One device – one package – all tools
The ultimate goals of FDI for suppliers are a common set of development tools and test requirements across the major protocols and for end users, a simpler path to integrating the essential information from intelligent devices across differing networks and the delivery of that information to the people that need it in operations, maintenance and process engineering.

The development of FDI technology marks an unprecedented level of cooperation among suppliers and foundations to achieve a single device integration technology across protocols for the management of information that comes from intelligent field devices throughout all areas of a plant. While end users will benefit from enhanced interoperability, manufacturers will benefit from cost reductions.

FDI fits perfectly with the strategy of PI. Suggestion: For both PROFIBUS and PROFINET it’s unquestionably a backbone for communication networks in process automation applications. It offers significant benefits to both our users and our device vendors.
Glenn Schulz
FDT Group
» FDI is fully compatible with all versions of HART, PROFIBUS and PROFINET, and Foundation Fieldbus, and all devices using those technologies. It’s also fully supported by FDT2™ and it works seamlessly with any control, asset management, manufacturing execution, or business application using those technologies.«

Ron Helson
HART Communication Foundation
» FDI is a powerful solution for the past, present and future. It protects your current investments by supporting the devices and technologies you currently have in your plant. FDI also protects your future investments by having the capability to support the most complex future devices and technologies.«

Thomas Burke
OPC Foundation
» All five organizations are committed to standards-based technology and interoperability. EDD provides excellent horizontal interoperability, and adding OPC UA will ensure that the enterprise layer will have rich vertical interoperability in a standard-based, open environment that is platform and operating system independent.«

Leading Technology
The key to interoperability
Today's field devices are looking more and more like computers themselves. Intelligent, microprocessor based devices residing across a wide choice of networks are offering a wealth of data that has never been available before. This increased data, however, creates an information management dilemma. How can we take the storm of data created by intelligent devices and turn it into useful information?

In this environment, the need for a universal, standardized and interoperable technique to comprehensively describe automation components is more important than ever. It is vital for everyday purposes like device configuration, device replacement, maintenance, diagnostics or audit trails – all essential building blocks in a modern field device management system. This description must be usable for all systems, independent of suppliers of devices, systems or tools. Without it, the true potential of decentralization, transparency, integration and a central view of all data and functions cannot be fully realized.

FDI is the path to the future. It has been specified and developed by the automation industry's leading technology foundations and major suppliers of process control systems and field instrumentation. The specification is based on close cooperation with end users and end user organisations. So the requirements of NAMUR and WIB have been included in the FDI specification. FDI provides an intelligent migration strategy from the past to the future using state of the art technologies for one reason: to make life easier for the end user.
Integrated solutions

The key to interoperability
FDI – how does it work?

**FDI – A Single Approach to Device Integration**
FDI technology has been developed and is supported by the automation industry’s leading technology foundations and suppliers. With FDI the advantages of FDT® are combined with those of EDDL in a single, scalable solution. FDI takes account of the various tasks over the entire lifecycle for both simple and the most complex devices, including configuration, commissioning, diagnosis and calibration.

FDI is more than just a new technology: FDI brings synergy to your existing solutions.

**A Perfect Team – Proven EDDL combined with the newest IT-technologies**
The core of FDI Technology is the scalable FDI Device Package. An FDI Device Package describes a field instrument or an automation component in all aspects. No other files are needed to work with such a field instrument or component. The core of an FDI Device Package is a device specific Electronic Device Description (EDD) which is based on the harmonized Electronic Device Description Language (EDDL, IEC 61804).

FDI Device Packages can be processed in FDI hosts as well as in an FDT2 frame application. This allows device suppliers to create a single FDI Device Package for their devices - instead of separate DTM’s and DD’s - while still providing users the choice of either an FDI host or an FDT host environment.

**FDI Hosts**
FDI hosts are able to import FDI Device Packages and allow the user to operate the corresponding device. The FDI host can be
- a stand alone tool
- an integrated tool in a Process Control System
- a tool with a client server architecture.

FDI cooperation provides uniform host components, such as the EDD Engine (interpreter), to ensure interoperability. These components can be used by any FDI host.

FDI specification supports a wide range of FDI host architectures up to a Client/Server-architecture where OPC-UA can be used for local and network-wide communication.
Future has just begun

The key to interoperability
Device Packages
The core element of FDI

Why do I need a Device Package?
First of all – don’t worry! In your daily work there will be no need to know any details about Device Packages – just this: there is exactly one package for each device and it is used by all your tools or systems, ranging from handheld devices and standalone PCs to complete process automation systems with sophisticated control and asset management functions. The usage of such tools is state of the art, even for simple devices.

A Device Package describes a field instrument in terms of
- Definition of general aspects of a device (Def)
- The business logic of the device (BL)
- Structure and content of the user interface (UID)
- Optional user interface plug-ins (UIP)
- Attachments

The Device Definition (Def) describes the field device data and the internal structure (e.g. blocks)

The Business Logic (BL) of the device primarily ensures that the device data remain consistent, e.g. refresh data when unit is changed.

User Interface Descriptions (UID) and User Interface Plug-ins (UIP) define the field device user interfaces. The mandatory UID allows the complete operation of a field device. The optional user interface plug-ins (UIPs) offer the advantages of freely programmable user interfaces familiar from FDT, based on Windows Presentation Foundation (WPF).

Product documentation, protocol-specific files, such as GSD or CFF, etc. will all be added to the FDI Package as Attachments.
A new definition of workflow

The key to interoperability
FDI Hosts – Unique and Powerful Interface to Field Devices

What is an FDI Host?
An FDI host could be
- Device management software as part of a Process Control System
- A Plant Asset Management System
- A device configuration tool on a laptop or a handheld field communicator.

Hosts and Device Packages
Device packages are imported by FDI hosts and not installed like programs in the basic operating system (e.g. Windows). After importing a device package for a specific device type a user may immediately start operating the device. No reboot of the machine is needed. All interoperability problems with Windows versions and components are a thing of the past.

Common Host Components
Interoperability is a major requirement for the process industries, just as it is for FDI. To guarantee this, FDI has developed a collection of uniform, multiprotocol standard host components to ensure that an FDI Device Package behaves in the same way in various systems. These components could be used by FDI hosts.

Host components are
- EDD Engine
  The EDD Engine supports the entire scope of EDDL in a multiprotocol manner, in accordance with IEC 61804. It is backward compatible with existing EDD formats.
- UI Engine
  The UI Engine ensures that user interface elements of the device package, UID and UIP, are executed in the same way in various host systems.
Open interfaces and scalable architecture with FDI

Openness and scalability – key success factors of FDI
The FDI standard allows the implementation of different software architectures for a host. A host can be implemented starting from a tool for a single user up to a distributed multi-user application with a client/server-architecture which typically consists of three main components: FDI clients, an FDI server and one or more FDI communication servers.

- FDI client(s)
  An FDI client is used by operators to work with instruments or other automation components. It contains the UI Engine, which shows the user interface on the screen, interacts with the user and sends and receives data to/from the FDI server.

- FDI server
  The FDI server is the core component of the FDI architecture. It manages device packages, invokes online communication to connected devices, maps the communication topology of the automation system and controls access to the database without the risk of unauthorized access and damage.

- FDI communication server(s)
  Normally an FDI server supports standard protocols like HART, PROFIBUS, PROFINET and Foundation Fieldbus natively. Additional communication paths can be integrated by communication servers. All needed interfaces are defined in FDI.

Generic OPC UA client(s)
The usage of the standard interface OPC-UA in FDI hosts allow easy-to-use access from other applications. This results in a big benefit as these applications can be designed and developed independently – without any support by the supplier of the FDI host. The OPC UA services supported by the FDI server allows safe and secure access to the device or to stored offline data. Generic OPC UA clients can be maintenance tools or MES or ERP systems.
The path is clear
Currently, most commonly used tools are based on EDDL or FDT technology. Hundreds and thousands of device types are supported by these tools. These devices come from a broad range of suppliers. They may be brand new device types with an FDI package, or devices that have been installed and operating for decades using DTM or EDDs. This means FDI has to support FDI packages, DTM and EDDs in parallel.

FDI hosts – Formerly EDDL based
Device packages are imported by any FDI host and not installed like programs in the basic operating system (e.g. Windows). If you have existing EDDs you will have the capability to use them in an FDI host.

FDT tool supporting FDI
One way to enable an FDT host to support FDI packages is to develop a so-called FDI-DTM. This is a DTM that supports FDI packages. All other components like user interface and communication interfaces may be unchanged.

Migration of new standards
EDDL has been standardized and harmonized, but new innovations and market requirements will continue to drive changes to the EDDL standard. FDI manages such innovations very easily and is designed to accommodate such changes: The FDI Common Host Components will be updated to incorporate these changes and provide access to new functionality while guaranteeing backward compatibility. After integration of these new components in an FDI host by the host supplier the new standard is supported and the user can enjoy the benefit of the innovation.
Innovations welcome with the key to interoperability

EDDL based FDI hosts support existing EDDs

FDT2 based FDI hosts support existing DTMs
The story of device integration

>> The late 1980s – EDDL first appeared around 1990 for use with HART instruments. A technician with a universal handheld communicator was able to walk up to any HART instrument, plug in, calibrate and adjust the instrument in the field. All that was needed was the correct EDD file. Interoperability was born!

>> The early 1990s – All in all 26 companies using the HART protocol in their products formed a user group. This marked the beginning of an “open” communications technology. These companies went on to establish the HART Communication Foundation (HCF) in 1993. Many users wanted to obtain the data via a digital interface, so EDDL was standardized to describe the information in an interpretable manner for a host control system.

>> 1994 – the Fieldbus Foundation (FF) adopted EDDL as a standard. Profinbus adopted EDDL as well, but the three organizations each supported the technology independently and slightly differently.

>> 2002 – FF, HCF and PNO enhanced EDDL and extended the concept of interoperability to the user interface and device diagnostics. It became an international standard in 2003 – IEC 61804-2.

>> 2003 – The FDT Group was started as an informal association by ABB, Endress+Hauser, Invensys, Metso, and Siemens

>> 2004 – the EDDL Cooperation Team (ECT) was founded at the Hanover Fair to promote and enhance EDDL technology. The team comprised HCF, FF, PNO and, now, the OPC Foundation.

>> 2005 – the OPC Foundation announced its adoption of EDDL as the descriptive technology used in its Unified Architecture (UA), thus extending interoperability even further.

>> 2005 – the “FDT Group” was founded in September 2005 as an International Not-For-Profit Association

>> 2006 – a revision to the International Standard was approved in 2006 as IEC 61804-3.

>> 2007 – The FDI standardization project was launched at Hanover Fair in 2007. Since then, the project has carefully shaped the technology direction for the converged FDI solution.

>> 2011 – The FDI Cooperation, LLC was formed by FDT Group, Fieldbus Foundation, HART Communication Foundation, PROFIBUS & PROFINET International, and the OPC Foundation. The activity is supported by seven major supplier companies: ABB, Emerson Process Management, Endress+Hauser, Honeywell, Invensys, Siemens, and Yokogawa.
Ease of use for users
- FDI provides the same look & feel for all devices within an FDI host, independent of device type, manufacturer, and communication protocol.
- Style Guide helps vendors to achieve the same look & feel.
- Wizards make complex procedures such as setup and calibration easy and reduce time, effort, and mistakes.
- A standard multilingual dictionary of parameter labels, options, and help, further promotes consistency.
- FDI hosts can support FDI Device Packages for generic HART, Foundation Fieldbus, and PROFIBUS devices, ensuring basic device functionality can be accessed even if the proper FDI device package has not been loaded.

Ease of use for system administrators
- Connectivity to ERP and MES systems based on OPC-UA
- As FDI packages are imported by the FDI host no software installation is required. This makes system administration much easier and reduces the cost.
- Common functions like save, print, export, and reconcile are device independent.

Robustness
- FDI packages do not impact system robustness.
- FDI packages are not programs which have to be installed and do not overwrite system files or make registry entries.
- An FDI package for one device type does not have any impact on already integrated devices.
- Multiple versions of the same device type can coexist.

Migration and investment protection
- New versions of FDI hosts must be compatible with older versions of FDI Device Packages.
- Installed and proven devices will continue in operation as an FDI host may support EDDL or FDT in parallel with the new FDI technology.

Interoperability
- The HART Communication Foundation, Fieldbus Foundation, and PI International perform conformance tests and register FDI packages and FDI hosts.
- Interoperability relevant software components of an FDI host (EDD Engine, UI Engine) are maintained centrally by the FDI Cooperation, LLC.
- The EDDL based Device Definition, Business Logic and UID parts of the FDI package are mandatory, ensuring devices can be commissioned without optional UIP.
- An FDI package uses harmonized EDDL compatible with the FDI standard host components.
- Interfaces between an FDI host to clients or communication servers are based OPC-UA.
Host suppliers supporting integration of field devices with FDI technology.

Host vendors:

More than 100 different suppliers of field devices and automation components from all over the world support EDDs for their device. Thanks to the backward compatibility of EDDL all devices will be supported by FDI hosts.

Device vendors (selection):
In 2011 NAMUR summarized the following most important requirements on Device integration\(^\text{1)}\), which have to be met by FDI (Field Device Integration) to be accepted as the new standard for device integration. With FDI, functions and information from devices can be made accessible to superordinate systems with the aid of device integration (e.g. to central PCS or maintenance systems), which is generally independent of the manufacturer and the data transfer method employed.

- Harmonized EDDL must be used within FDI (e.g. within the device packages).
- FDI standard common host components must be utilized completely and consistently as the standard interface for device packages in all FDI systems (servers, FDT (2.0)....). These standard common host components must be centrally administered as a toolkit.
- The EDD blocks “Device Definition”, “Business Logic” and “User Interface Description” must be mandatory in all device packages in order to support the start-up of the devices.
- Migration solutions should ensure further operation of devices presently installed within new FDI systems.
- Each device must only have one device package. The selection of several device packages for a device (e.g. with different functionalities inside device packages) is not permissible.
- FDI servers, communication servers and clients must have a certified manufacturer-independent and standardized interface (e.g. OPC).
- There must be independent certification of all products (including frames/host interfaces/servers, style guide, device packages...). All new product versions must also be certified. Only certified products will be approved.
- Installation of a single device package (not only libraries) must be possible.
- Device packages must contain the complete functionality of a device, including cyclic and acyclic communication (e.g. GSD files).
- Standard profile device packages and profile communication packages (e.g. for nested communication) must be available.
- All certified download products (e.g. device packages) must be centrally available on an FDI homepage.
- Standard profile device packages and profile communication packages (e.g. for nested communication) must be available.
- Licenses restricting use of device packages and license fees are not permissible.
- A life cycle concept should exist for investment protection.

\(^{1]}\) Please find complete requirement list under http://www.namur.de/publikationen-und-news/news/\(\rightarrow\)

19.10.2011: FDI-User-Requirements 2011, in addition to NE 105
FDI Cooperation, LLC

The five major automation foundations, including the FDT Group, Fieldbus Foundation, HART Communication Foundation, PROFIBUS & PROFINET International, and OPC Foundation have developed a single common solution for Field Device Integration (FDI).

These foundations have combined their efforts to form a joint company named FDI Cooperation, LLC (a limited liability company under US law). FDI Cooperation, LLC is headed by a "Board of Managers," which is composed of the representatives of the involved organizations, as well as managers of global automation suppliers including ABB, Emerson, Endress+Hauser, Honeywell, Invensys, Siemens, and Yokogawa. FDI LLC marks an unprecedented level of cooperation among suppliers and foundations to achieve a single integration technology for the benefit of end users. FDI's mandate is to specify and develop a single technology for the integration of intelligent devices throughout all areas of the plant in automation solutions.

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