MANAGING WINDOWS 7 END OF LIFE IN EMBEDDED SYSTEMS

Abstract

Microsoft will end support for Windows 7 in January 2020. This presents a dilemma for anyone who has deployed Windows 7 as the OS for an embedded system. The simplest response to handling the end of life (EOL) of Windows 7 is to upgrade to Windows 10. However, for many devices, this is not possible without a costly hardware upgrade. But continuing to run Windows 7 unsupported is to court disaster, in terms of security and stability. Wind River offers two solutions to this dilemma: One is to add Wind River® Linux® and a hypervisor (i.e., KVM) to the software stack, making it possible to run Windows 10 on existing hardware. Second is to avoid the Windows upgrade cycle entirely by migrating the native operating system from Windows to Wind River Linux.

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INTRODUCTION

Microsoft will end support for Windows 7 in January 2020. This long-anticipated move creates a dilemma for makers of embedded systems that use Windows 7 as their OS. While it is possible to respond to the end of life (EOL) of Windows 7 by upgrading to Windows 10, this not a viable choice for many devices. Windows 10 may not be compatible with older hardware that runs embedded systems, so migrating to Windows 10 can require costly hardware upgrades. In many cases, upgrading the thousands of devices already deployed is impossible for practical or financial reasons.

At the same time, running Windows 7 unsupported is not a wise choice. It's arguably courting disaster, from the perspectives of security and stability. Wind River offers two solutions to this dilemma:

> 1. One involves adding Wind River® Linux® and a hypervisor (i.e., KVM) into the software stack. With the hypervisor in place, it is possible to upgrade and run Windows 10 on existing hardware.

> 2. A second approach is to migrate the native Windows 7 operating system to Wind River Linux, allowing longer lifecycles without the need to upgrade the OS. It also puts the embedded system onto a more secure and easy-to-manage open-source OS.

Windows 7 in Embedded Systems

Most people think of Windows as an operating system for laptop PCs and servers. However, Windows has also been put to work in a broad range of embedded systems. These include point of sale (POS) terminals, digital signage systems, ATMs, kiosks, industrial control systems, and medical devices. Embedded system engineers had good reasons to use Windows, but now it is causing some problems.

THE WINDOWS 7 EOL DILEMMA

Microsoft's announcement that it will end support for Windows 7 on January 14, 2020, effectively ends the working life of this operating system. While it is technically feasible to continue running Windows 7 without support, this is a very problematic proposition. Embedded systems with unsupported Windows 7 will be vulnerable to malware and other disruptions because there will be no more patches and system updates coming from Microsoft.

Upgrading embedded systems from Windows 7 to Windows 10 presents potential difficulties, too. The issue is hardware. While newer embedded systems may be running Intel processors and system boards that support Windows 10's 64-bit drivers and other requirements, older system boards do not. For instance, to run Windows 10, an embedded system must have a processor or System on a Chip (SoC) with a speed of at least a 1 gigahertz (GHz). The device needs 1 gigabyte (GB) of RAM for 32-bit or 2 GB for 64-bit.

There must be a minimum of 16 GB in hard disk space for Windows 10 32-bit or 20 GB for 64-bit. It requires a DirectX 9 or later graphics card along with a Windows Display Driver Model (WDDM) 1.0 driver.

Some Intel processors simply will not support 32-bit drivers for Windows 10. If an embedded system runs one of these chips, deploying Windows 10 is impossible. For example, Intel CPUs earlier than Cherry Trail (e.g., Intel® Pentium®, Intel® Celeron®, or Intel® Atom® processors) do not support 32-bit Windows 10 drivers. Even earlier generations of the Intel lineup such as Apollo Lake, Ivy Bridge, Haswell, Broadwell, and earlier generations are also incompatible with the 32-bit Windows 10 OS requirements.

Older Intel processors and system boards are simply incompatible with Windows 10.

Example: Windows 7 Use in Industrial/Medical Systems

Industrial systems (e.g., "operational technology" or "OT") present a telling example of the challenges embedded system makers are facing with the Windows 7 EOL. As shown in the simplified reference architecture in Figure 1, a typical industrial or medical device runs Windows 7 with 32-bit Windows drivers and sits on an older Intel PC system board, e.g., Intel Core i5. The industrial or medical equipment manufacturer runs its own unique application and user interfaces (UIs). The device may also connect with peripherals like sensors, gauges, and so forth through a USB port.
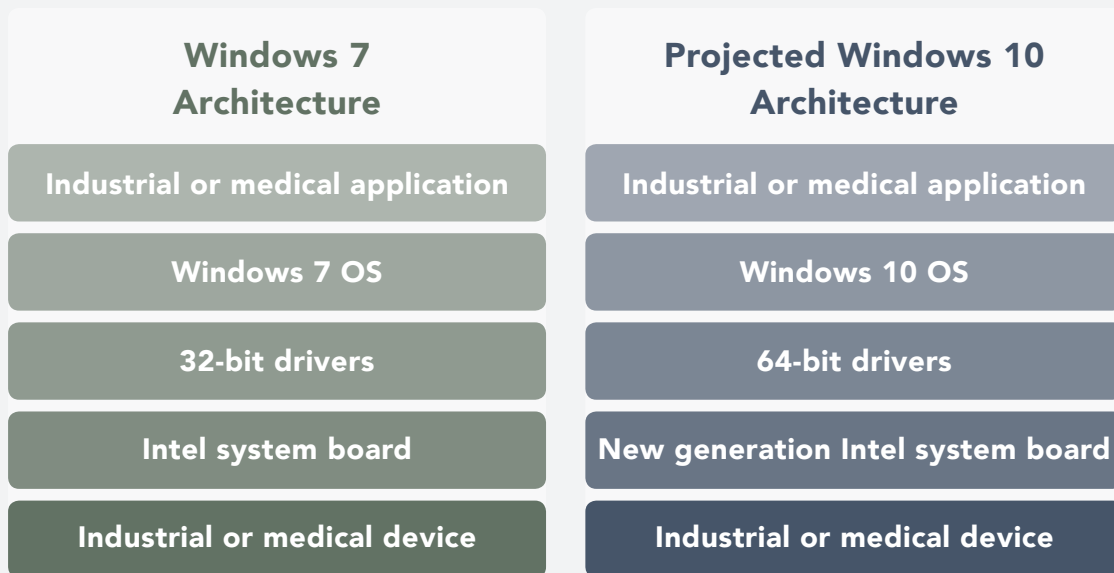
Windows 7 Architecture	Projected Windows 10 Architecture
Industrial or medical application	Industrial or medical application
Windows 7 OS	Windows 10 OS
32-bit drivers	64-bit drivers
Intel system board	New generation Intel system board
Industrial or medical device	Industrial or medical device

Figure 1 – Comparing system architectures for industrial systems running Windows 7 and one adapted to run Windows 10

Moving the Windows 7-based device to Windows 10 means upgrading to 64-bit Windows drivers. A new system board may be required, as Windows 10 is only supported on later-generation Intel system boards. An updated USB 2.1 interface is also required. These may not sound like big problems but replacing the system board has significant consequences for the equipment maker, which may have its devices installed in thousands of industrial facilities around the world.

The Impact of Hardware Incompatibility

As one might imagine, replacing internal hardware like system boards and USB ports on thousands of devices is a big project. It could easily run into tens of millions of dollars—if the maker can even locate all the devices. And, this is just one category. Windows 7 is running in millions of embedded systems, some of which are difficult to reach or cannot easily be taken offline, e.g., automotive, critical infrastructure systems, or medical devices.

Cost and inconvenience are only part of the problem. Microsoft traditionally ends support for an operating system after a 10-year life. The embedded systems industry is now in the fifth year of Windows 10 use. That means, in all likelihood, that Windows 10 will hit EOL in 2025. This entire cycle will then repeat itself. If hardware hasn't had to be replaced by now, it's almost guaranteed to need replacement five years from now—with all the same costs and practical difficulties this situation creates. Embedded system makers need alternatives, which are now available.

FINDING A SOLUTION WITH WIND RIVER LINUX

It is possible to migrate an embedded system from Windows 7 to Windows 10 without replacing hardware—even if the hardware itself won't support Windows 10 on its own. There are two possible solutions available using Wind River Linux. One is to run a hypervisor on Linux and place Windows 10 on top of it via virtual machine technology. The other is to move the embedded system applications directly onto Linux using the existing hardware.

<u>Solution 1</u>: Adding Wind River Linux and a Hypervisor

Embedded systems makers can add the Wind River Linux into the software stack of systems now running Windows 7. Then they can deploy Windows 10 to run on the hypervisor within a virtual machine, complete with its required 64-bit drivers. The hypervisor makes this possible by enabling a separation, or abstraction, between the OS and the underlying hardware. In this scenario, Windows 10 is running as a "guest" on a virtual machine. It makes no difference if the Intel system board will not support 64-bit Windows 10 drivers. Figure 2 shows how this looks in an updated software stack in the industrial device example.

Wind River Linux + Hypervisor Stack

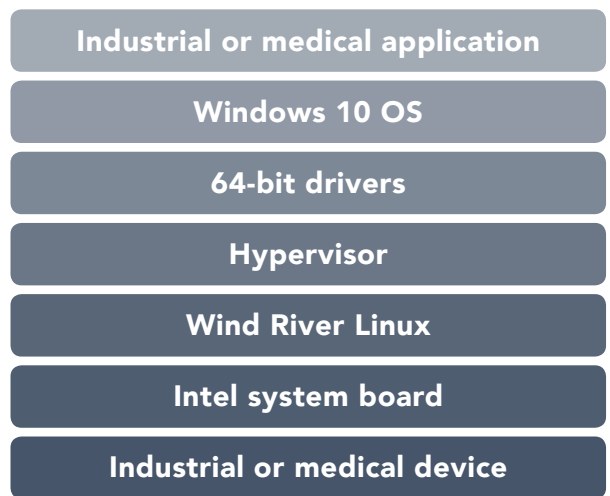| |
|---|
| **Industrial or medical application** |
| **Windows 10 OS** |
| **64-bit drivers** |
| **Hypervisor** |
| **Wind River Linux** |
| **Intel system board** |
| **Industrial or medical device** |

Figure 2 – Example software stack for an industrial or medical device running Wind River Linux with a hypervisor and Windows 10 with 64-bit drivers in a virtual machine.

A hypervisor is designed and typically optimized to host different types of operating systems, including general-purpose (e.g., Windows 10) and real-time OSes with a virtual machine environment. As a result, the embedded system can be processor-, OS-, architecture-, and hardware-agnostic. Using a hypervisor solution provides an upgrade path for embedded systems running Windows 7 that lack the hardware to support Windows 10.

Reduced Costs

In addition to avoiding hardware upgrades, a hypervisor virtualization solution helps reduce total cost of ownership (TCO) for the embedded system. Upgrading this way eliminates the need to re-architect applications and all features in Windows 10 work as intended, without any impact on performance.

Efficient Upgrades

To perform updates or patches, IT staff members won't have to travel to the device's location if the hypervisor has over-the-air updating options, as many do. The solution may also enable parallel operation of both stacks, side by side, during the implementation and testing phases of the hypervisor deployment. This is useful for testing the new architecture on critical systems that cannot be taken offline.

Improved Security

Using Wind River Linux provides advanced, built-in security including hard-disk encryption, whitelisting, secure boot chains, and product attestation. This provides hardened and integrated security at no additional cost.

Solution 2: Migrating from Windows to Wind River Linux

Another way to avoid the problems and expenses associated with the Windows 10 upgrade is to completely migrate away from Windows to Linux instead. Though there may be a need to adapt the embedded system's application software to run on Linux instead of Windows, the change should pay off with a variety of future savings and positive effects.

Longer Lifecycles

Linux enables longer device lifecycles because the device maker is not compelled to upgrade hardware to support software changes. Device management is simplified because there are fewer upgrades or patches to the OS compared to Windows. The APIs, drivers, and tools are equivalent to those used in Windows, making the transition relatively seamless.

Better Security

The Linux OS also provides better security than Windows because it is based on open-source code. Linux has fewer lines of code than Windows, so it runs faster with less chance of errors, and the reduced footprint presents a smaller attack surface area than Windows. Linux code is also readily available for the open-source community to scrutinize and assess for vulnerabilities and hidden malware.

Its security tools are built directly into the Linux distribution. In contrast, Windows requires a firewall, plus other tools such as antivirus, application whitelisting, encryption, and so forth.

Further security benefits arise from the fact that Wind River Linux patches are distributed more frequently than the Windows monthly schedule. This means that Linux patches tend to be smaller than those of Windows because they contain just the necessary security fix, while Windows patches may include other software updates. Additionally, with the subscription-based version of Wind River Linux, long-term support for the lifecycle of your products and continuous monitoring and fixes for all Common Vulnerabilities and Exposures (CVE) affecting the product come with the subscription.

Migrate Quickly

You shouldn't bet your business on a dead technology, and the deadline for Windows 7 EOL is fast approaching—it may even have passed by the time you read this. The time for action is now.

ENDING THE OS LIFECYCLE TRAP

The decision to deploy a hypervisor or migrate directly to Wind River Linux ends the OS lifecycle trap. The embedded systems industry is characterized by a disparity between the longevity of its devices and the comparatively short lifespans of the operating systems employed. If they choose to stay with Windows, embedded system makers will be forced to confront the EOL problem again in five years when Windows 10 reaches its EOL. Future misalignments between device and OS lifecycles are inevitable, but it is possible to get out of this endless, frustrating loop with solutions that are less expensive to maintain while offering greater security.

CONCLUSION

The Windows 7 EOL presents a challenge, but also an opportunity for the makers of embedded systems. With expensive hardware replacement in the offing, it's a wise move to add Linux and a hypervisor to migrate Windows 10 to the device's software stack or to replace Windows altogether with Wind River Linux. Either decision resolves the immediate problem, while permanently moving the device out of the endless OS update cycle.

Wind River has the technology and experience to make the move to Linux with a hypervisor or pure Linux a success. Our deep expertise and proven history of creating devices, systems, and networks with exceptional performance to meet critical safety, security, and reliability requirements for critical operations lead the industry. With significantly longer support horizons, a Wind River Linux subscription lets a device maker rely on predictive maintenance and 24/7 product support. Wind River can provide a custom hypervisor or Linux migration upgrade solution including industry-specific consulting and support that will eliminate the need for device makers to start all over again.

Talk to a Windows migration expert for a professional services assessment to determine which solution is best for your embedded systems.

LET'S TALK

ABOUT WIND RIVER

Wind River is a global leader in delivering software for the intelligent edge. The company's technology has been powering the safest, most secure devices in the world since 1981 and is found in more than 2 billion products. Wind River offers a comprehensive portfolio supported by world-class global professional services and support and a broad partner ecosystem. Wind River software and expertise are accelerating the digital transformation of critical infrastructure systems that demand the highest levels of safety, security, and reliability.

WHEN CUSTOMERS NEED IT TO WORK AND WORK RIGHT, THEY CHOOSE WIND RIVER