Integrating FDT2 and OPC UA

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The presentation will provide a report from the work of FDT PG OPC UA. After an introduction and a short discussion of the relation to Industrie4.0, the concept for integration of FDT2 and OPC UA will be discussed. The approach of the PG for integration of FDT2 and OPC UA are explained together with a reference to the defined use cases and the solutions for mapping of information from FDT2 DTMs to the OPC UA Information model. The presentation concludes with a discussion of the prototyping approach and of the status of work.
Agenda

- Introduction
- Concept for integration of FDT2 and OPC UA
- Approach for integration of FDT2 and OPC UA
  - Use cases
  - Mapping of information
- Approach for prototyping
- Status of work
Target of project group “OPC UA” is:

Standard definition for implementation of OPC UA Servers basing on FDT2, including

- Definition of Standard OPC UA Information model
- Standard integration of information provided by DTMs into the OPC UA Information model
OPC UA may be considered as strategic interface for:

- Device Asset Management
- Manufacturing Execution Systems (MES / MOM)
- Mobile applications for device diagnostics and configuration
- Industrie4.0
Alignment to Industrie4.0

Operation Management  Asset Management

Data

OPC UA

Physical Objects

Enterprise  Site  Plant  Unit  Equipment

I40-Component  I40-Component  I40-Component  I40-Component  I40-Component

IT System (Algorithms)

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Information provided by a DTM

Device parameter
Value range
Access information
Semantic Info

I/O-Data
Value range
Limits
I/O Usage

Device type
Online-Identification

Device Scan Info
Device Data Info
Process Data Info
Network Management Info

DTM Info

Device type
Information

Device Type Info

Device type
Offline-Identification

Device Ident Info

Network Configuration

Documentation of Data

References to
- Manuals
- Technical Documentation
- Certificates
- Device descriptions
  - DDs
  - PROLIST, eCl@ss, ETIM...

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OPC UA Architecture according to FDT2

Source: FDT2.0 Technical Specification, page 324
OPC UA Device Integration

FDT Information Model

OPC UA for Devices

- DA
- A&E
- HDA
- CMDs

OPC UA Base Services

- FDT specific Mapping
- Device Interface
- OPC Information Model
- All Necessary Services
OPC UA for Devices
(IEC 62451-100)

EDD

FDI Mapping
(IEC 62769–5)

FDT Mapping

DTM
(FDT 2.0 Spec)
Selection and description of supported use cases

Description of necessary information access for supporting the supported use cases

Description of accessing the information (mapping of information access from OPC UA interface to DTM interfaces)

Providing FDT Group specification

Providing proof of concept by prototyping
Initial topics to consider

- Mapping of information from DeviceType Information to OPC UA Information model
- Mapping of topology information to OPC UA information model
- Mapping of different DTMs
  - Device DTM
  - Communication DTM
  - Gateway DTM / Composite DTM
  - Module DTM
  - BTM
- Mapping of device identification
- Monitoring device status
- Accessing device diagnostic
- Mapping of Online/Offline data access.
  - Read device parameter
  - Writing device parameter (maintenance information)
  - Mapping of data (instance/device) / data types
- Mapping of Locking scheme
- Mapping of Upload / Download Methods
- Monitoring of network
Use cases to consider

Mapping of DTM–Information to OPC UA–Information model:
- Providing the topology
- Identify the device
- Get list of available device parameters
- Get Device Status
- Get Device Diagnostics
- Read parameters
  - Offline data
  - Online data
- Write parameters
- Audit trail

→ Simple use cases, provide the base for more complex use cases
Example for complex use-case
OPC Server

- Types
  - Data types
    - FDT specific data types
  - Object types
    - DeviceType (according OPC for Devices)
      - FDT DeviceType

- Objects
  - Representation of devices (instances) and of the network topology

- View
FDT DeviceType

- **DeviceType**
  - `<Identifier>`
  - DeviceClass (optional)
  - DeviceHealth (optional)
  - DeviceManual
  - DeviceRevision
  - HardwareRevision
  - Manufacturer
  - Model
  - RevisionCounter
  - SerialNumber
  - SoftwareRevision
  - Identification
  - Lock
  - DeviceTypeImage
  - Documentation
  - ImageSet
  - MethodSet
  - ParameterSet
  - ProtocolSupport

- **FDT DeviceType**
  - DeviceHealth (FDT: mandatory)
  - ManufacturerId
  - FdtDocumentation

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Representation of network

Objects

DeviceSet

NetworkSet

FI B101

FI B102

CP_B1

CP_B2

ModularDevice:
Station 1

Module: CP

Module: CPU

PN Network

PN CP 1

ConnectsTo

ConnectsToParent

ConnectsTo

Station1

FI B101

FI B102
Example: Multiple networks

- Objects
  - DeviceSet
    - Engineers
      - Engineer Station
      - CP_B1
      - CP_B2
    - FD B
    - GatewayDevice
      - PN CP 1
      - HART 1
      - HART 2
      - CP_B2
      - CP_B2
    - FD B

- NetworkSet
  - PN Network
    - ConnectsTo
    - HART Network 1
    - HART Network 2
  - ConnectsToParent

- Entry Points
  - Device
  - Network
  - ConnectionPoint

- Fieldbus Interface
- Profinet
- Gateway Device C
- Field Device B
- Field Device D
- Field Device E

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Representation of a device

- **BaseObjectType**
- **TopologyElementType**
- **DeviceType**
- **FolderType**
- **FunctionalGroupType**

**Device A**

- **BaseObjectType**: ParameterSet
- **BaseDataVariableType**: \(<\text{ParameterIdentifier}\>\)
- **MethodSet**
- **<MethodIdentifier>**
- **LockingServicesType**: \(<\text{Lock}\>\)

- **BaseDataVariableType**: Organizes

- **FunctionalGroupType**: \(<\text{GroupIdentifier}\>\)

- **BaseObjectType**: Locking Services Type
Mapping of device information

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Mapping of data and functions

Types

- FdtDeviceType
- Specific DeviceType

Object

A

ParameterSet

Variable_2

MethodSet

Method_1

DtmInstance

IFunction

IDeviceData

FdtDeviceType

Specific DeviceType

FdtFunctionalGroup: Group1

FdtFunctionalGroup: Group11

FdtFunctionalGroup: Group12

OPC

Organizes

Organizes

FdtFunctionalGroup

Group

Group

Group

Group

Group

Group
Prototyping

Stage 1: Data type-Prototyping

Stage 2: Full Prototyping
Tools of prototyping

- OPC UA Server SDK from Unified Automation
- Visual Studio 2013
- Frame Common Components from M&M Software
- Several DTM(s) from various vendors (products, prototypes, test versions)
Stage 1: Data type prototyping

- Modeling of data types

- Generated OPC UA Server
  - Without FDT2.0 implementation
  - Demo basing on simulated values

- Proving the ability to implement use-cases
Modeling of data types

- OPC UA Modeler
Mapping der OPC UA Datentypen auf FDT2.0–Informationen
  o Integration der FDT2.0–Frameapplikation
  o Implementierung der Zugriffe auf DTM
Selection and description of supported use cases

Description of necessary information access for supporting the supported use cases

Description of accessing the information (mapping of information access from OPC UA interface to DTM interfaces)

Providing FDT Group specification

Providing proof of concept by prototyping
The combination of FDT2 and OPC UA is important for positioning in regard of Industrie4.0

Important for device vendors:
- Develop FDT2 DTMs!
- Provide your DTMs with as much semantic information as possible!
  - Device data
  - Device documentation
- Provide consistent structure for IData and IFunction

Important for vendors of Frame Applications:
- Support OPC UA!
- Participate in prototyping of PG OPC UA!
Thank you for your attention!

Questions?

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