TTTech Industrial, an Industrial Internet of Things (IIoT) solutions provider, is employing Intel® technology to change how industrial businesses manage their machines. Nerve Blue software from TTTech Industrial offers a radically open edge computing platform that gives machine builders and end customers the independence to choose how they build up their systems. Its open architecture allows users to flexibly deploy and manage their own software or applications developed by third parties. Nerve Blue features enable users to reduce system complexity and cost, improve machine performance, and offer innovative new services to customers. With Nerve Blue software users can gain insights into industrial processes and make data-driven decisions based on data gathered from machines all over the world. Nerve Blue allows data to be accessed directly from the machine, then stored, processed, and analyzed, either at the device, on a local server, or in the cloud. This agility allows end customers and machine builders to implement analytics tools that deliver the greatest ROI. Nerve Blue was developed for Intel®-based devices and utilizes Intel® Edge Controls for Industrial as a software reference platform to speed up the development process.

The need for data solutions at the industrial edge

With the profusion of data-generating devices throughout all industries, the need for IoT edge applications to process that data close to its source has never been greater. This is more true in the world of industrial machine manufacturing than anywhere else. While other industrial sectors, such as telecom, have embraced the sort of data-driven, virtually managed, open platforms that we associate with IT technology, industrial controls have had a slower path to digital transformation. Rigorous requirements in the industrial environment, the need for real-time capabilities, and other considerations have left many industrial businesses in walled gardens when it comes to their operational infrastructure. They’re unable to find and adopt the solutions they want, because their machines are only compatible with products and services that the original vendor offers. And they’re just as limited in their ability to innovate to react to changes in the market, new technologies, or new opportunities. Often when a machine builder ships a solution to a customer, they no longer have any insight into how it performs. What sort of service might it need? Is it time for replacement parts? Are there new applications that can improve its productivity or profitability? Are new security risks coming online that need to be addressed? All these questions—and many more—are insights that the data produced by the machine can provide, but only if it’s captured or analyzed. With closed platforms, machine builders are left without the ability to offer ongoing remote support services or additional product offerings. TTTech Industrial and Intel are solving this problem with open industrial software platforms like Nerve Blue.
Reducing costs and deployment time

One of the principal objectives of Nerve Blue is to reduce the complexity and cost of both deploying and operating an intelligent control solution. Nerve Blue simplifies the process of implementing data solutions in the industrial environment by giving machine manufacturers an open and streamlined path to deploy the latest control software and applications to their products. To reduce hardware costs and decision-making complexity, Nerve Blue runs on off-the-shelf hardware and can scale seamlessly from gateway devices to powerful IPCs.

Increasing manageability and uptime

Nerve Blue greatly simplifies the process of updating and managing machines, making it easier to see all connected devices and software, solve software faults, and detect issues before they become problems. With Nerve Blue, users can remotely manage device and software configurations and perform over-the-air updates and upgrades to device software and applications. It enables VPN-like connections to Docker containers and VMs running workloads on almost any active device, so users can easily get remote screen and console access to devices and installed software. Not only are users able to deploy updates simultaneously to multiple devices in different locations, they can even simultaneously deploy applications across a dispersed and diverse infrastructure. As a result, end users benefit from a streamlined management experience for device and software configurations.

Nerve Blue also enables local management of devices, for times when connection to the central Nerve Management System is not possible. It provides key data readouts for the device, such as health and status information. If control applications are modified locally, they can be uploaded to the Nerve Management System.

Powerful analytics capabilities

Nerve Blue allows for the real-time gatewaying of data from existing PLCs and I/O infrastructures. Users can quickly and easily establish data sharing between time-series databases and applications running at the edge. To enable advanced cloud-based analytics, including deep learning, Nerve Blue supports data connections to any cloud service provider or ERP system. The resulting data analytics can be accessed locally via web-based data visualization.

More options for products and services

Nerve Blue helps machine builders expand their offerings, in terms of both products and support services. With remote management enabled by the Intel vPro® platform and Intel® Active Management Technology (Intel® AMT), machine builders can generate new revenue streams and innovate their business models by offering streamlined remote support of devices. They can also expand their offerings by easily adding applications to machines without needing physical access. A new model for machine builders as service providers is emerging, and Nerve Blue is leading the way.

Device consolidation and workload mobility

The flexibility and openness of Intel Edge Controls for Industrial and Intel® architecture allow businesses to consolidate multiple workloads, even mission-critical and real-time workloads, onto a single piece of hardware, helping to reduce CapEx costs. Nerve Blue enables a virtualized environment for running Windows or Linux virtual machines. It supports lightweight Docker containers so users can easily manage and move workloads from the cloud. Machine owners or managers can choose to use their own applications or employ third-party software, and Nerve Blue also integrates a soft PLC for running critical real-time workloads. What’s more, workloads can be easily migrated from device to device, as new machines come online or upgrades are made.

Built-in real-time workload performance

Nerve Blue addresses the pressing need of industrial controller solutions to support real-time workloads with features gained from Intel Edge Controls for Industrial. This reference architecture at the heart of Nerve Blue was developed with the real-time computing needs of industry in mind. The platform enables Intel® Time Coordinated Computing (Intel® TCC) and Time-Sensitive Networking (TSN). Supported on Intel Atom® x6000RE and x6000FE Series industrial processors, Intel TCC and TSN improve worst-case execution-time operation within individual processors and enable ultra-reliable low-latency communication systemwide by synchronizing data, communications, and executions across networks of IoT devices.

These technologies ensure both real-time and non-real-time workloads can run simultaneously without competing for compute resources. As a result, users can reduce latency and keep appliances and machinery working with exceptional coordination. Upcoming industrial-grade processors will offer features to improve real-time applications and deterministic capabilities.
TTTTECH NERVE BLUE BASE SYSTEM DETAILS

| **Base system**                  | Debian 10 (Linux Kernel 4.19.0)  
|                                  | Support for Intel Atom® and Intel® Core™ i5 and i7 processor-based COTS hardware (qualifiable as Nerve devices) |
| **Hardware support**             | TTTech MFN 100, Kontron A-250/A-150, Siemens SIMATIC IPC 127E/427E, Vecow SPS 5600 |
| **Hypervisor**                   | Xen 4.11 |
| **OS support**                   | Linux and Windows (as virtual machines) |
| **Soft PLC**                     | CODESYS V3.5 (PROFINET Primary/Subordinate, EtherCAT, Modbus TCP/IP)  
|                                  | Hosted in a real-time virtual machine to ensure isolation |
| **Workload management**          | Local UI for workload management  
|                                  | Resource management to ensure application performance |
| **Extensible architecture**      | Open for integration of third-party software firewalls |
| **Updates**                      | Over-the-air updates, security patching, and bug fixes for base system |
| **Communication security**       | Encrypted Transport Layer Security (TLS 1.2)–based communication  
|                                  | Firewall-friendly—Communication to the management system uses port 443 |
| **Application sandboxing**       | Applications are hosted as virtual machines and containers to maintain system separation |
| **Network segmentation**         | Configurable networking for separation of workload networks |
**Intel Edge Controls for Industrial**

In developing Nerve Blue, TTTech Industrial employed the ACRN hypervisor, a foundational component of the Intel Edge Controls for Industrial software reference stack. It enables the convergence of real-time, non-real-time, and noncritical workloads on the same computing hardware. This breaks down the barriers for how machine builders and industrial end customers run their workloads. They can consolidate multiple operations onto industrial PCs using virtualization and the computing power of Intel architecture.

Intel Edge Controls for Industrial can speed time to market and reduce the complexity of validating deterministic capabilities of an edge platform by offering a prebuilt and prevalidated reference stack targeted to control applications.

**Key features of Intel Edge Controls for Industrial**

**Real-time best-known configuration:** Optimize the firmware, hypervisor, kernel, and the application to use hardware-based features for the best real-time performance.

**Platform management:** Update firmware remotely and securely, update software on your system, and manage and statically provision containers while allowing integration with the data management system that works best for the customer.

**Orchestration:** Enables dynamic management of applications on a virtual machine or a container.

**Hardware:** Supports different Intel® platforms such as Intel Atom, Intel® Core™, and Intel® Xeon® processors.

**Hypervisors:** Supports a wide range of hypervisors in ECS 1.0 and 1.5 time frame, such as ACRN, RTS, and KVM.

**Operating systems:** Supports a wide range of operating systems. Windows has been integrated and verified in Edge Controls Stack. Yocto Project tools are used to create a Linux-based image.

**Container engine:** Support for Docker engine and others.

**Microservices and portable applications included with Intel Edge Controls for Industrial:**

**Human-machine interface:** Leverages the open62541 libraries for OPC UA, and is capable of ingesting OPC UA data.

**Control databus:** Bridges legacy systems.

**Motion control sample application:** Demonstration that speeds the development of motion control applications.

**Sample OPC UA applications:** Built on an open source OPC UA library for process automation customers.

**Performance benchmarking tools:** Replicate performance KPIs derived from implementing the real-time best-known configuration.

**Real-time tools:** Enables customers to scan their systems and look for optimal real-time communication configurations.

**Robotic applications:** Provides a sample AGV application and robotics application built on Robotics OS (ROS), ROS2.

**Security:** Maximizes the usage of Intel® hardware-based security.

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**Figure 1: Intel® Edge Controls for Industrial architecture**
Intel® Edge Software Hub

Intel Edge Controls for Industrial reference platform is an offering on the recently launched Intel Edge Software Hub. This easy-to-navigate, one-stop resource makes it simple for developers to quickly find, prototype, and integrate the edge computing software they need. It offers robust tools and deployment-ready software packages that are pretested and prevalidated—helping to save time and money. Solution development is complemented by Intel’s expansive portfolio of scalable, interoperable hardware solutions and vast ecosystem offerings.

The Intel Edge Software Hub helps developers overcome complex requirements and unique connectivity, security, and latency challenges. It enables open solutions that address the complexity of edge infrastructures and can reduce time to market for software developers. The Intel Edge Software Hub allows software developers to customize, validate, and deploy use case–specific solutions faster and with greater confidence. With it, Intel is accelerating the development of edge computing solutions and lowering the barriers to creating reliable, scalable applications.

Conclusion

With Nerve Blue, Intel and TTTech Industrial have proven the power of openness and collaboration to bring innovation to critical machine infrastructure. Nerve Blue acts as a platform for converging IT and OT by giving operational systems the same level of control, mobility, manageability, and orchestration that we generally associate with IT systems. No longer will machine builders have to gain physical access to control systems—some of which are in remote locations or time intensive to access—in order to maintain them, migrate workloads, or add new services. Nerve Blue cloud manageability features allow machine builders to observe and analyze the performance of machines, push updates and patches, detect possible failures or needed parts replacements, and much more from virtually anywhere in the world. This streamlines and simplifies the work of operating machines for end customers and opens up a whole new world of opportunity for machine manufacturers.

Learn more

Learn more about Nerve Blue and request a free online demonstration ›
Visit the Intel Edge Software Hub to see what it can do for your business ›
Learn more about Intel Edge Controls for Industrial ›

About TTTech Industrial

TTTech Industrial combines transformative technologies with hands-on experience in critical real-time systems to offer industrial IoT solutions that enable their customers to achieve smarter automation, better data access, and more flexible manufacturing. Their product platforms deliver simple and effective ways to bring IoT to industrial systems.
ttech-industrial.com

1. Based on internal TTTech data.
Intel® technologies may require enabled hardware, software or service activation.
No product or component can be absolutely secure.
Your costs and results may vary.
Intel does not control or audit third-party data. You should consult other sources to evaluate accuracy.
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