Closing the Industrial Communications GAP With a Secure, Virtualized Solution

Shanghai Baosight Software Co., Ltd. is one of the largest system integrators serving the industrial automation marketplace in the People's Republic of China. Founded in 2001, Baosight provides software solutions for China's metallurgy, chemical, equipment manufacturing, mining, and energy industries, with an expanding presence in new areas such as the Internet of Things (IoT), smart transportation, railways, and finance.

Baosight delivers a secure, virtualized, consolidated gateway solution using the Intel® Industrial Solutions System Consolidation Series, enabling customers to protect their sensitive internal networks while extracting the data for use across the enterprise.

**Challenge**

Traditional GAP products for industrial communication are typically designed with two sets of hardware systems, each with its own CPU and operating system to execute a single task. One system generally handles data acquisition from an internal industrial network, while the second system handles data transfer to an external network. This model has two drawbacks:

- **Security risk.** Data communication between the systems is via the TCP/IP networking protocol, which has the potential to expose an unguarded network to cyber-attacks that could corrupt the systems.
- **Cost, complexity, and footprint.** System proliferation in an industrial environment imposes a financial burden in terms of hardware purchasing, system support, and maintenance expense, while also introducing layers of complexity in terms of cabling, shielding, and networking.

**Solution**

- **Develop a secure gateway product** that can:
  - Consolidate the workloads of the two tasks into one CPU, and
  - Replace the conventional, less-secure TCP/IP communication between the two systems with secure inter-core communication to eliminate this potential point of risk and help thwart cyber-attacks.

- **Implement the Intel Industrial Solutions System Consolidation Series,** which simplifies the task of using virtualization technology to combine multiple discrete workloads on a single computing device. Intel's solution integrates key software and hardware components to streamline the development of consolidated, virtualized solutions.
An Integrated Device-to-Internet Solution for Securing the IoT

Baosight developed its iCentroGate-GAP* (ICG-GAP) product as one of a series of comprehensive solutions oriented to the Internet of Things (IoT) and the “smart city” concept.

The IoT is erupting as the new reality in the business world, ushering in the potential for hundreds of billions of smart devices ultimately coming to live in an Internet-connected cosmos—from cars to refrigerators and from stoplights to factory robots. As companies imagine and create intelligent devices that revolve and communicate in this cosmos, the need to protect valuable business systems and sensitive data will only grow more pressing.

Baosight’s gateway solution addresses the security problem for the emerging IoT by minimizing vulnerability to sensitive internal networks. By layering its application on top of the integrated Intel Industrial Solutions System Consolidation Series base platform, Baosight is enabling companies to securely draw data out of a manufacturing environment and onto other private and public networks. This level of security is not possible in traditional settings where factory operations have long run in isolation on unprotected networks.

The ability to plug into the Internet securely and extract data, and along with it, the ability to make that data useful and actionable with minimal risk, offers a compelling solution for industrial companies that recognize the transformative business advantages of the IoT.

Introduction

Three trends are converging in the industrial segment, transforming the factory floor from a system of isolated, single-purpose devices into an interconnected network of intelligent, efficient, multi-purpose machines. These trends suggest opportunity for Baosight’s new virtualized, consolidated gateway solution and form the rationale behind Intel’s recent introduction of the Intel® Industrial Solutions System Consolidation Series.

The three trends are as follows:

• Growing pressure for efficiency and productivity requires manufacturers and IT departments to streamline, simplify, and consolidate their complex array of systems to increase output while using fewer resources.

• As factories streamline, traditionally isolated industrial networks and systems are evolving into connected, intelligent, Internet-enabled devices capable of analyzing and harnessing data for business value—the “Internet of Things” (IoT). (See related sidebar.) Management is pushing for greater connectivity as this phenomenon transforms factories and plants worldwide.

• As these sensitive industrial environments become connected to the cloud and the Internet, the threat of cyber-attacks is rising. The discovery of Stuxnet, a computer worm designed specifically to disrupt industrial processes, has raised security concerns and created demand for solutions that can achieve both the connectivity that management requires and the protection needed for these formerly isolated networks.

Baosight Software identified the convergence of these three trends as a business opportunity. Company managers understand that the need to keep industrial infrastructure protected has never been greater, and that the cost and complexity of doing so is escalating. To minimize the risk of cyber-attacks on industrial systems in a cost-effective and simplified way, Baosight harnessed Intel’s new virtualized platform to develop a consolidated industrial network isolation solution with advanced levels of security.

Advancing Secure GAP With Intel Technology

Baosight’s iCentroGate-GAP* (ICG-GAP) product is designed to provide advanced security and a stable, integrated, and simplified system solution for industrial applications in China’s steel, metallurgy, petro-chemical, manufacturing, and transportation industries. This secure gateway solution is ideally suited to industrial scenarios focused on data acquisition, data processing, and intranet-to-Internet data transfer where high security is a crucial requirement.

Baosight implemented the Intel Industrial Solutions System Consolidation Series in its ICG-GAP solution, enabling the task of data acquisition from a company’s internal industrial network and the task of data transfer to an external network to be instrumented in two separate operating systems running on two cores of a single Intel® Core™ i7 processor. The solution relies on secure partitions in the virtualized environment and is supported by the Wind River Hypervisor and Intel® vPro™ technology.
Consolidating two workloads on a single processor differentiates Baosight’s solution from GAP products currently in the marketplace and offers users the benefits of saved hardware resources and their related operating and maintenance costs. Moreover, by providing a one-way data communication path from an internal network to an external network and replacing conventional TCP/IP communication with secure inter-core communication, Baosight’s solution ensures task isolation to help users avoid cyber-attacks and achieve highly secure and accurate data transmission. Replacing TCP/IP inter-system communication with inter-core communication also delivers advantages in terms of system stability and performance by means of strong computing capability and greater communication bandwidth between an intranet and the Internet.

**Workload Consolidation Through Virtualization**

Using virtualization technology to combine previously separate workloads on a single multi-core hardware platform is a growing trend in industrial automation today as an effective way to cut costs and sharpen efficiency. The Intel Industrial Solutions System Consolidation Series, with its proven virtualization technologies, facilitates this effort by pre-integrating, validating, and testing key software and hardware components. For solution developers, this can mean significantly less upfront engineering cost, shorter product development cycles, and faster time to market.

According to Baosight, the savings achieved by starting with Intel’s base solution are significant. Dong Wensheng, general manager of Baosight’s R&D Division, says: “Using the Intel Industrial Solutions System Consolidation Series product saved us an estimated 60 percent of development time and 50 percent of development cost compared to the typical time and cost of developing a two-system GAP solution.” In other words, according to Baosight, a consolidated system that typically costs $1 million USD to develop over a one-year design cycle could be completed within six months for a cost of approximately $500,000 USD, considering all cost savings from development, facilities, software, and engineering resources.

For end customers, systems based on Intel’s integrated solution should translate to less cost and complexity because multiple functions are consolidated, resulting in decreased operating expense, system footprint, energy consumption and integration and support effort.” Baosight notes that by consolidating two tasks on one CPU, total hardware system costs are reduced by as much as half. In addition, a consolidated system helps improve overall solution efficiency because customers need less energy and cooling power to run it. Plus, a consolidated system often has a better mean time between failures (MTBF) than the combination of subsystems it replaces because it has fewer components that could potentially fail.

**Powerful Software Meets Proven Hardware**

The Intel Industrial Solutions System Consolidation Series at the heart of Baosight’s new ICG-GAP product contains an industrial computer with a power-efficient, quad-core Intel Core i7 processor with Intel® Virtualization Technology (Intel® VT®) and supports common I/O interfaces for industrial applications.

It integrates a production-ready virtualization software stack with three preconfigured virtual machines (VMs), or partitions, running a combination of real-time and embedded operating systems on dedicated processor cores. Solution designers can use the two instances of the Wind River VxWorks® RTOS to run discrete applications with real-time performance requirements, while simultaneously running embedded and/or general-purpose applications on Wind River Linux® 5.0. Using a single multi-core platform to run multiple applications results in a compact footprint and decreases hardware size, weight, power, and cost.

Secure partitioning of the system is enabled by the Wind River Hypervisor, an embedded virtual machine manager that controls multiple applications and operating systems on a single multi-core platform to ensure low latency, determinism and real-time performance.

“The virtualization software stack in the Intel Industrial Solutions System Consolidation Series allows users to have multiple tasks implemented in parallel in different operating systems in one CPU,” Wensheng says. “Intel integrated this solution in such a way that those partitions are secure and the workloads can execute in a very stable, protected, virtualized environment. Our ability to deliver uni-directional data communication for sensitive data flows makes Intel’s solution the right choice for our secure GAP product.”

“The Intel Industrial Solutions System Consolidation Series is helping us provide a unique and innovative solution to our mainstream customers, which gives Baosight a huge technology advantage. By starting with the Intel solution, our development cost and time have been reduced significantly, which puts Baosight and our customers in a unique and favorable market and business position.”

Dong Wensheng, General Manager, Baosight Software R&D Division
Collaboration Is Key

Engineers from Intel, Baosight, and a third collaboration partner—Shanghai SymTech IT Co., Ltd., a vendor that contributed various hardware and software components—worked together to define the Baosight iCentroGate-GAP product. Intel also provided technical support across all hardware and software levels to integrate Baosight’s GAP application with the Intel Industrial Solutions System Consolidation Series.

The result, Baosight says, is a hardware device that’s simpler in design, much more integrated, and more compact than existing products, and one that provides the highest possible level of security. These advances empower the company and its products to be more competitive.

“The Intel Industrial Solutions System Consolidation Series is helping us provide a unique and innovative solution to our mainstream customers, which gives Baosight a huge technology advantage," Wensheng says. "We have integrated our applications on top of an Intel-based solution that provides integrated and fully validated hardware and a full stack of software. By starting with the Intel solution, our development cost and time have been reduced significantly, which puts Baosight and our customers in a unique and favorable market and business position.”

Learn more at www.intel.com/industrialconsolidation