Presentation to S1000D User Forum

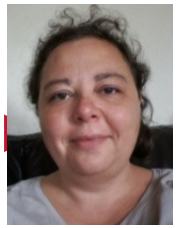
A bridge between XML standards for the technical publications of a Product and its embedded Software

Jean-Jacques Thomasson

Representing the group working on a bridge between S1000D – DITA and other standards

Vienna – 18th of September 2013

Voluntary members of the bridge S1000D-DITA WG



- **Guillemette Borrel (S1000D expert LGM, now @ Thales GS)**

- **Jean-Luc Borie (CEO of Componize)**

- **Michel Doméon (TechPub manager at Dassault-Aviation)**

- **Nicolas Dupuy (S1000D senior consultant at PTC)**

- **Philippe Zingoni (Sales support manager at Antéa)**

- **Jean-Jacques Thomasson (Euriware)**

And…

Alberto Franzetti (CEO at Antea)

- **And the gentle assistance of:**

David A. Reid (Thales NL)

Eric Oursel (Euriware & OPC Foundation Technical Advisory Council Member)

Mohamed Zergaoui
(CTO Innovimax , W3C, XML Prague & ISO SC 34)

Current Situation

PRODUCTS WITH EMBEDDED SOFTWARE

Products with Embedded Software

Facts

R&D effort (VDC study 2007)

Business activity	% of firmware in Product	% of Software in firmware
Automotive	56 %	41 %
Avionics / Aerospace	54 %	30 %
Industry / Automation	48 %	55 %
Telecom	58 %	30 %
Consumer / Home	62 %	59 %
Medical	53 %	14 %

« Briques Génériques du Logiciel Embarqué » Dominique Potier – 2010 – study sponsored by the French Ministry of Industry

Aircraft : 30% of the cost of an aircraft which 40% for Software

Livre blanc des premières Assises Françaises du Logiciel Embarqué, *Syntec informatique*, RNTL, Ministère de l'Économie, des Finances et de l'industrie, mars 2007

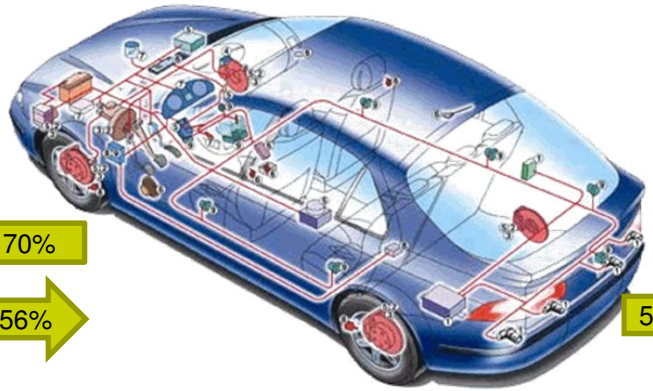
- TNO/IDATE report « Software intensive systems in the future" estimated growth on the period 2005-1015 : 4% for the Aerospace industry (2% in USA, over 6% in Europe) and 7% all industries markets

Products with Embedded Software

- **Increase of**
  - **Objects acting on software through RFID or any other tag/mean**
    - Software will use the data about the object recorded in databases
    - Those software and databases must be perfectly interoperable
    - Different from barcodes : tags are unique per object when barcode are only identifying a class of objects
    - Objects can also be identified by their geographical position, picture…
  - **Objects embedding software**

70%

56%



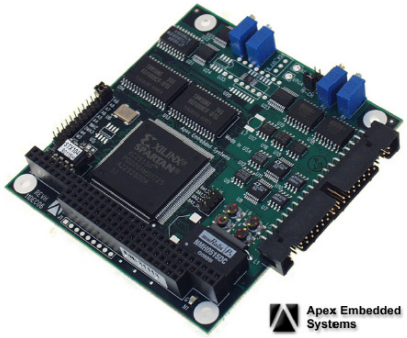
56%

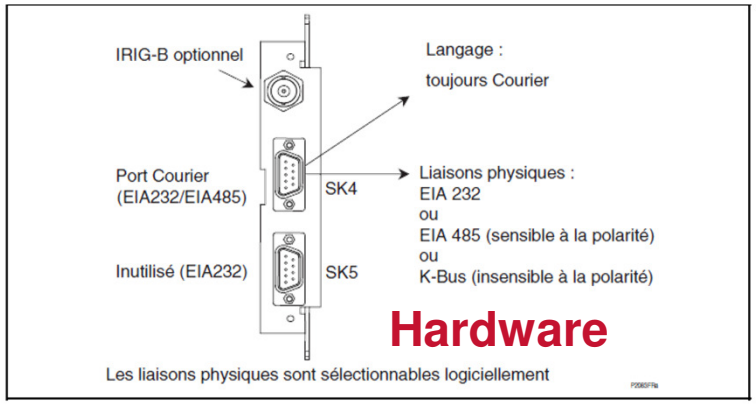
Figures issued in « Evolution du marché des systèmes embarqués en France - 4ème trimestre 2012 » Pierre Audoin Conseil

Documenting

STX104 Reference Manual

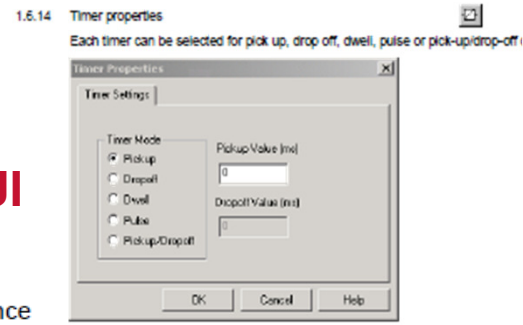
16-bit Analog I/O Module with 1M sample FIFO and dual 16-bit DACs.





Hardware

UI



According to the following formulas the P437 will determine the negative-sequence voltage and positive-sequence voltage, taking into account the set phase sequence:

Phase sequence A-B-C:

Formula

$$\underline{V}_{neg} = \frac{1}{3} \cdot \left| \underline{V}_{A-G} + \underline{a}^2 \cdot \underline{V}_{B-G} + \underline{a} \cdot \underline{V}_{C-G} \right|$$

$$\underline{V}_{pos} = \frac{1}{3} \cdot \left| \underline{V}_{A-G} + \underline{a} \cdot \underline{V}_{B-G} + \underline{a}^2 \cdot \underline{V}_{C-G} \right|$$

Settings

MiCOM P342, P343, P344, P345 & P391

Menu text	Default setting	Setting range		Step size
		Min.	Max.	
CLI1 Alarm Fn	Over	Over/Under		N/A
Operating mode of the current loop input 1 alarm element.				
CLI1 Alarm Set	50	Min. (CLI1 Min., Max.)	Max. (CLI1 Min., Max.)	0.1
Pick-up setting for the current loop input 1 alarm element.				
CLI1 Alarm Delay	1	0	100s	0.1s
Operating time-delay setting of current loop input 1 alarm element.				
CLI1 Trip	Disabled	Disabled/Enabled		N/A
Pick-up setting for the current loop input 1 trip element.				
CLI1 Trip Fn	Over	Over/Under		N/A
Operating mode of the current loop input 1 alarm element.				
CLI1 Trip Set	50	Min. (CLI1 Min., Max.)	Max. (CLI1 Min., Max.)	0.1
Pick-up setting for the current loop input 1 trip element.				
CLI1 Trip Delay	1	0	100s	0.1s
Operating mode of the current loop input 1 trip element.				
CLI1 I< Alarm	Disabled	Disabled/Enabled		N/A
Enables or disables the current loop input 1 undercurrent element used to supervise the 4-20mA input only.				
CLI1 I< Alm Set	3.5 mA	0	4 mA	0.1 mA

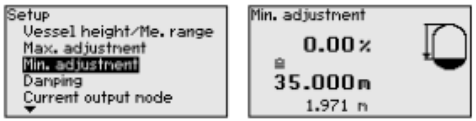
Lines of code

```
}
/*************************************************************************
/                                        ANALOG INPUT 8254 TIMING
*/
static void STX104_AI_Timing_8254_Set( int board, long time_interval_ns )
{
    long high_count;
    long low_count;
    unsigned int octet;

    STX104_Set_Bank( board, 0 );

    /* assumes 10MHz clock (i.e. no 1MHz jumper) */
    low_count  = 10L; /* 1 microsecond intervals */
```

HMI

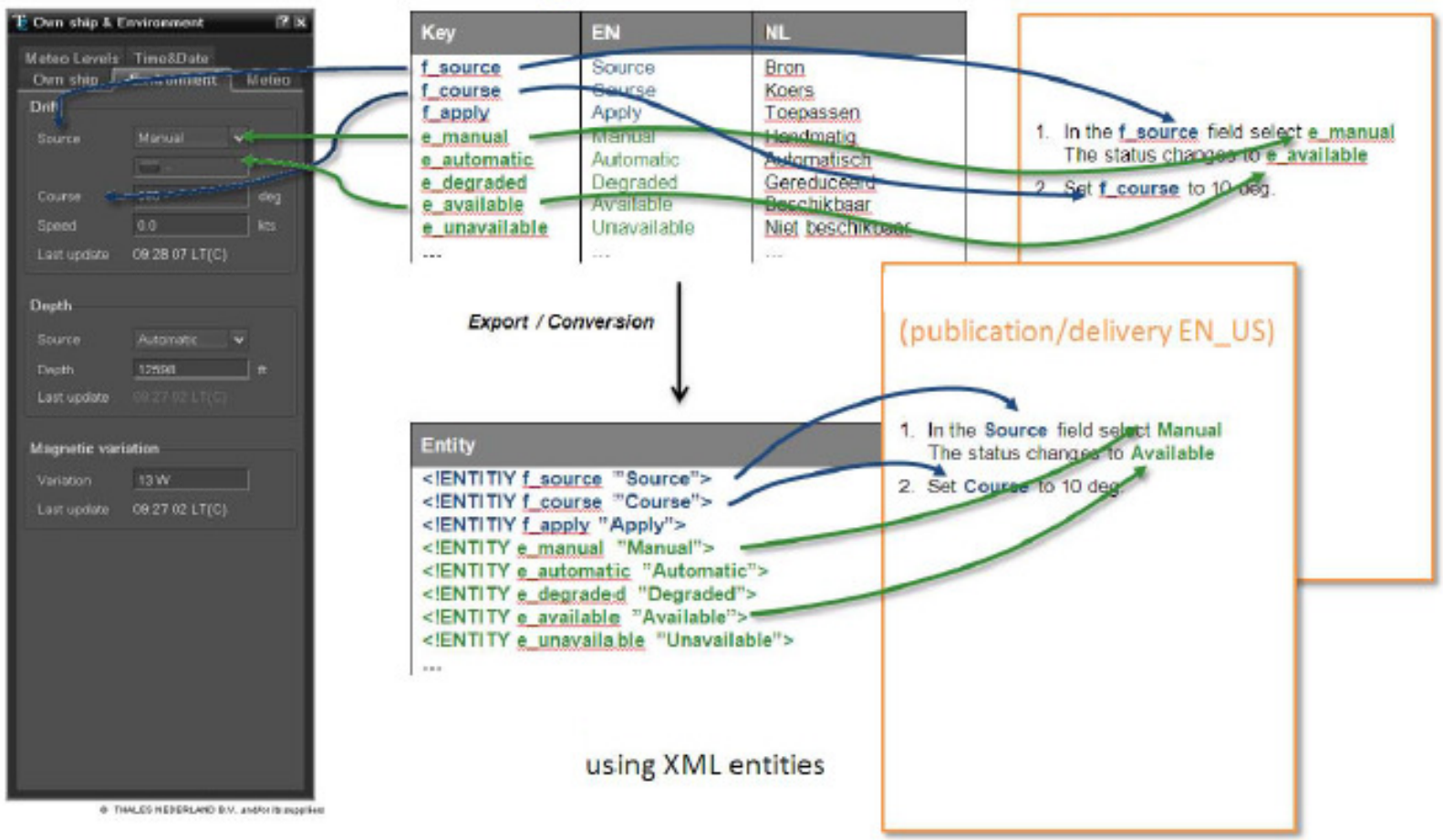
Proceed as follows:

1. Select the menu item "*Setup*" with ***[->]*** and confirm with ***[OK]***. Now select with ***[->]*** the menu item "*Min. adjustment*" and confirm with ***[OK]***.



Documenting

Translating: automatic substitutions of words and sentences.



With the gentle authorization of David Reid – His presentation at Congility 2013

Traceability

- **Embedded software doc needs traceability**
  - **From software to hardware , the technical publication must reflect the customer or reseller specificities**
    - Configuration Management and translation into the language of the end user
  - **Description, operating manual, maintenance task and parts list are all dependent on the final configuration**
  - **Traceability of data is important : *"which software component is used where, which data of that component is used when ?"***
    - 90% of the data closely relates to configuration management.
    - Software and devices from many different manufacturers have to be integrated
    - End user manuals are subject to translation

SMBE : Small and Medium Business Enterprise

Flexibility

- **Embedded software doc needs flexibility**
  - **IEEE**
    - 1451.4 Transducer Electronic Data Sheets (TEDS & xTEDS) : Description of interfaces, components, and messages for onboard systems (Space industry)
    - 1685 (IP-XACT) : Description of electronic components and their designs.
  - **OGC**
    - SensorML : Metadata & characteristics of a sensor
    - TransducerML : Data being exchanged with a sensor system
  - **IEC**
    - 62541-100 : description of devices, networks & connectvity and hosting system
    - 61360 : Common Data Dictionary for electric/electronic components and materials used in electrotechnical equipment and systems
  - **OASIS DPWS : Device Profile for Web Services**
    - Metadata of connected devices
  - **ISO 13584-32 ontoML & eCl@ssXML libraries of electronic components**

IEEE: Institute of Electrical and Electronics Engineers
OGC: Open Geospatial Consortium
IEC: International Electrotechnical Commission
OASIS: Organization for the Advancement of Structured Information Standards

Documenting

Software side

Plan for SW Aspects of Certification
Software Development Plan
Software Verification Plan
Configuration Management Plan
Software Quality Assurance Plan
Software Requirements Standards
Software Design Standards
Software Code Standards
Software Requirements Document
Software Design Document
Software Configuration Index
Software Env Configuration Index
Software Accomplishment Summary

Harware side

Plan for HW Aspects of Certification
Hardware Development Plan
Hardware Verification Plan
Hardware CM Plan
Hardware Process Assurance Plan
Hardware Requirements Standards
Hardware Design Standards
Verification / Validation Standards
Hardware Requirements Document
Hardware Design Data
Hardware Configuration Index
Hardware Accomplishment Summary

DITA

Product side

Crew/Operator information
Description and Operation
Maintenance Information
Wiring diagram data
Illustrated parts Data
Maintenance Planning
Mass and Balance
Recovery troubleshooting
Equipment
Weapon, Cargo & Stores loading
Role change
Illustrated tool and support equipn
Service bulletins
Material data
Common information and data…

S1000D

DO-178C Spec DO-254B Spec
Software and hardware considerations in Airborne Systems and Equipment Certification

DITA

- DITA is an XML standard widely adopted by software vendors and the semiconductors industry
  - ST, HP, Alcatel, Cassidian com, Cisco, Citrix, Cray, IBM
- DITA has a
  - DITA has
    user inter
- Off-the-she
- Native mec
- Native « Ex
  developers

```
<prolog>
 <metadata>
  <prodinfo>
   <prodname>Widge-o-matic</prodname>
   <vrmlist>
     <vrm version="1.0" release="2001-03-30" modification="0"/>
     <vrm version="1.0" modification="1" release="2001-10-03"/>
   </vrmlist>
  </prodinfo>
 </metadata>
</prolog>
```

- Resulting in DITA being a *de facto* candidate for Software documentation, in particular DO-178B and DO-254

Flexibility and traceability are possible with DITA

- **Initial content model for <P> is:**

```
<topic id="tttt">
    <title></title>
    <body>
        <p>The basic element p contains only the element ph which,
        in turn, contains <ph><</ph></p>
    </body>
</topic>
```

boolean
cite
data
data-about
draft-comment
fn
foreign

- **It can be restricted:**

```
<topic xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
    xmlns:ditaarch="http://dita.oasis-open.org/architecture/2005/"
    xsi:noNamespaceSchemaLocation="./specializationHi.xsd" id="i1">
    <title></title>
    <body>
        <p>In this constrainted p, the only authorized sub elements
            are <</p>
    </body>
</topic>
```

b
i
u
/p>
!-- -->
![CDATA[]]>

DITA is natively flexible

- **Or extended:**

```
<topic id="tt1">
    <title></title>
    <body>
        <p>A sample paragraph embedding XML descriptive data of an Electronic Transducer Data Sheet
            <xt:xTEDS name="Temp_AT90" version="1.0">
                <xt:Device name="ABC" kind="a123"></xt:Device>
                <xt:Interface name="Temp_data" id="12" >
                    <xt:Variable name="TempF" kind="temperature" format="FLOAT32" />
                    <xt:Notification>
                        <xt:DataMsg name="Temp_F" id="1" msgArrival="PERIODIC" msgRate="1.00" >
                            <xt:Qualifier name="TempF" value="37"/>
                        </xt:DataMsg>
                    </xt:Notification>
                </xt:Interface>
            </xt:xTEDS>
        </p>
    </body>
</topic>
```

a topic including a set of descriptive data conforming with the xTEDS XML dialect

xTEDS : XML Electronic Transducer Data Sheet

- **S1000D has no specific tagging scheme for Software**
  - **No tag for <screen>, <variable>, <parameter>, <ui>, <linesOfCode>…**
  - **Such a layout is not possible:**

- **No light, core or lean version**
  - **For SMBE suppliers and vendors with multiple customers**
  - ***"it is better to get a lean tagged XML file rather than nothing (Word file)"***
- **No stable core set of tags through different versions**
- **No free starter-kit is available for "Hello world" publications**

SMBE : Small and Medium Business Enterprise

Bridging S1000D and DITA

- **For embedded software documentation**
  - **Idea has been to use DITA…but we discovered that:**
    - 1.2 DITA XML Schema were not valid
    - and were not compatible with S1000D ones
  - **Bridge DITA and S1000D as SCORM and S1000D**

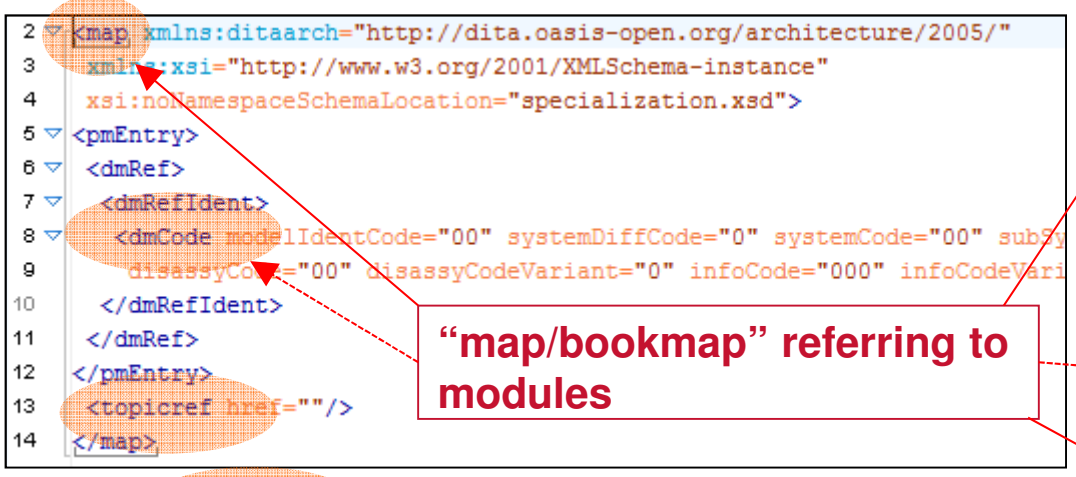
- **Proof of concept done by the working group:**
  - **A full redesign of DITA 1.2 XML Schema**
  - **Alignment with S1000D XSD (determination of conflicting elements)**
  - **Making "dmodule" a conforming DITA specialization**
  - **Use of modules and topics in same publications (MAP, BOOKMAP and PM)**

Bridging S1000D and DITA

```
<dita xmlns:ditaarch="http://dita.oasis-open.org/architecture/2005/"
    xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xsi:noNamespaceSchemaLocation="dita.xsd"
    ditaarch:DITAArchVersion="1.2" xmlns:dc="http://www.purl.org/dc/elements/1.1/"
    xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
    xmlns:xlink="http://www.w3.org/1999/xlink">
  <topic id="tt1">
    <title>Product data sheet</title>
    <concept id="c1">
      <title>General description</title>
      <conbody>
        <p>The LPC408x/7x is an ARM Cortex-M4 based digital signal controller for embedded
          applications requiring a high level of integration and low power
          dissipation.</p>
      </conbody>
      <dmodule>
        <rdf:Description> [12 lines]
        <identAndStatusSection> [163 lines]
        <content> [102 lines]
      </dmodule>
    </concept>
    <dmodule> [406 lines]
  </topic>
</dita>
```

S1000D Modules being combined with DITA Topics

Bridging S1000D and DITA



“map/bookmap” referring to modules

S1000D publication containing one DITA map

Working Group Activity

- **Started in 2011, with the goal to make these 2 major documentation standards interoperable**
- **Conference webex to manage the project**
- **Technical studies and proofs of concept**
  - **Structuration of DITA XSD to facilitate exchanges between DITA and S1000D**
    - reuse of S1000D meta-model principles
  - **A library of 20 Proofs of concepts**
    - POC #6 shows valid S1000D publication and DITA maps mixing topics and DMs
- **Presentations**
  - **Presentation to DITA TC (July 2012)**
  - **Presentation to S1000D EPWG and SC (September 2012)**
  - **Participation to XML Prague (February 2013)**
  - **Participation to S1000D User Forum (September 2013)**

Working Group future work / direction / plans

- **Technical work**
  - **Apply DITA mechanisms to S1000D**
  - **Introduce applicability and configuration management in DITA**
  - **Find out which emerging standard is the best suited for tagging software configuration, devices & sensor characteristics and data**
- **Standardization work**
  - **Discuss with DITA TC members for DITA 2.0**
    - Move from RNG to XSD
  - **Lean/core version of S1000D**
    - Propose a concept of modular S1000D
- **Business work**
  - **Make a real business case with one interested Company**

CONCLUSION

Conclusion

- XML standards will have to be more and more interconnected
  - Standard vocabularies and structures are necessary
- SMBEs need to have affordable solutions and standards
  - Either by having a lean version of S1000D
  - Or through the ability to submit, for example, DITA files
- Flexibility (extensibility) of the models is necessary for the traceability of some particular data, metadata and characteristics of the Hardware or Software

- « Open standards » is evolving into « open Data »
- And « ROI » becomes « ROD » : Return on Data
  - Meaning : the ROI will only be the result of the reusability of the data

Those interested are welcome and invited to join the working group

Thank you for your attention