

Smart Factory, Intelligent Manufacturing

Building smart factories based on Industry 4.0 principles requires intelligent sensors, robust data storage with rapid search and retrieval, refined Big Data analytics, secure communication networks, and robots that perform operations with the dexterity of human workers.

| By Chen Youjun, General Manager, Huawei Manufacturing IoT Domain

As a core component of Industry 4.0, a smart factory incorporates intelligence in design, manufacturing, equipment, business, and operations. This article looks at a few of the technologies and components required to implement this intelligence and describes Huawei's Smart Factory Solution, which brings together many of the necessary systems.

At the lowest level of the smart factory, intelligent sensors provide digital information along with anti-interference capacity and bi-directional communication that enables remote calibration between sensor units. These sensors enhance flexibility in production by enabling remote, dynamic adjustments at threshold values, which frees personnel from making the adjustments at each manufacturing work station. Intelligent sensors must function reliably in adverse production environments, which impose stringent requirements on their packaging materials and environmental isolation.

Interconnecting these devices reliably with higher-level control systems is crucial to achieving smart factory success. Machine-to-Machine (M2M) data communication improves equipment utilization, and industrial Ethernet and radio interfaces are gradually being adopted as a supplementary communication method to wired networks. This trend has tested the technical strengths of enterprises in a variety of fields, including network infrastructure, system data, and communication security.

The juxtaposition of production data with data on consumer behavior (purchasing and venue choices, for example) leads to a need for Big Data analytics to deal with constantly changing demands. Intelligent systems support decision-making, production adjustments, and manipulation of the information flows to efficiently produce high-quality, personalized products. The massive amounts of data generated during this hyper-connected production process give rise to "production data clouds" for use to continuously report upon status and accept policy revisions. Manufacturing solutions are devised to harness the power of these data clouds to further improve R&D, production, operation, marketing, and management.

Huawei's Smart Factory Solution

- **LiteOS and LTE-M for Building IP-enabled Smart Manufacturing Devices**

Because thousands of process controllers and production tools can be involved in making a smart factory, it is expected that huge amounts of monitoring data and control parameters need to be collected and transmitted in real time without interruption. The networked system must analyze production data, identify patterns, tabulate factory-wide schedule adjustments, and control each link in the production line. Updating existing manufacturing devices with IP capabilities and smart attributes is the key to building a smart factory.

Huawei provides two essential types of components for building IP-enabled smart manufacturing devices. The hardware component is a low-cost, low-power consumption eLTE chip designed to suit Internet of Things (IoT) requirements, and the software component is LiteOS, a lightweight open-source operating system that supports terminals running on the IoT.

LiteOS offers the following advantages for users to build an open-source IoT ecosystem:

- Effectively addresses common issues faced by manufacturers in interconnection and security. Provides multiple types of easy-to-use service profiles.
- Low-profile system capable of precise, real-time processing and minimal power consumption.
- Provides a comprehensive application development tool that incorporates Integrated Development Environment (IDE) functions for development, debugging, and release.
- Provides air interfaces – consuming little power and requiring minimal bandwidth for M2M communication – over LTE-M narrowband cells. The interfaces provide secure, reliable, and extensive coverage and can be flexibly deployed.

- **LTE-based Network for Wired and Wireless Convergence**

The Huawei Smart Factory solution fully supports the characteristics of existing networks in factories. Utilizing the company's strengths in LTE technologies, Huawei is helping customers build ubiquitous networks that provide converged wired and wireless connectivity.

The LTE system provided by the Smart Factory solution uniformly carries a variety of services that help manufacturers maximize their investment in network infrastructure utilization.

By providing factory-wide coverage, LTE helps reduce upfront capital costs in the move to Industry 4.0 while also minimizing ongoing maintenance costs. The high bandwidth and multi-service support delivered by LTE allow manufacturers to innovate new services such as wireless meter reading and

mobile inspection that affect the overhead necessary to support the in-house preventive maintenance program.

The Huawei Smart Factory Solution uses integrated switches and control platforms with both wired and wireless capabilities. Both network types share security management policies that allow the converged LTE network to seamlessly integrate with any existing network. A unified Network Management System (NMS) is used to simplify network deployment.

- **Dealing with Big Data for the Smart Factory**

After the data payload in a smart factory has reached a certain order of magnitude, a variety of Big Data services and applications can be launched to mine the data. Typical examples include procurement order management, operational forecasting, and marketing campaigns.

“Big” factory data, effectively utilized, is able to significantly improve the efficiencies throughout the facility: engineering, production, warehousing, distribution, and sales, at a significant reduction relative to today’s costs. For one example, just-in-time inventories have a direct, positive impact on supply chain optimization by interconnecting of sales-, sensor-, and supplier-databases to track inventories and pricing. The result is that manufacturers save money by improving the accuracy of predicted demand across their global markets.

Huawei’s Service-Driven Distributed Cloud Data Center (SD-DC²) architecture provides the capabilities needed to manage and utilize the Big Data associated with Industry 4.0. The major components of the architecture include:

- **FusionServer:** High-performance, highly scalable computing resource.
- **OceanStor:** Converged storage for Big Data that makes businesses more agile.
- **FusionSphere:** Unified cloud operating system with horizontal integration of IT operations and management.
- **FusionInsight:** Enterprise-level platform for implementing Big Data analytics.
- **ManangeOne:** Management platform for automated factory management.

Promising Returns for Confident Manufacturers

Industry 4.0 is revolutionizing manufacturing by gradually moving from closed systems to partially-open systems and then, ultimately, to completely open systems. As industry progresses through these phases, observers expect that the manufacturers who invest the time and money into smart factories will reap the higher rewards owing to the advantages of reduced costs for labor, productivity gains, and improved customer experiences.

Huawei is committed to helping manufacturing enterprises achieve their smart factory goals. Major ICT products and solutions provided by Huawei include intelligent terminals, ubiquitous network connectivity, and the SD-DC² architecture. By deepening cooperation with application vendors and major industrial partners, Huawei is able to help enterprises construct networked manufacturing systems that are fast, reliable, and secure.