Autonomous Material Transport & Robot Collaboration with Arendai Harmony and FANUC FIELD system Basic Package

Introduction

In modern factories and warehouses, autonomous material handling and seamless robot collaboration are key to efficiency and agility. **Arendai's Harmony Digital Twin** platform and **FANUC's FIELD system Basic Package (FsBP)** together provide a cutting-edge solution to these challenges. By integrating Harmony's AI-powered digital twin and fleet orchestration with the FsBP industrial IoT platform, businesses can enable **autonomous material transport** and advanced multi-robot coordination on the shop floor. This whitepaper outlines how the Harmony–FsBP integration works, the benefits demonstrated in a live showroom demo, and the value it offers to decision-makers seeking to optimize intralogistics and robotics operations.

Harmony Integration for Autonomous Intralogistics

Arendai Harmony is an AI-driven digital twin and robotics orchestration platform designed for Industry 4.0 operations. It connects with diverse automation systems to provide a unified, real-time view of operations. **FANUC FIELD system Basic Package (FsBP)** is an open industrial IoT platform that links machines, robots, and sensors at the edge. Through a straightforward API integration, Harmony can interface with the FsBP to exchange data and commands. This integration enables Harmony to manage autonomous mobile robots (AMRs) in concert with FANUC robotic cells and production lines, effectively creating one harmonized system. Key features and benefits of this integration include:

- **Vendor-Agnostic Fleet Management:** Harmony supports the VDA5050 standard for vendor-neutral robot control[1]. This means multiple brands of AMRs can be managed through one interface, alongside FANUC equipment, without custom interfaces for each vendor. Harmony provides *unified control* of the robot fleet, simplifying operations across different robot types[2].

- **Digital Twin Simulation:** At the core is a live digital twin that mirrors the facility's operations in 3D. The Harmony platform simulates robot movements, transport tasks, and process workflows virtually before and during deployment. This allows for **what-if scenario testing** and optimization of routes and schedules in a risk-free environment. The digital twin can model intralogistics flows and even FANUC robot cell interactions, ensuring that AMRs and fixed robots work in unison without conflict.

- **Intelligent Orchestration:** Harmony's AI engine continuously optimizes task allocation, traffic management, and robot collaboration. For example, if a FANUC

robotic arm signals via **FIELD system Basic Package (FsBP)** that a part is needed at a workstation, Harmony can dispatch an AMR to deliver it promptly. It uses intelligent path planning to avoid congestion and minimize travel time[2]. By analyzing real-time data from FsBP (robots' status, sensor inputs) and the AMRs, the system orchestrates **advanced robot collaboration**, such as coordinating an AMR's arrival with a robot arm's cycle to eliminate wait times.

- **Seamless Integration & Quick Deployment:** The Harmony–FIELD integration is designed for fast implementation. In a recent deployment at a FANUC site, Harmony was installed and connected to the **FIELD system Basic Package (FsBP)** platform in **under 14 days**. This rapid timeline—from initial setup to a functioning autonomous transport system—is possible thanks to standard interfaces and pre-built connectors. It highlights that even complex, multi-vendor automation solutions can be up and running in a matter of weeks, minimizing disruption.

From Digital Twin Simulation to On-Premise Deployment

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FANUC

Solution Selection and Requirements
- API Integration with FIELD system Basic Package
- Selection of AMR and Robotics
- Management of Transport Orders by external system
- Communication and monitoring of robot operations

Testing and Implementation in 10-Days
- On-Premise Deployment
- End-to-End Testing
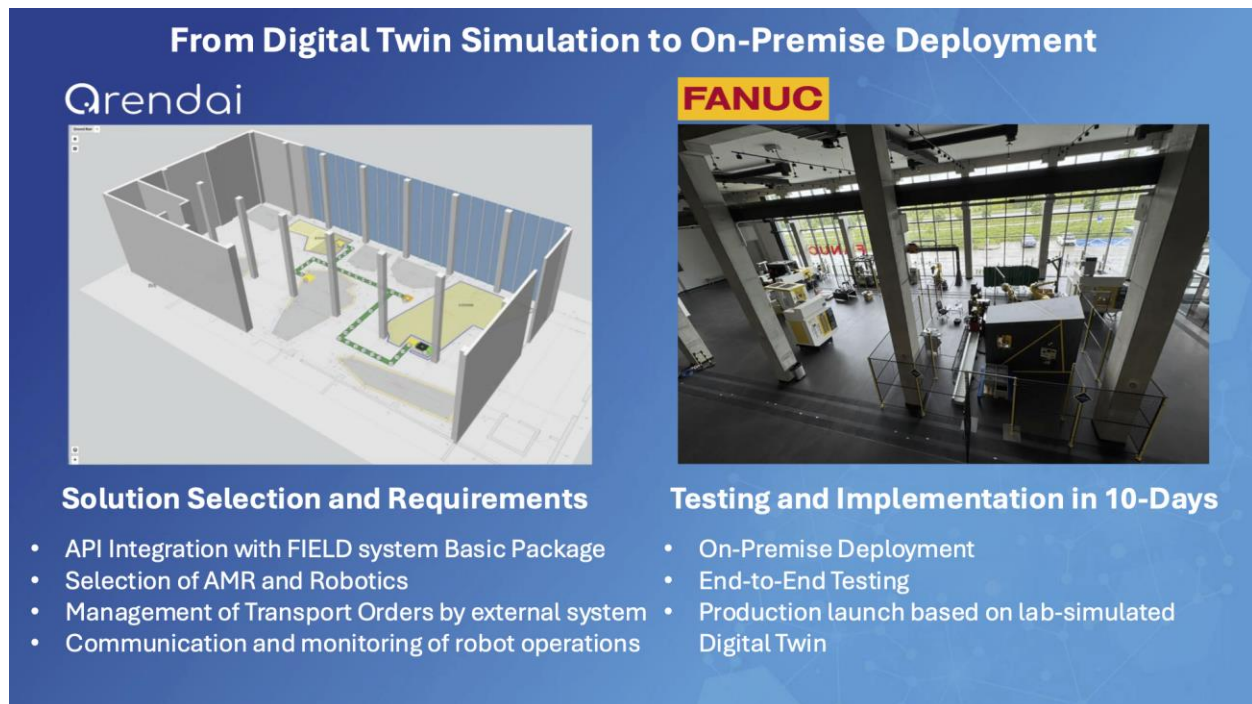- Production launch based on lab-simulated Digital Twin

Figure 1: Side-by-side photograph of FANUC Showroom and the corresponding Arendai Harmony 3D Digital Twin Layout that includes robot navigation path.

Orchestrating AMRs and Robots with Digital Twin Intelligence

Harmony's digital twin and AI capabilities turn autonomous intralogistics into a continuously optimizing loop. **Autonomous Mobile Robots (AMRs)** are directed by Harmony's central "brain." The system receives transport orders (e.g. move raw materials to a machine, or deliver finished goods to storage) from higher-level systems (MES/WMS or operators), and then:

1. **Plans Optimal Routes:** The digital twin simulation evaluates possible routes for each AMR, avoiding congestion and accounting for floor layout and human safety zones. Harmony's path planning optimizes travel paths and schedules to ensure timely deliveries and maximum fleet efficiency[4].

2. **Dispatches and Coordinates Tasks:** Using the unified fleet interface, Harmony dispatches tasks to AMRs in real time. It can coordinate multiple robots, preventing traffic jams and collisions through intelligent fleet management. For example, if two robots would cross paths, Harmony might adjust their routes or timings. All robots and FANUC machines operate under one orchestrated timeline.

3. **Synchronizes with Fixed Robots:** The integration with FANUC FsBP means Harmony is aware of the state of robotic arms, CNC machines, and other equipment. The system can synchronize mobile deliveries with production cycles. For instance, an AMR carrying parts can be scheduled to arrive exactly when a FANUC robot is ready for the next part, creating a smooth handoff. This **human-less handover** improves overall cycle time and keeps both mobile and stationary robots working at peak efficiency.

4. **Real-Time Monitoring & Simulation:** As robots work, the Harmony platform continuously mirrors the operations in the live digital twin. Decision-makers can visualize a real-time 3D model of their warehouse or factory floor, seeing the AMRs moving and interacting with workstations. This provides 100% visibility into operations and helps identify bottlenecks or idle times. Harmony's AI algorithms analyze the data streaming in to suggest improvements – for example, reallocating robots to busier areas during peak hours, or re-sequencing tasks to balance the load.
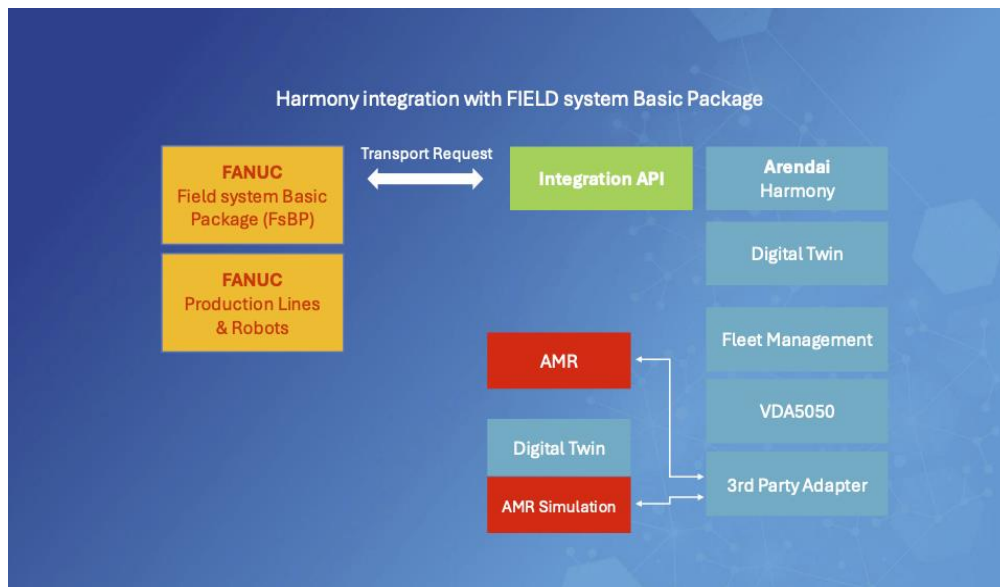

Figure 2: Integrated system architecture – Harmony Digital Twin orchestrates AMRs and FANUC robots via the FIELD system Basic Package (FsBP).

Behind the scenes, **AI-powered analytics** in Harmony look for patterns to improve throughput and reduce waste. The result is an intralogistics system that not only runs autonomously but also *learns* and adapts. According to Arendai, digital twin driven optimizations have been shown to significantly increase transport efficiency and warehouse throughput while cutting wasted travel and energy costs. In short, the Harmony–FsBP solution acts as the conductor ensuring every robot and resource is in the right place at the right time, all coordinated through a virtual model of the operation.

Live Demo: Rapid Deployment and Real-Time Insights

A highlight of this integration is the live demo available in the new FANUC showroom, which vividly demonstrates the system's capabilities to visitors. In this demo setup, an AMR and FANUC robot work together under Harmony's direction, giving a tangible example of "smart" intralogistics in action. Key takeaways from the live demonstration include:

- **Seamless Multi-System Operation:** Visitors witness a FANUC robotics cell and an AMR moving in sync. For instance, the AMR may autonomously pick up a materials bin and navigate to a robot station, where a FANUC robot arm unloads or processes the contents. All of this is managed by Harmony behind the scenes, showing how disparate systems can act as one. The **FIELD system Basic Package (FsBP)** serves as the bridge, conveying robot status and job requests to Harmony, which in turn commands the AMR – all happening instantaneously and reliably.

- **Deployment in Under 2 Weeks:** The demo underscores the **speed of deployment**. From scratch to a functioning integrated system took less than 14 days. This includes setting up the digital twin model of the demo area, connecting Harmony to the **FIELD system Basic Package (FsBP)** edge device, and configuring the AMR in the fleet. Such quick implementation means that even complex automation projects can deliver value fast – an important consideration for decision-makers calculating ROI.

- **Real-Time Anomaly Detection:** Enabled with on-site **Real-Time Location System (RTLS)**, every movement of the AMR (and even people or pallets, if tagged) is tracked with high precision. Harmony's platform uses this live location data combined with AI to detect anomalies or inefficiencies on the fly. In the demo, visitors can see the system automatically flag situations like an unexpected obstacle or an idle period. The digital twin dashboard might highlight, for example, if an AMR is delayed or if a handoff took longer than expected, immediately alerting operators. This **AI-powered live anomaly detection** capability helps identify and eliminate bottlenecks in real operations.

- **Dashboard & Simulation View:** The showroom features a visual dashboard where the live digital twin is displayed. Visitors see a 3D visualization of the AMR moving through a virtual map of the floor, the FANUC robot's status, and telemetry data (speeds, battery, etc.). They also see performance metrics and any alerts in real time. This transparent view builds confidence in how the system makes decisions and reacts. It demonstrates the value of having a "virtual mirror" of operations – one

can test optimizations in the simulation and immediately see the projected impact on throughput or resource utilization.

Figure 3: Demo at FANUC's Hidden Factory event on September 23, 2025

Overall, the live demo brings to life the concept of a smart factory logistics loop. It proves that with the Harmony and FsBP integration, autonomous robots can be integrated into existing workflows with minimal disruption and maximum synergy. The ability to deploy rapidly and get real-time insights into operations and anomalies is a game-changer for factories aiming to improve continuously.

Explore a Pilot Project or Integration Opportunity

The integration of Arendai's Harmony Digital Twin system with FANUC's **FIELD system Basic Package (FsBP)** showcases a powerful vision for smart intralogistics – one where **autonomous mobile robots, intelligent simulations, and industrial robots work in concert** to drive efficiency. The live showroom demonstration has proven that such a system can be deployed quickly and deliver immediate, visible benefits: streamlined material transport, real-time problem detection, and data-driven optimization of both operations and energy.

For decision-makers in FANUC's network of customers and partners, the message is clear: this technology is **ready to transform your operations**. By leveraging Arendai's digital twin orchestration on top of your existing FANUC infrastructure, you can achieve faster workflows, safer and more predictable processes, and significant cost savings in labor and energy. We invite you to take the next step – **explore a pilot project or integration**

opportunity with us. See first-hand how a unified digital twin and robotics platform can modernize your facilities in a matter of weeks, not months. Whether you run a manufacturing plant or a distribution center, if improving intralogistics and operational resilience is a priority, now is the time to harness Harmony and **FIELD system Basic Package (FsBP)**.

Contact us to schedule a live demo tour or to discuss how we can tailor this integrated solution to your specific needs. Together, FANUC and Arendai are committed to helping you orchestrate the factory or warehouse of the future – one where every robot and process works together seamlessly, guided by the intelligent insight of a digital twin. Let's turn this innovation into your competitive advantage.

About FANUC:
FANUC Europe Corporation, headquartered in Echternach, Luxembourg, is the European branch of FANUC Corporation, a global leader in industrial automation. With over 1,500 employees across more than 25 countries, FANUC Europe offers CNC systems, industrial robots, and factory automation solutions tailored to industries such as automotive, aerospace, electronics, and healthcare. Globally, FANUC is headquartered in Oshino, Japan, operates in over 100 countries, employs 8,000+ people, and has installed more than 9 million CNCs and 1 million robots. Known for reliability, innovation, and precision, FANUC supports digital transformation and Industry 4.0 across manufacturing worldwide.

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About Arendai:
Headquartered in San Diego, California, with engineering offices in Poland. Their flagship product, Harmony, optimizes intralogistics operations with AI Agents driven efficiency enabled by Digital Twin, 3D Simulation, Automation & Edge Computing across various industries.

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