

Digital twins for supercharged decision making.

Private 5G enabling new use cases
for government and business.



verizon✓

Foreword – Rob Le Busque

The realisation of digital twins is a combination of imagination and reality.

In the 1960s we imagined going into outer space. A digital twin was just one of the tools used to make that happen – to ensure informed decision making, supported by data – was available at important steps throughout each space exploration mission. That application drove the continued development of digital twins.

Today, what was imagined is now a reality and rockets are launched regularly into space.

Fast forward to our future, and digital twins will evolve to become an important tool for industries like cyber, health, manufacturing, infrastructure and planning which manage large, interactive systems requiring information in real time.

We are proud to be at the forefront of digital innovation: delivering multiple realities, powered by the 5G network, driven by imagination.

I trust this whitepaper provides you with useful insights and food for thought about your own innovation agenda.



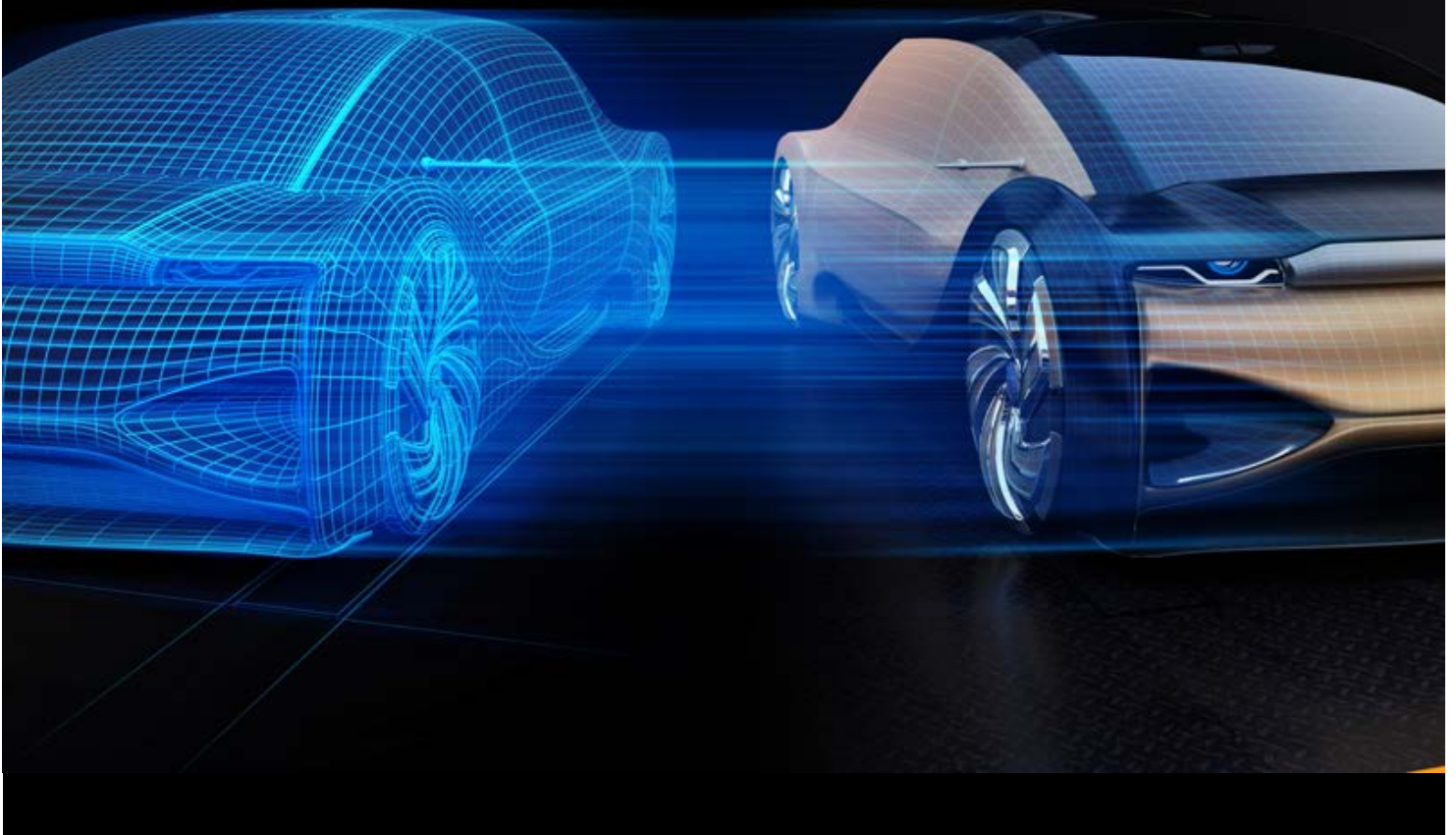
Rob Le Busque
Regional Vice President
Asia Pacific, Verizon Business Group

What is a digital twin?

A digital twin is a virtual replica of a physical object, process or real-world system. It can mirror its counterpart in real time, or at least near-real time, using data from sensors in the physical system.

A digital twin can represent a building, logistics system, city, manufacturing process or even a person. The model can be updated and adjusted with incoming data sets, allowing it to represent actual conditions and enable informed decision making.

Data from multiple models can also be blended to form a view across a number of real-world systems, leading to richer insights for business and government.



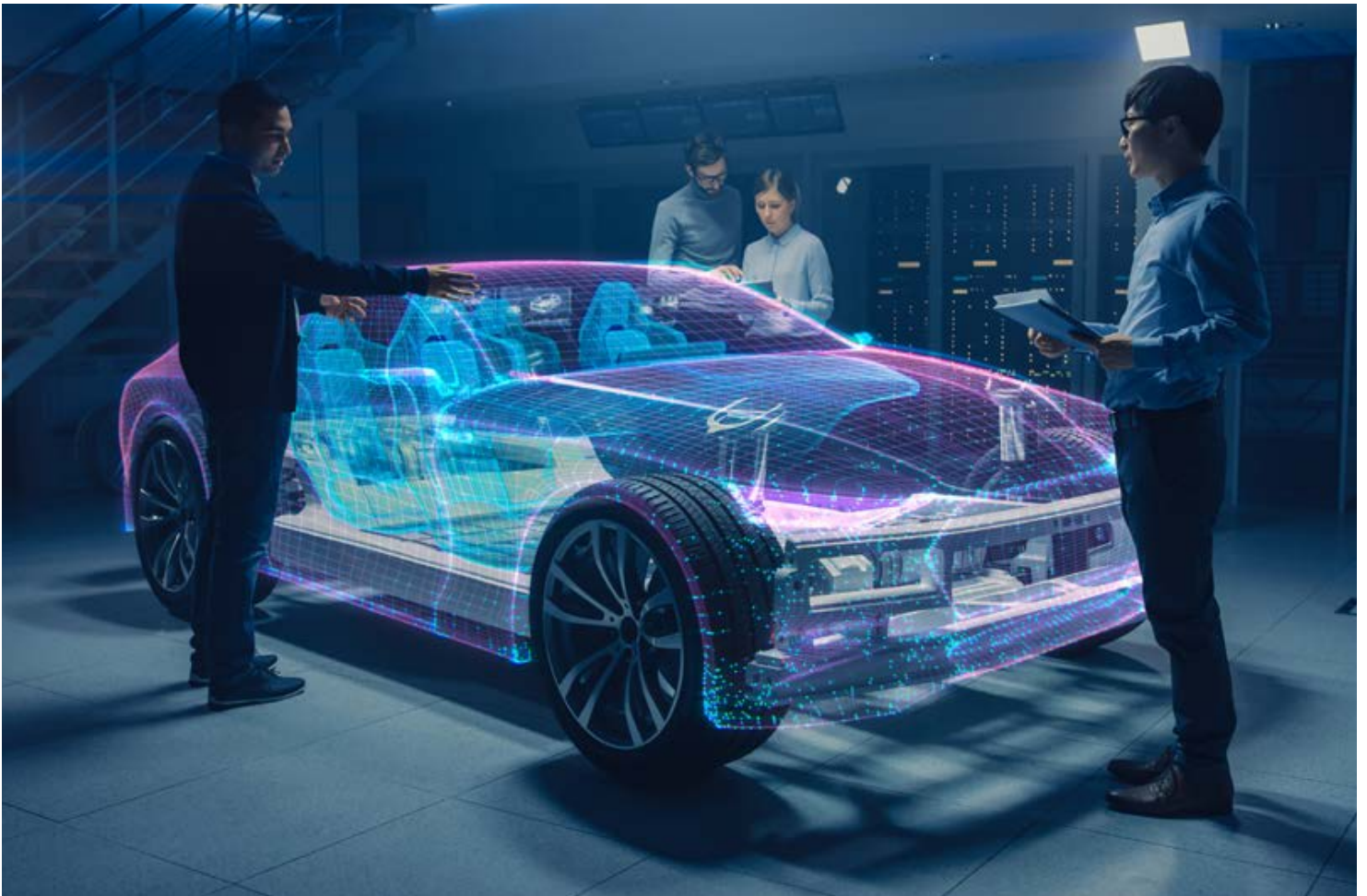
The evolution of digital twins

Digital models are not a new concept. NASA used the digital twin concept in its 1960s space program to create replicas of spaceships that carefully mirrored each decision made during missions. These digital models have become more sophisticated since then, with improved telecommunications and digitisation technologies enabling increased control and quicker reflection of the real world and associated scenarios.

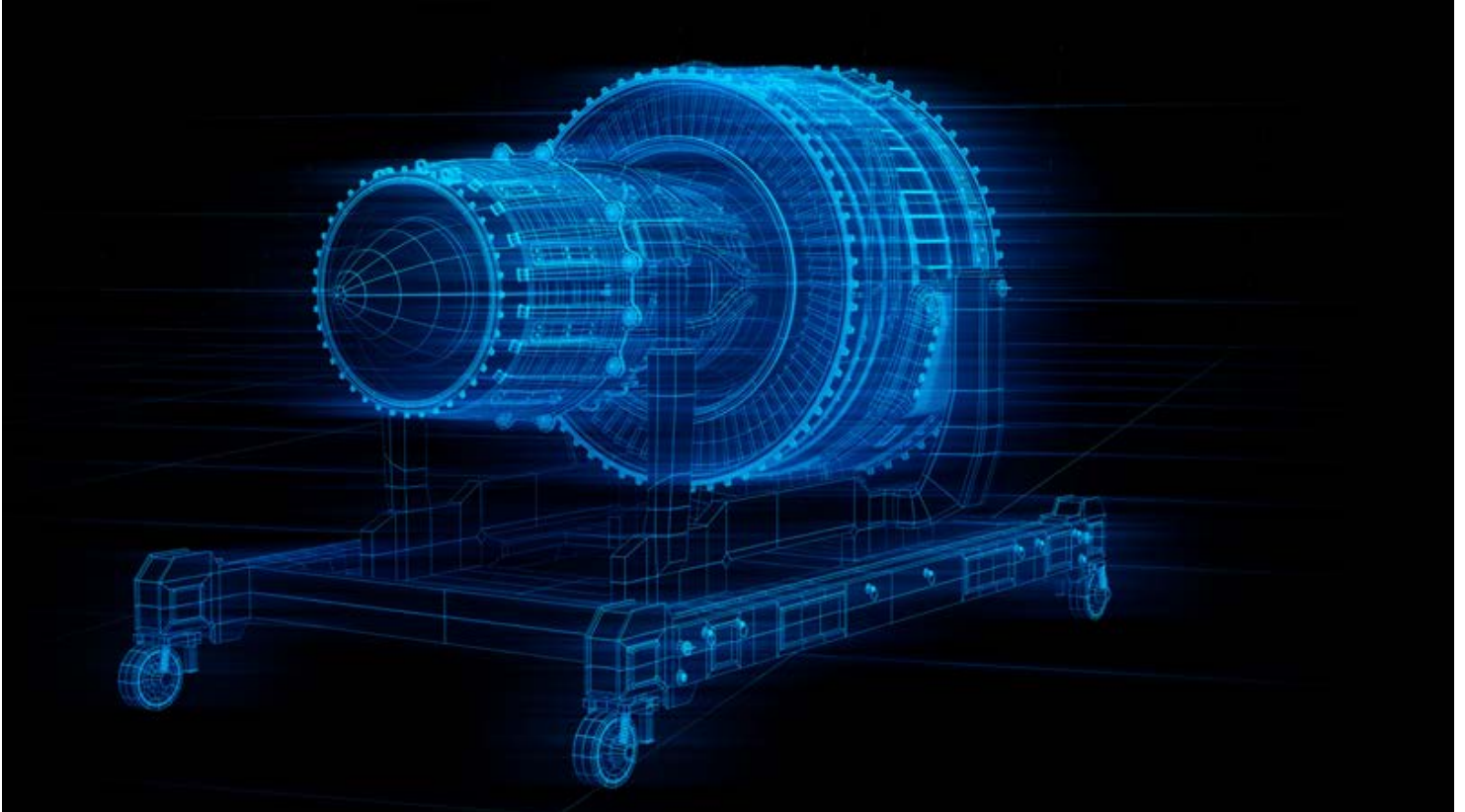
Bridging the physical and virtual worlds using 5G-enabled sensors, Internet of Things (IoT) and data will lead to powerful connections to deliver smart cities and smart industry solutions.

“The maturing and evolution of digital twins over the 60 years is mainly down to the speed of the process,” says Rob Le Busque, Regional Vice President, Asia Pacific at Verizon. “Digital twins started as static solutions that weren’t designed for efficiency. The model was built, then data was applied, then the analysis was undertaken manually.

“Fast forward to the 21st Century, and 5G, Mobile Edge Computing (MEC) and ubiquitous IoT sensors will enable the instant classification and sorting of real-time data – which in turn enables interactive digital twins that turn this data into powerful decision-making tools.”



Why use digital twins?



The use cases for digital twins are many and varied, across both the public and private sectors. Digital twin technology is helping a number of industries reduce operational costs, increase productivity, improve performance and innovate new ways to operate.

One of the main uses of digital twins is running 'what if' scenarios: to model what would happen, for example, if you run a production machine for a few more hours per day, or rearrange the layout of a factory floor. This can enable companies to accurately predict the impact of changes more quickly and cost effectively than running physical tests.

Digital twins enabled by 5G leverage a powerful combination of AI, data and digitalisation, creating seamless information for real-time decision making. Public sector agencies, for example, can take advantage of real-time 5G modelling with

digital twins beyond static infrastructure models. The overlay of new data will allow them to access greater potential from cities, citizens, and critical infrastructure.

"Interconnecting digital twins may sound like science fiction, but they're already being leveraged in commercial solutions for increased insights, greater efficiencies and cost savings," continues Le Busque. "We really are diving into virtual realms of possibility when we consider the applications of digital twins."

Applications of digital twins

Digital twins have been used in the manufacturing industry for some time to assess impacts and identify issues on production lines. They are also used to “stress test” manufactured products for reliability and performance.

5G-enabled manufacturing digital twins will be able to aggregate design, manufacturing, production planning, maintenance, repair and operations data to allow complete simulation of an actual production process and enable “on the fly” decision making – which in turn will generate more opportunities to reduce waste, speed up processes and limit energy use.

Governments are looking at digital twin technology for a long-term view of their cities. Interactive digital twins allow them to understand the impact of development decisions for years, or even decades, to come. Digital twins are also helping governments make better decisions on maintenance and where to invest in infrastructure.

For local councils, 5G modelling with digital twins allow the near-real-time analysis of event management and more accurate forecasting by modelling traffic congestion and

population service needs. 5G-enabled digital twins can collect near real-time feeds from devices, sensors, citizens and infrastructure to provide this information instantly and accurately.

Retailers can now apply sensors to all aspects of their value chain, allowing for the monitoring of people and footfall in stores and among individual product lines, for insights into what people are purchasing. Accrued data enables near real-time decisions about discounting the price or increasing the stock of certain items.

The building and construction industry uses digital twins to support its safety-first objective and overcome issues stemming from changes or delays due to supply chain issues. Smart construction companies are using digital twins coupled with multiple on-site sensors and drones to assess development progress and the impact of potential changes.

Digital twin technology provides situational awareness for first responders, giving near real-time feeds from sensors that indicate weather conditions during natural disasters or civil unrest issues in law enforcement situations. Connecting first responders to existing digital twins can provide immediate situational awareness in a crisis. For example, a university with a campus model of crowd flows and facilities usage could provide the data required to respond to any incidents on campus.



Digital twins for complex problem-solving

Governments globally are under pressure to address complex challenges such as climate change, city and urban developments, impacts of the global pandemic and escalating cybercrime – and many are turning to digital solutions. The Australian government, for example, has committed \$140 billion in funding to support the digitisation of infrastructure projects².

Digital twins offer the ability to collaborate and share information across different parties, from regulatory agencies to asset managers. They can also help governments better understand the costs of maintaining and updating critical infrastructure by using sensors to collect data in real time, then analyse these datasets without the need for inefficient manual measurement and human intervention.

Ultimately complex issues, such as smart cities and sustainable mobility, require these integrated and data driven approaches to enable long-term outcomes.



\$140B

**committed to support
infrastructure digitisation**

² <https://www.forbes.com/sites/sap/2021/10/18/the-digitalisation-behind-australias-140b-critical-infrastructure-spend/?sh=61893c0c84da>

Digital twins for enhanced security

Digital twin technology is being used to improve security – by better modelling the impact of cyber security attacks, mitigating risks to physical infrastructure and assets and supporting defence decision making.

With cyber security threats on the rise, there needs to be new ways to mitigate the risk to physical infrastructure. Ultimately, a cross-border, multi-stakeholder and cross-domain approach is critical to tackle future cyber threats to cities, governments and citizens.

“Cyber hubs – like those introduced by the Australian federal government in preparation for the centralisation of its networks – aim to understand cyber threat impacts by digitising critical infrastructure and constructing models around it,” says Le Busque.

“The government has been piloting cyber hubs to inform a future whole-of-government operating model – and now, by leveraging digital twins, these models can help further strengthen network defences with greater insights and a more informed and enhanced decision-making process around cyber-attacks.”

While digital twin technology is a security enabler, the increased number of connected devices in turn increases the attack surface vector – meaning security at the point of design is key.

“Naturally, by providing access to information that hasn’t been connected before, we’re widening the attack surface,” says Le Busque. “Security and resilience – in the form of systems that help mitigate risk by monitoring the entire network for malicious activity – are paramount considerations for connected digital twins.”

Verizon’s expertise in securing and ensuring resilient networks for enterprise and governments supports secure digital twin development.



Digital twins for supercharged decision making

Meshing 5G, IoT and data to create blended worlds is supercharging decision making for industry and government. There are growing use cases and resulting benefits of inter-connected digital twins, enabled by secure 5G networks.

Real-time 5G modelling with digital twins and the linking of digital and physical worlds – both public and private – has the potential to provide leaders with seamless information for real-time decision making across natural disaster management, critical infrastructure and cybercrime impact modelling.

As the gap between physical and digital worlds closes, 5G is generating more and more opportunities for improved security, operational performance and enhanced decision making.

Digital twins and 5G-enabled innovation will continue to help transform business operations globally.



How 5G enables a more connected world

Unlocking the extremely high-bandwidth and low-latency connectivity of 5G is enabling more people, devices, sensors and data than ever to be connected.

“Previous network generations, like 4G, sometimes have difficulty handling many devices in the same location,” continues Le Busque. “5G solves this issue by intelligently transmitting to each device, with high precision – which enables it to handle as many as 1 million devices per square kilometre.”

5G will enable the spatial interplay of digital models with their real-world locations, so the physical world can be re-enacted digitally in almost real-time. IoT sensor devices will gradually become embedded within digital twin ecosystems.

“With the number of connected devices increasing at about 25% per year¹, 5G enablement will be critical – particularly for densely populated areas such as metropolitan cities,” says Le Busque.

25%

**increase in
number of
connected
devices per year**

¹ <https://www.ericsson.com/en/reports-and-papers/mobility-report/dataforecasts>

Public vs private 5G networks

Businesses are weighing up public and private 5G solutions – but the reality is that a combination of both will be required for certain digital twins to work effectively.

Private 5G will provide immediate results for enterprise and government applications where security and operational performance of networks are critical, with greater operational flexibility and easier-to-manage throughput and latency. The security requirements for many applications of digital twins means they will likely rely primarily on private 5G solutions.

However, while the current coverage of public 5G is limited largely to metro areas, communication between digital twins and the wider community will ultimately rely on public 5G networks.

A good example is Verizon's work with Associated British Ports in the UK, where a private 5G solution is being implemented to control the stevedore, supply chain and logistics while in port. But when ships, trucks and containers move from the private 5G location in port, they will rely on public 5G networks for essential connectivity and data needs.

Similarly, in the US, Verizon works with first responders to deploy 5G mobile towers and create a perimeter for a small private 5G environment, but still relies on the public 5G network to communicate externally about the status of the incident.

Organisations could be considering how the power of 5G, IoT and real-time data for smart, fast, accurate and long-ranging predictions can help them now, without waiting for a public 5G rollout.

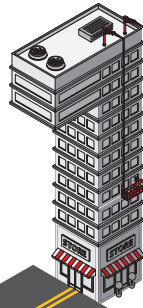
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5 truths on your journey to private 5G

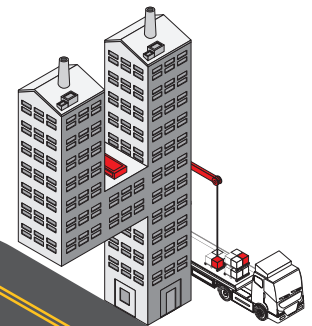
It's not just about speed

Private 5G is inherently secure and its connectivity can also enable you to monitor, analyse and improve on every aspect of your business operations.



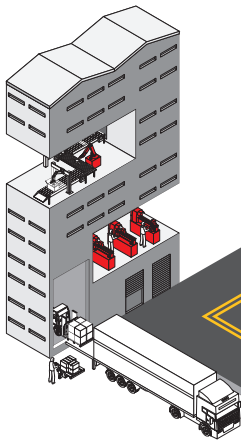
It's not the same as public 5G

With private 5G, every business has its own dedicated spectrum - which reduces interference and assures greater privacy and security for your operations.



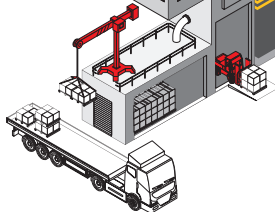
It's not the same as Wi-Fi 6

Its mobile signal covers the whole of your premises evenly, indoors and outdoors.



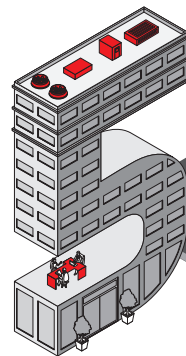
It's not only for innovations

While private 5G can enable revolutionary changes, it can also just be used to improve the connectivity of your existing business operations.



It doesn't have to replace your existing infrastructure

There's no need to rip and replace everything, you can add 5G-ready devices to existing infrastructure.



The ultimate truth about private 5G

Private 5G is a reliable and responsive network that can help your enterprise keep pace with the evolving challenges of today's business, making your operations more competitive, efficient and profitable. To find out more about how private 5G can make your business more agile, visit <https://www.verizon.com/business/en-au/solutions/5g/>



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