

Case Study

Intel vPro®
Intel® One-Click Recovery



Resilience at the Edge: Scaling Autonomous Operations with the ASUS NUC Pro Family, Intel vPro®, and Intel® One-Click Recovery



As enterprises push more intelligence to the edge, they need systems that can operate reliably without on-site support. ASUS and Intel deliver a resilient, edge-ready solution that combines robust hardware with advanced remote management to keep distributed environments running smoothly.

Executive Summary

Organizations managing large, distributed edge deployments need infrastructure that can remain stable, recover quickly, and support increasingly complex workloads. ASUS and Intel address this requirement with a purpose-built scalable foundation that combines the performance of the ASUS NUC Pro family with hardware-level remote management enabled by Intel vPro®, Intel® Active Management Technology (Intel® AMT), and the flexible deployment model of the Device Management Toolkit. This integrated approach reduces service overhead, accelerates recovery, and provides the stability and scalability required to support modern edge workloads, giving organizations a resilient foundation for long-term growth.

Challenge of Managing Devices at The Edge

AI workloads are rapidly shifting beyond the cloud, moving into hybrid and edge environments that put new pressure on local computing architectures. Enterprises operating at the edge require high-bandwidth, stable, and always-on operations to support secure, data-intensive deployments. Any gap in performance or availability carries costly consequences.

Managing hundreds or thousands of unstaffed remote installations has traditionally been an expensive and complex challenge. Without on-site staff, organizations have had to rely on costly physical dispatch visits and complex support logistics. The stakes are high: in distributed environments, downtime damages revenue and erodes customer satisfaction. The CrowdStrike blue screen outage took down more than 8.5 million PCs worldwide¹, and the estimated financial damage reached \$5.4 billion.²

Today's enterprises are actively seeking hardware and software solutions that are edge-AI ready, upgradeable, easily serviceable, and eco-certified for long-term value. At the same time, stable, high-bandwidth, and secure wired connectivity remains essential for always-on, data-intensive operations at the edge.

ASUS and Intel have partnered to meet this new reality and deliver a solution purpose-built for the edge, with advanced remote management capabilities that reduce operational burden, minimize downtime, and keep distributed deployments running at their best.

ASUS NUC Pro Powered by Intel® Core™ Ultra Processors and Intel vPro® Technology

The hardware

The ASUS NUC Pro family, powered by Intel® Core™ Ultra processors and Intel vPro® technology, is purpose-built to address the needs of modern commercial and IoT environments. From enterprise PC client deployments to edge computing, digital signage, retail, healthcare, banking, manufacturing, and smart city applications, ASUS NUC Pro systems provide a reliable and scalable foundation for organizations seeking dependable, long-life computing platforms.

Designed with business continuity in mind, the ASUS NUC Pro family combines enterprise-class reliability, remote manageability, flexible connectivity, and compact form factors. With features such as dual 2.5G LAN, multiple display outputs, high-speed memory, and advanced security capabilities, ASUS NUC Pro serves as a trusted building block for IT departments, Managed Service Providers (MSPs), System Integrators (SIs), and channel partners delivering mission-critical solutions across diverse vertical markets.



The performance

Powered by the latest Intel Core Ultra processor architecture, the ASUS NUC Pro family delivers the performance required for today's demanding commercial workloads while providing the scalability needed for future AI-enabled applications. Integrated Intel graphics, AI acceleration engines, and dedicated NPU capabilities enable efficient execution of productivity applications, edge analytics, computer vision, intelligent automation, and AI inferencing workloads.

By combining high-performance computing, enterprise-grade manageability, and proven reliability, ASUS NUC Pro empowers organizations to deploy, manage, and scale solutions with confidence. Whether serving as a commercial PC endpoint, edge server, IoT gateway, or AI-enabled appliance, ASUS NUC Pro provides a dependable platform that helps partners reduce integration complexity, accelerate deployment, and deliver long-term customer value.

Featured use cases:

- **Digital Signage & Kiosks in Critical Areas (airport, ATMs)** — ASUS NUC Pro enables dual-screen digital signage in tight spaces. Its compact, reliable design ensures consistent content delivery, while fTPM (Firmware Trusted Platform Module) security protects data and prevents tampering.
- **IoT, Edge AI, & Industrial Automation in Mission-Critical Infrastructure** — ASUS NUC Pro powers AI, ML, and edge data workloads with Intel Core Ultra and LPDDR5, offering flexible headers for peripherals, ideal for financial services, smart factories, and analytics.
- The ASUS NUC Pro family offers capabilities to support up to four displays via 2 HDMI® and 2 Thunderbolt™ ports. The ASUS NUC 15 & 16 Pro support dual M.2 2280 NVMe slots that can be configured into RAID 1, providing real-time data backups for enhanced data security.

The Power of Intel vPro® Platforms on ASUS NUCs Pro

The ASUS NUC Pro's powerful processing capabilities are only part of the story — Intel vPro technology and Intel Active Management Technology ensure that when those systems encounter failure, administrators retain full out-of-band control to diagnose, recover, and restore operations without ever stepping foot on-site.

Intel vPro® Platform Architecture

Intel vPro technology, introduced in 2006, integrates dedicated management components within the platform chipset. This architecture enables out-of-band functionality that maintains connectivity and control when primary operating system resources have failed. The platform has evolved over two decades into a mature solution deployed across industries worldwide. While in-band management tools rely on software agents running within the OS, Intel AMT—a key component of the Intel vPro platform—provides a management layer accessible even when the operating system becomes unavailable. This architectural difference enables continued system access during the failure scenarios that render software-only approaches inoperable.

Intel® Active Management Technology: Out-of-Band Control

The management engine maintains network connectivity even when the system is powered off or the OS has crashed, enabling management platforms to access and control systems regardless of OS state. Operating on an independent network stack separate from the host operating system's network layer, Intel AMT ensures network communication with the management platform remains functional even when the primary OS network stack has failed or become compromised. Through this connection, administrators can perform diagnostics, execute recovery procedures, and monitor system health.

How to Activate: Device Management Toolkit

ASUS and Intel have worked closely together to simplify the activation of Intel vPro—making deployment faster, management easier, and advanced capabilities more accessible to partners and customers of all sizes. The introduction of the Device Management Toolkit allows them to leverage one of the many OTA (Over-the-Air) solution providers to simplify the management console.

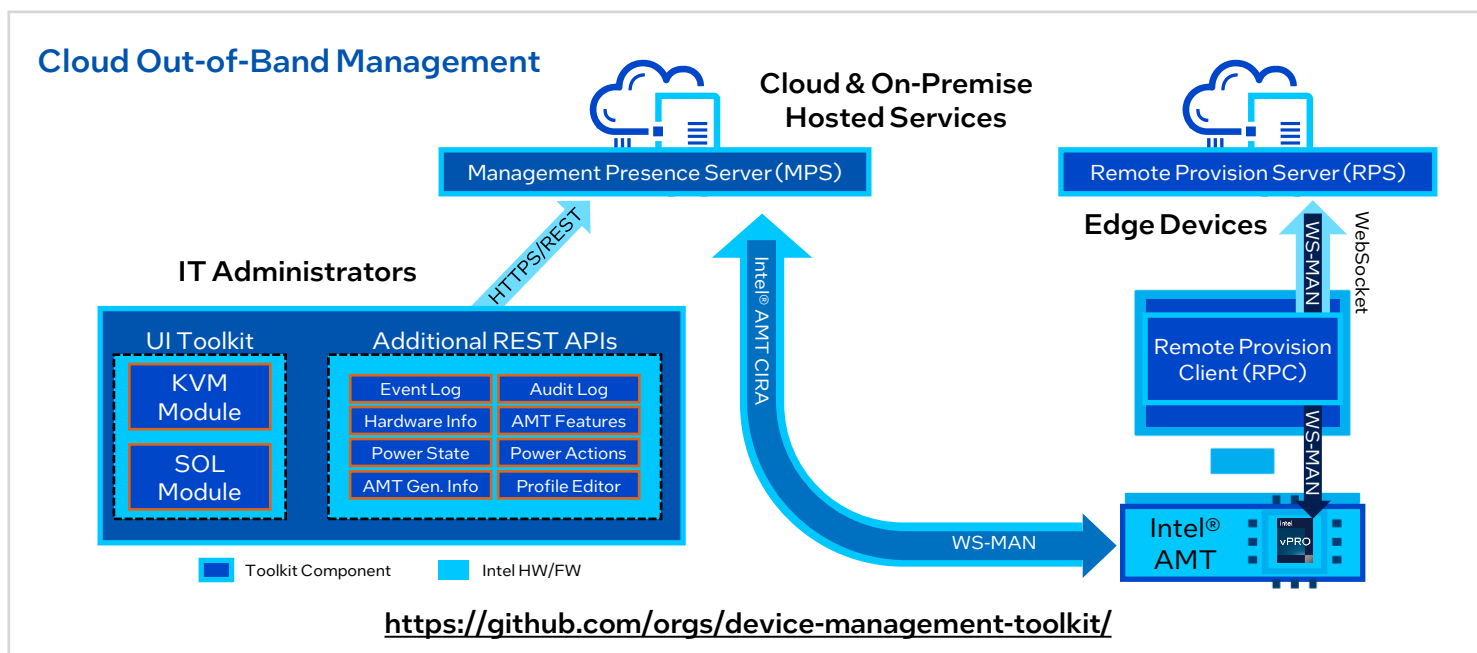


Figure 1—Device Management Toolkit and out-of-band management – How it works

The Device Management Toolkit provides a set of open source microservices that solution providers can integrate directly into their management platforms and host within their own infrastructure. This self-hosted “do-it-yourself” (DIY) approach gives providers complete control over the deployment architecture while delivering the same Intel AMT out-of-band management capabilities. The Device Management Toolkit supports both Windows and Linux operating systems, making it suitable for heterogeneous environments.

Among the new services provided by system integrators and partners, ASUS is aligned with Intel’s vision and values three features in particular: Intel® One-Click Recovery, Intel® Platform Service Record, and Intel® Remote Platform Erase. This case study focuses on the first one.

Intel® One-Click Recovery

Intel One-Click Recovery enables remote operating system reinstallation through HTTPS boot or pre-boot authentication. When an NUC experiences OS corruption or requires reimaging, administrators initiate recovery remotely. The system downloads a recovery image over the network and reinstalls the operating system without requiring physical media or technician presence, working through the hardware layer even when the existing OS installation is non-functional. This reduces recovery time from hours or days to minutes.

The illustrations below show Intel One-Click Recovery activated through Netop, one of the service providers that leverages this key Intel AMT feature to provide remote management capabilities on the ASUS NUC Pro devices.

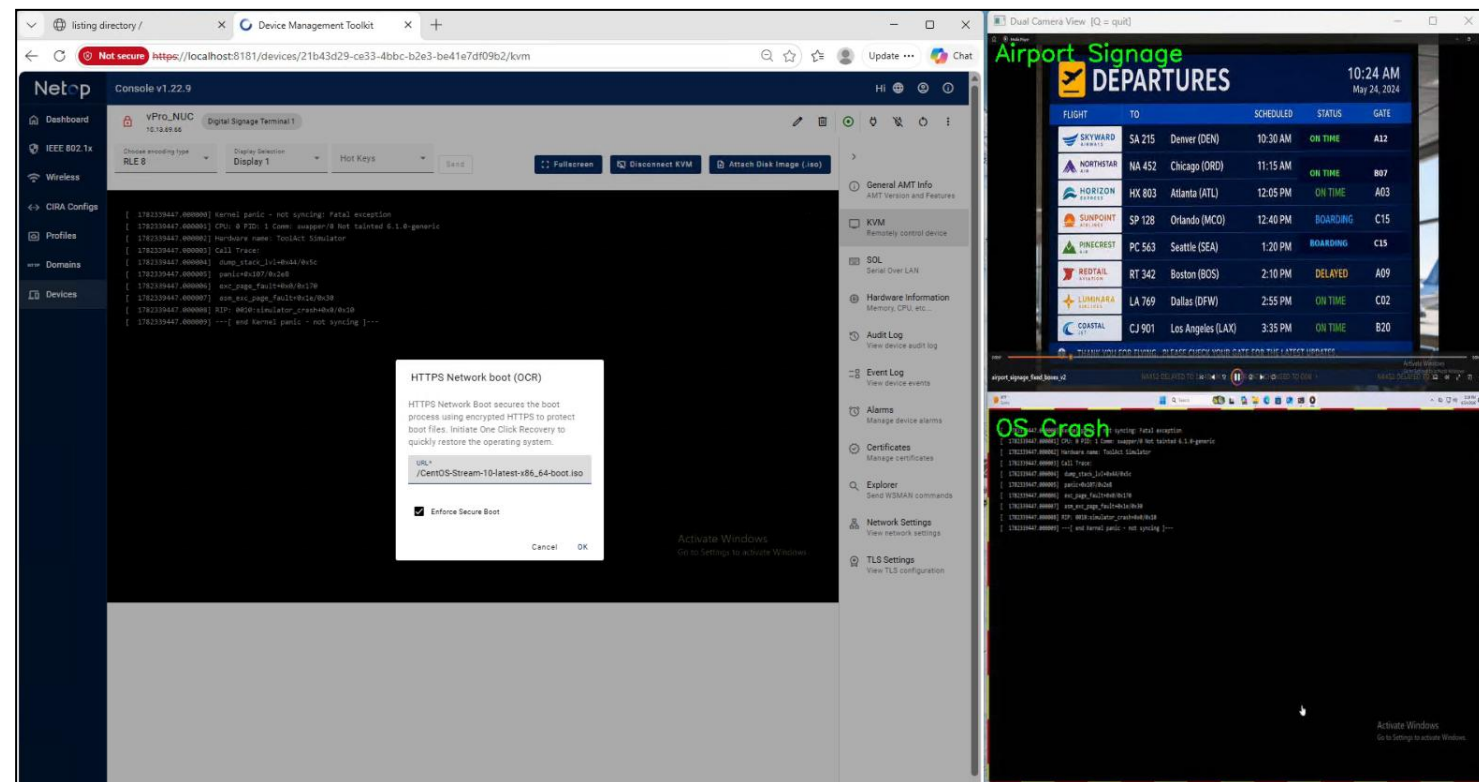


Figure 2 shows the Intel® One-Click Recovery initiation screen to restore failed airport digital signage.

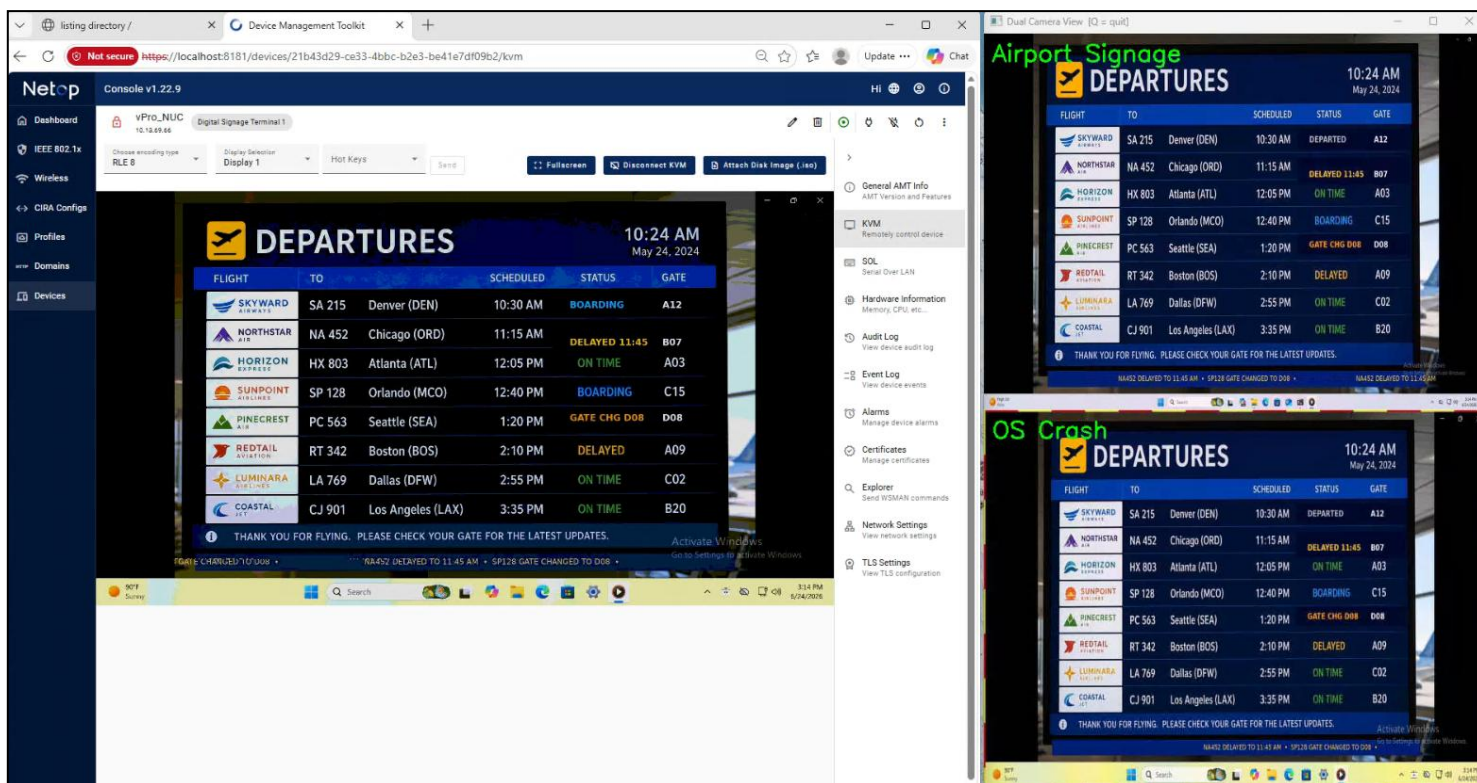


Figure 3 shows the recovered image of the previously failed airport signage successfully remediated.

Conclusion

The convergence of edge AI demands, business continuity requirements, and the high cost of unplanned downtime calls for a solution built from the ground up for resilience. That's exactly what ASUS and Intel deliver together: The ASUS NUC Pro combines cutting-edge processing performance with a hardware legacy defined by less-than-one-percent return rates, long-term reliability, and global service coverage across 84 countries. Paired with Intel vPro technology, a platform two decades in the making and continuously improving, enterprises gain a management foundation that provides continued system access regardless of OS state.

And with the open-source Device Management Toolkit microservices that integrate seamlessly with third-party solutions and support deployments across public cloud, on-premises, and hybrid environments, organizations aren't locked into a single approach. Together, this hardware and software solution gives enterprises the performance, reliability, and operational control they need to scale confidently at the edge — wherever that edge happens to be.

Resources

ASUS NUC 15 Pro: <https://www.asus.com/displays-desktops/nucs/nuc-mini-pcs/asus-nuc-15-pro/>

ASUS NUC 16 Pro: <https://www.asus.com/displays-desktops/nucs/nuc-mini-pcs/asus-nuc-16-pro/>

Intel vPro®: <http://www.intel.com/vpro>

Device Management Toolkit(GitHub): <https://github.com/device-management-toolkit>

Docs: <https://device-management-toolkit.github.io/docs>

Netop: www.netop.com



Notes

¹Microsoft. Helping our customers through the CrowdStrike outage. July 2024. <https://blogs.microsoft.com/blog/2024/07/20/helping-our-customers-through-the-crowdstrike-outage>

²TechTarget, CrowdStrike outage explained: What caused it and what's next, Oct. 29, 2024. [Link](#)

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Intel technologies may require enabled hardware, software or service activation. No product or component can be absolutely secure.

Your costs and results may vary.

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All versions of the Intel vPro® platform require an eligible Intel processor, a supported operating system, Intel LAN and/or WLAN silicon, firmware enhancements, and other hardware and software necessary to deliver the manageability use cases, security features, system performance, and stability that define the platform. See <https://www.Intel.com/Performance-vPro> for details.

Remote management requires a network connection; must be a known network for Wi-Fi out-of-band management. See intel.com/vpro for details. Results may vary.

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