



# BECKHOFF

## Beckhoff Achieves a Smaller Footprint by Switching from Windows CE to FreeBSD

Beckhoff Automation is a pioneering force in industrial automation, renowned for its innovative solutions and cutting-edge technology. Founded in 1980, Beckhoff implements open automation systems using proven PC-based control technology. Their portfolio includes industrial PCs, I/O and fieldbus components, drive technology, automation software, control cabinet-free automation, and hardware for machine vision.

Beckhoff has continually pushed the boundaries of automation with its PC-based control systems, EtherCAT fieldbus technology, and TwinCAT automation software. These offerings empower industries worldwide to achieve higher efficiency, flexibility, and precision in their processes. Beckhoff's commitment to open standards and modular architecture fosters seamless integration and scalability, enabling tailored solutions for diverse applications across various sectors, from manufacturing and automotive to energy and beyond.

### CHALLENGE

With end-of-life for Windows CE on the horizon, Beckhoff needed a non-GPL, stable, secure, and high-performance OS that supports the full range of hardware in their line from ARM to Xeon.

### SOLUTION

Beckhoff implemented TwinCAT/BSD across all its industrial appliances, offering a best-of-both-world solution between its proprietary TwinCAT real-time and an industrially proven OS in FreeBSD.

### IMPACT

Beckhoff was able to decrease its operating system footprint by almost seven times – from 1.5 gigabytes to 500 megabytes

## The Need For Change

For more than 25 years, Beckhoff has used Windows as the exclusive operating system for its industrial PC products. As a result, Windows CE served as the base for all of Beckhoff's smaller automation devices. In 2015, Beckhoff's customers noted ransomware attacks on their Windows-powered devices. With the end-of-life of Windows CE on the horizon, Beckhoff started to look elsewhere for an operating system.

Beckhoff needed a proven and reliable operating system that would support their product line's full range of hardware, from ARM to Intel Xeon. Preferring open standards, Beckhoff first looked at Linux as a choice to replace Windows CE but was deterred due to The GNU General Public License that would create additional legal complications for Beckhoff's customers as well as force Beckhoff to share their proprietary real-time, TwinCAT, which runs in kernel-mode. As a result, Beckhoff determined the need for an open source operating system with a permissive license, allowing them to adapt the kernel to accommodate the TwinCAT in real-time without needing to contribute TwinCAT's source code.

*A permissive license is a type of software license that grants recipients extensive rights to modify, use, and distribute software, often with minimal restrictions. These licenses typically allow the software to be used in proprietary or closed-source projects without requiring those projects to release their source code. Permissive Licenses contrast with copyleft licenses, which impose more stringent requirements on how the software can be distributed and modified.*

## Identifying and Building a Solution

Beckhoff turned to FreeBSD for its industrially proven and reliable reputation and its permissive licensing structure, which would allow Beckhoff to add TwinCAT to the kernel. FreeBSD has a healthy and active developer community that has driven innovation for over 30 years and continues to do so. In addition, FreeBSD supports some of the world's most recognizable brands, like NetApp, Netflix, Netgate, Juniper, and more.

With help from FreeBSD's permissive licensing structure, Beckhoff combined their proprietary TwinCAT real-time with FreeBSD to create TwinCAT/BSD, a packaged-based operating system that provides an alternative to Windows.

TwinCAT/BSD supports all TwinCAT 3 runtime functions and provides Beckhoff with a low-cost and low-footprint solution that fits Beckhoff's smallest devices. Heiko Wilke, Senior Product Manager at Beckhoff, notes that with Windows, Beckhoff used 1.5 gigabytes of memory in their devices for Windows installation alone. By comparison, Beckhoff's smallest device has only 2 gigabytes of RAM.

Because FreeBSD doesn't include processes that aren't needed, Beckhoff can reduce its use to about 200 megabytes of RAM usage, according to Heiko Wilke, leaving much more room for additional programs on top of their operating system. In addition, Beckhoff also deploys TwinCAT/BSD as a package-based system to enable easier updates and to allow the removal of even more unnecessary programs. Because of their package-based approach, Beckhoff's TwinCAT/BSD has about half the footprint of standard FreeBSD installations.

## Getting started with FreeBSD

Beckhoff's parting words of wisdom for any organization looking to implement FreeBSD are to consult The FreeBSD Foundation early and often. The FreeBSD Foundation can assist not only with technical and implementation questions but also with networking and connecting members of the community. If your organization is thinking about getting started with FreeBSD, send The FreeBSD Foundation an email using the [Contact Us](#) page of their website, or [download FreeBSD](#) to get started today.

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