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Commentary on FDT/DTM vs. EDDL

This commentary is highlighting some observations in the WIB test report T 2768 X 07 "FDT/DTM or EDDL for asset management using FF technology" dated November 2007, usually left out when referenced by the FDT Group. It also explains some misconceptions, probably due to only one device having been verified.

The report was sponsored by the FDT Group, and as stated by WIB "*The sponsoring manufacturer of the investigation has the right to use and reproduce this report for commercial or promotional purposes, under the proviso that for such purpose it shall only be used unabridged and in its entirety.*" However, in FDT Group presentations and articles, findings are presented selectively and it is not clear it's based on only one device and systems not yet interoperability tested. Many important advantages of EDDL and drawbacks of FDT/DTM from the report are not mentioned in FDT Group presentations and articles.

1. Introduction

The report states "*The Fieldbus Foundation as representative of ECT has been invited, but declined to participate*". This was probably so because at the time of this evaluation no FF devices were yet interoperability tested and registered with enhanced EDDL files, and no FF control systems had yet passed the new Host Registration Process testing EDDL support. Another possible reason may be that the FDT group had already joined the EDDL Cooperation Team (ECT) in April 2007 and the spirit was now that of cooperation for future developments.

2. Concept

2.1 DD and CFF

The report states "*The device vendor prepares a DD file by using a programming language DDL (Device Description Language*" It is correct the device vendor prepares the DD file. The device vendor knows the device best and designs the menu structure and includes wizards and expert help to guide the user in setup, calibration, and diagnostics. For EDDL the device manufacturer can even control how the system displays the device. However, DDL is not a programming language, DDL is a markup language (just like the HTML technology used to design web pages). The fact that DDL is not a programming language is the biggest difference between DDL and FDT/DTM (DTMs are programmed using programming languages like C and Visual Basic etc.). The fact that DDL is a markup language, not a programming language, is the basis of the many advantages DD (and EDDL) has over FDT/DTM. They include but are not limited to these points identified in the NAMUR NE 105 report:

- Synchronized client workstations
- Supports handheld field communicator and other non-Windows systems
- Inherently consistent look & feel among device vendors
- Investment protection
- Intrinsically robust, not interfering with system, permitting integrated device management
- Files not affected by Windows version
- Easy system update without IT expertise
- No license keys for devices

These NAMUR NE 105 requirements were not evaluated in WIB report. However, the BIS report confirmed these and other NAMUR NE 105 requirements are met by EDDL. An introduction to EDDL in light of NAMUR NE 105 is useful before we start:

Multi-user synchronized clients

Because EDDL is a text file the display is rendered by the system. Thus the system is responsible for display, device communication, and handling the database. Since the system handles the database it can ensure all user client workstations show the same information. That is, other clients are refreshed when one user makes a change. Since the system handles the device communication it can also ensure that if device configuration is changed by external means such as a handheld field communicator or the local operator display on the device the clients can be updated. That is, data synchronization will be supported for all devices, not just some. This meets the requirements of NAMUR NE 105 clause 5.5.

For FDT/DTM synchronization should be programmed by every device manufacturer since the display is the responsibility of the DTMs while the communication and database is taken care of by the FDT. Not all DTMs support such synchronization, thus for some devices ensuring all clients show the same information requires manual steps. Seeing changes by external means such as a handheld field communicator or the local operator display require manual steps.

Single universal solution

EDDL is based on text files, not programmed software, and is thus operating system independent and can be used with embedded operating system such as those found on handheld field communicators. This meets the requirements of NAMUR NE 105 clause 5.1. For process plants a handheld field communicator is a very important maintenance tool because some tasks still require work to be carried out in the field. This includes for instance transmitter sensor trim, valve position feedback trim, and troubleshooting as per NAMUR NE 74 recommendation clause 5.1. Original DD technology is the basis for the universal HART field communicator which has served plants since 1992.

Because DTMs are software components programmed for the Microsoft Windows operating system requiring Microsoft COM and .NET, FDT/DTM does not support handheld field communicators, embedded web servers, or other systems not based on Microsoft Windows. Lugging a laptop into the field is not always practical. The IEC 62453 standard does not improve the situation because real-life implementations of FDT/DTM do not follow the standard but the technical report IEC/TR 62453 which is based on Windows. That is, in spite of the platform independent IEC standard, FDT/DTM products depend on the Windows version.

Note the parallel between EDDL and HTML. Both are text-based. Both work on any operating system. Both work on computers, laptops, and portables (browser plug-in software is another matter).

Consistent look & feel

EDDL is based on a text file in which the device vendor has described how they want the device to be displayed to be easy to use. That is, the device vendor controls the content & structure for the device information to be displayed in the system. The graphics as defined in the EDDL file is rendered by the device management software. The software renders menus, waveform graphs, trend charts, toolboxes, and dial gages etc. the same way, and all color coding to indicate a value is changed and must be downloaded, mismatch between device and database, communication error, or device failure is the same for every device in the plant regardless of protocol, manufacturer, or type. This ensures the highest level of consistency and ease of use. The same applies for access to help. This meets the requirements of NAMUR NE 105 clause 4.3.

Because DTMs are programmed software components, device manufacturers typically apply their own artistic style in spite of the existence of style guides since many years. Each DTM is essentially different software sharing a common Windows titlebar. Therefore devices are operated differently because functions for graphic pan and zoom, downloading changed values, help, and color coding

work differently and style is hard to test and enforce. In many cases the DTM is the device's stand-alone software with an FDT/DTM interface "wrapper".

Note the parallel between EDDL and HTML. Both are text-based. Web browsers render different web pages consistently (buttons, hyperlinks, text boxes, dropdown lists, etc. work the same way on all pages), and device management software renders different device pages consistently (waveform graphs, trend charts, toolboxes, dial gages etc.). Browser plug-in software is another matter.

Investment protection

EDDL is based on text files which are independent of and unaffected by the Microsoft Windows operating system version. That is, an EDDL file is compatible with any Windows version. The same EDDL file works on old as well as new versions of Windows. Therefore, when a new device type or version comes to the plant there is no need to upgrade the system (Windows version) in order to make the system work with the EDDL file for the new device. The system is not made obsolete by new devices. The investment is protected. Similarly there is no need to upgrade Microsoft.NET framework. This meets the requirements of NAMUR NE 105 clause 3.1.

Because DTMs are programmed software components, they work only for certain versions of Windows, not for much older or much newer generations. Therefore, as new devices and versions come to the plant the operating system may not be compatible with the DTM for the new device. The system quickly goes obsolete in that new device versions may not be supported in the existing system. Plants may be forced to upgrade their systems earlier and more frequently than planned. Upgrading the operating system may cause compatibility issues with other DTMs or the device management software and DCS software translating into cascading upgrades.

NOTE: The IEC 62453 standard is claimed to be operating system independent (and therefore Windows version independent) which is theoretically true. However, real-life implementations of FDT/DTM does not follow the standard but the technical report IEC/TR 62453 which is based on Windows. That is, in spite of the platform independent IEC standard, FDT/DTM products depend on the Windows version.

Note the parallel between EDDL and HTML. Both are text-based. There is no need to upgrade Windows just because a newly created web page is visited. There is no need to upgrade Windows just because a newly released device is added.

Non-interfering

EDDL is based on text files which are interpreted, not executed on the system. This means the EDDL file does not have direct access to system memory, hard disk, or Windows registry and thus cannot interfere with other EDDL files or system software. The EDDL files are copied and pasted onto the system, not installed. Every version of every device type from every manufacturer has its own dedicated file. This means loading files for new devices or versions does not overwrite other EDDL files, or interfere with system software, and does not make registry changes. Therefore EDDL is permitted on the DCS itself (not confined to an isolated maintenance system). Device diagnostics can thus be seen on the operator console and enabling operators to take action to protect the process in case of device failure, and to alert maintenance technicians in the field. Device alerts shall be prioritized such that only critical alerts affecting the process reach the operators to prevent alarm flooding. This way device diagnostics can become a natural part of maintenance practices. This meets the requirements of NAMUR NE 105 clause 3.2 and NAMUR NE 74 clause 2.4.

Because DTMs are programmed software components they have direct access to system memory and hard disk which can potentially be corrupted (due to bug in DTM) causing a system "crash". The procedure calls between the FDT container and the DTM component may not return as expected (due to bug in DTM) causing the system to "hang" waiting indefinitely. Because DTMs are programmed components they must be installed just like other software. After several DTM

upgrades system may become slow ("Not Responding"). DTMs consist of multiple DLL (Windows Dynamic Link Library) files, some shared with other DTMs or system software. When DTMs are installed there is a possibility that DLL for previously installed DTMs are replaced with an incompatible DLL-file preventing another DTM or application from working. Conversely, uninstalling an unwanted DTM may inadvertently remove a DLL file required by another DTM or software. This phenomenon is common for all Windows applications and is called "DLL-hell". The problem is compounded because many DTMs for many devices must be installed and updated over the life of the system as new device types and versions come to the plant over the years. Interoperability testing (both independent and by system manufacturer) may not uncover DLL-hell problems as these challenges depend on other DTMs installed before and after, order of installation, and other system applications etc. A DTM can support more than one device. For instance, some DTMs support all the manufacturer's device types including different protocols. This has the drawback that any time any of the manufacturer's devices has a new version a new DTM must be reinstalled increasing the chances of other devices being affected. Similarly Windows registry entries may be affected. This is what clause 5.3 is referring to as a *"vulnerability"* stating FDT/DTM is *"less attractive for the DCS"* and the reason why FDT/DTM can only be used *"in a dedicated maintenance server*". Similarly, for the same reason the IGR recommendation 04/2008/EMR states "*Due to interoperability reasons and plant availability reasons it is recommended to not utilize device integration by means of FDT-DTM directly in the control system engineering tool*" (translation from original in German). The drawback of having device management in a dedicated maintenance station is that device alerts are not seen in a timely manner because maintenance stations are typically not manned since maintenance technicians are out in the field. Therefore device diagnostics only shown in a maintenance station does not become incorporated as a natural part of daily work processes.

Note the parallel between EDDL and HTML. Both are text-based. HTML pages are secure and robust because it is not executed (browser plug-in software is another matter.). Device pages are secure and robust because EDDL is not executed.

Operating system version compatibility

EDDL is based on text files which are independent of and unaffected by Windows version, .Net framework version, Service Pack, and security patches. Therefore, as Windows is upgraded there is no need to obtain updated EDDL files for device type from the manufacturer (just upgrade the system software). Existing EDDL files just keep working. This meets the requirements of NAMUR NE 105 clause 5.3.

Because DTMs are programmed software components, they work only for some versions of Windows, not for much older or much newer generations. Therefore, when Windows is upgraded some DTMs may no longer be compatible. Therefore, when upgrading Windows it is not only sufficient to upgrade the system software, but newer versions of the DTMs for many of the devices must be obtained from each device manufacturer. Managing this will be time consuming. Even if system supplier takes on this responsibility via maintenance contract, one problem remains: For some old devices, new DTMs compatible with the latest Windows version may not be available. These devices become obsolete.

NOTE: As explained above, FDT/DTM implementation is not platform independent. That is, in spite of the platform independent IEC 62453 standard, FDT/DTM products are affected by Windows upgrades.

Note the parallel between EDDL and HTML. Both are text-based. There is no need to redesign web pages just because Windows is upgraded (browser plug-in software is another matter). There is no need to get new EDDL files just because Windows is upgraded.

Easy system update

EDDL is based on text files which are copied and pasted onto the system, not installed. Therefore IT skills are not required to update the system to support new devices as they come to the plant. It is a very quick procedure. Some systems even have wizards to assist in loading the EDDL files making sure they are saved in the right folder. The system automatically identifies the right EDDL file for the device based on its file name. System administration is thus easy. Password with 'administrator' level access need not be granted to technicians - it can remain the supreme authorization level preventing, software installation and uninstall. There is no need to close other Windows software to load EDDL files. EDDL files can be copied from system to system and be backed up as easy as documents. Because the EDDL files are small and not programs, system vendors load EDDL for all devices and versions, not just those originally planned, so system is ready for devices unexpectedly part of package units. This meets the requirements of NAMUR NE 105 clause 4.1.

Because DTMs are programmed software components they must be installed, on each computer, just like other software. Therefore, the technician commissioning a new device requires IT expert knowledge or system manufacturer support to tackle perplexing installation dialogs on DLL component replacement and license key management.. For instance, the technician may be asked if DLL files shall be replaced, about file locations, resources, and about license agreements. To install a DTM all instrument technicians are required to have a password with 'administrator' level access on the system. This constitutes some cyber security risk because the technician can install any software on the system or inadvertently cause some problem. Software installation is time consuming, and each device must be manually mapped to its DTM. Maintaining the library of installation CDs with the latest DTMs and service packs is an additional system administrative task.

Note the parallel between EDDL and HTML. Both are text-based. You don't have to install web pages, the HTML files are simply read (copied) from the web server (to browser). A browser plug-in software is another matter. You don't have to install EDDL files, they are simply copied.

No license keys

EDDL is based on text files. Therefore license key lockout of functionality is not possible. Thus there is no hidden license key cost or administration overhead associated with EDDL files. This meets the requirements of NAMUR NE 105 clause 5.2 and NAMUR NA 114 clause 3.

DTMs are software programs that support license keys. Therefore many DTMs are licensed using different licensing schemes. Some DTMs can work for 30 days for free but then require license. Other require license to unlock advanced features and so on. Apart from the additional cost, there is a heavy administrative burden to obtain license keys for every computer from every device vendor, and to keep these keys current as DTMs are upgraded.

Note the parallel between EDDL and HTML. Both are text-based. HTML pages cannot have license keys because they are not programs. EDDL files cannot have license keys because they are not programs

2.2 EDDL concept

The report states "*The new EDDL language covered new items such as methods, menus and parameter descriptions*" but methods (wizards) and parameter descriptions (plain text label and help) have existed since 1992, just that some DCS did not fully support all features of EDDL until 2009 when it became mandatory in FF Host Registration Process (interoperability testing for systems).

The report states "*The EDDL language determines the level of device complexity that can be handled*" implying EDDL is inadequate for sophisticated (complex) devices. However, the graphical elements (waveform graphs, trend charts, dial gages, bar-graphs, bar-charts, histograms,

LED indicators, and images etc.) are the same in simple as well as complex devices, only that complex devices have more of the same. These functions are already built-in, part of EDDL and are provided by the system, no programming required. EDDL enhancements provide graphics without the drawbacks of software components, that is graphics without compromise. The same applies for hierarchical menu systems and pop-up windows as well as wizards. This is how EDDL is used for such complex devices such as radar level transmitters, valve positioners, machinery health transmitters, ultrasonic flow transmitters, and variable speed drives etc. since 2006. However, no device makes use of all capabilities of EDDL, a variety of devices would have to be evaluated to see the full capability of EDDL. Since the testers were limited to evaluating just one device with enhanced EDDL they did not have a chance to experience the full capability of EDDL.

Corrupted

The report states "*This device vendor producing the EDD has to be aware of all different DCS EDD Services (resulting in different displays per device) to ensure that his EDD will not be displayed corrupted*" referring to figure 13 in which the Invensys systems displays cryptic hexadecimal codes instead of the descriptive text it is supposed to show. This is not a problem with the EDDL standard. This is happening because the EDDL technology is not yet fully implemented in that particular system. Had the Invensys system undergone the Host Registration Process this would not happen. The evaluation was premature.

2.3 FDT/DTM concept

The report states "*... HART organisation support the FDT/DTM technology*" which is not correct because the HART Communication Foundation (HCF) has no FDT/DTM specifications. HCF only has specifications for EDDL (document numbers HCF_SPEC-500 and HCF_SPEC-501). The same applies for Fieldbus Foundation (document numbers FF-900 and FF-901). Although the FDT Group have their own specifications for HART DTMs and FF DTMs, these are not developed with the HART Communication Foundation and Fieldbus Foundation.

Note that system manufacturers may also develop DTMs for various proprietary communication protocols and interface hardware for which only they can provide compatible field devices. Be weary of investing in such solutions, and do not let it delay migration towards standard protocol field devices.

As compared to EDDL the report says "*...DTMs are in concept more powerful, enabling device manufacturers to give end-users readily and open access to their advanced and competitive functionality*" implying EDDL does not give end-users open access to advanced functionality in devices. However, the EDDL technology was created by device manufacturers to enable them to meet the needs of the users of their devices, simple and complex. The EDDL standard includes the graphical elements, help mechanism, and wizards etc. required to give users access to advanced and unique device features. As explained for clause 2.2, EDDL is used for many complex devices but only one device was verified for this report, hence the full capability of EDDL was not seen.

It should be noted that EDDL technology does not provide unlimited functionality, and for a very good reason. EDDL files do not have direct access to system memory, hard disk, or Windows registry and thus cannot interfere with other EDDL files or system software. Thus EDDL is a more robust and secure solution. This is a highly valued characteristic in the process industries.

Another point to note is that although FDT/DTM technology indeed has the potential for immensely powerful graphics, most DTMs do not make good use of this capability and merely show parameter values. Systems manufacturers may supply the FDT container together with DTMs for third-party devices merely show parameter values, not providing the same functionality as the device manufacturer's own DTM.

Lastly, note the parallel between EDDL and HTML. Both are text-based. Both are interpreted thus preserving security (browser plug-in software is another matter).

About FDT/DTM the report correctly states "*Device commissioning and parameterisation is at present relatively poorly supported, often requiring multiple external software tools*" This is not mentioned in the FDT Group's summaries

The report correctly states "*Hence there is an overlap in the various technologies*" That is, FDT/DTM and EDDL are not complementary so you don't need both' as is often claimed by FDT Group. That is, the functionality provided by FDT/DTM is also provided by EDDL. Thus a system that has EDDL does not need FDT/DTM, thus just one technology to master.

However, the opposite is not true. An FF system cannot function without EDDL files. A system that supports FDT/DTM must also support EDDL. Therefore two technologies to master.

Advanced Diagnostics of Complex Devices, Graphics, Calculations, Wizards

As compared to EDDL the report states "*However, the DTM provide more powerful GUIs (Graphic User Interface) to support the parameterisation, configuration as well as diagnostic interrogation of complex devices. Furthermore (online) complex calculations and wizards can be implemented and displayed in the DTM.*" implying EDDL has limited graphics unable to support setup and diagnostic of sophisticated devices, EDDL cannot do calculations, and EDDL does not support wizards. As explained for clause 2.2, EDDL is used for many complex devices but only one device was verified for this report, hence the full capability of EDDL was not seen. Some device displays are implemented with more wizards than others. And the level of sophistication of wizards also differs from one device to another. One device is not representative of the full capabilities of EDDL. Calculations mostly run in the device itself, in real-time, whether the device page is open or not, for local display, access by DCS control strategy or historian etc, not using FDT/DTM or EDDL. EDDL is only used to display the result when the user opens the page. The EDDL pages for some devices may perform additional dynamic mathematic expressions on data before display. Diagnostics mostly runs in the device itself, in real time, whether the device page is open or not, to detect and alert faults even if nobody is watching. EDDL is only used to display the result when the user opens the page. Depending on the device, diagnostics may be displayed in the form of numbers, text, bar charts, histograms, or waveform graphs etc. EDDL is used with advanced diagnostics in sophisticated machinery health transmitters, ultrasonic flow transmitters, valve positioners, and drives etc. As explained for clause 2.2, EDDL is used for many complex devices but only one device was verified for this report, hence the full capability of EDDL was not seen.

Look & Feel

The report correctly states "*The DTM is programmed and delivered by the device manufacturer to interpret the device data and display it to the user with a device manufacturer specific look & feel...*" That is, FDT/DTM look & feel is not consistent in devices from different manufacturers. This is not mentioned in the FDT Group's summaries. The statement continues "*...although the DTM for one vendor is the same displayed on all systems...*" but that does not help the user with respect to dealing with many types of devices from different manufacturers. The report continues "*...there is a style guide trying to create some consistency among different vendors*" but as noted in the following paragraph the style guide which has existed since 2000 has not been successful in curtailing individualistic creativity among device manufacturers and is not possible to enforce and therefore the style guide attempt is unsuccessful in establishing consistent look & feel.

The report states "*In case of EDDL the look and feel is fully determined by the DCS vendor. This includes the option to not show all device parameters if the DCS vendor decides so.*" Original DD technology from 1992 did not support standard graphics, hence graphics in proprietary formats were created by each DCS vendor. However, this is not the case for EDDL. As explained above, EDDL enhancements include standard graphics enabling device manufacturers (not the DCS manufacturer) to define how they want their device to be displayed in the system to make it intuitive to use. Since the content & structure is defined by the device manufacturer (not the DCS manufacturer) no information is not shown.

The report does not make clear on the important distinction between "content & structure" on the one hand, and "look & feel" on the other. The ability to separate "content & structure" from "look & feel" is key to the display consistency achieved with EDDL. For EDDL the device manufacturer (not the DCS) determines the content & structure (e.g. if there is a button or not, and where in the menu the button is located). Yet, the look & feel (e.g. the size and color of all buttons) is rendered the same way for all devices on the system. Because the look & feel is rendered, EDDL is intrinsically consistent.

The report correctly states "*At present the style guide is not resulting in the same look and feel for DTM's from different device vendors.*" because look & feel cannot be tested and therefore not enforced so a style guide is not an effective approach to curtail the DTM programmer's artistic flair and individual style. This is not mentioned in the FDT Group's summaries

Figure 2

About EDDL the table again shows "*Visualization and configuration by DCS vendor*" but as explained earlier this was for the original DD technology and is not the case for EDDL with enhancements.

The report correctly states "*However, the DDs are needed for the system engineering tools to correctly identify the FF parameters in the devices*" That is, an FF system must have the traditional DD files or enhanced EDDL files and all FF systems support both DD and EDDL. This is not mentioned in the FDT Group's summaries. The report continues "*The consequence is that EDDL and FDT/DTM have natural complementary tasks*" However, as the report noted in section 2.3, there is an overlap in functionality between FDT/DTM and EDDL. That is, EDDL supports both DCS configuration and device management and thus FDT/DTM is not required. All Fieldbus devices come with DD or EDDL files. The report continues "*It is recommended that DCS systems will support both EDDL and FDT/DTM technology.*" However, mixing two device management technologies has many drawbacks. Rather than getting the best of both worlds, plants get the worst of both worlds. First, rather than having to obtain just the EDDL file each time a new device comes to the plant, instrument technicians must also get the DTM driver. Second, the technicians will end up with two different ways of calibration and two different ways of diagnostics and so on. That is, a lot more to learn and a lot more to do. Lastly, by installing DTMs, the drawbacks identified in NAMUR NE 105 materialize: some client stations not synchronized, inconsistent look & feel, obsolescence, interfering with other software components and Windows registry, dependency on Windows version, difficult system update, license keys management, and interoperability issues. Plants are better off just using only EDDL.

Table 1

Function	Summary of Above Comment
The report correctly states FDT/DTM has no support for "*FF block configuration*"	Therefore DCS must use EDDL. This is not mentioned in the FDT Group's summaries. That is, since the system must use EDDL, and one technology is easier to manage than two, just using EDDL is the best option.
The report states EDDL support for "*Device Setup Wizards*" is "*limited*"	As explained, EDDL supports wizards (called "methods"), supporting sophisticated devices.
The report states EDDL "*Programming flexibility*" is "*limited*"	As explained, EDDL is not programmed at all. EDDL is descriptive not programmatic. This is one of its greatest benefits as explained in 2.1.
The report states EDDL "*State of the art GUI*" is "*very limited*"	As explained, device manufacturers included all features into EDDL they need to enabling the user to see every aspect of simple as well as sophisticated devices
About EDDL being "*Capable of any type of*	As explained, the EDDL pages for some devices

complex calculations" the report states "*limited*"	may perform additional calculations on data before display
The report states EDDL support for "*Advanced diagnostics for sophisticated devices*" is "*limited*"	As explained, EDDL is used with advanced diagnostics in sophisticated machinery health transmitters as well as positioners etc.

As explained for clause 2.2, EDDL is used for many complex devices but only one device was verified for this report, hence the full capability of EDDL was not seen.

3. Evaluation configuration

Table 3

The report states "*A few FF devices enable EDDL and/or FDT/DTM. Table 3 shows the available devices for the test as well as the available technology.*" As explained for clause 2.2, only one device was verified for this report.

The report states "*It is noted that Yokogawa has not developed an EDDL for the EJX910 as the equivalent DTM functionality cannot be achieved in an EDDL.*" It is not clear what functionality this refers to. Presumably it refers to offline calculation of equation constants based on flow related parameters (fluid properties, operating conditions, primary element) then used in the device for computation of compensated flow. Although EDDL can do arithmetic, the multivariable DP flow transmitter has one complicating matter: the equations and tables for fluid properties are intellectual property licensed from third-parties and must not be revealed. However, EDDL is an open technology allowing the system to read it. The solution is to embed proprietary know-how inside the device where it belongs and cannot be copied. This approach has the secondary benefit that complete setup information is stored in the device (not as offline configuration file) and is therefore not lost, and configuration from handheld universal field communicator or even local display becomes possible. These computations were not possible on old device hardware, but with new microprocessors and memory this one-time calculation could be done inside devices, instead of external software. Other device types do not have this unique setup problem. Nevertheless, in spite of the setup challenge, an EDDL file must be provided for interoperability test and registration of every FF device, thus enabling advanced diagnostics from any EDDL system. For plants not using multi-variable differential pressure flow transmitters this is not an issue. Until manufacturer is able to embed setup calculations in the device, use standalone setup software. Do not compromise system integrity with FDT/DTM just for setup of multi-variable differential pressure flow transmitters.

4. Evaluation procedure

The report states "*Table 4 shows all 35 available combinations*" As explained for clause 2.2, only one device was verified for this report.

5. Evaluation results

5.1 DD evaluation

The report states "*No issues were observed with implementing the provided DD and CFF files into the DCS systems*" That is, original DD has no interoperability problems, it just works. This is the most aspect of any technology. This compares favorably against FDT/DTM but is not mentioned in the FDT Group's slides and articles

5.2 EDDL Evaluation

The report states "*A total of 4 combinations are available...*" but as explained for clause 2.2, only one device was verified for this report.

Figure 8

The report states, "*The EDDL approach provides a clear tree structure for the configuration and set-up of the device*" That is, the EDDL menu structure makes devices intuitive to use. This is not mentioned in the FDT Group's summaries

About EDDL the report states "*in the configure/setup tab no alarms/alerts and diagnostic information on the actual device is provided*" is complaining that the software does not have a status bar at the bottom of the screen showing general health for the device currently opened. However, this is not a problem with EDDL technology itself, it is simply how EDDL is implemented in the software. One of the many other EDDL software applications may have such a status bar. However, such a status bar may not even be necessary considering how device management software is used in a plant. The technicians are not sitting in front of hundreds or thousands of open configuration/setup screens waiting for the status to change. In the plant, a fault is captured by the alert monitor software, a horn is sounded, and the device appears in the alarm summary list. From this list the technician clicks on the device to open the full diagnostics page. A status bar does not come into play.

About EDDL the report states "*The compare tab is a unique DeltaV feature that allows data and parameter comparison against historical captured values*" However, EDDL enables any system to compare parameters in the device against its own database and audit trail. Possibly the other systems had not yet fully implemented this capability of EDDL.

Because EDDL is a text file that itself does not "do anything", the system is responsible for both device communication and the database. Thus the system can display a page where the technician can compare and reconcile configuration between the device and the system database. That is, configuration reconciliation will be supported for all devices, not just some. This meets the requirements of NAMUR NE 105 clause 5.5.

For FDT/DTM, parameter compare/reconciliation should be programmed by every device manufacturer since the display is the responsibility of by the DTMs while the communication and database is taken care of by the FDT. Not all DTMs support such comparison and reconciliation, thus for some devices this is not possible.

Note the parallel between EDDL and HTML. Both are text-based. The web browser tracks history of visited HTML web pages. The device management software tracks parameter changes made from EDDL device pages.

Figure 9

About EDDL the report states "*The step test configuration parameters are in different tab than the step test results making result interpretation difficult.*" This is not a problem with the EDDL technology. EDDL permits any parameters mixed on any page. It is simply the way the device manufacturer decided to design their pages. Other device manufacturers may have designed their device pages to combine test conditions and results on the same page.

About EDDL the report states "*There is no wizard available to support the configuration of this test. The results cannot be stored.*" This is not a problem with the EDDL technology. EDDL supports wizards. The device manufacturer chose to not provide a wizard for this function. Other manufacturers have wizards for this feature. Similarly, persistent data storage (archiving test results for later retrieval) is supported by EDDL. The system can do just about anything with device data accessed through EDDL, including export as a file in various formats (identical to figure 15), printing, and access through OPC. These features are already implemented in some of the many systems supporting EDDL

About EDDL the report repeats "*Furthermore note that the parameters for the test can not displayed in the same window as the actual graphical test results.*" that this is possible is already explained above.

Again "*test parameters and graphical results in different displays*" but that this is possible is already explained above.

Figure 10

The report states "*Because the EDDL approach does not have data storage, the data buffer will hold the results of the last test performed. By switching between different preformatted graphics the wrong combination of data and graphics is obtained.*" This is not a problem with the EDDL technology. The EDDL standard supports persistent data storage. This is happening because the version of Emerson DeltaV AMS Device Manager used in the evaluation did not yet implement persistent data storage. Had the system undergone the Host Registration Process this would not happen. The evaluation was premature.

Figure 11

About EDDL the report states "*The look and feel are complete determined by the DCS vendor. The same capture with the same EDDL at IACC has a completely different result.*" omits the important distinction between "content & structure" and "look & feel". On closer examination, figure 11 and 13 have the same content: the exact same 17 pieces of information. They also have same structure: organized in the exact same three frames of 2, 2, and 13 indicators respectively, where the last frame is divided into two columns with 9 and 4 indicators respectively. The menu systems are also identical:

First Level Menu	Second Level Menu	Third Level Menu	Parameter Frames
Device Diagnostics Process Variables	Lifecycle Diagnostics Counter Diagnostics Online Diagnostics Valve Offline Tests	Device Status Lifecycle Diagnostics Counter Diagnostics Online Diagnostics Alarm Limits Event Log	Operation Mode Device State Device Failure

That is, for the two systems the content & structure is exactly the same, completely controlled by the manufacturer. Therefore, regardless of system chosen, the plant can fully benefit from the full capability of the device: EDDL is the key to interoperability. The WIB report demonstrates the preservation of content & structure of EDDL very well

Consistent look & feel

Having established that with EDDL "content & structure" is the same and that interoperability is assured, what about "look & feel"? Let's briefly step away from FDT/DTM and EDDL to establish what "look & feel" is. Every system has a different look & feel, for engineering station and operator station. Some systems have menus based on hierarchical trees, while other systems have menus based on nested tabs. Both do the job. Some systems let user toggle between binary (on/off) options using a checkbox (√) while others have a dropdown list (▼). Both do the job. Some systems indicate binary status looking like an LED light while other systems use plain text such as "OK" and "fail". Both do the job. That is, "look & feel" is how a particular piece of information is presented, not if it is shown or hidden.

Ease of use is all about consistency. The menu system, selections, and indications must work the same way for all devices and all workstations. If one device is using hierarchical tree menu, checkbox selection, and LED indication while another device uses tabbed card menu, dropdown list selection, and plain text indication, use would not be so intuitive. Similarly, if engineering and operator stations are using hierarchical tree menu, checkbox selection, and LED indication while

the maintenance station uses tabbed card menu, dropdown list selection, and plain text indication, use would not be so intuitive. Well, that's what you get with FDT/DTM because every device manufacturer control not only content & structure but also look & feel as noted in clause 2.3.

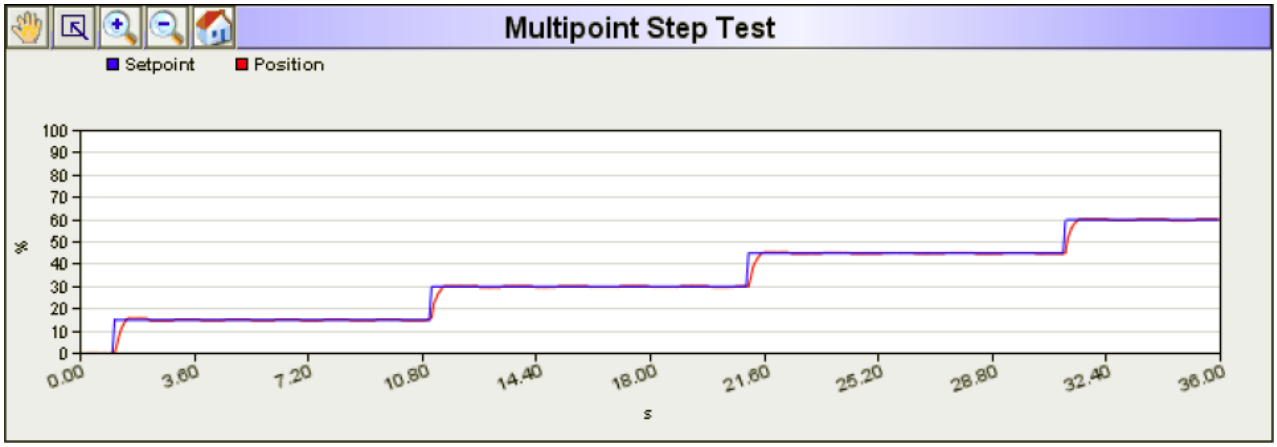
For EDDL, the device manufacturer controls content & structure but not look & feel. Therefore all devices are displayed with the same look & feel regardless of manufacturer, and the look & feel for all these devices is the same as the operator and engineering consoles. That is, look & feel is consistent throughout systems and devices. Only EDDL can achieve this. And at the same time, the content & structure is controlled by the device manufacturer to ensure access to the full capability of the device. That is, the Metso/Neles valve positioner is in the Emerson system displayed with the same look & feel as all devices from other manufacturers and as other applications in the DeltaV system. The same positioner is in the Invensys system displayed with the same look & feel as all devices from other manufacturers (integrated through EDDL) and as other applications in the IACC system. Yet the two systems show the same information, just as intended by the Metso/Neles factory experts. The WIB report demonstrates the preserved content & structure of EDDL very well.

As noted in clause 2.2, the Invensys system displays cryptic hexadecimal codes instead of the descriptive text it is supposed to show. This is not a problem with the EDDL standard. This is happening because the EDDL technology is not yet fully implemented in that particular system. Had the Invensys system undergone the Host Registration Process this would not happen. The evaluation was premature.

About EDDL the report again states "*Diagnostics (red) only visible in this tab*" but as explained for figure 8, this is not a limitation of EDDL

About EDDL the report again states "*Deadband results in wrong graphics*" but as explained for figure 10, this is not a limitation of EDDL

About EDDL the report states "*Only one parameter per graphic*" but that is the way the device manufacturer wanted it. The "valve analysis test" at the top of the same screen and figure 9 show two values, identified by blue (Setpoint) and red (Position) pens. For EDDL technology the limit is many more and perhaps nonexistent. There are examples of graphics with many more variables in other devices not evaluated. As explained for clause 2.2, EDDL is used for many complex devices but only one device was verified for this report, hence the full capability of EDDL was not seen.



About EDDL the report again states "*Compare tab only in DeltaV*" but as explained in figure 8, this is not a limitation of EDDL

Figure 12

About EDDL the report states "*The look and feel is different in comparison with the same test on DeltaV*" is a mix-up because it compares "valve deadband test results" against "valve analysis test result 1" which is something entirely different and cannot possibly be the same. As proven for figure 11, EDDL interoperability ensures same content & structure.

Figure 13

About EDDL the report again states "*...the cryptic parameter display is not useful*" but as explained for clause 2.2 and for figure 11 this is not a problem with the EDDL standard.

About EDDL the report again states "*The DCS vendor has a major impact on how the information is displayed independent of the provided EDDL*" as explained for figure 11, this is a mix-up of "look & feel" and "content & structure". EDDL interoperability ensures same content & structure.

"*All tested EDDLs are interoperable at the evaluationd platforms*" and this is what matters most. EDDL just works. This is not mentioned in the FDT Group's summaries

About EDDL the report again states "*Graphical limitations are observed which are contributed to a single data storage buffer and the predefined representations of EDDLs*" but as explained for figure 10 this is not a limitation of the EDDL standard.

About EDDL the report concludes "EDDLs are indeed good for simple devices with limited functionality (no complex calculations and intelligent wizards) and for parameterisation (mainly used during commissioning)" but as shown for clause 2.3, EDDL is not limited, is already used for sophisticated ("complex") devices, also for troubleshooting.

5.3 DTM Evaluation

The report states "The DTM for the SRD991 from Invensys was initially not interoperable. Interoperability was achieved only after major changes to the applied comm.-DTMs in PACTware. FieldMate and PRM (CS3000) require a patch to achieve the interoperability". This is in spite of existing since 1998. Contrast this against EDDL which just works. This is not mentioned in the FDT Group's summaries

Figure 16

About showing several graphical results in one display and online calculation the report states "*Such features are impossible with the passive (no executable) EDDL approach*" but as explained for figure 10 this is possible with EDDL. The advantages of non-executable files were explained for section 2.1.

Figure 17

The report again states "*EDDLs have a single data storage buffer holding results of only one test.*" but as explained for figure 10 this is not a limitation of the EDDL standard.

The report states "Not all DTMs proved to be interoperable. The Frame applications require patching" This is in spite of nearly ten years in the industry. Contrast this against EDDL which simply works. This is not mentioned in the FDT Group's summaries

The report again states "DTMs provide an enhanced functionality (multiple graphics, online calculations, etc.) over EDDLs, which makes them more attractive to end-users" but as explained for clause 2.3, EDDL provides the same functionality.

The report correctly states about FDT/DTM "*An executable file structure has to be applied (see chapter 2), which makes it less attractive for the DCS systems*" referring to the Microsoft Windows DLL file and registry issues identified by NAMUR recommendation NE 105 clause 3.2 as

explained in above clause 2.1. And that FDT/DTM therefore cannot be used in the DCS as also advised by the IGR report. NAMUR NE 74 clause 2.4 touches on the requirement for non-interference. This is not mentioned in the FDT Group's summaries. The report continues "*However, this vulnerability can be overcome by applying them in a dedicated maintenance server*" suggesting a separate maintenance system. However, although this removes the FDT/DTM risk from the DCS, doing so results in device diagnostics not being integrated into the operator consoles, thus operators cannot use this predictive diagnostics to preempt impact on the process. Because it is the process operators that keep their eyes on the plant, they are the first to see device faults and process upsets. Operators need to be able to access device diagnostics at a click on the operator station to determine if the upset is a device problem or process problem. The key to using device diagnostics and realizing the value of fieldbus technology is to have device information at a click of a button to be able to see the device problem to know who to call. If operators need to shift to another workstation, logon, etc. the stand-alone device management system will soon fall into disuse. An isolated maintenance system will not be utilized. An integrated host is required. This is not mentioned in the FDT Group's summaries

5.4 Execution times using DD, EDDL or FDT/DTM

The report states "*This more reflected in EDDL because each graphic point is communicated as single data point. A DTM provides the data in an array format which results in faster execution at IACC.*" The slow performance of EDDL in the IACC cannot be a technology issue since EDDL in DeltaV is faster than FDT/DTM in the IACC. Possibly EDDL in IACC is implemented using a so called interpreterDTM (iDTM), a DTM that interprets EDDL files, in which case a total execution time is the aggregate of delay in EDDL plus delay in FDT/DTM.

5.5 Summary of the findings

The report states "*No DD nor EDDL interoperability issues are observed.*" That is, EDDL works right out of the box. This is what matters most. This is not mentioned in the FDT Group's summaries

The report states "*The FF devices used in this test are very new and hence none of them have passed any certification.*" that is, the evaluation was premature.

About FDT/DTM the report states "*The interoperability issue with the SRD991 and the PRM part of CS3000 is still there because no patch has been installed similar to FieldMate*" This is in spite of nearly ten years in the industry. Contrast this against EDDL which just works. This is not mentioned in the FDT Group's summaries

The report states "*No certification exists for Frame applications. The consequence is that the Frame applications have a different approach to handling the communication DTMs (used to establish communication using a specific protocol) and the device DTMs. This results in interoperability issues.*" This is in spite of nearly ten years in the industry. Contrast this against EDDL which just works. This is not mentioned in the FDT Group's summaries. Also note that since 2009 the Fieldbus Foundation tests and registers EDDL host applications and have made EDDL support mandatory.

6. Conclusions and Recommendations

The report makes the following conclusions and recommendations:

Report Conclusion	Commentary
"*The basic claims on the advantages and disadvantage of FDT/DTM and EDDL technology are confirmed using FF technology*"	No. On closer scrutiny of the evaluation results, the claims of EDDL being limited cannot be supported. A later report by BIS Prozesstechnik (formerly Infraserv Hoechst) confirmed EDDL

	meets the NAMUR NE 105 requirements.
"*Both EDDL and FDT/DTM as applied to FF technology are not mature yet*"	Yes, the evaluation was premature. At the time of evaluation, registered devices and systems with enhanced EDDL were not yet available for evaluation.
"*Limited number of FF devices are supported with EDDL and/or FDT/DTM*"	Yes, the evaluation was premature. At the time of evaluation, registered devices and systems with enhanced EDDL were not yet available for evaluation.
"*Interoperability issues are observed with EDDL and with FDT/DTM*"	No. The evaluation report gave good marks for EDDL interoperability (clause 5.2 and 5.5) Yes. FDT/DTM had interoperability issues (clause 5.3)
"*FDT/DTM lacked the dtmINSPECTOR test during this evaluation.*"	Yes, the evaluation was premature.
"*EDDL offers the required data accessibility and functionality as used in commissioning (parameterisation) of FF smart devices*"	Yes. And the evaluation report made clear commissioning is poorly supported by FDT/DTM (clause 2.3)
"*FDT/DTM in concept offers the enhanced data accessibility and extended functionality as used in commissioning (parameterisation) and maintenance of FF smart devices in a very effective manner.*"	No. On closer scrutiny of the evaluation results, the claims of EDDL being limited cannot be supported. A later report by BIS Prozesstechnik (formerly Infraserv Hoechst) confirmed EDDL meets the NAMUR NE 105 requirements.

Report Recommendations	Commentary
"*Systems should support both EDDL and FDT/DTM*"	No. Managing two technologies is more difficult than one. It brings the worst of both worlds.
"*EDDLs and DTMs for more FF devices are required*"	
"*Certification procedures for FDT Frame applications must be implemented*"	
"*All DTMs (device/communication/gateway) must be certified using the latest version of the DTM test tool dtmINSPECTOR (current version 2.0).*"	The interaction between software components (EXE/DLL/OCX files and registry entries) make full testing of DTMs impractical
"*Improve style guide for DTMs to obtain same look and feel (use commissioning and maintenance views)*"	Style guide conformance is subjective and hard to enforce.
"*Vendors should more exploit the opportunities to implement intelligence in DTMs*"	No. Intelligence shall be in the device so that it can be accessed from local operator interface and from software not using FDT/DTM or EDDL.

# # #

Postscript

Only one device was verified for this report which is not representative of the full capability of EDDL technology, nor an average representation of FDT/DTM implementation. The report was premature.

Observations

The following important observations from the report are omitted from FDT Group summaries in presentations and articles:

- “Hence there is an overlap in the various technologies” [FDT/DTM and EDDL]
- “The FF devices used in this test are very new and hence none of them have passed any certification”
- “No issues were observed with implementing the provided DD and CFF files into the DCS systems”
- “The EDDL approach provides a clear tree structure for the configuration and set-up of the device”
- “All tested EDDLs are interoperable at the evaluation platforms”
- “No DD nor EDDL interoperability issues are observed”
- [FDT/DTM] “Device commissioning and parameterisation is at present relatively poorly supported, often requiring multiple external software tools”
- “The DTM is programmed and delivered by the device manufacturer to interpret the device data and display it to the user with a device manufacturer specific look & feel...”
- "At present the style guide is not resulting in the same look and feel for DTM’s from different device vendors”
- “However, the DDs are needed for the system engineering tools to correctly identify the FF parameters in the devices”
- “The DTM for the SRD991 from Invensys was initially not interoperable. Interoperability was achieved only after major changes to the applied comm.-DTMs in PACTware. FieldMate and PRM (CS3000) require a patch to achieve the interoperability”
- “Not all DTMs proved to be interoperable. The Frame applications require patching”
- “An executable file structure has to be applied (see chapter 2), which makes it less attractive for the DCS systems.” [FDT/DTM]
- “The interoperability issue with the SRD991 and the PRM part of CS3000 is still there because no patch has been installed similar to FieldMate” [FDT/DTM]
- “No certification exists for Frame applications. The consequence is that the Frame applications have a different approach to handling the communication DTMs (used to establish communication using a specific protocol) and the device DTMs. This results in interoperability issues”

Clarifications

In this review the following misconceptions on EDDL were clarified

- EDDL is not a programming language
- EDDL wizards, menus, and description guidance are not new
- EDDL is not limited to simple devices
- EDDL technology does not display corrupted
- FDT/DTM is not part of the HART standard
- EDDL provides open access to advanced devices
- EDDL graphics is not limited
- EDDL supports parameterization, configuration, and diagnostics of advanced devices
- EDDL supports calculation and wizards
- EDDL interoperability ensures system device page content & structure is determined by the device vendor
- EDDL need not be complemented by FDT/DTM
- A single device integration is sufficient: EDDL
- Device alarms are managed from a device alarm summary list, not from individual device pages. Device alarms shall be integrated in operator consoles to be used effectively.
- Reconcile/compare configuration can be implemented in any EDDL software
- EDDL permits diagnostics setup and results parameters in the same page
- EDDL supports storage of test results
- EDDL supports multiple pen waveform graphs and trend charts
- An interpreterDTM (iDTM) in an FDT container is not as fast as native EDDL software

- FDT/DTM offers no significant value above EDDL
- All leading DCS support EDDL enhancements

Be cautious before investing in FDT/DTM or accepting FDT/DTM as part of system upgrade. DD and FDT/DTM systems can be migrated to EDDL.

References

1. NAMUR Recommendation NE 105 "Specifications for Integrating Fieldbus Devices in Engineering Tools for Field Devices", 24.08.2004

2. " Applicability & Usability of Enhanced EDDL (IEC61804-3) when applied to typical Use Cases in Process automation", Sven Seintsch (BIS Prozesstechnik), presented at ARC's Twelfth Annual Orlando Forum February 7, 2008

3. NAMUR Recommendation NE 74 “NAMUR-Field Bus Requirements”, 01.02.2001

4. NAMUR Recommendation NE 114 ‘Best Practice Fieldbus Applications - Selection, Planning, Installation, Commissioning and Operation of Fieldbuses”, 03.11.2006