



Intel® Industrial Solutions System Consolidation Series

Simplifies development, accelerates time to market, and provides more affordable access to development tools and software

Product Overview

A growing trend in industrial automation is to use virtualization technology to combine what were previously discrete subsystems into a single system. The Intel® Industrial Solutions System Consolidation Series greatly simplifies this effort by pre-integrating key software and hardware components, thus reducing development time for original equipment manufacturers (OEMs). Systems based on this integrated solution should enable product manufacturers to reduce cost and complexity because multiple factory functions are consolidated, resulting in decreased operating expense, factory footprint, energy consumption, and integration and support effort.¹

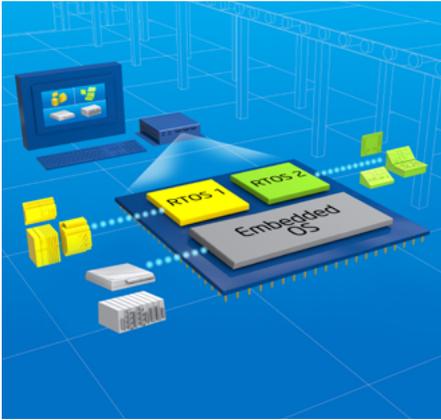
The system consolidation kits contain an industrial computer with a power-efficient, quad-core Intel® Core™ i7 processor with Intel® Virtualization Technology (Intel® VT)² and supports common I/O for industrial

applications such as RS-232/422/485, USB 2.0 and 3.0, Ethernet, VGA+DVI dual-display output by DVI-I connector, and mini-PCI Express* sockets. The platform is fanless and ruggedized for use in industrial environments and includes a minimum 120 GB solid-state drive and 16 GB DDR3 memory. The solution integrates a production-ready virtualization software stack with three preconfigured virtual machines (VMs) running a combination of real-time and embedded operating systems. Developers can utilize the two instances of Wind River VxWorks* RTOS to run applications with real-time performance requirements while simultaneously running embedded and/or general-purpose applications on Wind River Linux* 5.0. To help developers port their applications to the multi-OS environment, the development kit provides the Wind River Workbench* development environment.

The system consolidation series includes two kits:

- **Development kit:** provides hardware, software, documentation, and a Wind River Workbench development environment for engineers looking to accelerate and simplify their system development.
- **Production kit:** contains pre-validated hardware and key software ingredients essential for OEMs to manufacture their consolidated industrial computing devices.





Using a quad-core platform, the Intel® Industrial Solutions System Consolidation Series hosts two virtualized RTOSs and one embedded operating system, supporting multiple unique workloads on a single computing system.

Consolidating Industrial Systems through Virtualization

Some industrial control systems are designed with multiple boards because they support varying applications like a control console, data acquisition, programmable logic controller (PLC), motion control, and machine vision—each with different sets of requirements. PLC and motion control are time-critical applications best served by a real-time operating system (RTOS) that delivers deterministic performance. In contrast, developers of control console and data acquisition applications may prefer an embedded operating system for general ease of use.

Figure 1 shows how the Intel Industrial Solutions System Consolidation Series with virtualization technology can address all these requirements. Multicore Intel® Core™ processors with virtualization technology allow systems to simultaneously run multiple RTOSs and embedded OSs, each on dedicated processor cores. This configuration enables the deterministic behavior of time-critical applications, allowing them to run unencumbered by non-real-time tasks that would otherwise compete for CPU resources on a non-

virtualized system. Developers can build systems with applications running on all the OSs simultaneously or choose to port applications to only a subset of the OSs depending on their needs.

Simplifying Virtualization Technology Adoption

The system consolidation series enables OEMs to unlock new multicore opportunities and deliver virtualized, real-time systems. Since the virtualization software components ship with the kits, developers do not have to spend time finding the appropriate software components and negotiating licensing terms with all the various software providers. Pre-integrated, validated, and tested, the development kit works right out of the box and eliminates typical high upfront engineering costs by including development tools, hypervisor, and operating systems.¹

By providing a significant amount of pre-integration and validation, the system consolidation kits may significantly reduce the upfront cost and complexity of bringing consolidated industrial solutions to market, enabling OEMs to focus on offering differentiated value right away.¹

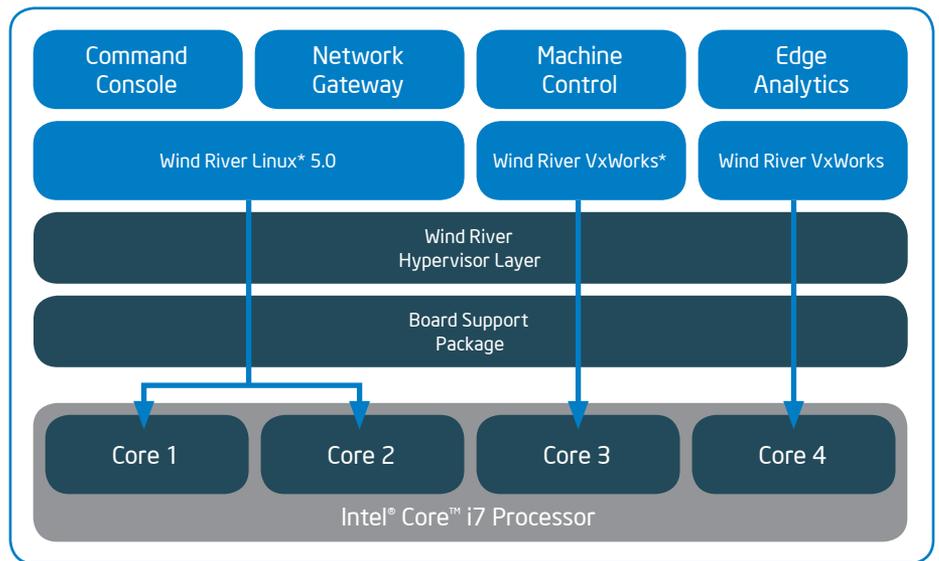


Figure 1. Sample Solution Using the Intel® Industrial Solutions System Consolidation Series

TABLE 1. INTEL® INDUSTRIAL SOLUTIONS SYSTEM CONSOLIDATION SERIES

COMPONENTS	DEVELOPMENT KIT	PRODUCTION KIT
Hardware Components		
Intel® Core™ i7 processor	✓	✓
I/O Interfaces: GbE, PCI Express* mini card sockets, USB 2.0 & 3.0 ports, RS-232/422/485	✓	✓
Support for up to two independent displays	✓	✓
Up to 16 GB system memory (RAM)	✓	✓
Chassis	✓	✓
Software		
Wind River Hypervisor* 2.0	Preloaded	Per unit runtime licenses
Wind River Linux* (32-bit) 5.0	Preloaded	Per unit runtime licenses
Wind River VxWorks* (32-bit) 6.9.3	Preloaded	Per unit runtime licenses
Wind River Workbench* Development Environment (on flash drive)	✓	
Documentation and tutorials (on flash drive)	✓	

Hardware-Assisted Virtualization Technology

Intel has added hardware features to its processors to improve the performance and security of virtualization. This hardware-assisted technology, called Intel VT, enhances the capabilities of software-based virtualization technology. It performs various virtualization tasks in hardware, like memory address translation, which reduces the overhead and footprint of virtualization software and improves its performance, security, and reliability. For instance, memory access time is significantly faster when virtual-to-physical memory address translation is performed in hardware, rather than software.

In addition, Intel VT increases the robustness of virtualized environments by using hardware to prevent the software running in one VM from interfering with the software running in another VM. Along these lines, virtualization helps avoid unintended interactions between applications by preventing one from accessing another's memory space.

Software Elements Included

Wind River Hypervisor*—Embedded Virtualization

Wind River Hypervisor is an embedded hypervisor that consolidates multiple applications and operating systems onto a single multicore platform to decrease hardware size, weight, power, and cost. It provides low latency, determinism, and real-time performance—all in a small footprint. Wind River Hypervisor enables the consolidation of legacy applications, with added new capability, and mixed safety and security levels.

Wind River VxWorks RTOS—Real-Time Performance

Wind River VxWorks* RTOS provides scalability, reliability, and real-time performance, with comprehensive multicore processor support, including asymmetric multiprocessing (AMP) and symmetric multiprocessing (SMP) OS configurations and hardware-optimized multicore acceleration capabilities. VxWorks ensures high performance along with deterministic behavior. Key features

include a tunable memory footprint, hard real-time performance, state-of-the-art memory protection, advanced multicore processor support, and extensive connectivity options. Together, these features deliver the capabilities and support demanded by mission-critical, connected, intelligent systems.

Wind River Linux 5.0—Embedded Linux

Wind River Linux 5.0 is a commercial-grade Linux solution for embedded device development. Wind River Linux combines the necessary elements to enable customers to build and support highly differentiated devices: an optimized run-time; a flexible, scalable build system; pre-integrated middleware packages for specific device types; an integrated development environment; and an open-source toolkit, adapted and extended for embedded development.

Get Started Right Away

The system consolidation series offers a powerful path forward for product manufacturers looking to minimize costs and support effort while conserving valuable factory floor space. Along these lines, virtualization technology running on Intel Core processors helps reduce cost and complexity through the consolidation of computing devices for motion control, PLC, HMI, machine vision, data acquisition, safety, and other applications. This approach enables OEMs to deliver greater value to their customers and more easily offer new functionality capable of generating more revenue.

Solutions in the system consolidation series can dramatically lower risk and speed the development of consolidated systems using virtualization technology. Learn more about the Intel industrial automation solutions and the system consolidation series at: www.intel.com/industrialconsolidation

For more information about Intel solutions for industrial automation, visit www.intel.com/industrial.

Benefits from Consolidation

By consolidating devices using virtualization technology, original equipment manufacturers (OEMs) developing industrial automation solutions can provide substantial benefits to their customers, such as:

- **Lower overall solution cost:** A consolidated device often costs less to manufacture than multiple separate subsystems because the total bill of materials (BOM) is smaller.
- **Reduced integration cost:** Since the networking, cabling, shielding, and configuration, etc., that connect multiple subsystems together are handled within a single system, integration is simplified.
- **Smaller factory footprint:** Consolidated equipment likely takes up less factory floor space than the individual systems it replaces.
- **Reduced overall energy consumption:** The power efficiency of Intel® Core™ processors used in a consolidated industrial system can yield a solution that consumes less total power than multiple individual subsystems.
- **Simpler to secure:** With fewer subsystems, the attack surface of the factory is reduced, potentially resulting in a smaller variety of security solutions to support.
- **Higher reliability:** A consolidated system often has a better mean time between failures (MTBF) than a combination of subsystems it replaces because there are fewer potential points of failure.
- **Easier system management:** A consolidated system presents a smaller number of devices for factory IT personnel to install, provision, and manage.

1. Results have been estimated based on internal Intel analysis and are provided for informational purposes only. Any difference in system hardware or software design or configuration may affect actual performance.

2. Intel® Virtualization Technology requires a computer system with an enabled Intel® processor, BIOS, and virtual machine monitor (VMM). Functionality, performance or other benefits will vary depending on hardware and software configurations. Software applications may not be compatible with all operating systems. Consult your PC manufacturer. For more information, visit <http://www.intel.com/go/virtualization>.

3. Source: <http://www.wurldtech.com/data/content/file/Certified%20Products/WindRiver%20VxWorks%20OS.pdf>.

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