FIJISHI

# Dynamic Network Slicing for Industry 4.0 Smart Factories.

*India, 04 June 2025/ 11:22 PM IST*

**Use Case: Dynamic Network Slicing for Industry 4.0 Smart Factories**

**Industry:** Manufacturing & Industrial IoT

**The Challenge:** A large automotive manufacturer was building a new "smart factory" heavily reliant on a dense array of interconnected robots, AGVs, real-time quality control cameras, and IoT sensors. Each application had vastly different connectivity requirements: robots needed ultra-low latency and high reliability, cameras demanded high bandwidth, and sensors required consistent, low-power connectivity. Managing these diverse Quality of Service (QoS) demands on a single, dynamic network was a significant challenge, leading to potential bottlenecks and operational inefficiencies.

**The FiRIS Solution:** FiRIS was implemented as the intelligent orchestration platform for the factory's private 5G/6G network, integrating with a network of strategically placed Reconfigurable Intelligent Surfaces (RIS) and edge compute nodes.

- **Self-architecting & Intent-driven "Omni-Symphony":**
    - **Service-Centric Intent-Based Control:** Factory operators defined high-level business intents: "Robot control: sub-5ms latency, 99.999% reliability," "Quality control video stream: 1Gbps throughput," "Sensor data: always-on, low power." FiRIS autonomously translated these intents into network configurations.
    - **Decentralized Autonomous Agents:** AI agents distributed across the network and RIS panels made real-time, local decisions to optimize signal paths and resource allocation based on the defined intents.
    - **Federated Multi-Objective Reinforcement Learning:** FiRIS continuously learned from network conditions and application performance, autonomously optimizing resource allocation across different "network slices" to meet all defined QoS objectives simultaneously, even in highly dynamic factory environments.
- **Quantum-cognitive "Synapse":**
    - **Multi-Modal Data Fusion:** Combined data from network performance, robot telemetry, and environmental sensors to gain a holistic view of the factory floor, allowing for highly adaptive network adjustments.

**Impact and Benefits:**

- **Guaranteed QoS for Critical Applications:** Ensured robots operated with required precision and reliability, preventing production line stoppages.
- **Maximized Network Efficiency:** Optimal resource allocation meant no over-provisioning, reducing infrastructure costs and energy consumption.
- **Rapid Production Line Reconfiguration:** The network could dynamically adapt to changes in factory layout or production demands, significantly reducing downtime for retooling.
- **Enabling True Industry 4.0:** Provided the foundational, intelligent connectivity necessary for advanced automation, real-time analytics, and predictive manufacturing.

- **New Revenue Opportunities for Operators:** Telecom providers can offer "Network-as-a-Service" for private industrial networks, customized to specific manufacturing needs.

**Key FiRIS Features Highlighted:**

- Self-architecting & Intent-driven "Omni-Symphony" (Service-Centric Intent-Based Control, Decentralized Autonomous Agents, Federated Multi-Objective Reinforcement Learning)
- Quantum-cognitive "Synapse" (Multi-Modal Data Fusion)
- Self-Healing & Elasticity.