Smart industry

SPECIAL REPORT

THE DIGITAL TWIN

Overcoming **Minor Challenges** to Uncover **Massive Opportunities**

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SPECIAL REPORT

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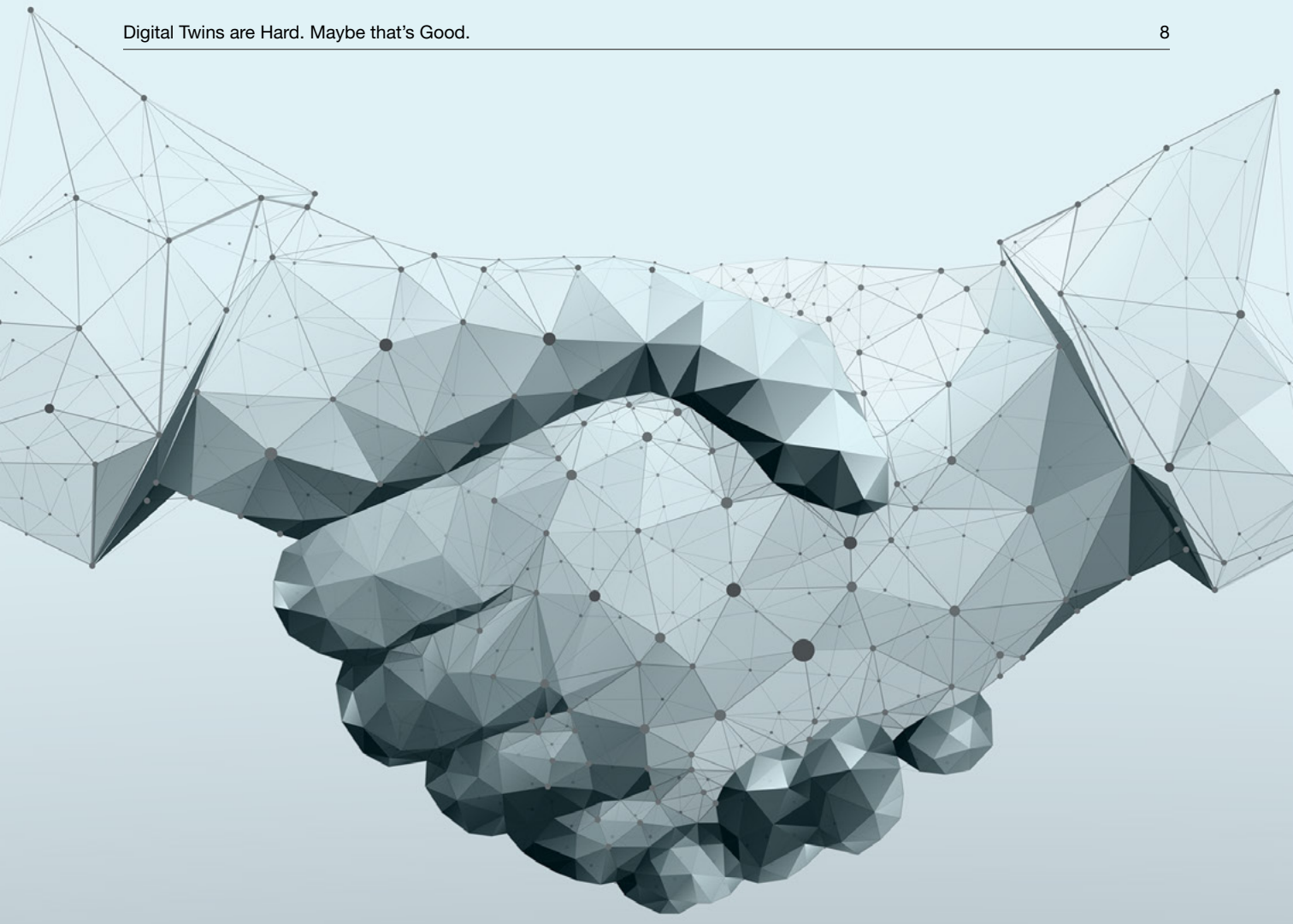


Virtual Vision, Real Rewards

By Chris McNamara, Smart Industry editor in chief

I've seen sexy versions of Digital Twins—glittering digital displays on massive clear touchscreens mounted in front of the plant floor, enabling you to "grab" a machine with your fingertips, open it up and study real-time data or projected information based on operation changes.

Very cool. Very fun to play with.

But displays like that are bells-and-whistles, really. Just eye-catching toys to pique your interest in what's really going on with a Digital Twin.

The actual abilities are actually much cooler.

A Digital Twin is a modern day crystal ball, enabling us to see more clearly. We can get a crystal clear vision—enabled by comprehensive data collection—of the current state of operations. That data also enables us to peer into the future—to study potential paths—and optimize our strategies without the risk of implementing faulty changes in the real world.

I've seen it in countless use cases. The capabilities are game-changing. We've covered applications of the Digital Twin in the manufacturing space for years now and, in that time, we've seen confusion and skepticism mature into interest and adoption. Early adopters are reaping real rewards. Laggards are realizing, quickly, that they need to get on board if they hope to remain competitive.

Solution providers are refining their offerings and, perhaps more importantly, simplifying the process for business owners who are wary of taking this approach. (In a nutshell…it's not that complicated and the wins come quickly.)

As our machines tell us more about their performance and our software is able to better contextualize that information into guidance for human operators, everything runs, for lack of a more complicated term, better. Uptimes are up. Downtime is down. Inefficiencies are discovered and corrected. Profits soar. Pilot programs with Digital Twins validate scaled efforts and those initial successes multiply.

The Digital Twin may not exist in the real world, but the benefits sure do.

A Digital Twin is a modern day crystal ball, enabling us to see more clearly.

The Minor Challenges and Massive Opportunities Delivered by the Digital Twin

By Sean Evoy, Wind River product line manager

Digital Twin is an increasingly common term. Unfortunately, when the topic of Digital Twin comes up the conversation frequently turns to the challenges of implementation and conclude in:

Digital Twins are too complicated. They are too complex to be effective for us.

And that's fair. I understand why people might be reluctant to make the up-front investment of Digital Twin. But imagine the massive opportunities available with implementing Digital Twins as part of your solutions if you could overcome some of these challenges.

Let's distill it down to its essence—a Digital Twin is really just a model of a real-world thing. Sure, that model can be enormously complicated, but it can also be very simple. And once you have a Digital Twin up and running—an analog version of a real-world thing—you can do some amazing things with it.

You can pre-stage updates. You can monitor your systems like never before. You can perform sophisticated and comprehensive testing that would be costly or impossible to perform with the physical hardware.

In short, a Digital Twin is a simple idea with a very powerful payoff.

A Digital Twin is a simple idea with a very powerful payoff.

WIN WIN DIGITAL TWIN

To fully grasp a Digital Twin in your environment, it helps to consider the drivers: what is the motivation to implement this tool? Your drivers to implement a Digital Twin should align with your larger business drivers. Technology for the sake of technology doesn't benefit anybody.

One of the most common business drivers we see is using a Digital Twin to manage risk. Nobody wants to push an update to a device that either compromises operations or adds security vulnerabilities or, worse still, takes it out of commission and forces it to be re-issued. And let's be honest, nobody wants a mistake they made to end up in the news.

Being able to pre-test and pre-deploy an update or a security patch on a Digital Twin *before* you make it available to a real-world system is a very powerful advantage. And there is an added benefit: the data that comes from these devices is actually a business asset, enabling you to improve your profitability and efficiency by monitoring and making sure the configuration and operations of systems is optimal, which allows you to pursue new lines of business and potentially monetize the data.

In addition, most people operate under some combination of safety, quality and/or legislative constraints. Having a Digital Twin helps you meet those standards

more easily, in a strategic, standardized manner. There are huge cost-savings here, as well.

MITIGATING COMPLEXITY

In many cases, one of the greatest challenges that developers face when building digital systems is the complexity of the hardware at the core of it. (Sound familiar?)

Having a Digital Twin creates a smoother path to the development of the next version of your application by reducing your dependence on those complex assets for the data they generate.

A digital representation, which delivers the same information as the actual hardware, is a streamlined path to getting those actionable insights. You can store and manage data with unprecedented access and accuracy. You can perform optimizations through root-cause analysis and study full data sets. Because it is a digital representation you are not bound by physical limitations, giving you a much greater degree of flexibility of what and how you test. Likewise, fully knowing the state of your assets allows you to reapply the normal state when they come back online after a disruption or shutdown.

And imagine being able to roll out a system for which you already have a Digital Twin. Speed is enhanced. Costs are reduced. Set configurations can be delivered to that physical device in the opposite direction—moving from the digital realm to the physical world courtesy of insights from a Digital Twin.

A Digital Twin creates a smoother path to the development of the next version of your application.

SO WHY THE RELUCTANCE TO GET STARTED?

That's a good question. Part of the problem is that it's not always obvious to business owners exactly what kind of Digital Twin they need to build. Consider a car, which in the real world is, essentially, a rolling computer platform. As an automaker, you don't really care about every piece of data, every system in the car. But the challenge is determining what systems warrant their own Digital Twin.

If one of the main data-generators you care about is the instrument cluster (you want the telematics data coming from it) a Digital Twin provides insight on the state of being and the ability to patch the IVI or entertainment systems. Then, scaling out efforts, perhaps you want to manage the state of one or more of the ECUs running on the car. Done!

Notice how we've very carefully pared down the model so that it only represents the things that are important. Frankly, this has been the single greatest challenge that people face when they begin to create digital models. *Where do we stop?*

The key is determining what you want to monitor and, then, doing so accurately. Mere data is not enough. You need a model of state and a model of behavior.

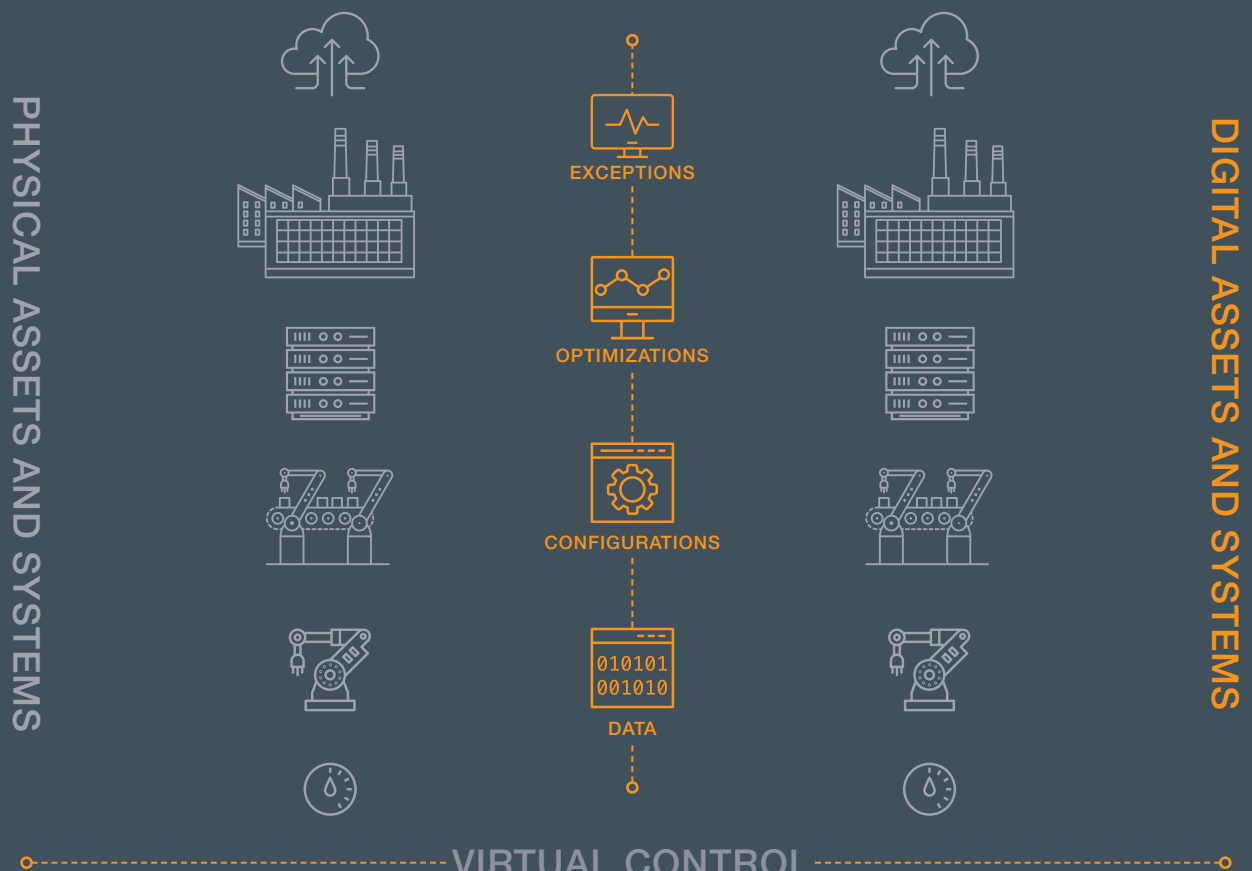
And remember, while model accuracy is critical to this whole approach, it is also double-edged sword. You must remove the data you don't care about while precisely managing the data that is critical to your operations.

Selecting the right, complete solution to build an effective Digital Twin is critical to its success. Our Simics is that solution. Hopefully this article gave you some useful things to consider as you create and employ Digital Twins in your embedded solution. ◻

DIGITAL TWIN

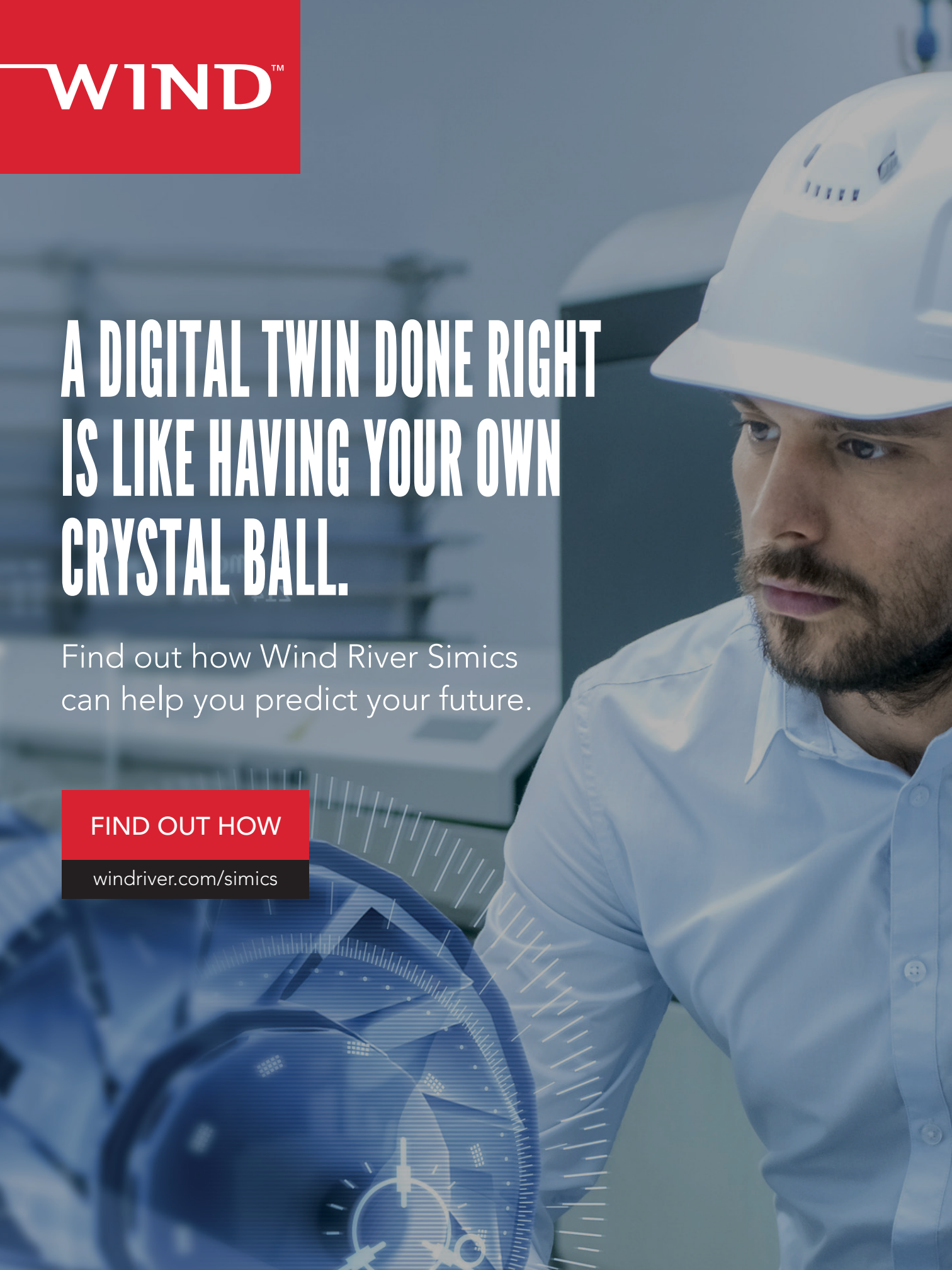
ADVANTAGES

- Manage risk by deploying to a Digital Twin prior to a production system
- Improve profitability and efficiency by monitoring configuration of systems and/or individual assets
- Abstract hardware complexity and dependencies out of edge application development equation
- Leverage digital assets and their data to preserve system capabilities during disruption
- Ensure your solution meets quality and legislative standards



"Assets in the physical world can sometimes have blind spots in regards to optimization and execution. In addition, they may not be available in quantity at the right locations, or at the time needed to do the job. These are some of the reasons why moving data and compute from the physical to the digital world is so powerful. The data itself is useful, as is the ability to store and manage configurations. Working in a digital environment that mirrors the physical gives you the flexibility of performing optimizations through data set and/or root-cause analysis and exception management, as well as a host of other capabilities not possible in the real world. These are key drivers pushing people to consider Digital Twins and realize the advantages they can bring."

—Michel Genard, VP product management, Wind River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Digital Twins are Hard. Maybe that's Good.

By Jeff Gowan, Wind River product line marketing manager

Why hasn't the practice of using a Digital Twin been more widely adopted? Simple; because it can be complicated to implement and costly to maintain. But, just because it's hard doesn't mean it isn't worth doing. In fact maybe it's even more worth doing as the companies who can effectively leverage a Digital Twin stand to have a significant leg up on their competition . Consider the potential benefits: adopters can develop and get their products to market faster, can more efficiently test and deploy updates, and significantly decrease risk in their production systems.

A simple definition of a Digital Twin is that they enable a digital replica of physical assets. A Digital Twin provides increased confidence in the quality and correctness of a solution. Teams enjoy lower program costs and faster time to market. A Digital Twin can enable more rapid innovation, non-destructive testing for maintenance, and can even help meet legislative mandates to test with hardware in the loop more efficiently.

Digital Twin as a concept has been used at least since the 1960s in the Aerospace & Defense (A&D) and Space industries. Recognizing it is impossible to put an aircraft or satellite on every engineer's desk, teams such as NASA IV&V use a Digital Twin instead to enable engineers to develop and test their applications and systems. This simulation also enables them to develop on virtual hardware when the real thing is either unavailable or in short supply. Then, simulation enables engineers to test updates in a myriad of ways that just isn›t possible in the real world.. When the updates are ready to deploy , they can be applied with confidence because they have been so thoroughly tested. An added benefit is that once a model of a system is built, it can be re-used on subsequent projects, resulting in cost savings and increased value.

But Digital Twins aren't just for A&D. Telecommunications equipment manufacturers use Digital Twins to help with their 5G roll-out, they can be found in manufacturing and process control as we move into Industry 4.0 and

Adopters can develop and get their products to market faster, can more efficiently test and deploy updates, and significantly decrease risk in their production systems.

IIOT, and we're now also seeing applications in smart cities.

For some of our customers, Simics provides enough coverage to be an effective Digital Twin solution on its own. Simics provides full-system models that include processor cores, peripheral devices, memories, interconnection buses, and network connections. It allows teams to inspect a running system at any time and the software stack can run without any modification. Add to that some powerful features such as automation, time manipulation, and fault injection and Simics makes for a powerful tool for a Digital Twin.

However, for more complicated systems, Simics leverages all the features above and becomes an integration point to connect to multiple simulators in order to capture and manage an entire system. In this scenario your system just became much more complex, but also much more comprehensive and powerful. Imagine having a central dashboard where you can run and automate your testing for a complete replica of your production system. How might that help you innovate and evolve your product or system in ways your competitors couldn't?

A Digital Twin is a tool that has proven to have significant benefit through all stages of a product or system lifecycle. Click here to find out how Simics can enable this powerful tool. Not sure if Simics would be a good fit for your Digital Twin? Let's have a conversation to see how Wind River can help.

The Intelligent Software Platform for Industry 4.0

Wind River®, an intelligent software platform leader, delivers the technology and expertise that enable the deployment of safe, secure and reliable Industry 4.0 systems.

Learn more at Wind River.

Contact Wind River here.

Feel free to reach out to Jeff Gowan at jeff.gowan@windriver.com