Actual Projects using ASAM GDI (ISO 20242)
Author

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   ASAM GDI to ISO 20242, KPIs for Manufacturing Execution Systems

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   mechanical engineering, factory automation, communication and integration

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   Association of Decentralized Measurement systems
Company

Messtechnik und Fertigungstechnologie GmbH
Measurement and Manufacturing Technology Ltd.

- Patent on high resolution A/D-Converter for Inductive Sensors
- Experienced in Fieldbus Technologies
- Universal Equipment Integration based on ASAM GDI / ISO 20242
- Device Configuration based on XML
- Tools for handling ODX and FIBEX files
- Lean PPS/MES for small and medium companies
Dipl.-Ing. Bernd Wenzel

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   Actual maintenance manager of GDI

➢ Senior Technical Consultant ASAM e.V.
   Support of business manager and Technical Steering Committee
Company

M&K Mess- und Kommunikationstechnik GmbH
Measurement and Communication technology Ltd.

- **Software Solutions**
  middleware for device and application integration, inter process communication

- **Communication Interfaces**
  Protocol and Interface integration

- **Embedded Systems**
  embedded systems development and testing including communication access

**M&K Connected solutions**
Contents

Standardization in ISO

LAPI Device Configuration

AGILITA Software Agents

M&K Middleware
Environment of ASAM GDI in ISO

TC 184  Automation Systems and Integration
SC 5   Architecture, Communications and Integration Frameworks

Picture: Em Dela Hostria, Rockwell Automation, Chairman of TC 184 / SC 5, 2010

See also AGILITA project
Structure of ISO 20242

Picture: ISO 20242-1, 2005

Testing Application Program (CAT)

Application Program Service Interface

Coordinator (Software)

Device Capability Profile Template

Part 5, WD GDI: Coordinator

Part 4, DIS GDI: DCD

Device Capability Description (File)

Virtual Device Service Interface

Device Driver (Software)

Device Driver (Software)

Device Driver (Software)

Part 3, DIS GDI: DD-API

Part 2, IS GDI: PA

Resource Management Service Interface

Platform Adapter (Software)

Computer Operation System

Physical Device

Physical Device

Physical Device

Physical Device

Virtual Device

Virtual Device

Virtual Device

Virtual Device

Part 1, IS Overview

Part 6, tbd Conformance Criteria

TestingExpo Europe 2010  Dr.-Ing. Robert Patzke
Cooperation with MICX

Manufacturing Information Collaboration systems with XML technology

- Integration Model

ISO 20242 Part 4 Annex B
Device Capability Profile Templates for Manufacturing Applications

Picture:
Taro Harima, Mitsubishi Electric, 2006
Cooperation with ORiN

Open Robot/Resource Interface for the Network

ISO 20242 Part 4 Annex C
Device Capability Profile Templates for Robot Applications

www.orin.jp/e

Picture: ORiN Specification 2.1, 2008
Cooperation of ASAM GDI and OPC/UA

Motion in Germany, DIN AA 060-30-05 AK4

- Win-win-Situation for Device Users and Device Vendors:
  - Own range of application supported by the other standard
    - applications created for GDI devices may also access OPC devices
    - applications created for OPC devices may also access GDI devices.
  - Reasonable converters (software only)
    → device vendors may offer
    - GDI devices also in the OPC user market and
    - OPC devices also in the GDI user market.
Advantages of ISO Standardization

- **International Promotion**
  ASAM e.V. and GDI standard get known worldwide in area of automation systems and integration

- **Improved Specification**
  Discussions with international experts increase know-how and improve technologies

- **Increased Reliability**
  Structure of ISO stands for stability of standards

- **Extended Application Range**
  Ideas from other countries for widening the scope
Contents

Standardization in ISO

LAPI Device Configuration

AGILITA Software Agents

M&K Middleware
- Supplier Independent Configuration of Data Loggers and Measurement Modules (driven by BMW AG, Daimler AG and Porsche AG)
- In use at Daimler since October 2009
- Definition of Configuration API, Device Profiles, XML Schemas, XCP Usage, Measurement Chain and more
Objects of LAPI 1.0/1.1 standardization

Measurement Chain

ISO 20242-4

Configurator (software)

XML Schema

LAPI-library (.dll, .so)

XML Instance

Device Profiles

ISO 20242-3

ISO 20242-4

driver (.dll, .so)

device description (GDI-DCD)

device interface (GDI-driver)

X-API

Usage of XCP

ISO 20242-2

GDI-PA-Extension XCP/CAN

Project Management

“Products” of OEMs

test description (measurement task)

configuration-file (project)

“Products” of the LAPI-project

“Products” of the LAPI-project

“Products” of the device suppliers
Objects of LAPI 2.0 standardization
Improving/extending 1.0/1.1 specification and technical features

- Improving Schema construction
- Improving interaction on configuration by online value presentation
- Complete Bus-Analysis and -Trace
- Define LAPI-Scripting
- ......

About 50 topics for LAPI 2.0 are published in LAPI forum at
http://www.asam-gdi.net/forum → LAPI-AK → Version 2.0
Objects of future LAPI standardization
Including Measurement Planning and Result Evaluation

Strategies jointly defined by BMW AG and Daimler AG
other OEMs are invited to join
Cooperation with other projects

Big chance for synergy effects by handling the overall Measurement Management and Execution with proven standards.

Supplier independent Measurement Data Management
www.mdm-community.org

Supplier independent Device Configuration
www.lapi-ak.de

XML Schema

dr.ing. robert patzke
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- Standardization in ISO
- LAPI Device Configuration
- AGILITA Software Agents
- M&K Middleware
AGILITA and ISO 20242

www.autonomik.de  www.agilita-projekt.de

• German (government) funded project “Agile Production Logistics and Transport Systems” combining RFID, Automatic Guided Vehicles and Agent based Manufacturing Execution System for manufacturing in aviation industry

• Configurable Software Agents with ISO 20242 part 3 interface are the application backbone (A-MES)

• Software Agent Capability Description with XML Schemas, as defined in ISO 20242 part 4 are the base for configuration

• Unsolicited Services VDSI_InfReport and VDSI_Accept of ISO 20242 are the base for autonomy of agents
ISO 20242 Software Agent Communication

- Application Configurator
  - XML config
  - ISO 20242 Agent 001
  - Basic Configuration
  - Interactive Configuration
  - Runtime Communication

- Blackboard
  - ISO 20242 Agent 002
  - ISO 20242 Agent 007

- Blackboard
  - XML config
Using Agilita Software Agents

Compare LAPI project with *Data Loggers = Software Agents*

1. Configure an application  
   e.g. define requirements for material transport

2. Select Software Agents  
   may be automated

3. Create offline configuration for Software Agents  
   typically automated

4. Interact with Agents for optimal configuration  
   may lead to corrections of application

5. Start Agents with Configuration Data  
   restart on errors (not expected)

6. Let the Agents do their Tasks
Contents

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Bernd Wenzel, M&K: GDI based Middleware

- Abstract Device Functionality Modelling

- Abstract description of device functionality
- Process of device functionality modeling
- Described how it shall be used from user point of view
Bernd Wenzel, M&K: GDI based Middleware

- Usage of Device Functionalities in Applications

**Python (Scripting)**

```python
class fnDevice1:
    def opUpdate(self, Data):
        
    def opPrepareForMC(self, SetReady):
        
    def geteSignalType(self):
        
    def writeeSignalType(self, value, bWrite=1):
        
    def readeSignalType(self, bRead = 1):
        
    def init (self, hFOHandle):
```

**C++**

```cpp
/* This class describes the FO fnDevice1 */

class fnDevice1
{
    public:
        /*
        * operation opUpdate
        */
        void opUpdate(LPFIXCHSignalGenerator_opUpdate pComplete = NULL);
        /*
        * read eSignalType
        */
        ToGeneratorType readeSignalType (bool bRead = true, LPCHFixSignalGenerator pGen = NULL);
        /*
        * get current value of eSignalType
        */
        ToGeneratorType geteSignalType();
```

**Transformation**

- **Interface**
  - fnDevice1 ()
  - Op (self, Data)
  - opPrepareForMC (self, SetReady)
  - geteSignalType (self)
  - writeeSignalType (self, value, bWrite=1)
  - readeSignalType (self, bRead=1)
  - init (self, hFOHandle) opUpdate

- **Funktionsname**
- **Createparam**
- **CreateParameter**
- **Parameter**
- **Definition parameter**
- **Op Subfunktionen**

**Device Capability Description**

**Class Description**
Bernd Wenzel, M&K: GDI based Middleware

- Principle Concept of ASAM GDI

- Middleware encapsulate from interface specific knowledge
- Directly access to device functionality
- Dynamic integration of different device drivers
- Different interface versions can be used at same time
- Hide complexity
- Operating system independent
Bernd Wenzel, M&K: GDI based Middleware

- Device Driver Development

  - Generation of an executable C++ program skeleton for a device driver out of a DCD
  - Complete usage of the GDI API and linkage to the platform adapter
  - Automatic user code integration through directed programming and re-engineering
  - Consideration of inheritance, class references and service functions
  - VD state control and complete implementation of the Control VD
Bernd Wenzel, M&K: GDI based Middleware

- Device Driver Testing

- Efficient application generation for testing of application sequences and effective usage of device drivers
- Class Stub based on DCD (Module, Interfaces) for object oriented applications
- available for C++ and Python
- Stub classes encapsulate GDI specific Coordinator access (Coordinator API version independent)
- Profile independent usage of GDI device drivers
Bernd Wenzel, M&K: GDI based Middleware

- Test Application and Device Development
Bernd Wenzel, M&K: GDI based Middleware

- Test Application for Installation Proving

- Testing of whole application purpose in interconnection with different devices
- Check of application purpose
Bernd Wenzel, M&K: GDI based Middleware

- Running Application used worldwide

- End of line testing
- Chassis Dynometer
- Car filling systems
- Inside Ebench Systems
Bernd Wenzel, M&K: GDI based Middleware

- Device Exchange
Bernd Wenzel, M&K: GDI based Middleware

- Conformance Test

- Acceptance test of devices
- Test can be done by end users
- Device can be also integrated in full environment
Bernd Wenzel, M&K: GDI based Middleware

- Device Application Development

- Software development for Embedded Systems
- Middleware connects between device base software and development environment on host
- Embedded base function are triggered and accessed from IDE in host via middleware
- Device base functionality directly available for Device application software on host
Bernd Wenzel, M&K: GDI based Middleware

- System Test on Target

- Device application can be tested with developed unit tests after integration into target
- Unit tests are running on host
- Middleware realizes the connection between unit test on host and target software
Epilogue

• First time standard application causes big efforts, since whole development is handled in short time. Proprietary solutions mostly are developed in small units over a long time period.

• Benefit of standardisation is not only technology but more improvement of handling. Standards help to put heavy loads on several shoulders.

• Standards do not propagate by their own. Proprietary solutions mostly have marketing because of commercial background.

Standards need marketing from their beneficiaries.