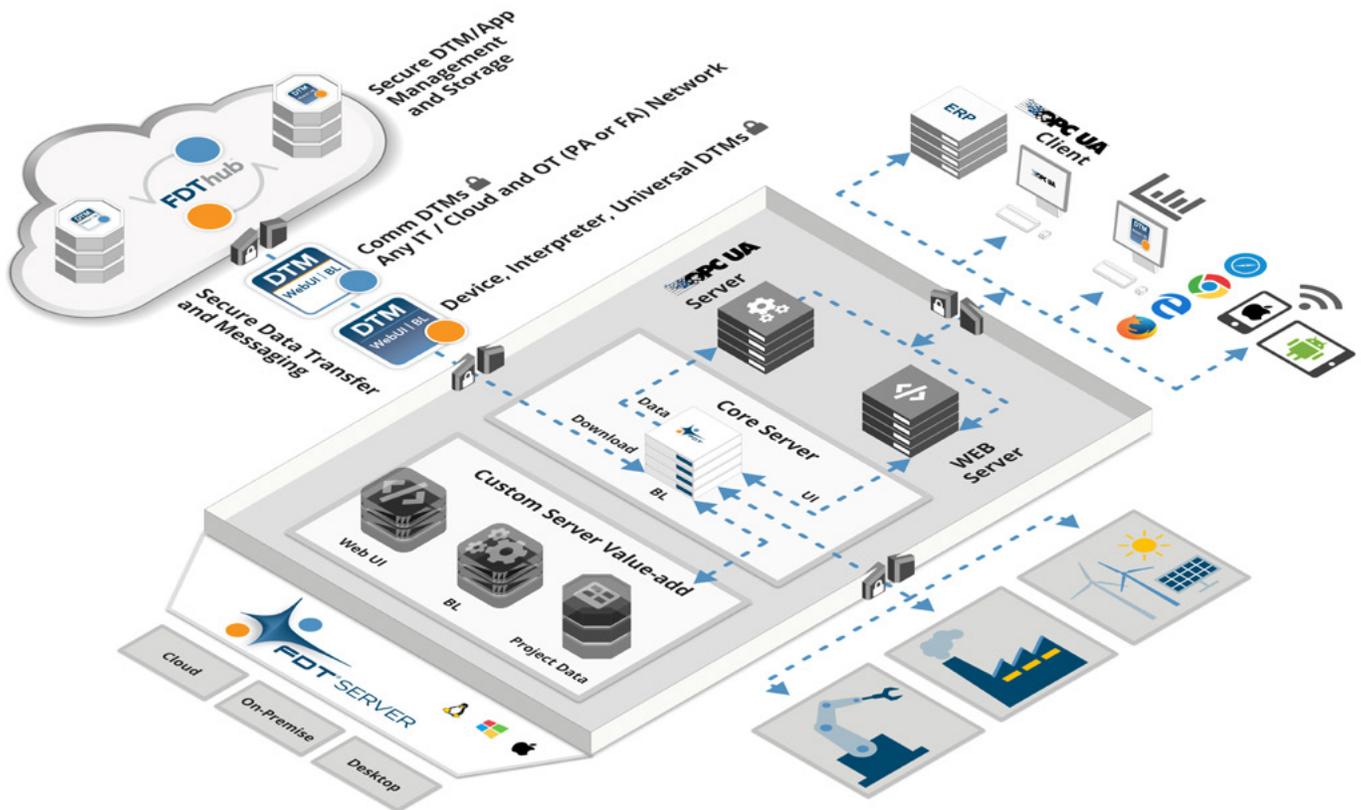
The IIoT offers endless productivity improvements in automation, operations information, and advanced analytics through smart devices and systems that link machines through open platforms and enable them to think, learn and react in real-time.

At the heart of the IIoT is FDT Group's integration standard. FDT provides an embeddable software-based environment allowing all systems and all devices to connect and communicate independent of vendor, protocol/network or device/type. Using FDT in the background allows for open, platform-independent, data interoperability solutions, with security, configuration and visualization for modern control and asset management environments.

The FDT integration standard allows users to use embedded FDT based hosting environments available from all major system vendors to seamlessly manage a diverse range of increasingly intelligent devices using FDT Device Type Managers™ (DTMs™) provided by device vendors. To help advance smart manufacturing, FDT Group has introduced the FDT Unified Environment (UE), also known as FDT 3.0 standard, enabling a robust data-centric and Information Technology (IT) and Operational Technology (OT) integration solution with a secure gateway to network/device data and health information.

FDT enables a data consistent user interface (UI) supporting field/skid to cloud integration, engineering and configuration, and now benefits both the IT and OT workforce with a unified server environment supporting a service-oriented data hub architecture.





Digital Transformation with FDT (3.0) Unified Environment (UE)

For end users, system and device suppliers, FDT 3.0 is the data interoperability standard for the secure and reliable configuration and visualization in industrial automation devices and systems independent of communication protocol, vendor, device/device type/representation or information model, supporting all aspects of a control system lifecycle. This single user interface benefits both the automation supplier and end user communities in the process, hybrid and discrete manufacturing markets as these major market sectors merge and streamline per market demands and for better overall efficiency, production and quality.



# Universal Device Integration Standard for Modern Industrial Markets

Smart manufacturing thrives on device data, and the key driver of FDT's smart manufacturing functionality starts with its core software-based embedded technology component—DTMs running the new FDT 3.0 standard.

Globally adopted and internationally recognized by ISA 103, GB-T 29618-2017 and IEC 62453 organizations, tens of millions of DTM-enabled devices worldwide are serviced by FDT-enabled hosting/system environments, and all major control system and device vendors support FDT technology.

The FDT standard incorporates several specific DTM types, including Device, Interpreter, Universal, Communications, and Gateway. These DTMs empower a standardized way of communicating, automatically making device data and health information available via an OPC UA Server or Web Server embedded on the FDT Server used in the FDT 3.0 architecture. This architecture flattens the automation pyramid so that any application requiring data from devices can retrieve it directly from OPC or FDT clients through the DTM.

FDT is the only universal integration standard allowing all networks, devices and industries to connect, communicate and seamlessly integrate all industrial networks into one project view.

Intended for use with both simple and complex devices, the FDT DTM contains the application software that defines the parameters and capabilities included in each instrument. The DTM encapsulates all device-specific data, functions and business rules such as the device structure, its communication capabilities, internal dependencies, and its human-machine interface (HMI) structure.



Process



Hybrid



Factory

## Open Integration

- Standardized
- Data centric
- Mobile
- Remote Access

## Flexible Architecture

- Scalable
- Agile
- Secure and robust
- Compatible



The FDT Server is a pivotal IIoT data hub empowering the intelligent enterprise. This distributed, multi-user server solution employs a web services portal allowing access from authenticated mobile devices or any major browser along with an OPC UA Server for enterprise access to real-time plant floor data. Its rich features ensure any industrial communication protocol or vendor device can be seamlessly integrated as part of smart manufacturing practices.

FDT 3.0 is system agnostic and vendor-independent, supporting multiple protocols with a multi-network, multi-vendor and multi-operating system approach. With it, users have the freedom to access consistent data through a distributed architecture. This benefits both the automation supplier and end user communities in the process, hybrid and discrete manufacturing markets.

FDT 3.0, with its FDT Server and built-in OPC UA and Web server solution, enables robust IT/OT integration and provides a secure gateway to network/device data and health information.



# FDT UE Provides Seamless Communication for Systems and Devices

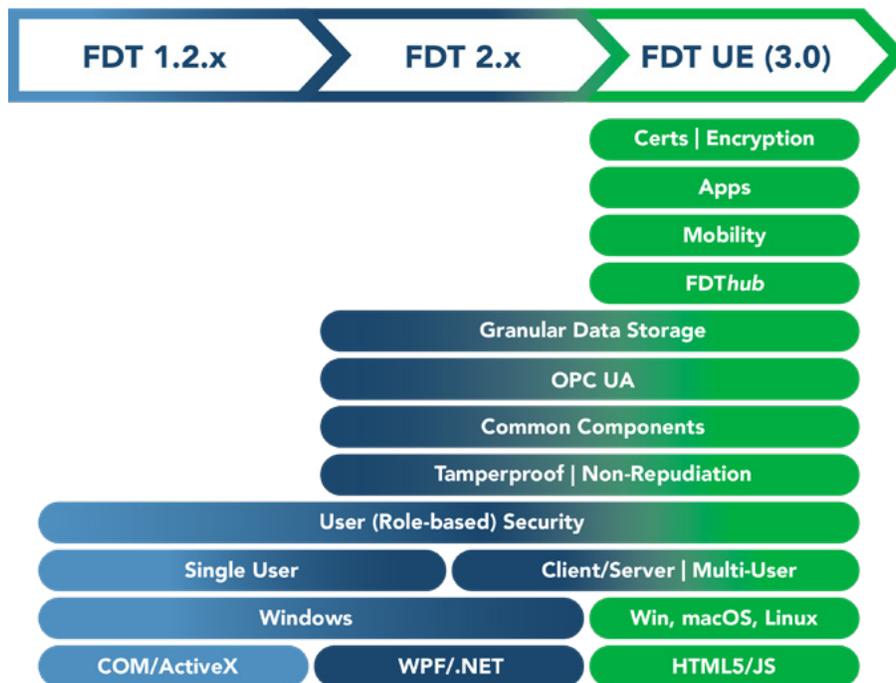
At the core of FDT's digital transformation pathway is the introduction of the FDT Server, empowering a robust, platform-independent environment, enterprise-wide IT/OT data harmonization, and browser-based access supporting mobile and remote operations.

This solution transforms asset management practices and business system integration for both the automation supplier and end user communities. The FDT Unified Environment works with any major web browser, programmable logic control (PLC) or distributed control system (DCS), at the business and enterprise-level, to access real-time plant floor data.

While seizing emerging business opportunities can be difficult for control system and device suppliers, FDT Group has delivered a modernized development environment with a secure-by-design architecture, simplifying the establishment of innovative business models supporting cross-platform FDT UE solutions.

FDT standards 1.2 and 2 continue to be the de facto industry standard for industrial device integration. DTMs delivering data to host systems via older standards can now take advantage of the unified environment of FDT 3.0 to address the challenges of IIoT.

## FDT Technology Evolution



# Customer Use Cases: Mobility, Security, DTM Repository

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FDT Group's IIoT transformation path to connect and empower the intelligent enterprise is based on comprehensive, industry-driven feedback. The organization's standards development has focused on security, performance, ease of use, and investment protection to allow automation suppliers and end users to take advantage of an evolving open integration and information sharing architecture.

FDT Group has long recognized the critical importance of industrial cyber security and developed a comprehensive security approach to meet both connected and air-gapped requirements, support virtually any automation architecture, and comply with contemporary security policies in a typical industrial operation providing end-to-end interoperability trust.

FDT 3.0 was designed and developed to provide:

- **Open Interoperable IIoT Architectures** – Enabling a future-proof FDT Server-based distributed architecture that is operating system, network, device, information model and vendor independent
- **Secure, Scalable, and Adaptable Platforms** – Providing embedded end-to-end trusted interoperability supporting cloud, edge, on-premises, or enterprise-wide agile architectures
- **Comprehensive Control and Configuration** – Empowering a natively integrated OPC UA server for IT/OT data harmonization and IT/enterprise access along with a web server empowering OT/operations, mobility, and web-browser-based access supporting modern asset manufacturing practices
- **Standardized Universal Device Integration** – Delivering a unified collaborative engineering platform and ecosystem for design, operation, and maintenance, of Process Automation (PA) and Factory Automation (FA) systems

FDT traditionally supports asset management and device configuration, commissioning, monitoring, diagnostics, parameterization and replacement. A main focus for FDT is consistency, or a single way to integrate all PA and FA devices, and to work with all devices so less training is required. FDT creates one way to handle a device in different situations, including in the vendor tool, in the system environment, and in the service tool, and to consistently store the data of all devices.

This is important because traditionally different tools were used in different use cases. With FDT 3.0 the same server can be used for supporting all the different use cases so a device vendor can store the data of the whole device lifecycle, from commissioning to dismantling, in one place. This would mean that all changes to the device can be tracked in a central audit trail.



FDT UE is multi-faceted, scalable and agile, and can be utilized in a host of diverse operating environments. This approach results in a **flexible FDT Server architecture and robust FDT Desktop environment**, bridging the current FDT install base with next-generation technology and creating an excellent starting point for new applications.

Working groups focused on user-driven requests:

- FDT *mobility* – expanding access to critical device data and improving workflow for plant workers with its mobile device management interface along with apps to enhance maintenance efficiency.
- FDT *security* – empowering a comprehensive secure by design architecture to safeguard data access from the enterprise all the way down to the device level for connected and air-gapped requirements.
- FDT*hub*<sup>™</sup> – providing a single device DTM repository designed for both cloud-based and on-premise air-gapped system deployment, providing easy access to all certified DTMs.

## Mobility

Mobility is an enabling technology that enhances the ability to improve service efficiency, reduce maintenance costs, increase equipment uptime, extend asset life and enhance the bottom line. The latest advancements in FDT 3.0 technology help standardize and optimize industrial organizations, operations and maintenance departments by enabling cloud-based enterprise data access, device diagnostics and mobility applications; modernizing asset management practices; and improving predictive maintenance programs.

The familiar FDT DTM UI has evolved to include a web interface environment incorporating browser-based visual solutions running on any authenticated mobile device on all networks. The FDT mobility solution's platform independence provides the flexibility to use any computing platform along with customizable app development. This approach contrasts with common proprietary, one-off solutions for industrial mobility applications.

## User-Driven Enhancement



### Enabling mobility strategies.

FDT 3.0 enables evolving mobility strategies.

Developers can write a DTM and then provide the same UI on a laptop, tablet, desktop, or phone—no matter the operating system. Since DTM web UIs are portable and can also be displayed in browsers on phones and tablet devices, developers can create UIs that are completely responsive per the needs of different devices and screen sizes.



## Security

With the convergence of IT and OT, there is a need to safeguard data access from the enterprise all the way down to the device level. The server benefits from a secure by design architecture with end-to-end data interoperability trust and access. This use case features multi-layered security and leverages vetted industry standards such as transport layer security (TLS) enabling web sockets secure (WSS) and hypertext transfer protocol secure (HTTPS); utilizes on-the-wire-security for enabled industrial automation protocols; implements role-based user security and supports 509v3 certificates for authentication.

Additionally, FDT Group has set up a certification process for DTMs; certified DTMs contain an embedded digitally signed certificate from the FDT Group. Updated security measures provide non-repudiation and tamper evidence so users can be confident of the source of their DTMs and know their functionality has not been altered by a third-party.

## User-Driven Enhancement



### Securing all layers of the architecture.

FDT 3.0 enables open, secure and scalable skid-to-cloud architectures and field-to-cloud integration. At the same time, it includes inherent security features that complement their own detailed security models. FDT deploys a secure by design approach, including robust security at all points of ingress or egress in the architecture—from the DTM to the network layer (if applicable) and across all related components.



## FDThub

The *FDThub* provides convenient access to certified Device and Communication DTMs in a single, online or offline repository. Many consider the new *FDThub* the most important feature of the FDT 3.0 standard for both the device developer and end user communities.

Designed for cloud-based, on-premise or air-gapped deployment, the *FDThub* is now part of the DTM certification process. Once a DTM is certified, it is uploaded to the *FDThub* and made available when the vendor's product is ready for release. This solution supports automatic device discovery and makes it easy to notify end users when there is a new or updated certified DTM available directly from a centralized repository.

With this versatile resource support for machine-to-machine communications with 509 electronic security certificates for machines with authorized access, an end-user at one location simply applies for access to the *FDThub* for that site. Upon approval, they receive a 509 certificate that can be installed within their application. This step provides automatic authorization for the application to access the repository in the background to obtain DTMs.

### User-Driven Enhancement



#### **Repository eliminates device management headaches.**

When implementing an automation project, end-users won't have to go searching for FDT/DTMs for their field devices. All of the correct DTMs will be located in the *FDThub* and made available for automatic download and installation.

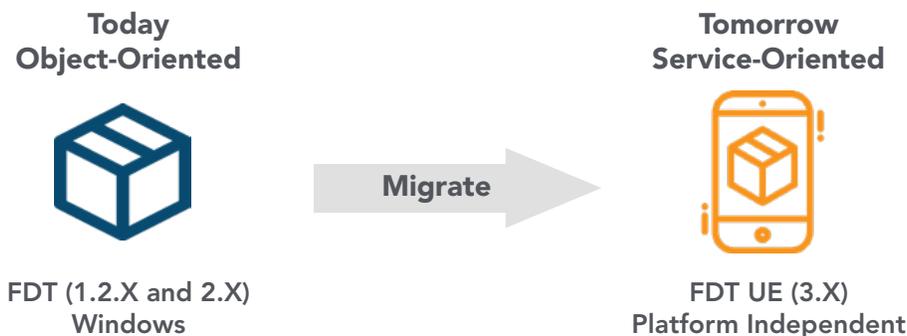


# Protect Your Investment: FDT UE Offers Backwards Compatibility For Easy Migration

Suppliers new to FDT or upgrading an existing product line will benefit from advancements that empower next generation FDT solutions. This includes an open, secure, fully standardized, and data-centric integration ecosystem connecting legacy investments with cloud, on-premise, edge, and enterprise access.

A major difference between the earlier FDT 1.2 standard and FDT 3.0 is separation of the graphical user interface (GUI) and business logic (BL). The millions of DTMs using FDT 1.2 and FDT 2.0 have backwards compatibility so users can take advantage of new capabilities without changing devices. FDT 3.0 supports phased migration so users can migrate field devices when they are ready either through greenfield (new) applications or brownfield (migration of existing assets).

End users can expect data transparency through the cloud application, data-driven analytics and enhanced mobility. A familiar look and feel, based on the browser-based configuration, gives users a consistent experience and offers easier maintenance and universal operation. With the open, embedded FDT Server, data is available to higher level systems as common parameters define how to display diagnostic data.

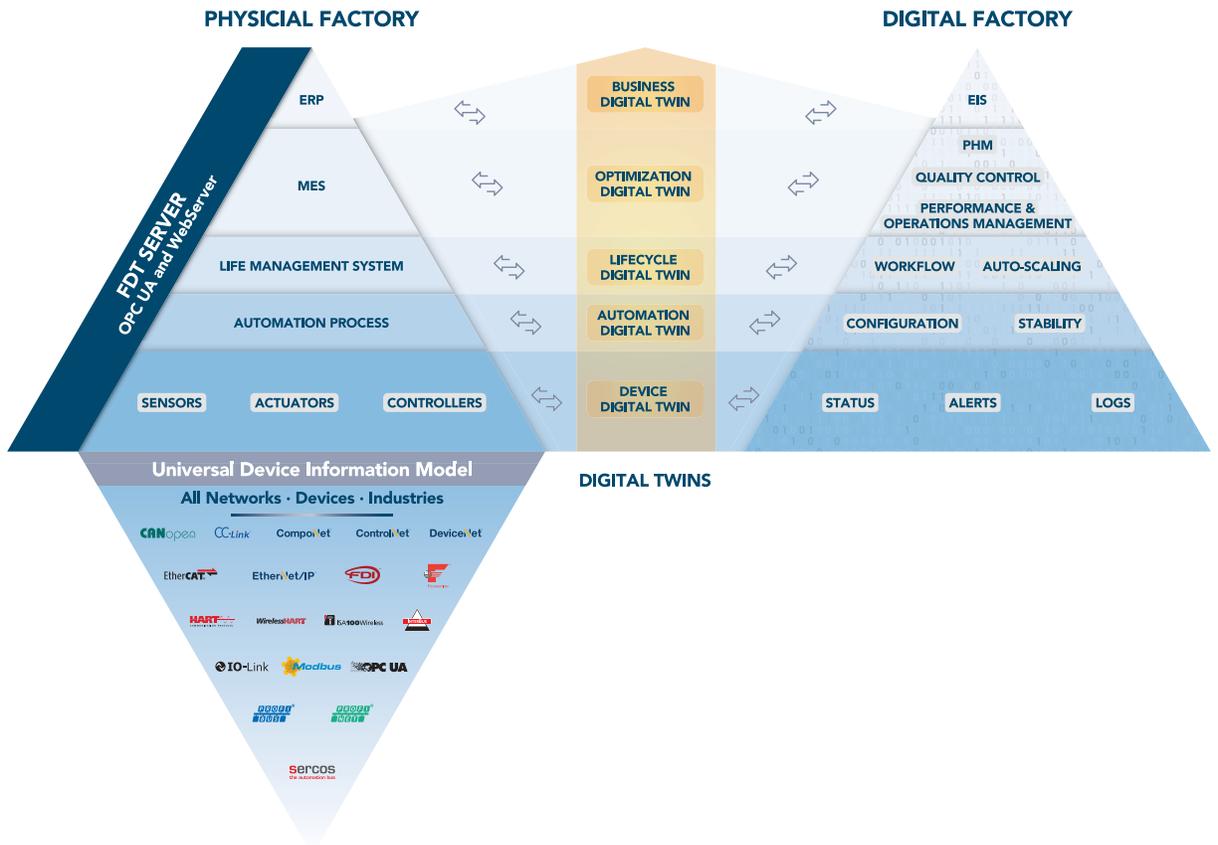


FDT moves from an 'object' oriented architecture to 'service' oriented architectures unleashing universal industrial device management business benefits with endless scalability. From a single-user desktop application for device integration, configuration, and monitoring to a multi-user distributed server application architecture, FDT UE enables modern remote operational lifecycle management and allows:

1. **Device Vendors** – to offer predictive analysis and preventive maintenance, sell upfront analytics as a service, and be more proactive with a clear view of what's happening in the operation.



2. **End Users** – to deliver a better overall maintenance strategy and take advantage of mobility and standardized UI to configure all devices across any network, device or industry.
3. **System Manufacturers** – looking for IT/OT convergence to benefit from a secure, scalable, and adaptable platform.



FDT’s strength in visualization and data analytics extends to emerging technologies — like digital twin – supporting better decision making, improved data insight and visualization, more modern and consistent workforce training and efficient standard operating procedures.

With FDT 3.0’s platform independence, every device vendor or service provider can utilize an edge gateway or cloud instance to push data from multiple facilities to a centralized location for enterprise monitoring and asset management.

**System Side** – At the core of FDT’s digital transformation pathway is the introduction of the new FDT Server. Empowering a robust, platform-independent environment, the FDT Server natively integrates an OPC UA Server for enterprise-wide data access and a web server mobilizing remote operations. This innovative solution transforms asset management practices and business system integration for both the automation supplier and end user communities in the process, hybrid and discrete manufacturing markets.



**Device Side** – Device suppliers transitioning from the use of FDT 1.2 to FDT 3.x-based DTMs will no longer have to deal with the coding challenges associated with the co-mingled BL and UIs that limit access to single user applications. FDT 2.0 DTM BL and UIs were developed as separate files to support distributed client/server architectures for improved accessibility and data modeling. With FDT 3.0, DTMs continued with the separated BL and UI format, but the UI was enhanced to a WebUI (HTML5 and JS) allowing interfaces to become portable and responsive and usable via browsers and mobile devices supporting multi-user FDT Server environments.

## Essential DTMs

Traditionally, automation manufacturers have employed two types of DTMs: Communication (Comm) DTMs providing direct access to a communication component for a specific class of device, and Device DTMs that interact with a Comm DTM to access its field device. FDT 3.0 technology encompasses essential classes of DTMs:



- **Device DTMs:** Utilized by a host of instrumentation—from simple devices to complex instruments—that employ DTMs for advanced diagnostics and asset management. Device DTMs can support one or a family of common devices such as pressure or temperature transmitters.



- **Universal DTMs:** Represent all devices with the compliant parameters of a specific protocol.



- **Interpreter DTMs:** Interpret other types of device representations, such as Device Descriptions (DDs), Electronic Device Descriptions (EDDs), Field Device Integration (FDI) Device Packages, and IODD to allow configuration and parameter access within an FDT system.

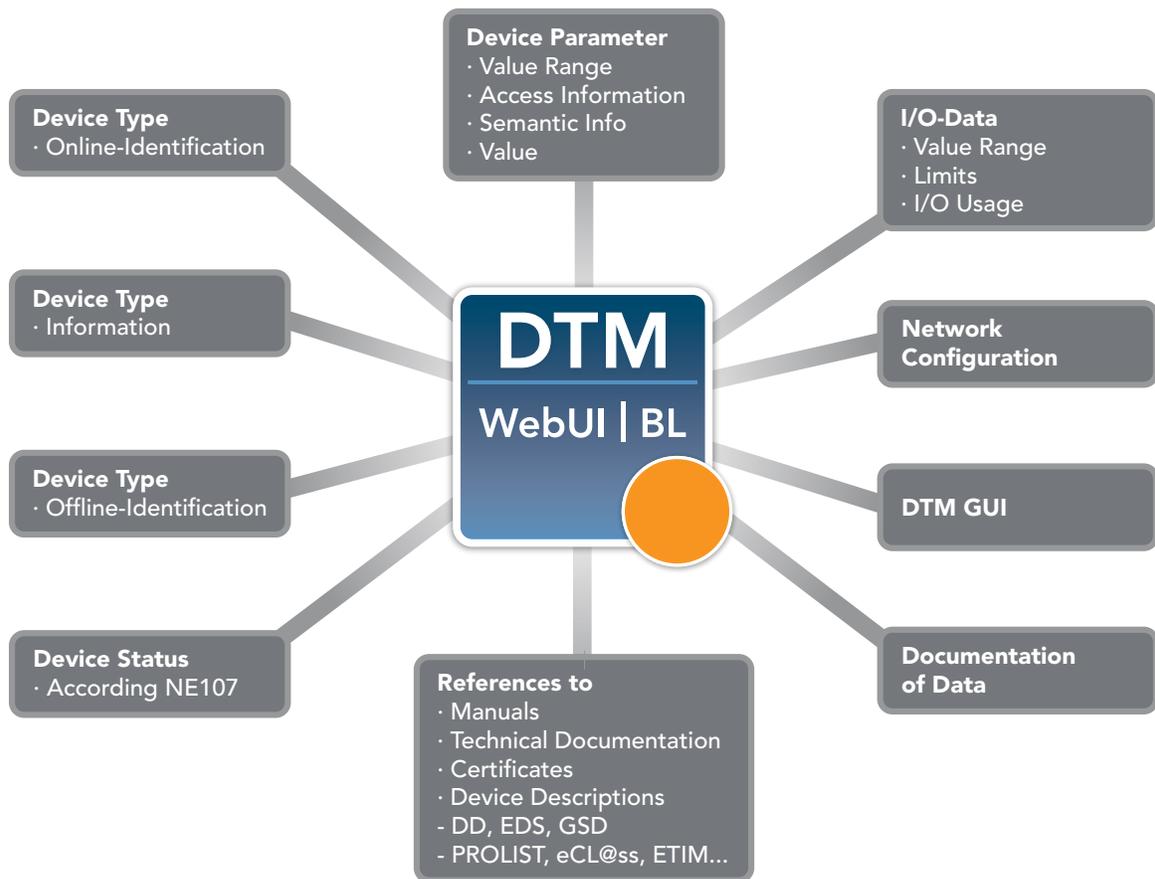


- **Communication DTMs:** Standardize the communication channel to the operations of the mapped IT/OT network protocol.



- **Gateway DTMs:** Allow communication to transition between the communications paths of different protocols.





Today, FDT/DTMs are designed to run in an FDT/FRAME™ (also known as an FDT Desktop), a software application that enables a graphical interface used to configure, maintain and diagnose intelligent devices from different suppliers. The FDT-enabled engineering application initiates the DTMs and automatically routes the communications and information exchange through complex, disparate networks for data transparency. With a portable UI, the FDT Server is independent of configuration tools, a control system/PLC engineering tools, operator consoles and asset management tools, enhancing mobility.



# Common Components Toolset: Key to Compliance, Interoperability and Reduced Time to Market

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With the introduction of the FDT 3.0 standard, FDT Group released a Common Component toolset to help the vendor community jump-start FDT development with a modernized Integrated Development Environment (IDE) to create next-generation, data-centric solutions, including compliant FDT Server, FDT Desktop and FDT DTM components.

There is no extra coding needed for OPC UA access, and device data will automatically be accessible across the enterprise. These features free DTM development teams to focus on value-added parameter profiles for device functions, web UI and customized app features.

The FDT 3.0 standard and its DTM Common Components support a secure DTM deployment procedure, enabling developers to package and sign DTMs and offer customers the assurance they have been tested and certified by FDT Group.

Companies that use Common Components will see reduced cost and effort for DTM development and certification.

Common Components include thousands of lines of prewritten and tested code that ensure DTM base code complies with the FDT standard. This robust toolkit frees DTM developers from writing and debugging their code to focus on enhancing their products with advanced parameter profile features. Common Components Help Files provide step-by-step instructions for optimizing DTM development activities.

Leading developer organizations supporting FDT Group have devoted thousands of engineering hours to the Server, DTM and Desktop Common Components to optimize R&D efforts within the automation vendor community. The toolset has been tested together to ensure a high level of confidence in the interoperability of different generations of supplier components. Working groups within the FDT organization developed Server and DTM prototypes in tandem to ensure they work and interact seamlessly.

## Migration Decisions

FDT 3.0 is the universal standard for IT-network/OT protocol and device integration including any vendor or device representation (DTM, DD, IOOD, GSD, EDD, FDI, etc.).

**System vendors:** Upgrading the FRAME to an FDT 3.0 Desktop solution makes it easier for current users and a legacy install-base to accept FDT 3.0 DTMs since desktops are backwards compatible with all DTM generations. Consider adding an FDT Server to your asset management solution to phase in 'lines' and introduce scalability with distributed control focused on a data-centric, service-oriented business model approach for next-generation manufacturing.



**Device vendors:** The work of migrating from FDT 1.2 to 3.0, with the need to rearchitect the BL and UI, is done through the DTM Common Components. DTMs will be Information Model Ready and work seamlessly in the FDT Server with OPC client and web interface access, as the data parameters are uniform and can pass seamlessly. This allows the DTMs to have service access on the OPC UA or FDT client side.

## DTM Style Guide

The Style Guide conforms to NE 107 device health status symbols. The UI design for measurement and control applications has critical importance within modern industrial operations, as it leverages operator behavior and machine communication together delivering the best “human-centric” user interface experience possible.

UI design for today’s web-based environment isn’t just about buttons and menus; it’s about the interaction between the user and the application or device, and in many cases, it involves the interaction between multiple users through that device.

A well configured UI is key to ensuring an effective user experience (UX). And the design of an optimized Web UI requires adherence to a Style Guide, which is a development tool that brings cohesion to a digital product’s user interface experience. Style Guides employed for Web UIs focus on intuitive user interactions—ensuring that the interface has elements that are consistent, uniform, and easy to access and understand.



Style Guide Responsive WebUI Template

As part of FDT Group’s comprehensive DTM testing process, accredited test sites test DTMs against the current FDT specifications. DTMs that are compliant with the specifications allow open access to intelligent devices and the information available from those devices, networks, and plant and factory processes. FDT 3.0 DTMs pass both conformance and Style Guide tests to receive certification.





## FDT 3.0 | Universal Platform

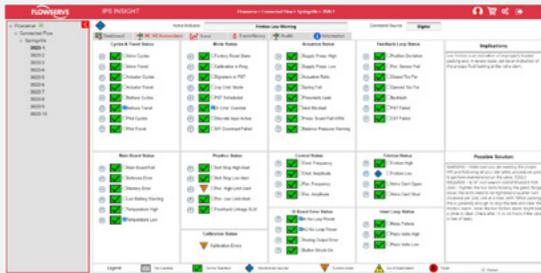
Responsive FDT DTM WebUI via FDT Server

# Scalability Benefits: End Users, System and Device Suppliers

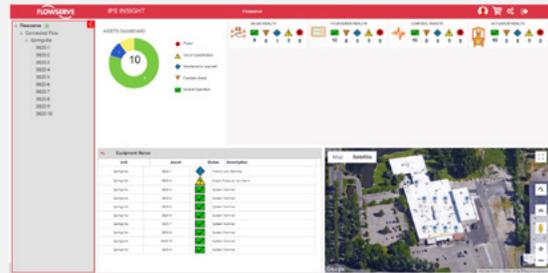
FDT is a powerful, data-centric integration technology that can bridge current automation assets, network, and any proprietary network. The technology provides expanded access to data from a single, centralized location so analysts can make better use of the information to improve operations. End users can install a single instance of an FDT Server and make it accessible across their facility for deployment. All real-time data from installed devices is automatically available through OPC UA to enterprise-level applications such as manufacturing execution systems (MES), enterprise resource planning (ERP), computerized maintenance management systems (CMMS), and dashboards.



## Example of a customized service-oriented portal via the FDT Server



Device list of NAMUR Alarms



Plant Dashboard



Device event history



Specific Device Dashboard

The new FDT Server empowers a scalable solution and provides end users with flexible options on how to distribute their data within the enterprise with pre-wired OPC UA and Web servers. The FDT Server environment can scale from a small, low-cost Linux box running a remote OEM skid asset management environment, up to a multi-facility, enterprise-wide, cloud-based installation.

The FDT scalable solution allows users to take control of critical operational data and obtain the information needed from different networks and devices—regardless of protocol.



Development of a proprietary server solution can often require years of work by a dedicated team of specialists which often results in another automation island rather than a multi-vendor integrated solution. With FDT 3.0, there is no need for automation stakeholders to develop their own IIoT server. They can deploy the FDT Server with native OPC UA capabilities and web services right out-of-the-box with no additional coding.

### Empowering End Users



- Fully enables secure remote access of all functions
- Seamlessly integrates all industrial networks into one project view
- Scalable from skid to enterprise cloud level
- Securely access device data across the enterprise without PLC/DCS host intervention
- Supports all wireless mobile platforms for increased productivity and flexibility
- IT/OT integration
- Confidence from built-in, multi-layer security
- All certified DTMs automatically accessible from the FDThub

### Enabling System and Device Suppliers



- Empowers innovative business models through scalability and flexibility
- State of the art, secure, platform independent server architecture – skid to cloud
- Multi-layer security throughout helps to protect brand value
- Platform independent OPC UA server is pre-wired into the FDT Server Common Components
- Easily integrate into larger control/asset management solution or use for standalone deployment
- FDT Desktop backwards compatibility supports the installed base



# Conclusion

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The FDT 3.0 standard makes it possible for automation companies to deploy new business models. These models leverage the advantages of improved interoperability, a modern Web UI providing customization and mobile access capabilities, streamlined DTM certification and cloud repository features, and easier developer tools to help reduce time to market.

FDT 3.0 covers digital transformation use cases for data harmonization and visualization. FDT's strengths now offer embedded extensions to the enterprise and modern web-based access for the OT workforce.

With information so readily available, companies with strategies to harvest it become more productive and globally competitive. End users, system and device suppliers migrating to the latest technologies can increase the productivity of their people and their customers, more easily innovate, and unlock new opportunities and sources of revenue.

Take advantage of actionable data and get the most out of current resources and systems by proactively planning migration rather than waiting until the end of a system's lifecycle. Keeping up on current versions of software and applications means you are more likely to realize the immediate and long-term benefits of features like mobility while having the latest technology to support business needs.

Contact the FDT Group at [inquiry@fdtgroup.org](mailto:inquiry@fdtgroup.org) to ask about FDT 3.0 Common Component toolsets and specifications.





Empowering the Intelligent Enterprise



## For More Information

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