Presentation to S1000D User Forum

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

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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)
PRODUCTS WITH EMBEDDED SOFTWARE
Products with Embedded Software

Facts

- R&D effort (VDC study 2007)

<table>
<thead>
<tr>
<th>Business activity</th>
<th>% of firmware in Product</th>
<th>% of Software in firmware</th>
</tr>
</thead>
<tbody>
<tr>
<td>Automotive</td>
<td>55 %</td>
<td>41 %</td>
</tr>
<tr>
<td>Avionics / Aerospace</td>
<td>54 %</td>
<td>30 %</td>
</tr>
<tr>
<td>Industry / Automation</td>
<td>48 %</td>
<td>55 %</td>
</tr>
<tr>
<td>Telecom</td>
<td>58 %</td>
<td>30 %</td>
</tr>
<tr>
<td>Consumer / Home</td>
<td>62 %</td>
<td>59 %</td>
</tr>
<tr>
<td>Medical</td>
<td>53 %</td>
<td>14 %</td>
</tr>
</tbody>
</table>


- 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

Growth 4-7%* per year
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**

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

\[ V_{neg} = \frac{1}{3} \left( V_{A-G} + a^2 \cdot V_{B-G} + a \cdot V_{C-G} \right) \]

\[ V_{pos} = \frac{1}{3} \left( V_{A-G} + a \cdot V_{B-G} + a^2 \cdot V_{C-G} \right) \]

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**Formula**

**Hardware**

**UI**

**Settings**

**Lines of code**

```
marca 8254_TIMING

void STX104_AI_Timeing_8254_Set ( int board, long time_interval_ns )
{
    long high_count;
    long low_count;
    unsigned int octet;
    STX104_Set_Rank( board, 0);
    /* assumes 10MHz clock (i.e. no 1MHz jumper) */
    low_count = 10L; /* 1 microsecond intervals */
```

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**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].
Translating: automatic substitutions of words and sentences.

With the gentle authorization of David Reid – His presentation at Congility 2013
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
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 & connectivity 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**
### 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

### Hardware 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

### Product side
- Crew/Operator information
- Description and Operation
- Maintenance Information
- Wiring diagram data
- Illustrated part 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...

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

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

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S1000D User Forum Vienna – 18/09/2013
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 specific software template specialization:
- DITA has a core set of tags (39) for describing software (programs and user interfaces)

Off-the-shelf tools and toolkit exist:
- Native mechanisms for extensibility / simplification
- Native « Export to DITA » from environments used by developers (Eclipse Java/C)

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>`</p>
  </body>
</topic>
```

- **It can be restricted:**

```
<topic xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
      xsi:noNamespaceSchemaLocation="/specializationHi.xsd" id="ii">
  <title></title>
  <body>
    <p>In this constrained p, the only authorized sub elements are `i`, `u`, `/i`</p>
  </body>
</topic>
```
DITA is natively flexible

▶ Or extended:

```xml
<topic id="tt1">
  <title></title>
  <body>
    <p>A sample paragraph embedding XML descriptive data of an Electronic Transducer Data Sheet</p>
    <xt:TEDS name="TempAT90" 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:TEDS>
  </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
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

S1000D Modules being combined with DITA Topics
Bridging S1000D and DITA

S1000D publication containing one DITA map

“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