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Choosing the right
Validation Approach for

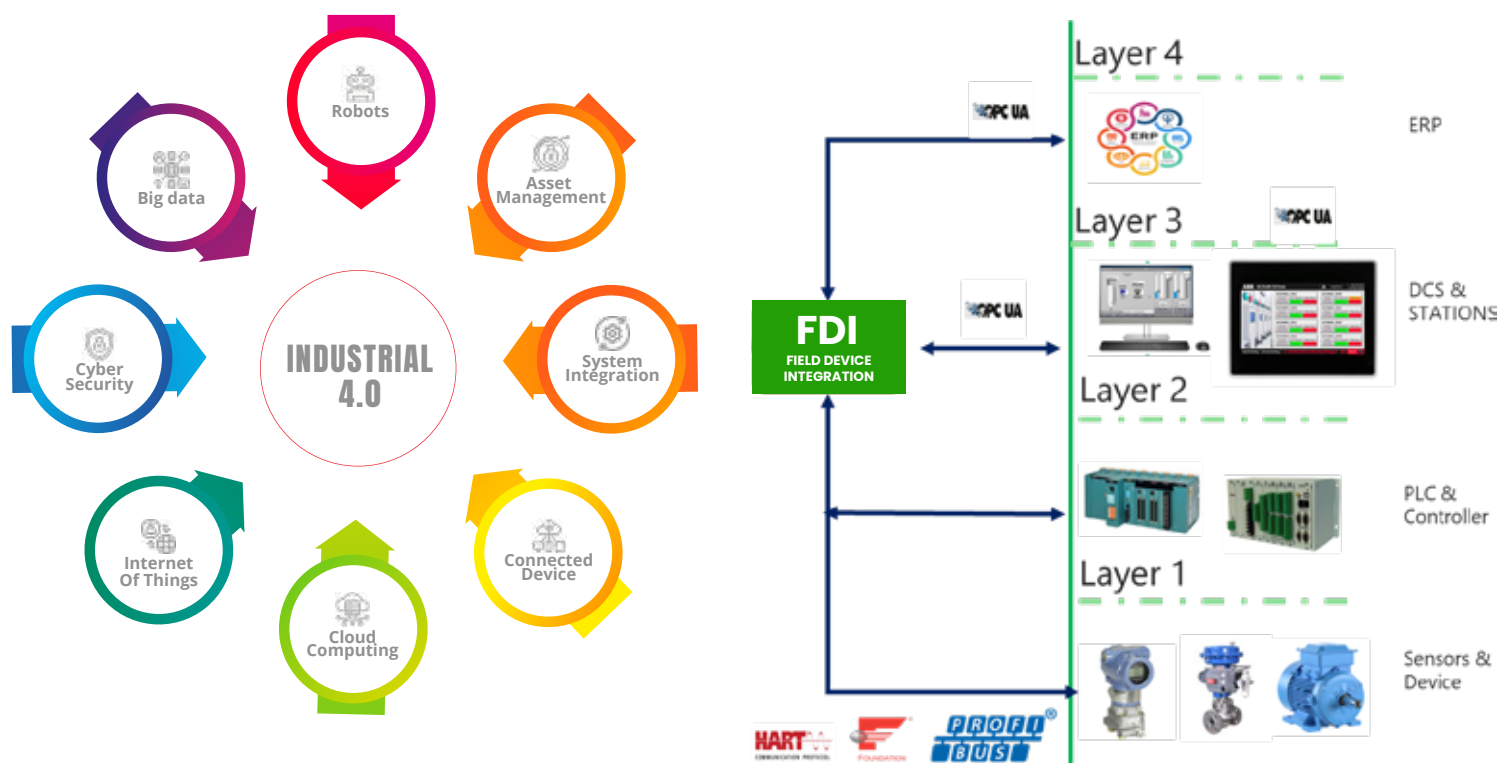# Asset Management
Software in
Industry 4.0

INTRODUCTION

In the age of digitization, asset management plays a crucial role. The concept of using software for asset management has been around for more than two decades, particularly in the industrial automation and process manufacturing industries. With the advent of smart technologies, the management of physical assets has evolved into a dynamic process, incorporating sensors, data analytics, and predictive maintenance. Asset management software helps to improve predictive maintenance, optimize industrial processes, and create a linked ecosystem. It seamlessly integrates wired and wireless sensors with distributed systems used across various industrial platforms, such as machinery health tools, vibration analysis, oil refineries, power plants, among others.

Several technologies help to solve problems, and EDDL and DTM Solutions are among the most widely used in the process manufacturing industry – however, both have their own advantages and disadvantages. The need of the hour was to integrate the best of both and we saw the emergence of Field Device Integration (FDI), which offers a standardized interface for field device communication and enables smooth interoperability between various industrial assets. Additionally, FDI provides a centralized setting for the integration of devices, guaranteeing effective setup and upkeep.

Field Device Integration (FDI) and Device Test Manager (DTM) Technology are utilized by Industry 4.0 frameworks to address some of the most critical challenges faced by the industry, such as asset management, system integration, and connected device problems.

DTM software and FDI's standardized device integration strategy make it easier to manage and communicate with field devices. This integration ensures interoperability and improves diagnostic capabilities, making it easier to configure and maintain various industrial assets. FDI Device Test Manager software drives Industry 4.0, which is a revolutionary force that enhances industrial processes, boosts dependability, and puts companies at the forefront of technological innovation. With the FDI/FDT toolchain available in a single application, it is now simpler and more effective to write, run, and test FDI Device Packages for FOUNDATION Fieldbus, HART, PROFIBUS and PROFINET, Ethernet IP, OPC UA, and Modbus devices.

Field Device Technology & Filed Device Package

FDI focuses on device integration for process automation, using technologies like EDDL (Electronic Device Description Language) and DTM (Device Type Manager) to provide a unified solution.

The FDT group has been promoting the IEC 62453 standard, or Field Device Technology, for over a decade. It offers a framework for intelligent device integration across all industrial communication networks, including those for discrete and process automation. Transparent information flow from devices to host systems across various industrial communication networks is made possible by FDT's nested communication. The FDT standard completely supports and integrates sixteen distinct wireless and tethered industrial communication networks.

FDI Device Package contains device drivers like EDDL, UPI, and attachment. There are different types of DTM such as –

- **Communication DTM**
- **Device DTM**
- **Protocol Specific DTM**
  - (HART, Foundation Fieldbus,
  - PROFIBUS, OPC UA)
- **Gateway DTM**

The FDT/FDI host contains FDI DTM UI Engine and DTM Business Logic. Both standalone and integrated FDI hosts are available, with the latter working with distributed control systems.

Key Features of
FDI & FDT

The asset management software using Device Type Manager (DTM) offers a standardized method for managing field devices and is an essential part of industrial automation. Among DTM's features are:

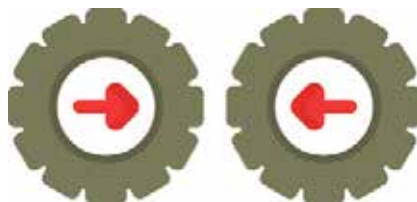**Networking & Device Configuration**

Monitoring

User Management

Diagnosis

Reporting

Backwards Compatibility

Interoperability & Conformance Testing

Approach for Test Validation of
FDI/FDT

To ensure unbiased assessment of quality, it is important to perform test validation on both software and hardware functional and non-functional testing needs. A comprehensive prioritized report on all quality aspects can be generated using the FDI 2.0 Standard defined in IEC 62453. A hybrid approach can be employed to achieve good test coverage using s imulators, real devices, and calibrators. Predefined and customized strategies can be used to test different aspects of quality.

Functional Testing

Non-Functional Testing
- Protocol Specific (HART, PROFIBUS, FF)

Integration Testing
- Protocol Specific (HART, PROFIBUS, FF)

User Acceptance Testing

System Testing
- HOST Specific Standalone vs Integrated host
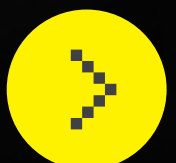
Test Automation
- IO Simulator (HIL)

Test Automation
# Solutions & Workflows

Test automation solutions and workflows play a crucial role in software development and quality assurance. They help expedite the testing process and boost productivity. A standardized test automation solution employs an organized workflow that ensures thorough testing. By following this workflow, a well-planned test automation system not just speeds up the testing process but also enhances overall development efficiency, reduces time-to-market, and elevates software quality.

The approach below explains the best practices for test automation solutions and workflows of FDI/DTM package for devices using open-source tools and software –

- Test Automation jobs are triggered from the Jenkins CI/CD Pipeline.

- Test Station & Test Software start the test case needed to execute with the necessary prerequisites for the test case.

- Test Station triggers the input command to the IO Simulator to generate the necessary sensor value mimicked like actual sensors.

- The device reads and converts the physical signals to digital signals and sends the information back to PLC based on the protocol which the device supports.

- PLC reads the data and serves the FDT host request.

- Test Station reads the data from the FDT host using the Control ID of that application.

- Test Automation Scripts validate the input and output of the device, decide the PASS/FAIL criteria, and update the test report.

TEST AUTOMATION SOLUTION& WORKFLOW
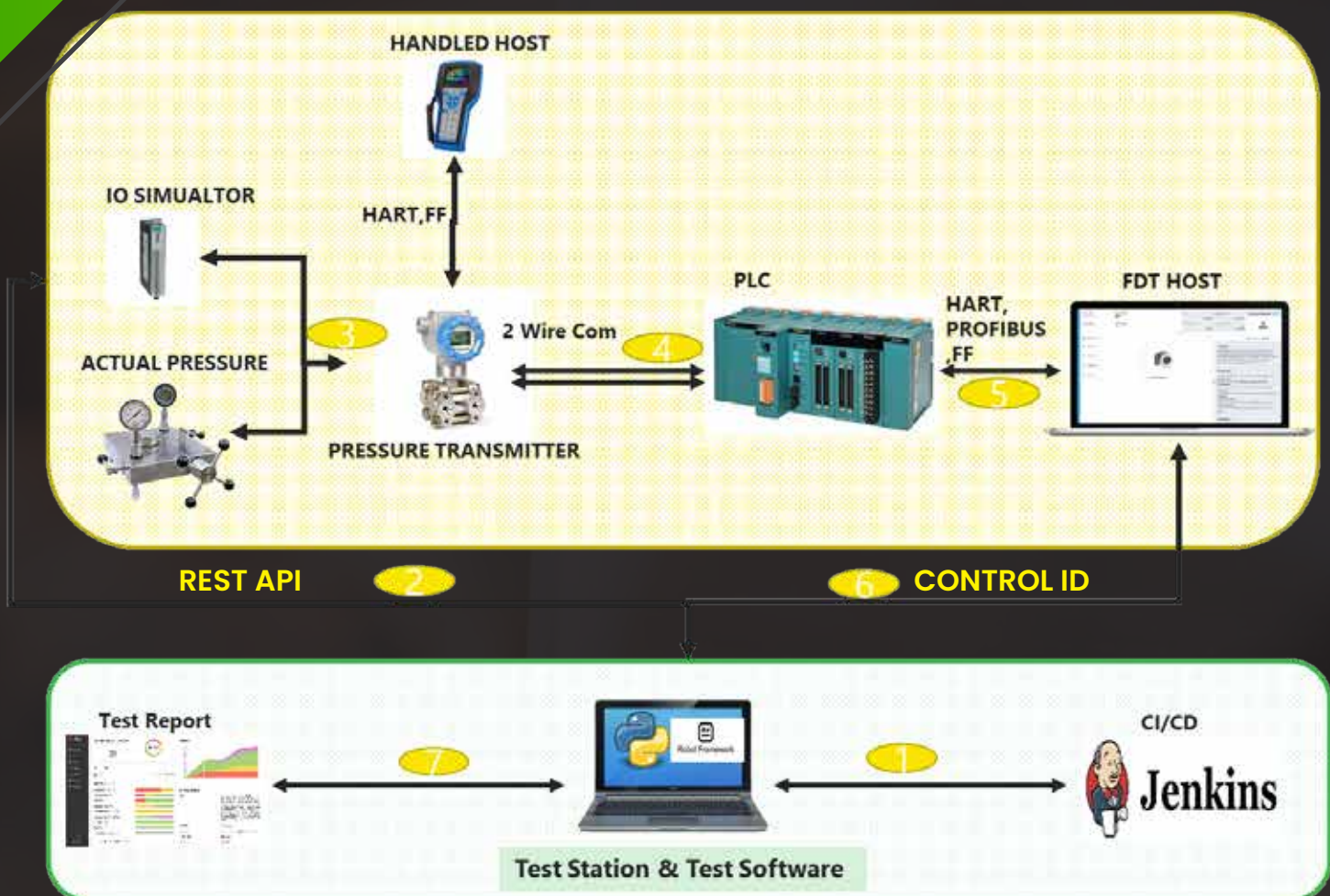
TEST FOCUS AREA

- Assure appropriate device configuration and communication we can carry out from the DTM.
- Comm DTM & Protocol Specific.

- Features are operating as intended by testing the monitoring capabilities.
- Live Data Streaming, Graph Plotting.

- Make sure role-based permissions and safe user access are in place.
- Calibration Access, Device Units Conversion.

- Make sure the configuration parameters are accurate and functional.
- Device Address, Brust Mode, Units, etc.

- Verify compatibility with earlier DTM versions and devices through backwards compatibility testing.
- Testing for interoperability: Make sure that gadgets made by various manufacturers integrate seamlessly.

- Assess the DTM's performance under high loads.
- By connecting multiple same type of device.

- Ensure the DTM's interface is user-friendly and intuitive.
- Verify the accuracy and completeness of user documentation.

- Verify response times for different operations under normal and peak loads.

- Verify smooth installation and setup procedures.
- Upgrade Testing: Ensure seamless upgrades from previous versions without data loss.

- Use backwards compatibility testing to confirm compatibility with previous DTM versions and devices.]
- Interoperability testing: Ensure that devices from different manufacturers work together harmoniously.

HYBRID TEST VALIDATION ENHANCES THE UPSIDE OF FDI & FDT

Field Device Integration (FDI), a component of Industry 4.0, improves productivity, connectivity, and adaptability in manufacturing. Through smooth communication and interoperability between various field equipment, FDI promotes an intelligent and more integrated industrial ecosystem. This leads to enhanced diagnostics, streamlined maintenance procedures, and real-time data access. Industry 4.0 using FDI not only streamlines operational processes but also makes predictive maintenance easier, which lowers downtime and boosts overall productivity. This is made possible by increased automation and data-driven decision-making. The FDI-driven convergence of smart technologies in Industry 4.0 creates the framework for an industry that is more responsive, flexible, and networked.

To ensure FDT and FDI's quality and interoperability across multiple host systems, a proven HYBRID Robust Test Validation approach is essential. This Hybrid Test Automation approach entails requirement analysis, data preparation, methodical test execution, extensive test environment setup, careful test planning, precise test design, and test automation.
The asset management software now follows a Hybrid Test Validation Approach, which enables the speedy execution of test cases across various platforms, configurations, and scenarios. This velocity improves the development lifecycle, making faster releases and feedback loops possible. Furthermore, automated tests guarantee repeatability and consistency, which facilitates cycle time reduction. The continuous testing feature helps identify any problems before they arise in production and aids in the early discovery of bugs.
In the end, a more robust, flexible, and dependable solution is produced by the dedication to a rigorous validation approach, which promotes long-term success and innovation.

ABOUT THE AUTHOR

Vishnu Prasath Krishnan has 16+ years of experience in Industrial and Manufacturing Product Validation. He has an expertise in testing multiple products used across Level 0 to Level 4 in the Industrial 4.0/5.0 Space. Designed and Implemented Multiple Test Strategy & Test Framework like Data-Driven Development (DDD), Test-Driven Development (TDD), Keyword Test-Driven Development (KTDD). Subject Matter Expert in the areas of IOT, IIOT, Gateway, DCS, PLC, RTU, Asset Management Software (EDDL, DTM), SCADA, Mobile APP, Server, and ERP. Protocol: – OPC UA, Modbus, HART, FF, Profibus, MQTT, REST API.

He is currently leading Industrial Automation and Manufacturing Programs for customers at Happiest Minds.

Vishnu Prasath Krishnan
Senior Test Architect
Product Engineering Service