



CONTAINER TECHNOLOGY PAVES THE WAY TO A NEW ERA OF AVIONICS SOFTWARE

Delivering an effective way to deploy innovative embedded software with built-in high security and strong manageability

July 2023 Interview with Nicolas Chaillan

Container technology has forged strong inroads in the aviation and aerospace sector, providing a clear-cut way to securely update software and compile audit trails for avionics systems. Maintaining isolation between containers — being able to update a single container without affecting other containers or software components — is an important factor in their adoption, as is portability between platforms.

Containers have been deployed by leading aviation firms. Airbus streamlines software updates on its A350 aircraft with containers. GE Aviation uses containers for software updates to its jet engines. The Boeing 787 Dreamliner also relies on container technology to perform software updates.

We recently sat down with former U.S. Air Force and Space Force Chief Software Officer Nicolas Chaillan to find out precisely why container technology is so important to modern avionics development. Below, we've consolidated some of his main points from our wide-ranging discussion.

Team Access to Modern Applications

Nicolas Chaillan: In 2019, when I started as the chief software officer for the Air Force and the Space Force, we explained to leaders that a container was not a shipping container to ship to Afghanistan but a software thing that could be used to effectively cut key software modules into pieces and create components that could be reused across teams.

More importantly, each container and each module leverage a lot of open source software that has to be assessed and updated regularly with the latest capabilities and security patches. Teams can have access to best-of-breed software and avoid getting locked into monolithic architectures.

Container Orchestration

I think the key benefit that we see from moving to containers is not just having containers per se — it's also the orchestration of containers. And that's why we pick Kubernetes as an open source stack that can be embedded inside of very complex platforms.

ABOUT NICOLAS CHAILLAN

Nicolas Chaillan is the founder of Ask Sage and the former U.S. Air Force and Space Force Chief Software Officer. He is a strong proponent of DevSecOps practices and has spurred adoption of this development model throughout the Department of Defense. The company he founded, Ask Sage, applies AI technology to give government teams a secure mechanism for gaining data and information relevant to their missions.



Benefits of Containers for Organizations

I think it's not really an issue, whether or not to use containers. Organizations don't have a choice. Otherwise, they cannot keep up. You're going to be causing a massive negative impact to your velocity if you don't embrace the modern way of building software.

By being modular and flexible, containers have the ability to update software multiple times a day, enabling tremendous capabilities for deployment. It works well with jets, and other aircraft. My team and I were the first ones to put Kubernetes on jets and then update software while flying the jet. We also put AI on the jet without changing the architecture and keeping the legacy hardware. Having the ability to decouple the flight control – that doesn't really need to change – and bring in new capabilities as a separate set of containers enables you to update those containers rapidly, without impacting the airworthiness of the aircraft.

And it's not only the modularity, and the reuse across teams, and your ability to receive – particularly if you're a larger organization. You also see the benefit of security. I think this is a game-changer – especially when moving to zero trust, which I think everybody should.

Wanted: More Tools and Understanding

The adoption of containerization, and Kubernetes as a container orchestration stack, is obviously complex because of the complete change of thinking and culture. Software is a factor, both in terms of architecture design and the effort of going to modular architecture.

The software is more flexible and nimble, but it is also different in terms of tools and our understanding of everything that we know.

There's definitely a massive talent gap. It's a big issue. People are realizing that they have no choice but to reinvent themselves every year.

I argue that first you need to catch up, and then you need to keep up. And it's funny how we underinvest in our people. It reminds me of this meme where you have a CTO saying, "What if we invest in our people and they leave?" And the CEO says, "Well, what if we don't invest in them and they stay?"

Insights from Simulation and Modeling

A digital twin exponentially enhances modeling and simulation. It empowers teams to know exactly how the system is going to behave before bending metal. A lot of people look at software agility and forget that you can do a lot with that.

You don't have to always be in a waterfall universe in hardware. You can now easily swap hardware, swap compute with a rack or some type of easily replaceable hardware, or increase storage capability – on jets, on ships, you name it.

We have to demonstrate the value of being able to do that. A digital twin is going to show you exactly how the system is going to behave.

Accelerating Change

The velocity of change used to be in a 20-year cycle, maybe 10. But now it has really accelerated drastically, to the point where a startup can show up and disrupt an entire market.

We've seen this with Uber and many other examples, such as Netflix. Big companies had the opportunity to buy them, and they missed the boat. Then they pay the price – and suddenly they don't exist anymore.

We laugh about it, but I can tell you that I think this effect is going to grow. With embedded systems, particularly in the fast-moving avionics sector – if you don't have that knowledge on a day-to-day basis, you're not going to be able to compete. Today, some organizations are getting away with ignoring the issue, but it doesn't mean you should.

The Concept of "Software Defined"

The term *software defined* is great. To me, it sounds like something that will be nimble and more agile and less stuck in time.

Like Tesla: You buy a car. It might be four years old, but you are still getting new features. That's really something that was created by Tesla and no one else. You can buy any other brands and the software updates you get, if any, are mostly bug fixes. You would never see a new feature show up magically on your dashboard.

But that is the kind of world people are getting used to living in. *Software defined* tells me that it's nimble, it's agile, it's decoupled from hardware, and it's able to move at a pace of relevance. It's intangible in terms of the physical world, in terms of being stuck with hardware or legacy constraints.

Strengthening Embedded Systems with AI Capabilities

Paying attention to the capabilities we're building in terms of continuous integration, scanning, and testing... I think the world is moving to a continuously monitored universe of behavior detection using AI capabilities. Increasingly, we're going to have the ability to bring this stuff up on smaller footprints.

Embedded systems have limited memory, but there's enough nowadays to do some cool, lightweight AI behavior detection. With this feature, we can see exactly what's going on and proactively detect malicious behavior that scanners would not be able to detect.

Containerization and AI/ML

When it comes to containerization in the future, I think the important point is how it is going to streamline the adoption of artificial intelligence and machine learning. They are both dependent on containerization and the scalability of containers. I think having the enabler baked in, and having the ability to do machine-learning operations and deploy models rapidly – as containers – is just the right way to do business.

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 digital transformation of critical infrastructure systems that demand the highest levels of safety, security, performance, and reliability. To learn more, visit Wind River at www.windriver.com.

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