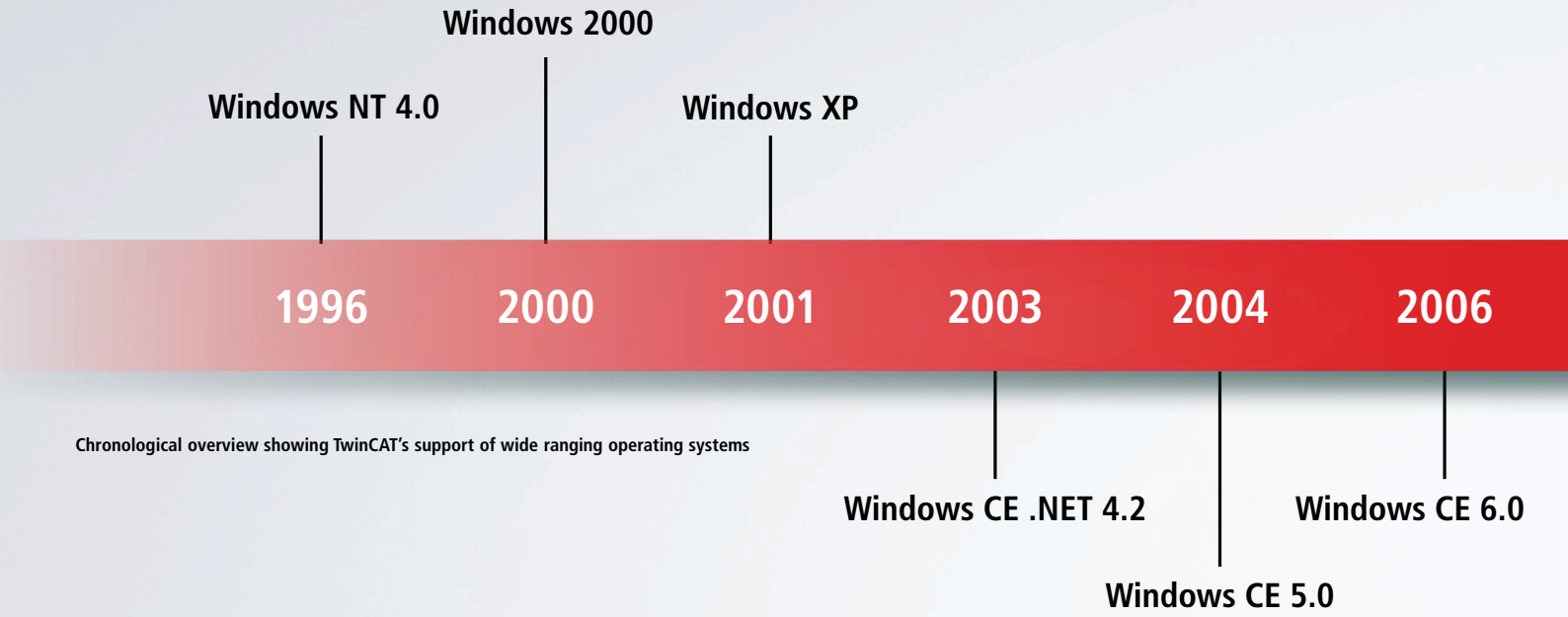
TwinCAT offers optimal coordination of runtime and operating systems



Chronological overview showing TwinCAT's support of wide ranging operating systems

Since the execution of the TwinCAT Runtime is closely related to the hardware used, it must be optimally adapted to the respective CPU platform. In turn, the runtime also provides access to the hardware itself (Ethernet controller, fieldbus interfaces, NOVRAM, etc.). It therefore provides some drivers for execution and is a small kernel in its own right. However, to make the well-known "convenience functions" of a PC available, such as user input with mouse and keyboard as well as screen display, many additional drivers and components are required. In order to avoid unnecessary load on the TwinCAT Runtime, the functions of a standard operating system are used for this purpose.

Operating systems manage the resources of the PC and provide user input, among other things. They also provide file systems for easy data storage. In addition, some standard network protocols are available for data exchange (e.g. SFTP, SMB) or for further functions (NTP, DHCP, ICMP/Ping). All these functions can be easily provided using the operating system, so that they do not have to be implemented in the TwinCAT Runtime. It's for all these reasons that TwinCAT Runtime requires a "host" operating system that takes care of the PC "administration tasks." This is the only way to provide a PC-based controller with the features users are familiar with – PC functionality combined with real-time capability.

Supported operating systems

In 1996, the first TwinCAT version was released that ran on the basis of a Windows NT 4.0 operating system. Since then, TwinCAT could be run with any newer version of the Windows NT kernel. While the "NT" eventually disappeared from the operating system names, the Windows 2000, XP, Vista, 7, 8 and 10 operating systems still used a so-called NT kernel.

Starting in 2003, Beckhoff also supported Windows CE. This operating system had the advantage of having a much smaller footprint and could fit on a small CompactFlash card with just 64 MB of memory. This was the preferred storage medium for the first Beckhoff Embedded PCs of the CX series, which delivered compact PC-based control in a DIN rail mounted format. Up to this point in time, large hard disks were necessary, which is why Industrial PCs had to be installed in correspondingly large housings. With the introduction of the CX series and Windows CE, another very successful product line has been established in the Industrial PC (IPC) sector to date, especially since it is now possible to run a "large" Windows 10 OS on Embedded PCs without any problems due to the increased processor performance and much larger memory card storage.

TwinCAT Runtime is the execution layer for programs developed using TwinCAT Engineering (XAE). The runtime application provides the required environment for previously compiled modules. TwinCAT Runtime is not only available for several CPU platforms (x86, x86-64, ARM), but also for different operating systems (Windows CE, Windows 7, Windows 10, TwinCAT/BSD, TC/RTOS).

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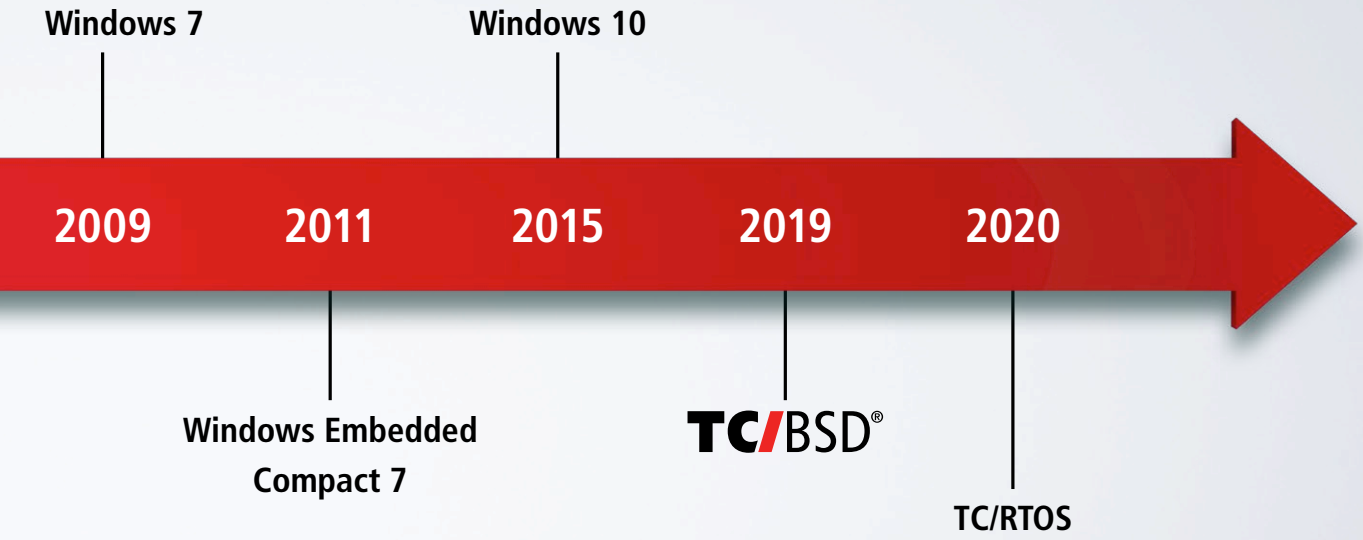

Due to customer requests, but also due to the obsolescence of Windows CE (now renamed Windows Embedded Compact), Beckhoff introduced TwinCAT/BSD as an additional operating system in 2019. TwinCAT/BSD is based on the industry-proven and reliable open source operating system FreeBSD, which was adapted for TwinCAT Runtime. This means that users now have the option of choosing not only the "large" Windows 10, but also a compact and robust operating system that serves as a successor to Windows Embedded Compact. Compared to Windows Embedded Compact, TwinCAT/BSD also offers numerous additional functions that would otherwise be reserved for the larger Windows operating systems, such as multi-core support and the installation of proprietary and third-party software. Furthermore, TwinCAT/BSD enables docker containers to be used in parallel with TwinCAT Runtime on a Beckhoff IPC for the first time. This enables many new use cases and applications, especially in the areas of IoT and edge computing.

In addition, TC/RTOS has also become available, which represents a combination of the TwinCAT Runtime with the FreeRTOS framework. This firmware operating system has been specifically developed for microcontrollers and is used, for example, in the CX7000 Embedded PC for use as a small controller.

Conclusions

All systems are based on the same TwinCAT Runtime – with all familiar features. Therefore, it does not matter which device you are working with. Over the years, TwinCAT has continuously supported newly introduced operating systems or operating system versions. The TwinCAT platform thus offers a foundation built on reliability and long-term stability for automation applications, regardless of the respective operating system used. Developments with regard to virtualization will play an increasing role in the future and are already supported by TwinCAT/BSD today.

More information:
www.beckhoff.com/twincat-bsd