FDT 3.0 Developer Workshop

Agenda

Volker Herbst, Glenn Schulz

Agenda

- **FDT 3.0 Overview**

  – Glenn Schulz, FDT Managing Director

- **dtmINSPECTOR5 for FDT 3.0**

  – James Loh Chia Woon, Test & Certification Working Group Chairman

- **Common Components for FDT 3.0**

  – Manjunath Atchutanna, DTM CCB Chairman

     Renato da Silva Goncalves, FDT Server CCB Chairman

Agenda

- **Using an OPC/UA Client with the FDT Server**

  – Thomas Hadlich, FDT Architecture and Specification Chairman

- **Features of the FDT 3.0 Desktop Common Components**

  – Manfred Gundel, FDT Architecture and Specification Member

- **Licensing and Agreements**

  – Glenn Schulz, FDT Managing Director

Agenda

- **IO Link Interpreter DTM**

    – Volker Herbst, Key Account Manager – EMEA Marketing Member
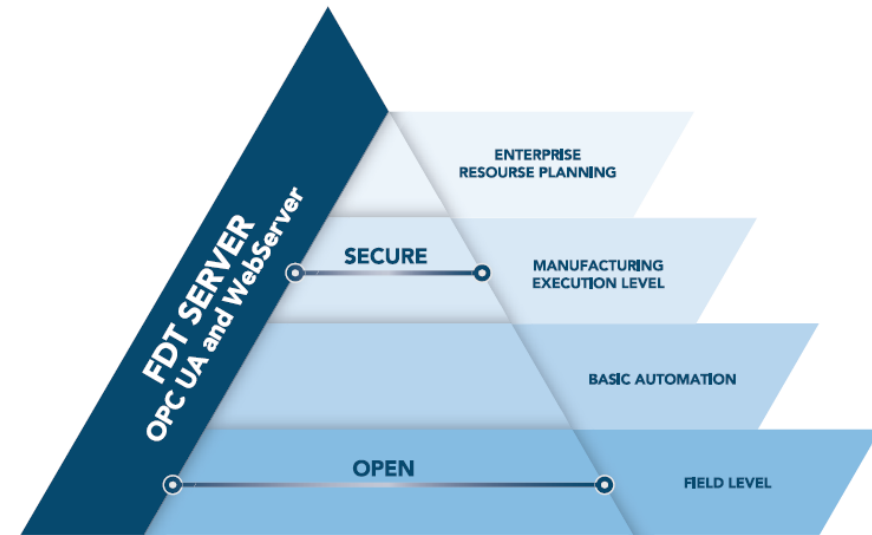
- **The Session will be recorded**
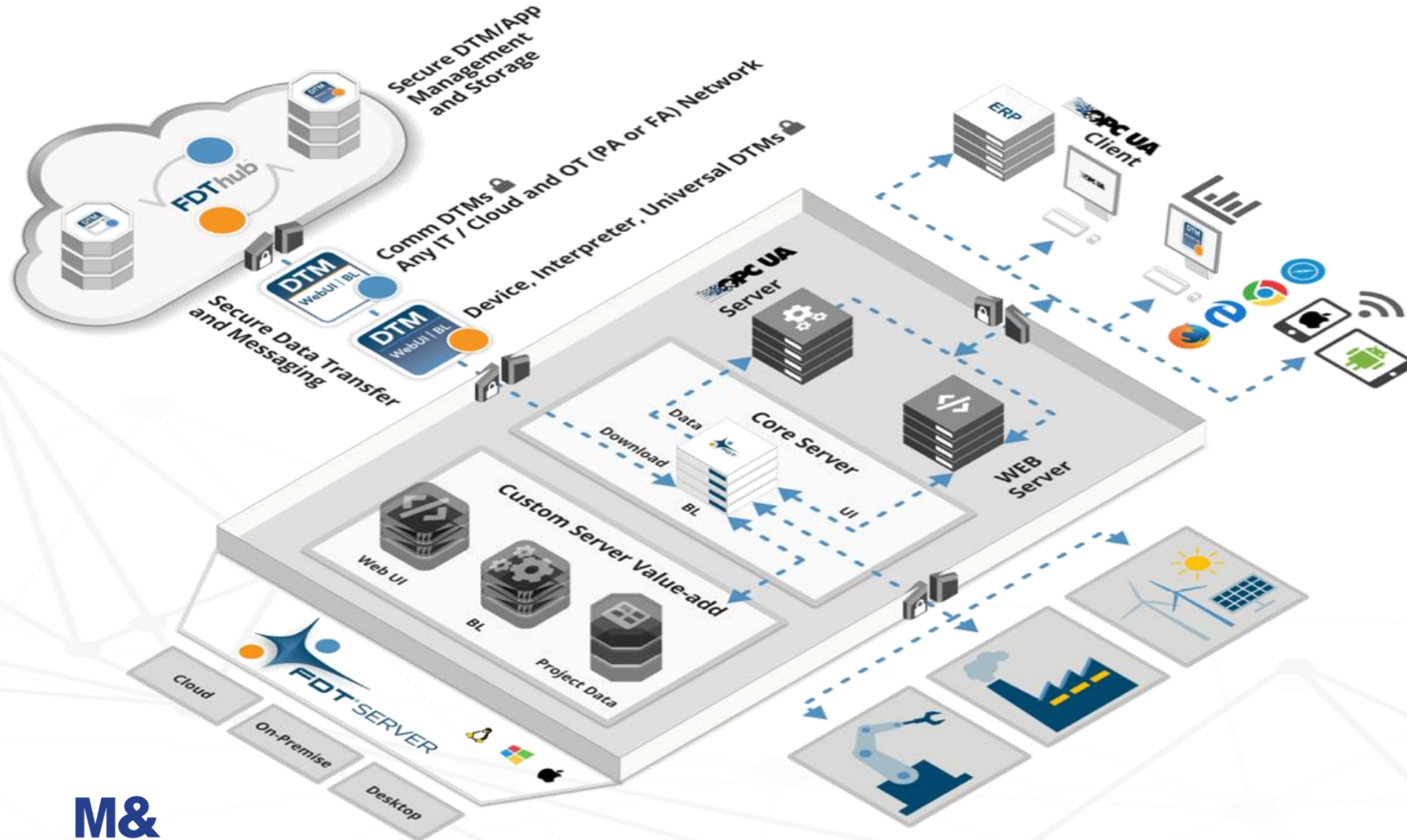
FDT 3 Overview

Glenn B. Schulz

Managing Director

What is new in FDT 3?

- **Platform Independent**
  - One run-time image for Microsoft, Linux and Apple O/S
    - Applies to DTM and Server

- **Browser based client**
  - All user access via a browser instead of desktop application
  - Responsive display supports tablets, notebooks and smart phones

- **Server based architecture**
  - All users supported by a single server
    - Local, enterprise, edge or cloud
  - All communications authenticated and encrypted
  - Desktop version still available/supported

- **Native OPC UA support**
  - All DTM automatically support OPC UA
  - The FDT Server includes a pre-wired OPC UA server

- **FDTHub provides centralized DTM storage and access**
  - All FDT 3 DTMs are certified and in the FDTHub

FDT SERVER
OPC UA and WebServer

ENTERPRISE RESOURSE PLANNING

SECURE — MANUFACTURING EXECUTION LEVEL

BASIC AUTOMATION

OPEN — FIELD LEVEL

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The FDT 3 Architecture

FDT 3 Developer Tools

- **DTM Common Components**
  - Develop and deploy platform agnostic DTMs using Visual Studio
  - Sample DTM included

- **Server Common Components**
  - Deploy a full FDT Server
  - Includes Web and OPC UA server
  - Extensible features but ready to build and launch
  - Visual Studio environment

- **Desktop Common Components**
  - Legacy single user architecture but adds FDT 3 DTM support
  - Visual Studio environment

- **dtmINSPECTOR**
  - Pretest compliance prior to mandatory DTM certification

New Capabilities = New Style Guide

- **New FDT 3 Style Guide**
  - Provides consistent user experience
    - Allows vendor creativity
  - Responsive design
    - Adjusts to aspect ratio
  - Soft keyboard and touchscreen features
  - Standardized FDT 3 icon libary
- **FDT 3 Style Guide Compliance is Required**
  - All DTMs must pass style guide certification as part of mandatory certification process

Thank You for Your Attention

dtmINSPECTOR for FDT3

James Loh

Chair, WG Test and Certification

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Agenda

- **Recap**
- **What's new for certification for FDT3?**
- **What changes will we see in dtmINSPECTOR5?**
- **Quick preview of dtmINSPECTOR5**
- **How to get the dtmINSPECTOR5**

Recap

- **dtmINSPECTOR is the tool used by the FDT Test Sites for the certification of DTMs. It is also used by developers to subject their DTMs to internal testing (as a step before submitting for official certification)**

- **Versions of dtmINSPECTOR**
For FDT1.x – dtmINSPECTOR3
For FDT2.x – dtmINSPECTOR4
For FDT3.x – dtmINSPECTOR5 [New!]

What's new for certification for FDT3?

- StyleGuide test has been made mandatory to pass.

- All certified DTMs are uploaded and hosted on the FDT Hub. This provides a means for users to find and download DTMs from a single location. The FDThub allows for automatic device discovery and notifications when new DTM updates are available, and vendors can manage their DTMs with user role access privileges.

What changes will we see for dtmINSPECTOR5?

- **dtmINSPECTOR5 is built mainly upon its predecessor, *dtm*INSPECTOR4. This translates to a small learning curve for developers.**

- **Relevant existing FDT2 test cases are retained and updated to adapt them to the FDT3 specification. Thus, many of the test cases would already be familiar to you.**

- **StyleGuide Test cases are now incorporated into dtmINSPECTOR5. This enhancement reduces the burden on developers and provides them with additional test coverage before submitting their DTM for certification.**

Quick preview of dtmINSPECTOR5

- **Let's do a quick preview of the dtmINSPECTOR 5:**

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How to get the dtmINSPECTOR5

- **Contact the FDT business office for a developer licence and the tool**

Thank You for Your Attention

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Common Components for FDT 3 – DTM CC

Manjunath Atchutanna

DTM CCB Chairman

Agenda

- **DTM CCB Team**
- **DTM CC - What's New**
- **DTM CC - Architecture**
- **DTM CC - DTM Communication Manager**
- **DTM CC – Assemblies**
- **Synchronization**

DTM CCB Team

Name	Company
Suriya Selvaraj	Yokogawa/FDT Group
Thomas Hadlich	Rockwell/FDT Group
Manjunath Atchutanna	FlowServe/FDT Group
Michael Gunzert	Codewrights
Robert Hartmann	Codewrights
Linda Meinzer	Codewrights
Julian Grimm	Codewrights
Frank Fährmann	Hilscher
Renato da Silva Goncalves	Hilscher
Manfred Gundel	M&M Software
Da Xin	M&M Software
Sebastian Wagner	Schneider Electric
Peter Horn	Sick
Stefan Spengler	Vega
Yoshiyuki Jinguu	Yokogawa

DTM CC – What's New

- **DTM Common Component implements FDT2.0 and FDT3.0 interfaces for interaction**

- **FDT3.0 DTM CC Based on .NET Standard library.**

- **Ensures correctness of standard FDT workflows**

- **Provides a set of implementation rules that help to minimize compatibility and interoperability problems.**

- **Common implementation rules for**

  – Interfaces thread safety

  – FDT threading rules

  – Exception handling

  – Cloning of data objects

DTM CC - Architecture

DTM CC - Architecture

# DTM CC - DTM Communication Manager

Functionality

- Communication via parent channel

- Child communication via own channels

- Online state machine

Responsibilities

- Start/stop communication
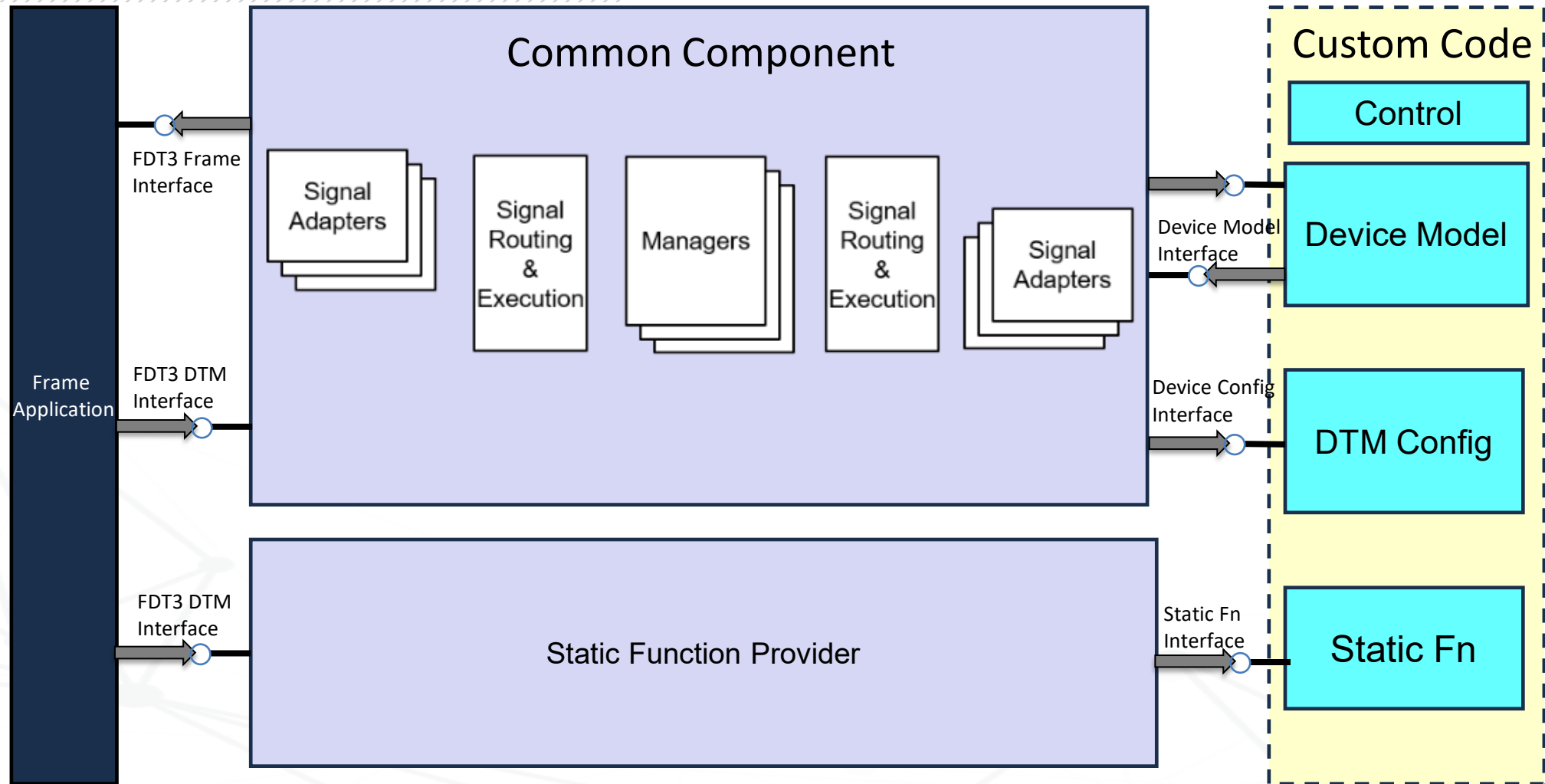
- Parent communication operations
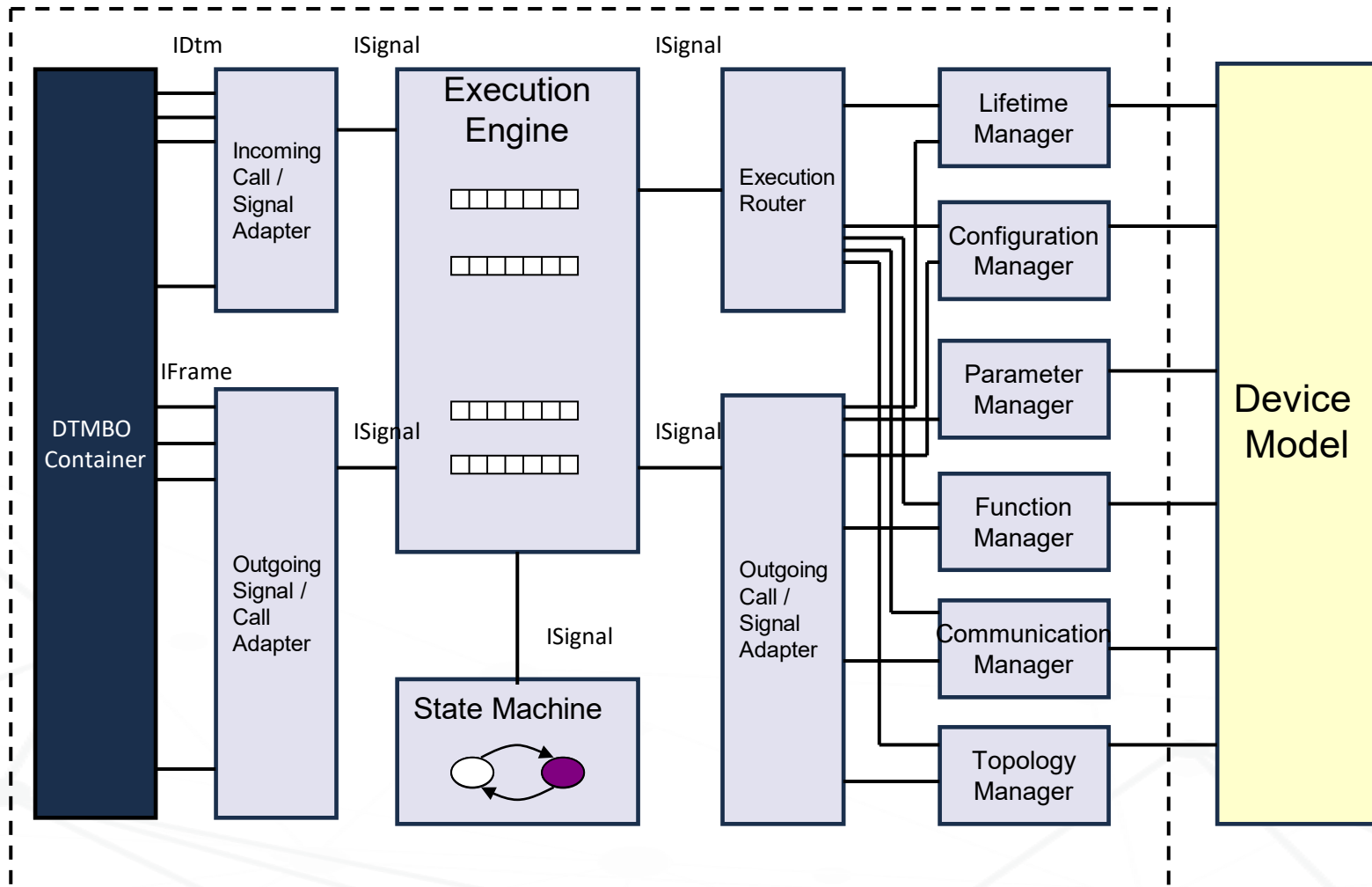
- Child communication operations

Rationale

- Ensures correctness of standard FDT workflows

- Implements online state machine and checks operations against it

DTM CC - Assemblies
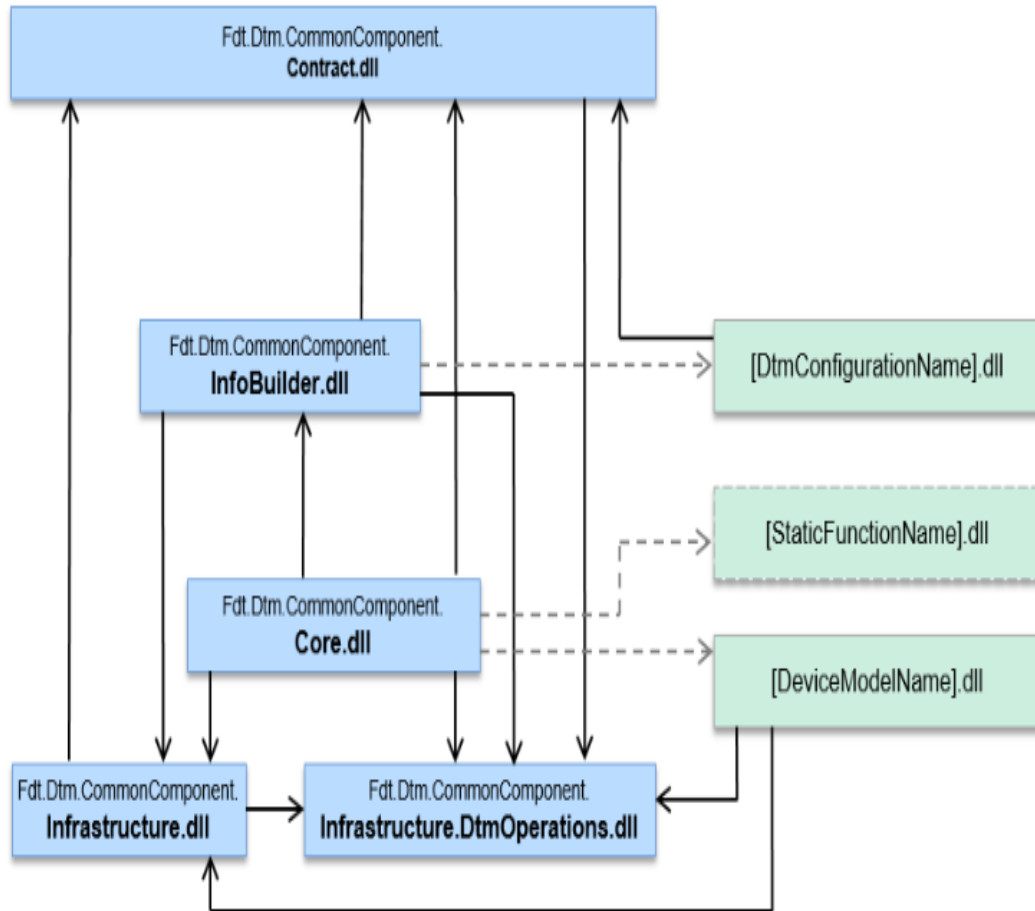
Contract
>   definitions for the DTM CC specific types, interfaces and exceptions.

InfoBuilder
>   DTM Info Builder that provides support for FDT catalog scan.

Core
>   During the initialization of a DTM, it loads the [DeviceModelName].dll and [DtmStaticFunctionName].dll from the Custom Code. IDtm interface to the Frame Application and controls all interaction during the DTM runtime.
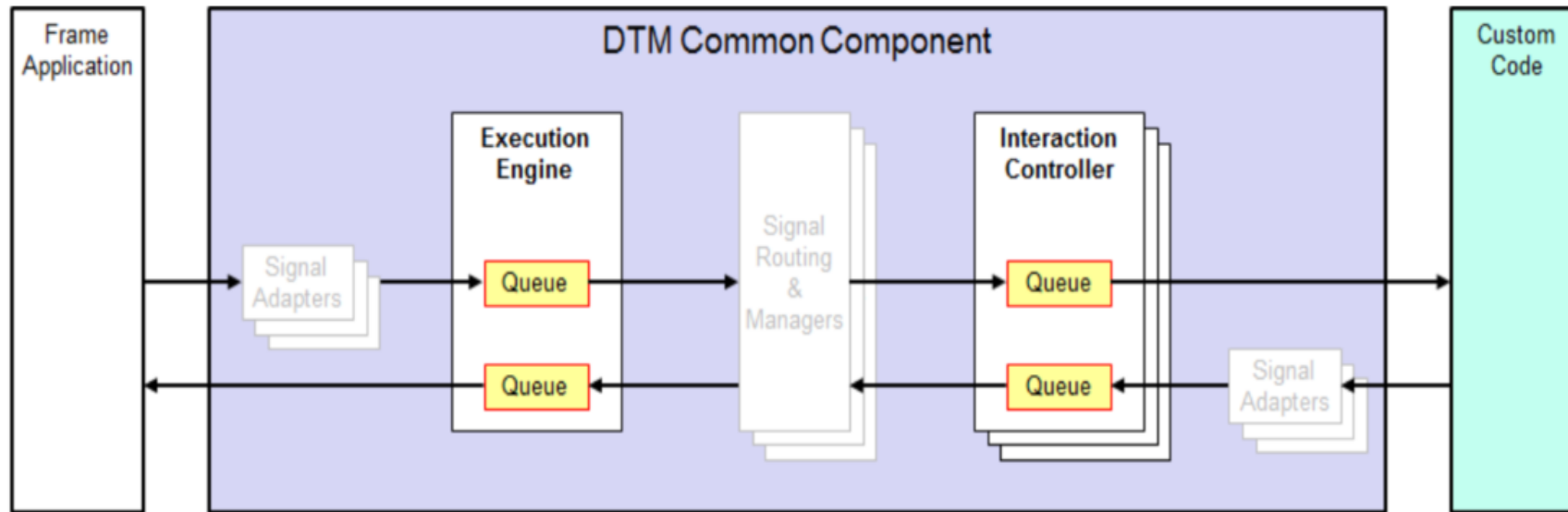
Infrastructure
>   Custom Code like Logging and state machine support

DtmOperations
>   Functionality to execute asynchronous operations.

Synchronization

Mechanism that is designed to make execution of call sequences more deterministic.

Synchronization

Low-level Synchronization

– All incoming / outgoing calls are queued and processed sequentially in a dedicated thread

– Different queues for incoming and outgoing calls (can be processed in parallel)

High-level Synchronization

– Asynchronous operations are queued as task and executed in a dedicated thread

– Different queues for incoming / outgoing and internal tasks (can be processed in parallel)

– Device Model can create internal tasks that are managed by the DTM Component

Conclusions

- **Common Components**

1 provide <u>common FDT behavior</u>

+

2 <u>decouple</u> System specific and Device specific implementations

=

4 <u>significantly reduce interoperability issues and efforts</u>

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FDT Server CCB

Renato da Silva Goncalves

Chairman FDT Server CCB

Contents

- **Introduce myself**

- **What is FDT Server CCB**

- **Current state of CC**

- **Planned Changes and Enhancements**

- **Feedback**

INTRODUCE MYSELF

Introduce myself

- Renato da Silva Goncalves

- Working for Hilscher since 8 years

- Developing Frame Application

- Chairmen of FDT Server CCB

Source: https://www.hilscher.com/de/unternehmen/ueber-uns/

WHAT IS FDT SERVER CCB

What is FDT Server CCB

- **CCB stands for <u>C</u>hange <u>C</u>ontrol <u>B</u>oard**

- **Needed Changes, Enhancements and Bugs are discussed and prioritized here**

- **We are 10 members from different companies**

- **We meet us once a month**

- **Responsible for: Desktop CC (<u>C</u>ommon <u>C</u>omponent)
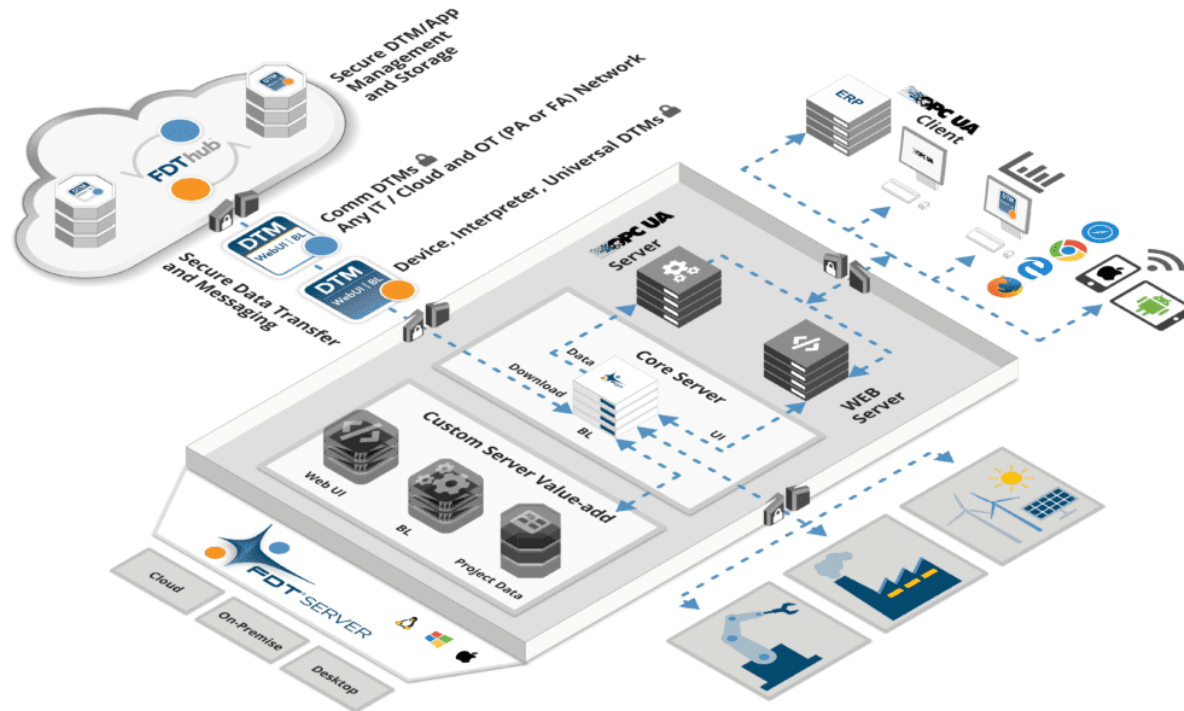 FDT Server CC (<u>C</u>ommon <u>C</u>omponent)**

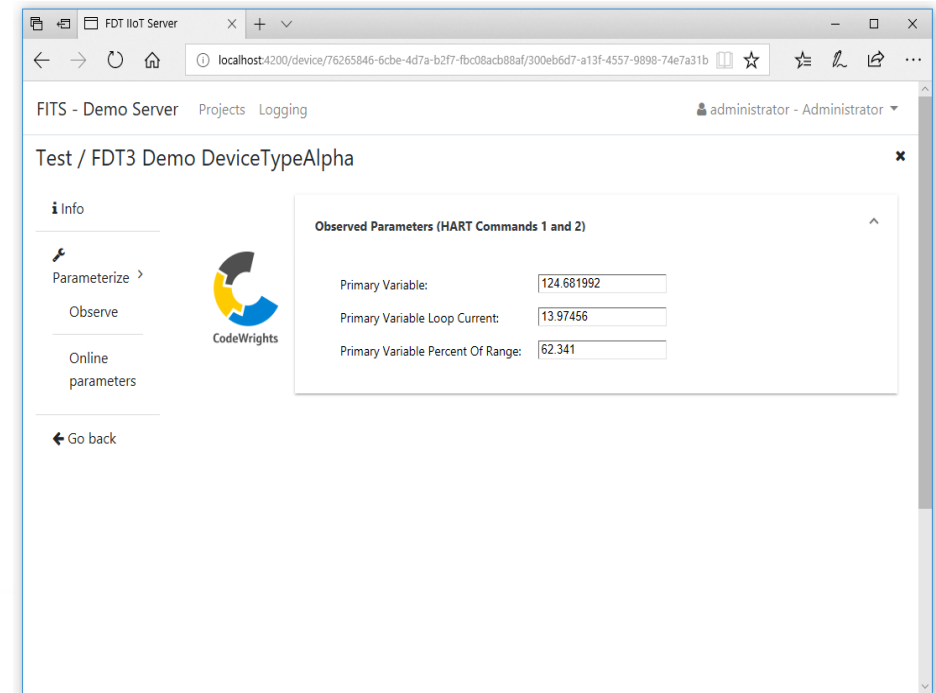# What is FDT Server CCB

- **Desktop CC**
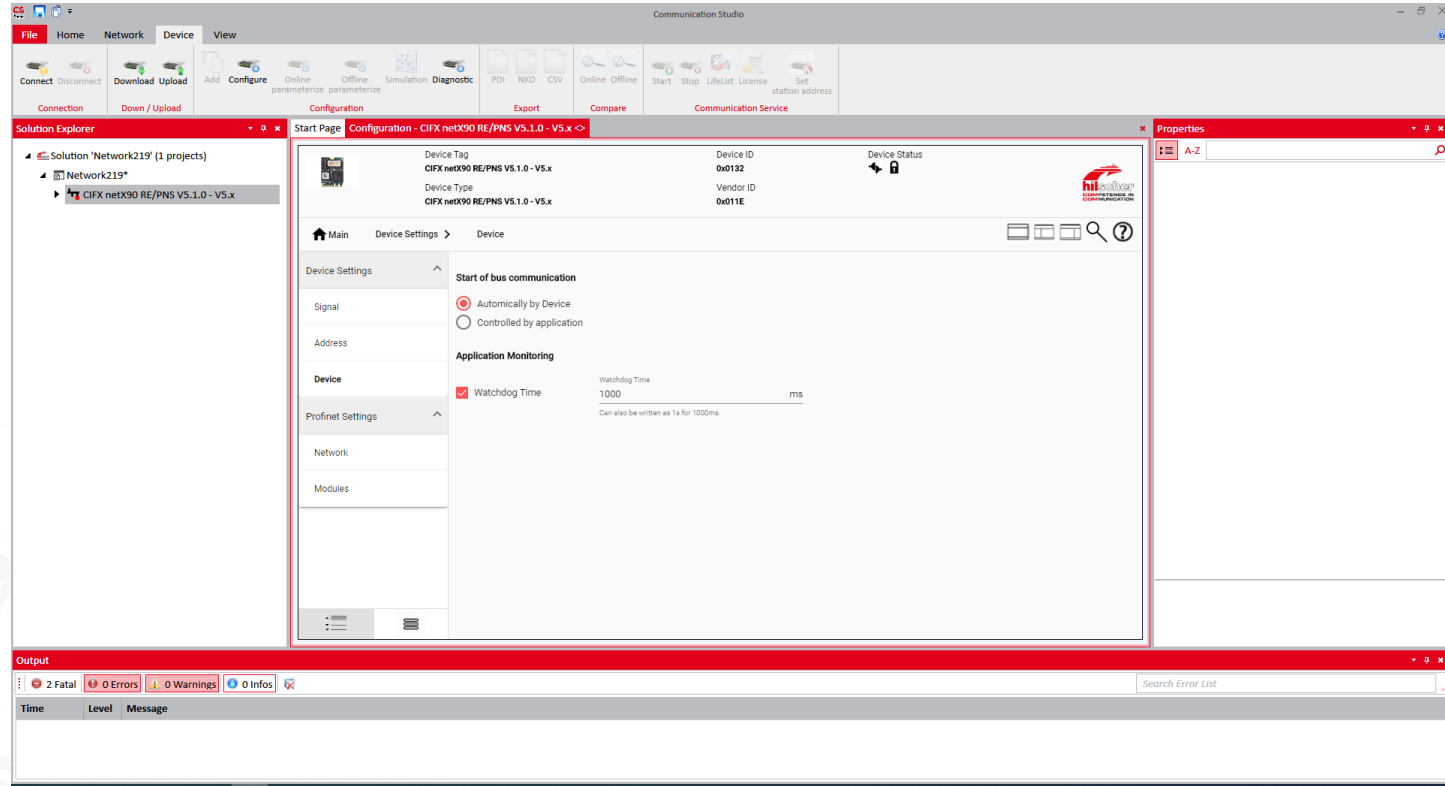
Source: picture of Communication Studio

What is FDT Server CCB

- **FDT Server CC**

Source: https://www.fdtgroup.org/wp-content/uploads/2019/10/fits_automation_big_picture_9-30-19-fdthub-1-1024x610.png

Source: picture of FITS Demo Server

CURRENT STATE OF CC

Current state of CC

Desktop CC (v4.0.21183.4)

- Several bug fixes
  (E.g. to be FDT3 specification conform)

- Changes and Enhancements were
  collected

FDT Server CC (v1.0.2020.4)

- Changes and Enhancements were
  collected

- Budget plan for the next year.

PLANNED CHANGES AND ENHANCEMENTS

Planned Changes and Enhancements

Desktop CC

- Provide the DTMInstaller also for the Desktop CC

- Including access to FDTHub

- Partial Reload Catalog

FDT Server CC

- Edit / Create projects
  (e.g. create a new project or edit an existing one)

- Extended documentation

- Including access to FDTHub

- Offline / Online state configurable

FEEDBACK

Feedback

- **What else would you like to see included in the CCs?
  Do you have any suggestions or proposals?**

- **If you can think of something later, please feel free to contact me
  Rgoncalves@hilscher.com**

Thank You for Your Attention

# Using an OPC/UA Client with the FDT Server

Thomas Hadlich

Chair PG OPC UA

Agenda

- **PG OPC UA**
- **FITServer overview**
- **Connecting to FITServer via OPC UA**
- **Browsing project structure**
- **Accessing device information**
 - Documents
  - Data (offline and online)

PG OPC UA

- **Joint working group – OPC Foundation + FDT Group**
- **Since 2017**
- **Members from**
  - Endress + Hauser, Flowserve, M&M Software, Rockwell Automation, Schneider Electric, Thorsis Technologies, Turck, Weidmüller, Yokogawa
- **Meetings**
  - One monthly meeting (mostly web conferences)
- **Recent publications**
  - OPC UA Companion Specification for FDT v1.01
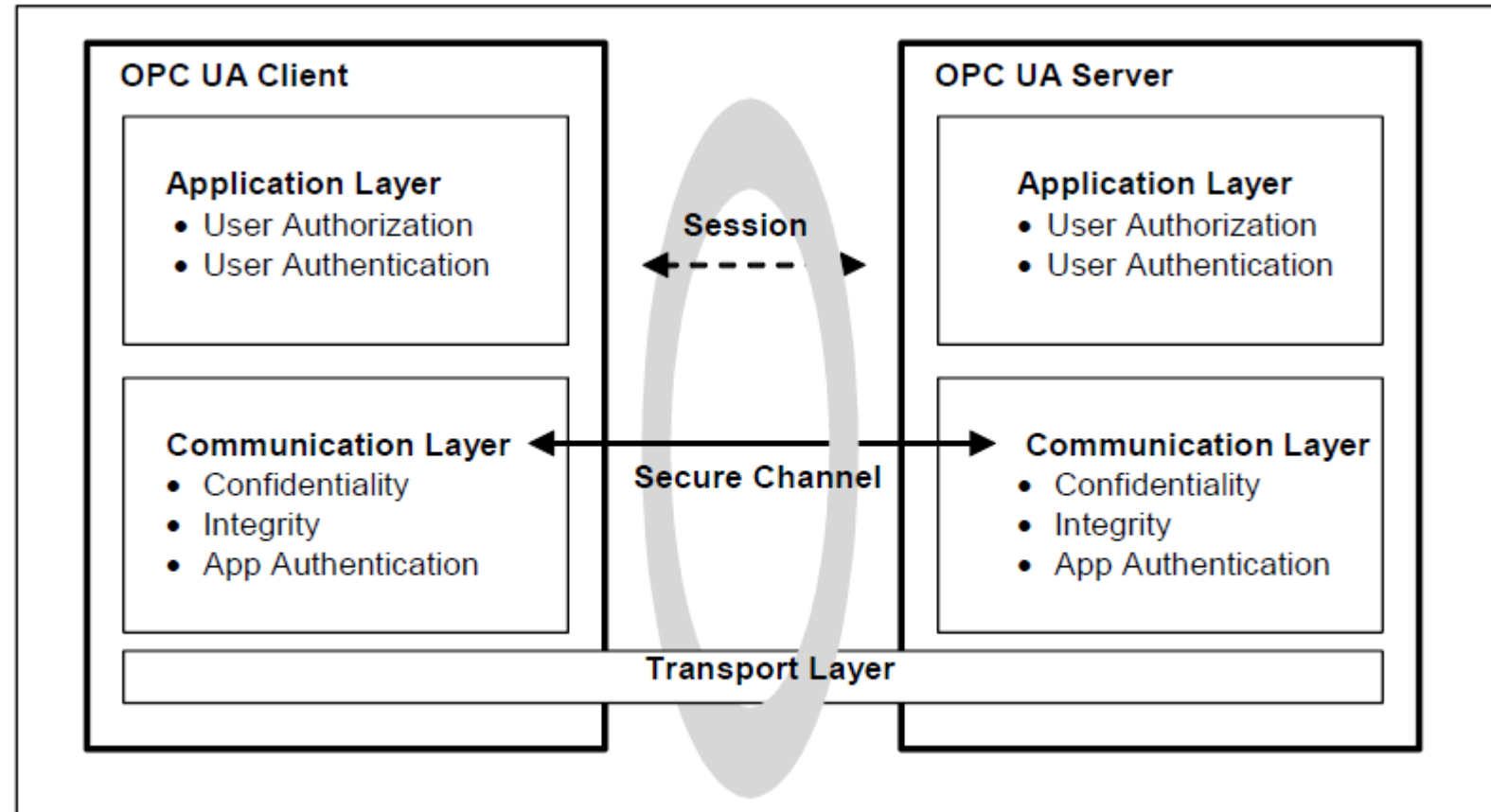   (based on OPC UA for Devices)

FITServer overview
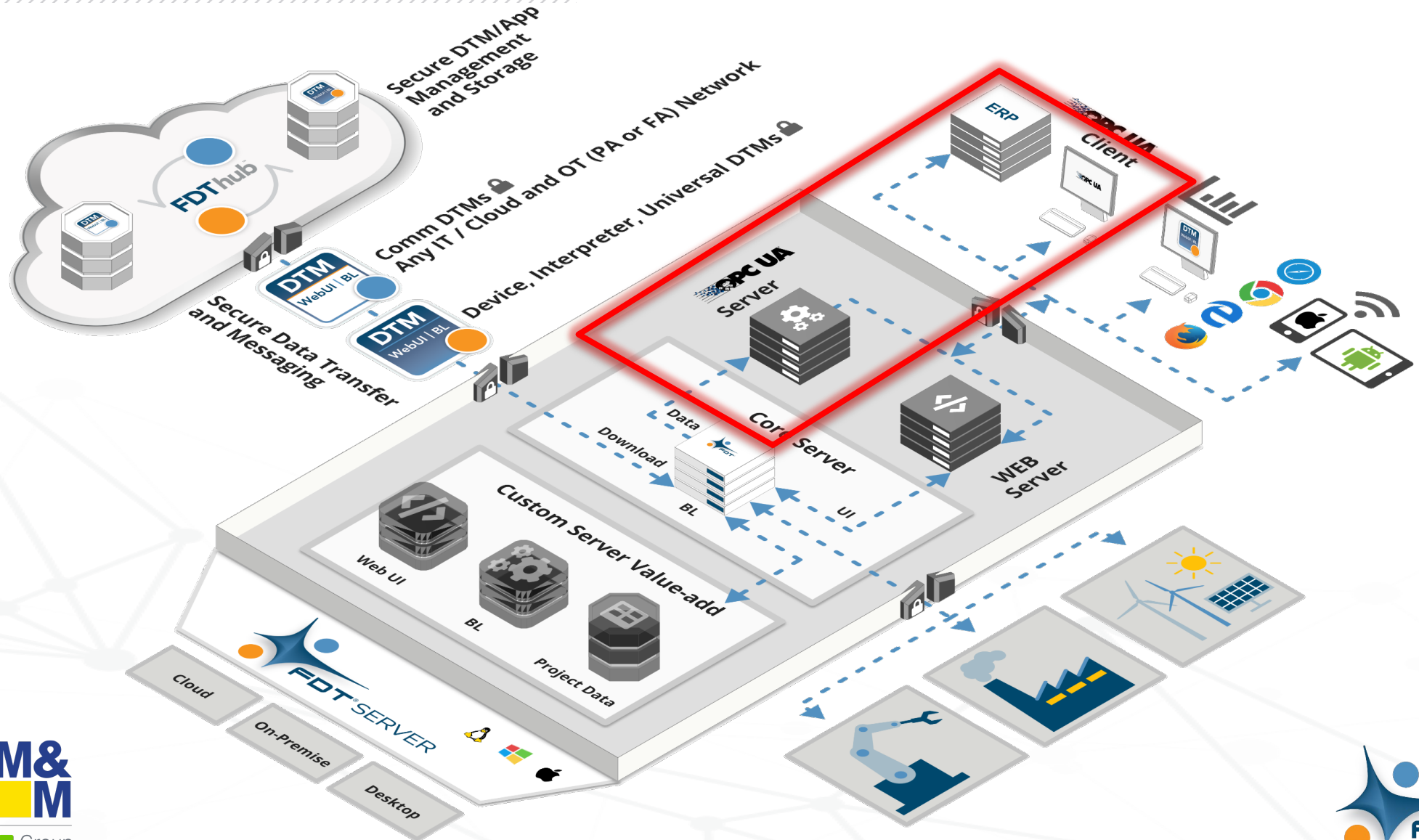
OPC UA Information model to Network topology
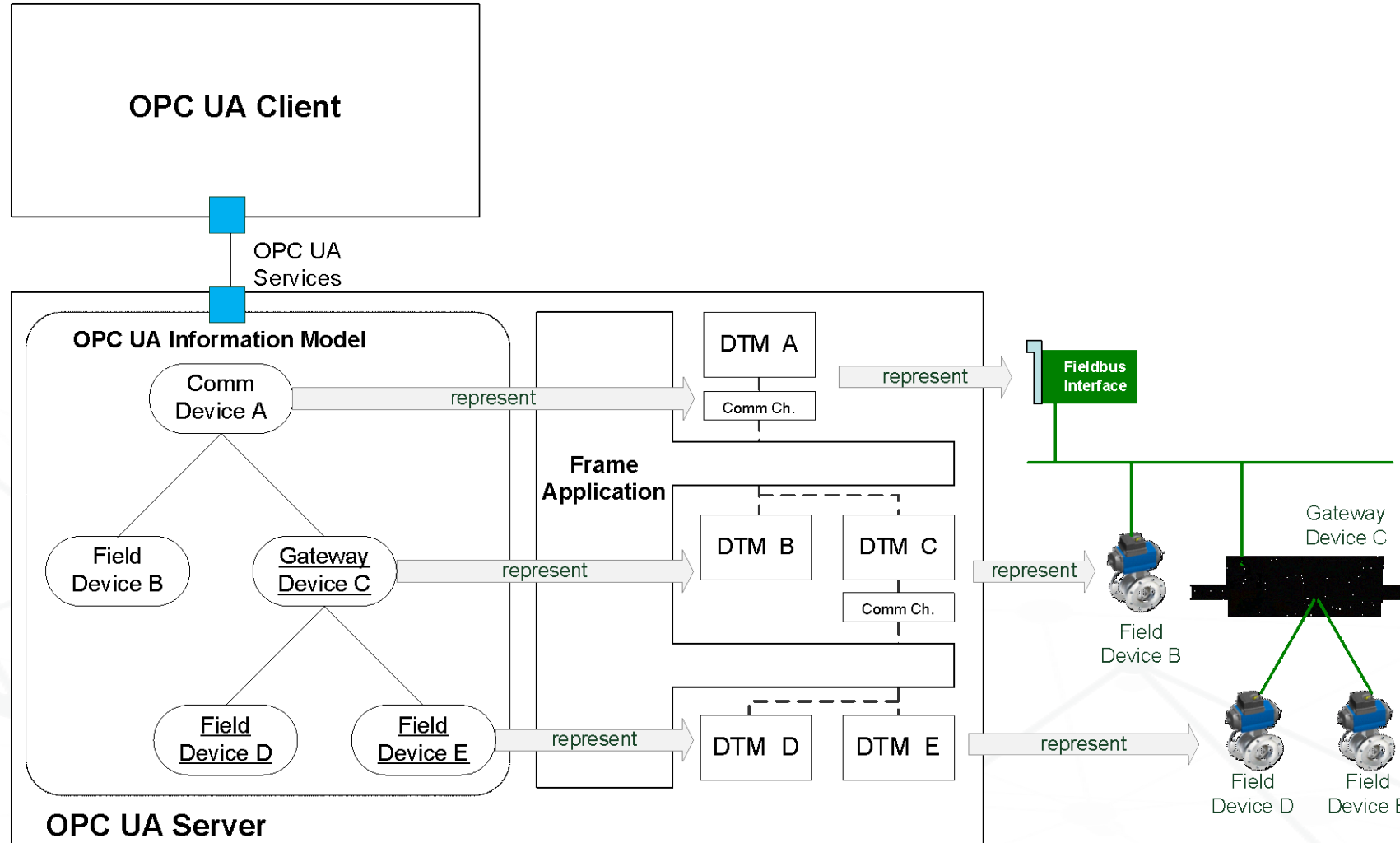
Connecting to FITServer via OPC UA

- **OPC UA Connection**
  - Security
    - Authentication
    - Authorization
    - Confidentiality
  - Connection control
    - Session
    - Session timeout
  - Data encoding
    - Binary
    - XML

Connecting to FITServer via OPC UA (2)

- **Open secure channel**
  - Exchange of certificates
    - Client + Server
      - Software certificate (product)
      - Application instance certificate
  - Different security modes
    - None
    - Messages signed
    - Messages signed + encrypted
  - Lifetime of security token
- **Create + activate session**
  - User identification
    - User name / password
    - User X509
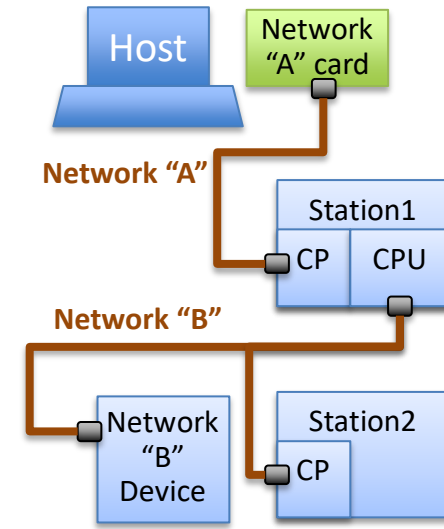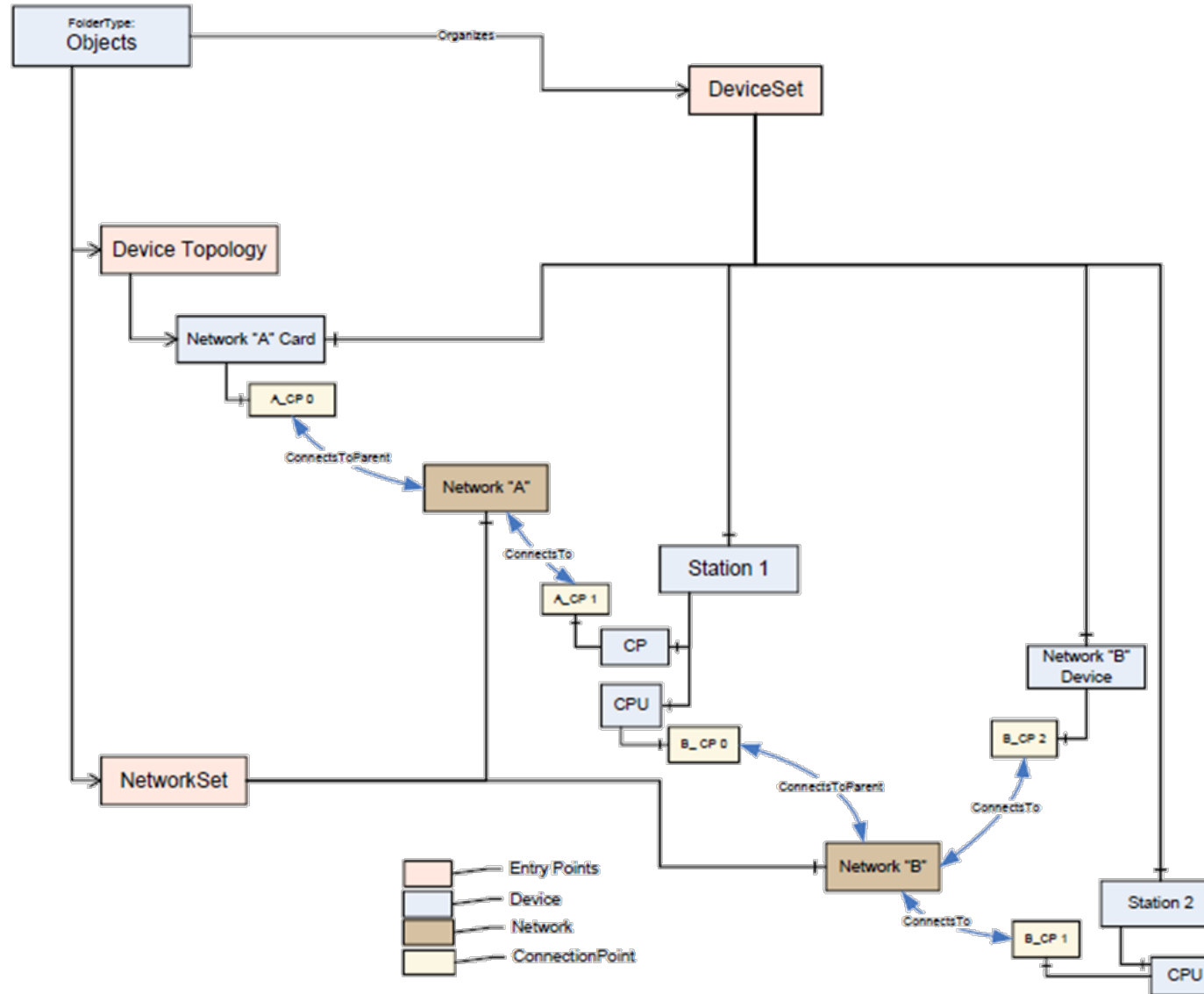   - User token
  - Session timeout
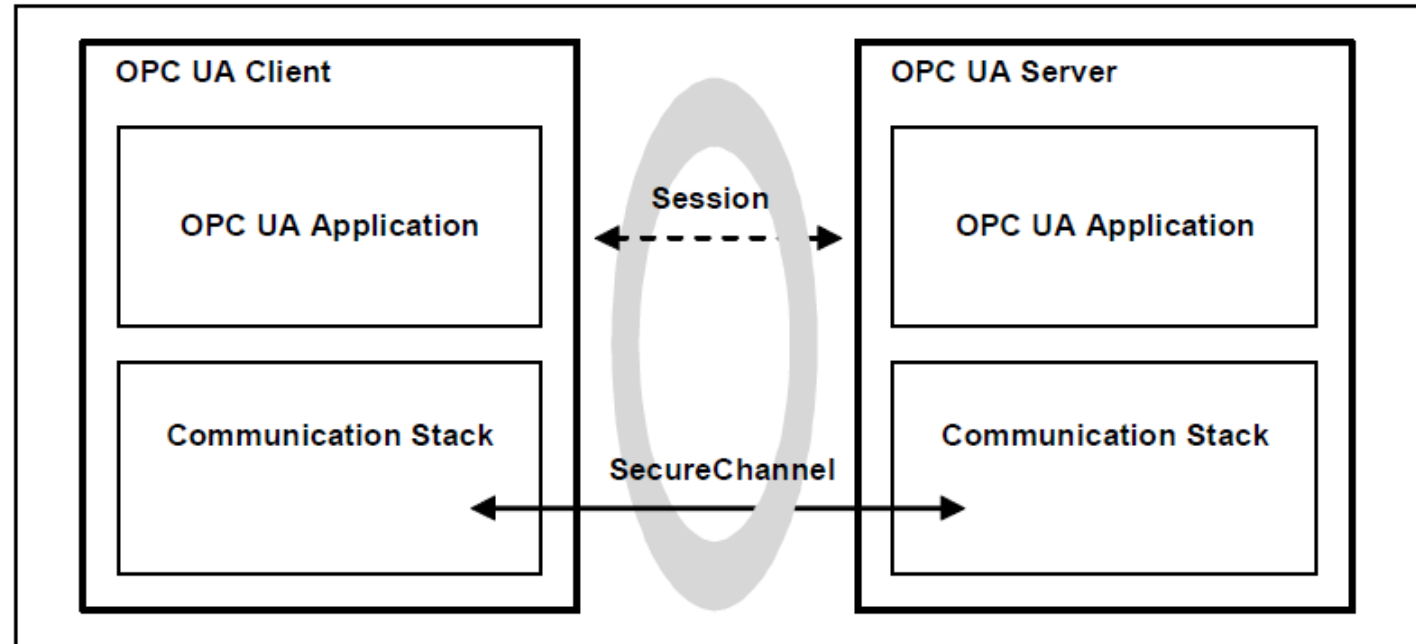
Project structure

- **OPC UA CS for FDT v1.01 -> based on OPC UA for Devices**

- **Project structure is defined by OPC UA for Devices**
  - Device model
    - Different classes of equipment (component type, device type, software type, block type)
    - Representation of a device
    - Device set
  - Device communication model
    - Description of connection points, networks and protocol support
  - Device integration host model
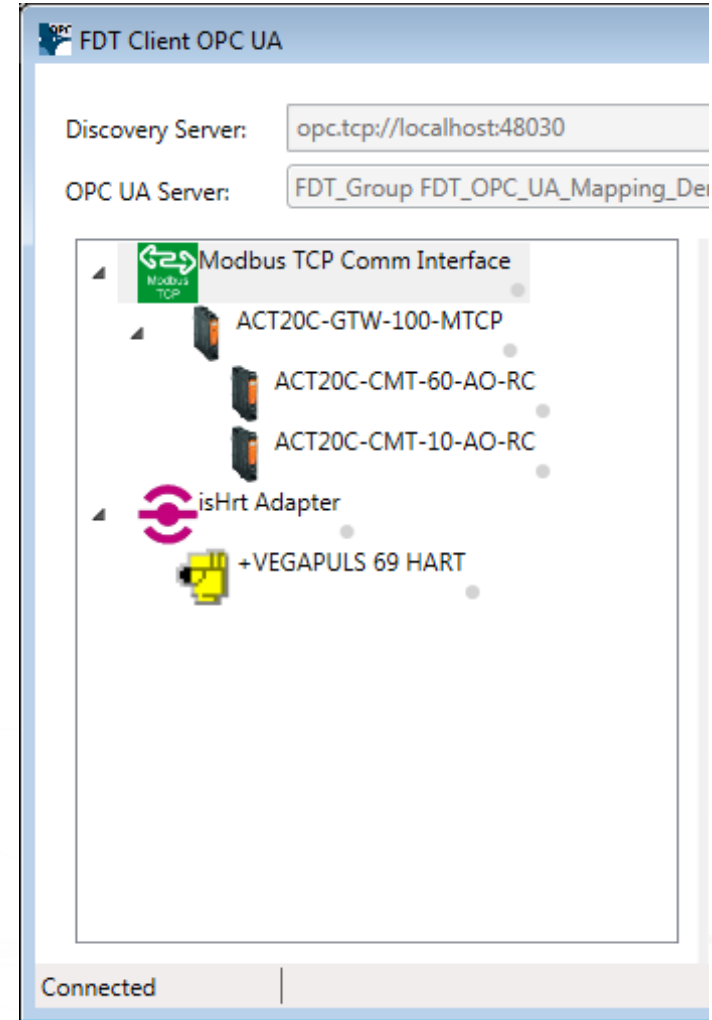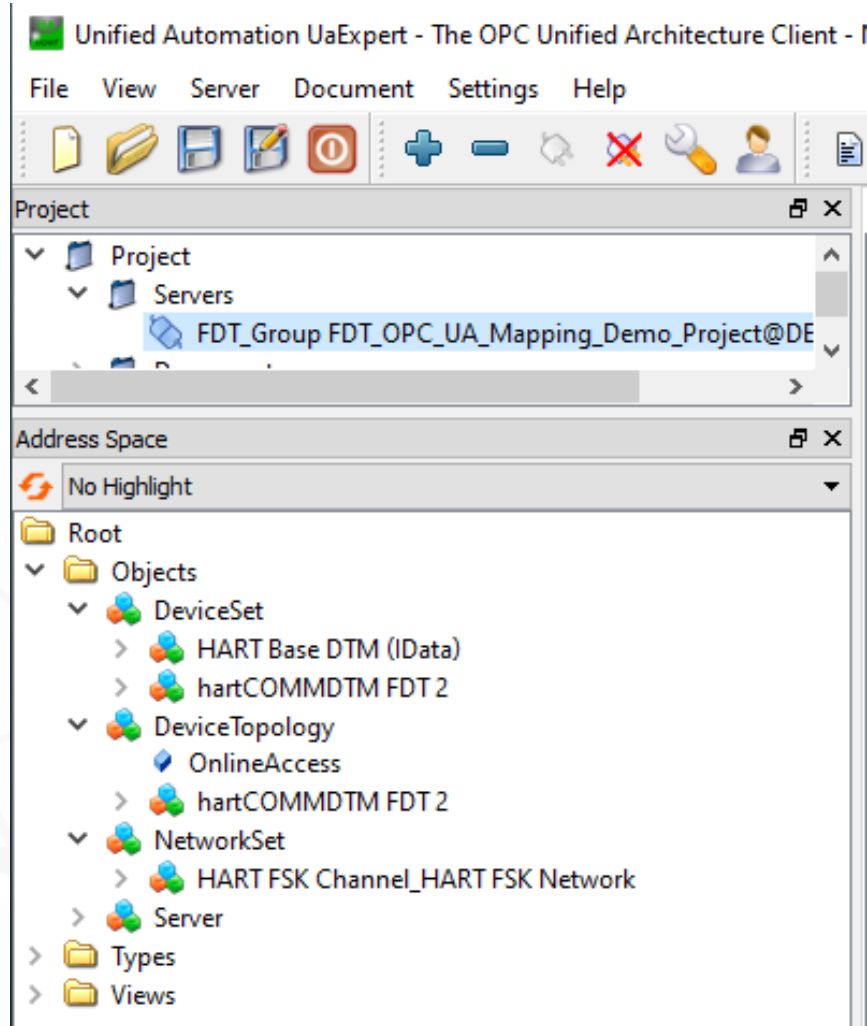   - Representation of the topology as seen from the server
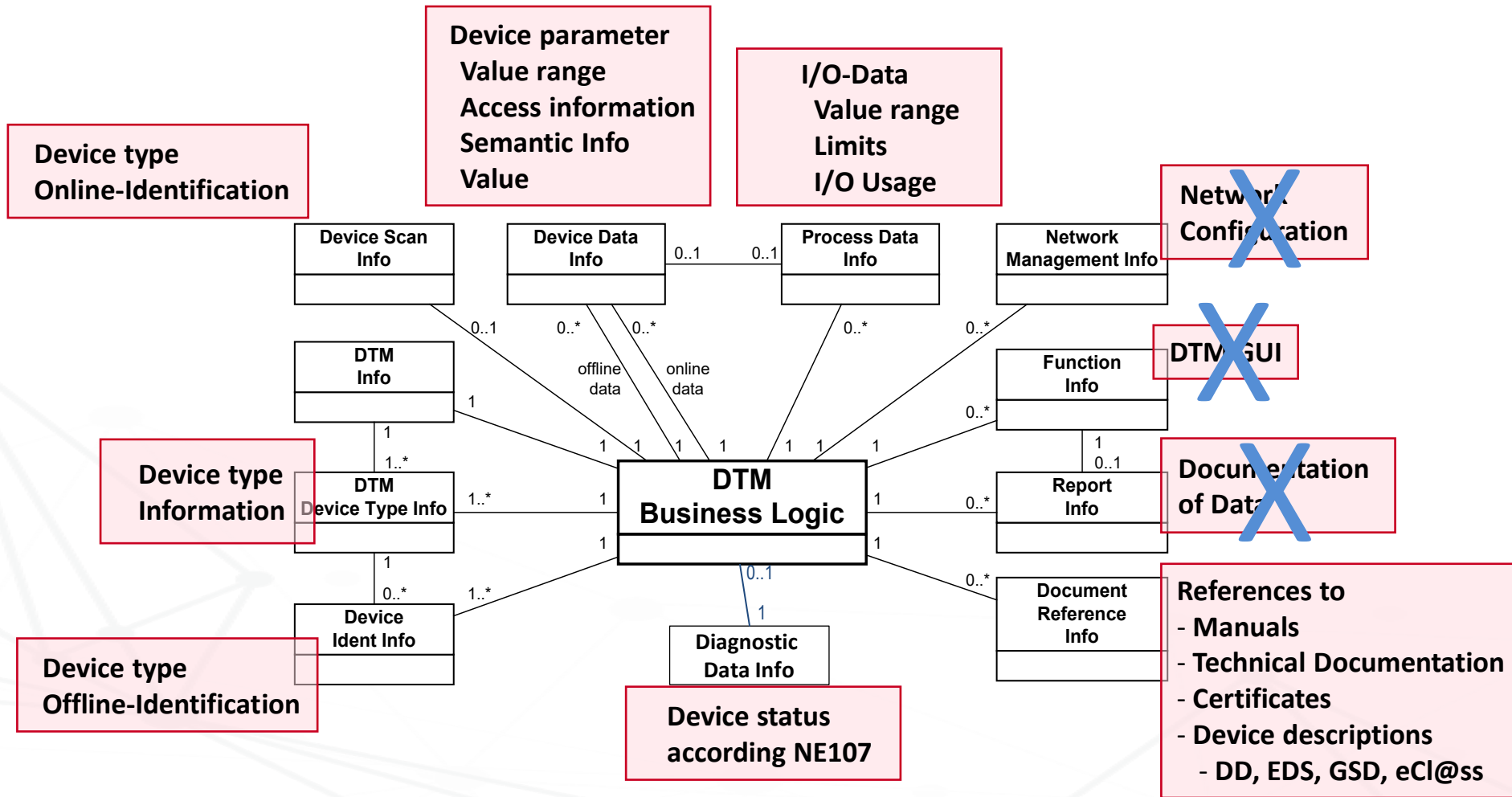
Communication topology
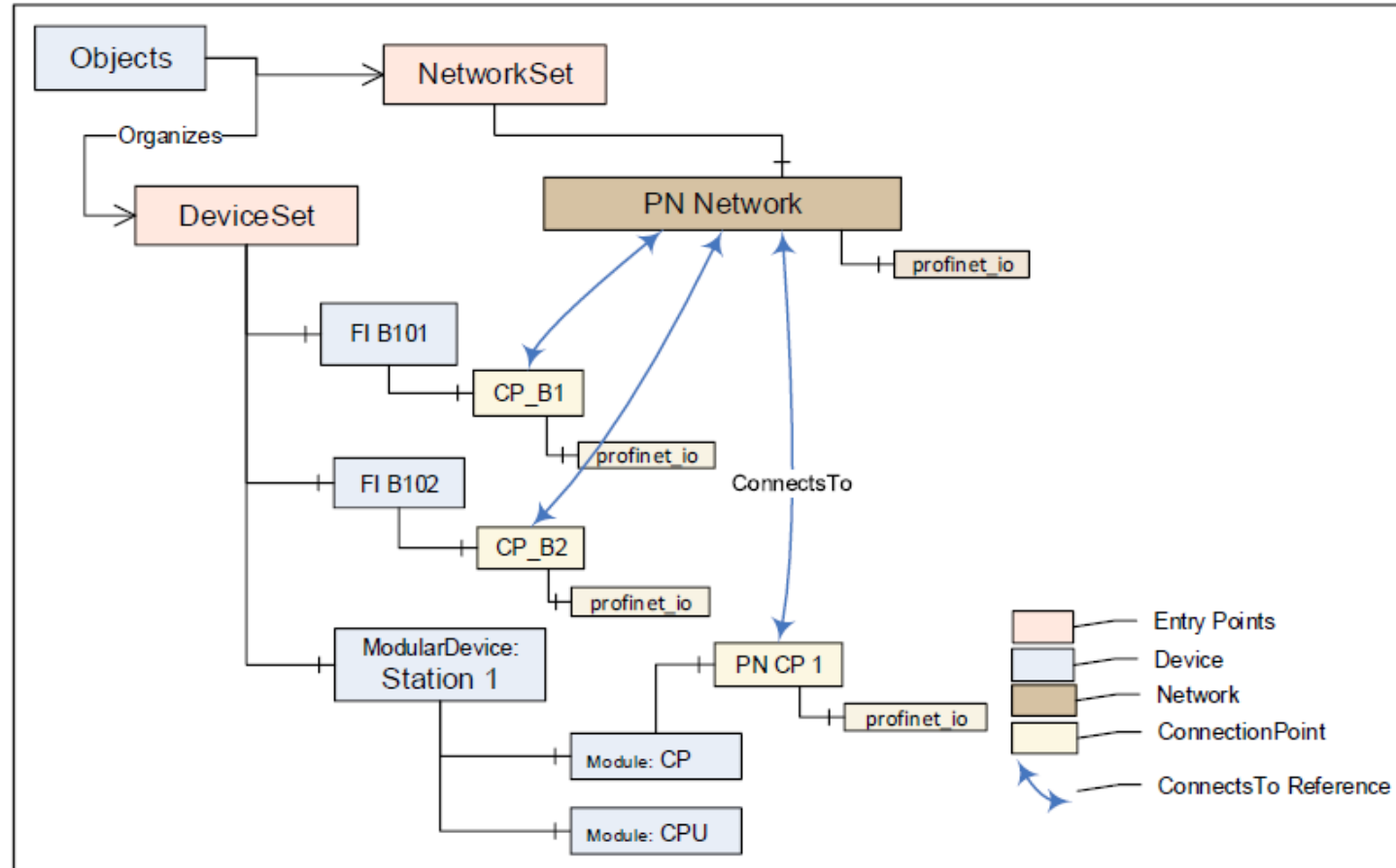
Representation of project structure

Demo: Representation of project structure

FDT: Accessing device information

Device type
Online-Identification

Device parameter
Value range
Access information
Semantic Info
Value

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

Network Configuration

Device Scan Info

Device Data Info

Process Data Info

Network Management Info

DTM GUI

Function Info

Documentation of Data

Report Info

DTM Info

Device type Information

DTM Device Type Info

DTM Business Logic

Device type Offline-Identification

Device Ident Info

Diagnostic Data Info

Device status according NE107

Document Reference Info

References to
- Manuals
- Technical Documentation
- Certificates
- Device descriptions
  - DD, EDS, GSD, eCl@ss

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Demo: access to device info

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Contact: thadlic@ra.rockwell.com

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FDT3 Desktop Common Components

Manfred Gundel

M&M Software GmbH

FDTCONTAINER FEATURES

fdtCONTAINER component Overview

- **Runtime to execute DTMs in an application**
- **Integrates FDT into any system**
- **Base for custom-made FDT frame application**
- **Simplifies the maintenance of your application**
- **Hides FDT specific complexity**
- **Efficient and cost-effective FDT integration**
- **Base of *fdtCONTAINER* product family**

fdtCONTAINER component Overview

Custom FDT Application

GUI

fdtCONTAINER Component

| DTM Catalog | Project | Topology | Proxies | ... |

Database

Comm Channels

Surrogate / Proxies (Clr Extension Concept)

FDT Version Adapters
FDT 1.2.x <-> FDT 2
FDT 1.2.x <-> FDT 3
FDT 2 <-> FDT 3

Log

FDT 1.2.x DTMs

FDT 2 DTMs

FDT 3 DTMs
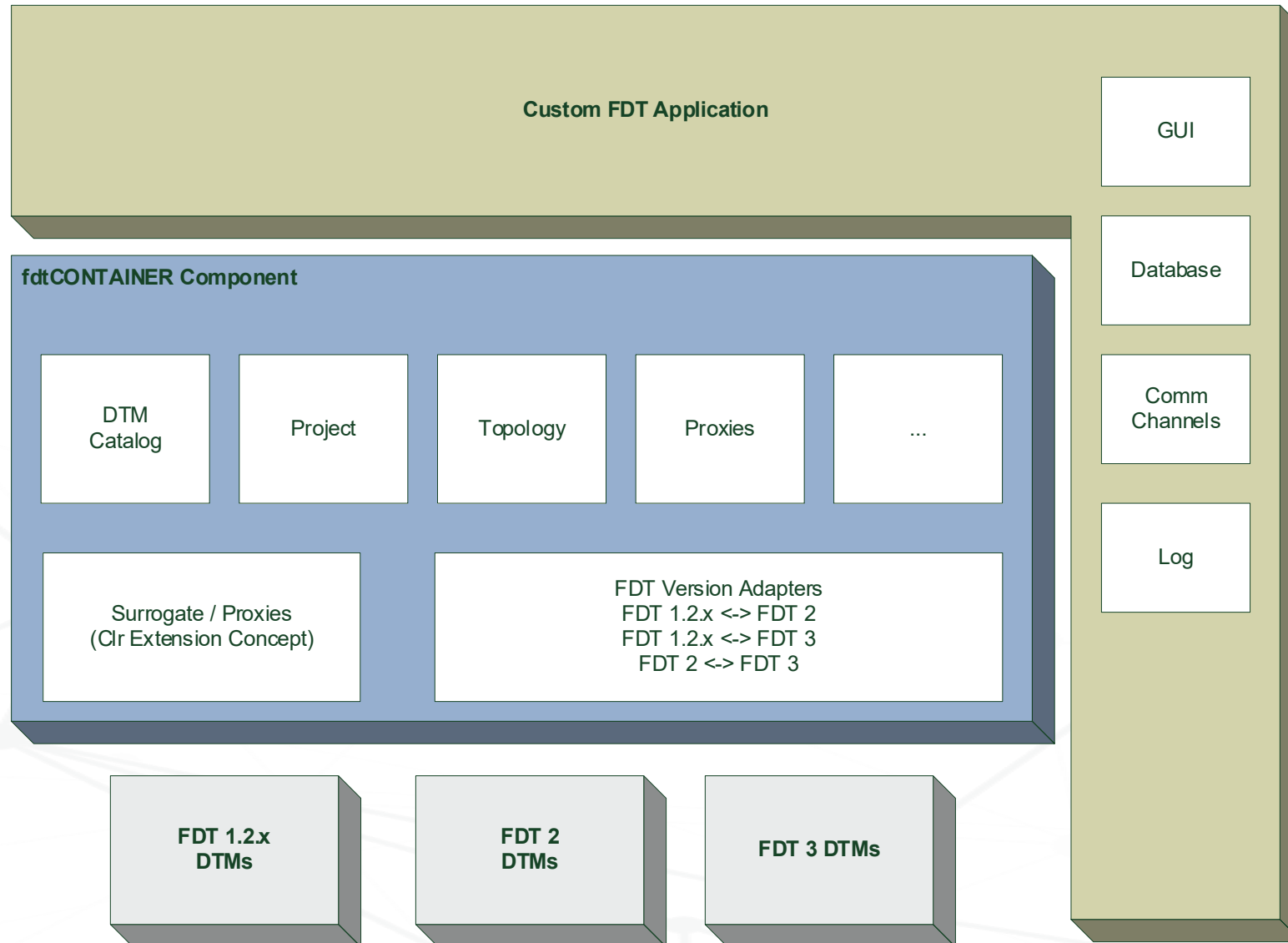
fdtCONTAINER component Overview

- **API Implemented in C# / .NET Framework 4.8**
  - Sub-Process for FDT1.2 uses native implementation
  - Sub-Process for FDT3 also uses .NET Framework 4.8

- **Bound to Windows as platform**
  - This is unavoidable because of the FDT 1.2 support

- **Provides an MSI Merge Module for easy integration into setups**

fdtCONTAINER component Overview

fdtCONTAINER component **Features**

- **Encapsulate common FDT sequences and provide a simplified API**
  - Less effort for custom application developer
  - Specification conform implementation of FDT workflows
  - Custom application developer can focus on domain specific problems and not on FDT problems

fdtCONTAINER component Overview

fdtCONTAINER component Features

- **Provide structured API for typical FDT tasks**
  - DTM Catalog
  - Project Management
  - Topology Management
  - DTM Proxies (Functions, Online Operations, Scanning, ...)

fdtCONTAINER component Overview

fdtCONTAINER component **Features**

- **Provide memory and resource management**
  - E.g. shutdown unused DTMs to save resources
  - E.g. for FDT 2 DTMs: Load instance data only on demand
  - E.g. for .NET DTMs: Create catalog in external process

fdtCONTAINER component Overview

fdtCONTAINER component **Features**

- **Abstraction of FDT versions**
  - E.g. add a DTM from the catalog $\Rightarrow$ no version specific hanling needed by the frame developer
  - Access to FDT version specific information is still possibble if required

- **Provide .NET data types for FDT 1.2.x XML schemas**
  - Avoids XML parsing code in the Frame Application

fdtCONTAINER component Overview

fdtCONTAINER component **Features**

- **Robustness features**
  - Start DTMs in separate processes so that DTM problems do not crash the main process

- **Diagnostic features**
  - Logging of FDT calls and exceptions

- **Interoperability**

fdtCONTAINER component Overview

fdtCONTAINER component **Features**

- **Communication channels**
  - Optionally, the custom FDT application can provide communication channels which are used in the topology

- **Logging (Log Event Listener)**
  - Optionally, the custom FDT application can listen to log events. For example, it could display them in a log viewer window on the user interface
  - Log entries are provided by the *fdtCONTAINER component* (FDT method calls, errors, ...)

fdtCONTAINER component Overview

fdtCONTAINER component Features

- **Provide configuration parameters**
  - DTM threading model
  - Limit number of started DTMs
  - Directory paths (e.g. FDT 1 XML schemas)
  - ...

fdtCONTAINER component Overview

Responsibilities of the Custom FDT Application

These responsibilities are NOT in the scope of the *fdtCONTAINER component*!

- **Application / Domain specific features**
  - The *fdtCONTAINER component* does **not** provide specific features for domains such as DCS

- **Display of user interfaces**
  - Triggered by the *fdtCONTAINER component* via callback interfaces
  - Custom FDT application without user interface (e.g. services) are also possible

fdtCONTAINER component Overview

Responsibilities of the Custom FDT Application

These responsibilities are NOT in the scope of the *fdtCONTAINER component*!

- **Persistency implementation**
  - Runtime Frame loads and saves data through callback interfaces (Database Adapter)
  - Project Data (Engineering Data)
  - DTM instance data
  - DTM catalog data
  - Actual persistency (database, XML file, ...) is implemented by the custom FDT application
  - A reuseable default implementation exists

fdtCONTAINER component Overview
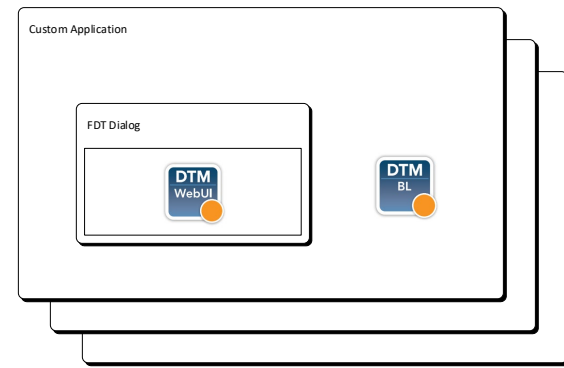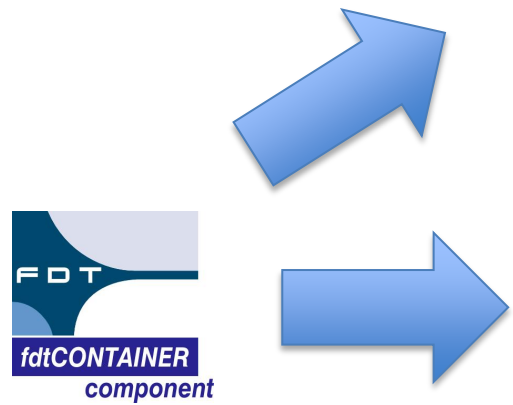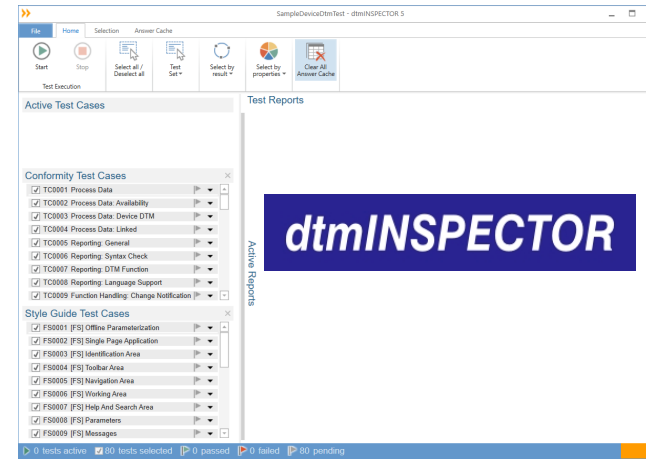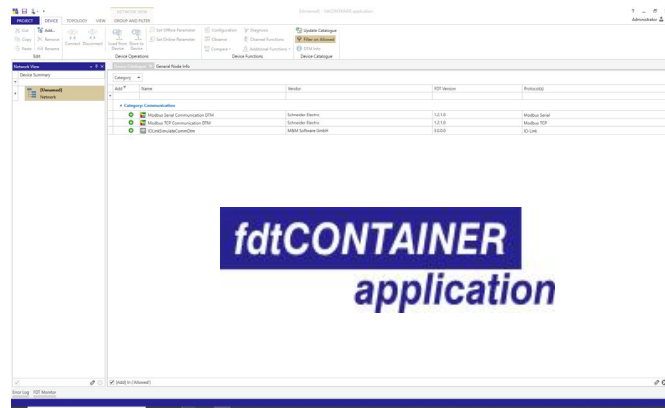
Desktop CC vs. Server CC
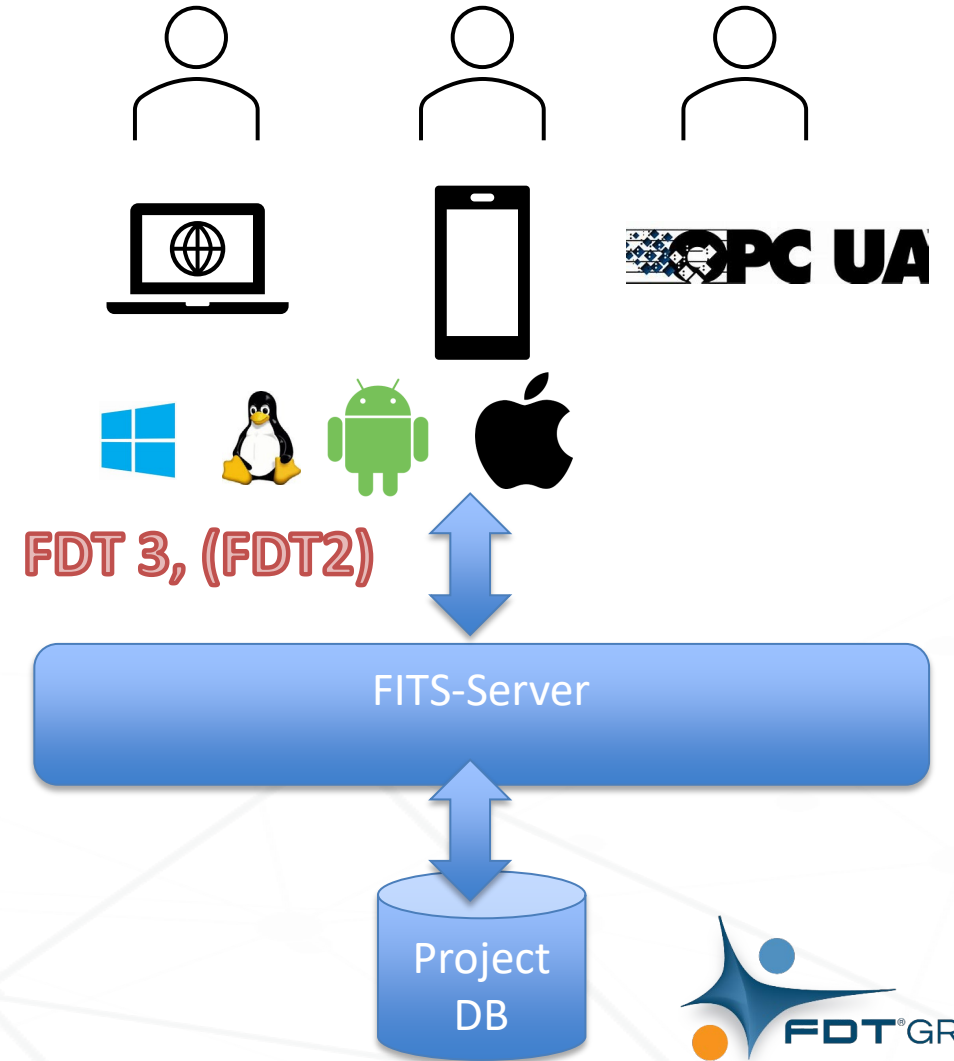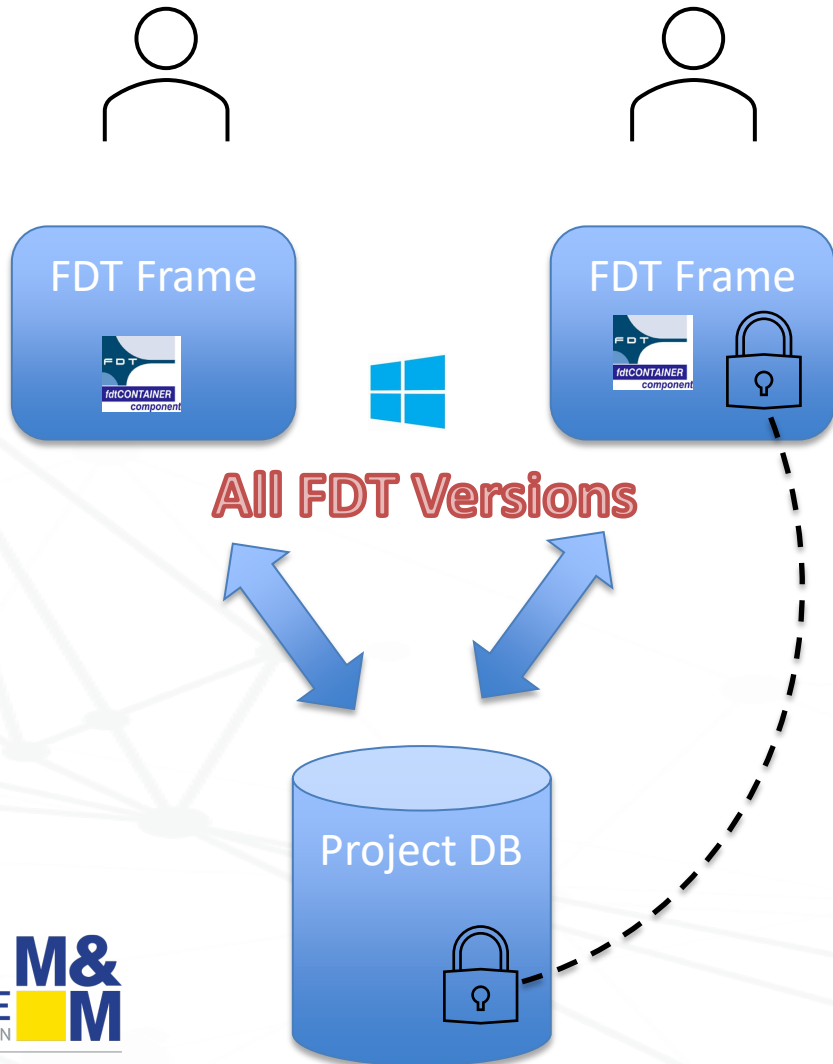
Contact

* **More information**

  – Volker Herbst, M&M Software GmbH, vht@mm-software.com

LIVE DEMO

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FDT 3 Licensing and Agreements

Glenn B Schulz

Managing Director

Developing and Releasing FDT 3 Products

- **All FDT 3 Vendors Must Have an FDT Vendor ID**
  - Includes vendors using third party developers
  - Obtained by completing the "The FDT Group Standard Collaboration Agreement"
  - Grants access to the Specification and ancillary documents

- **All FDT 3 Servers and DTMs Must Incorporate Common Components**
  - License the tools from the FDT Group
  - FDT 3 'Desktop' license from M&M Software

- **FDT 3 DTMs**
  - Must be certified before release
  - Must be accessible in the FDTHub
    - Automatically achieved as part of certification process

The FDT Group Standard Collaboration Agreement

- **Mutually signed document between the Vendor and the FDT Group**
  - Provides the FDT Vendor ID
  - Legal basis for development of FDT 3 products
  - Provides for mandatory certification of DTMs
  - Provides that DTMs are accessible in FDTHub
  - Provides mutual NDA and consolidated damages
- **Obtain a copy from the FDT Group Business Office**
  - businessoffice@fdtgroup.org
  - Sign and return to the business office
  - The business office will return a completed copy

FDT 3 Licenses and Requirements

- **License costs are based on membership level**
  - One time licensing fee plus annual maintenance agreement
- **A standard licensing agreement must be completed for each tool set**
  - Vendor ID is required for tool licensing (completed "FDT Group Standard Collaboration Agreement")
  - Contact businessoffice@fdtgroup.org for a license copy
  - Sign and return to the business office
  - The business office will return a completed copy of the license

FDT 3 License Costs – Developer Tools

Developer Tools Catalog	List Price	Corporate (Class A-D)	Affiliate (LVL 1-3)	Affiliate (LVL 4)	Non-Member	Try Before You Buy
Item	Euros	Discount	Discount	Discount	Discount	Discount
Specification						
FDT 3.0 Specification Vendor ID / License to Develop Products **(Note 1)**	15,000 €	100%	100%	0%	0%	N/A
Developer Tools						
DTM Common Components (includes one year of maintenance)	9,500 €	50%	20%	0%	0%	80% **(Note 2&3)**
DTM Common Components Annual Maintenance Contract	1,500 €	20%	20%	0%	0%	N/A
FDT Desktop Common Components	Market	Market	Market	Market	Market	Market
FDT Desktop Common Components Annual Maintenance Contract	Market	Market	Market	Market	Market	Market
FDT Server Common Components (includes one year of maintenance)	15,000 €	50%	20%	0%	0%	80% **(Note 2&3)**
FDT Server Common Components Annual Maintenance Contract	3,000 €	50%	20%	0%	0%	N/A

NOTES:
1.) Mandatory for FDT 3.0 product development
2.) Try before you buy does not allow product development
3.) Try before you buy fee refunded if purchase made within 30 days

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FDT 3 License Costs – Test Tools

Developer Tools Catalog	List Price	Corporate (Class A-D)	Affiliate (LVL 1-3)	Affiliate (LVL 4)	Non-Member	Try Before You Buy
Item	Euros	Discount	Discount	Discount	Discount	Discount
Test Tools						
dtmINSPECTOR Tool (includes one year of maintenance)	3,000 €	50%	20%	0%	0%	N/A
dtmINSPECTOR Tool Annual Maintenance Contract	750 €	20%	20%	0%	0%	N/A

Thank You for Your Attention

ioddINTERPRETER Demo

Generic IO-Link FDT 3.0 DTM

Volker Herbst, EMEA Marketing Member

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ioddINTERPRETER

- **Generic DTMs enable a lot of devices for FDT**

- **ioddINTERPRETER uses IODD files for IO-Link devices**

    – 5000 IODD files for more than 21.000 devices of 111 vendors are available

    – https://io-link.com/de/IODDfinder/IODDfinder.php

- **FDT Group planes to provide generic DTMs to ease the use of FDT**

    – ioddINTERPRETER is the first for FDT 3.0

ioddINTERPRETER

- **ioddINTERPRETER DTM history**

  – Available for FDT 1 since about 10 years

  – Driven by more than 10 huge IO-Link vendors

  – One of the main IO-Link configuration tools

  – ioddINTERPRETER for FDT 1.2 available at M&M Software

ioddINTERPRETER

- **Status**

  - Beta Version of Device DTM available

  - Final IO-Link Annex in work

  - Communication DTM development possible after Annex is finished

  - Final release of ioddINTERPRETER after CommDTM is available

Contact

- **More information**

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