IoT Now: ISSN 2397-2793

Q3 2021 • VOLUME 11 • ISSUE 3

IoT NOW

HOW TO RUN AN IoT ENABLED BUSINESS

TALKING HEADS

Wind River's Kevin Dallas says the future is already here as intelligent machines thrive on 5G, cloud, AI and security

THE IoT NOW CEO GUIDE TO INTELLIGENT MACHINES 2021

PLUS: 7-PAGE Beecham Research analyst report on intelligent edge evolution • Carlsberg extends digital manufacturing across 28 breweries • Aramco improves worker safety with real-time video streaming analytics from FogHorn • Berg Insight reports that global cellular IoT connections reached 1.7bn in 2020 • Illumio research reveals 98% of organisations plan to implement a zero trust architecture • Wind River on intelligent systems at the edge and the second wave of digital transformation • News online at www.iot-now.com

THE IoT NOW CEO GUIDE TO INTELLIGENT MACHINES 2021

IN THIS ISSUE

MANAGING EDITOR
George Malim
Tel: +44 (0) 1225 319566
g.malim@wkm-global.com

EDITORIAL DIRECTOR & PUBLISHER
Jeremy Cowan
Tel: +44 (0) 1420 588638
j.cowan@wkm-global.com

DIGITAL SERVICES DIRECTOR
Nathalie Millar
Tel: +44 (0) 1732 808690
n.millar@wkm-global.com

SALES CONSULTANT
Cherisse Jameson
Tel: +44 (0) 1732 807410
c.jameson@wkm-global.com

DESIGN
Jason Appleby
Ark Design Consultancy Ltd
Tel: +44 (0) 1787 881623

PUBLISHED BY
WeKnow Media Ltd. Suite 138,
80 Churchill Square, Kings Hill,
West Malling, Kent ME19 4YU, UK
Tel: +44 (0) 1732 807410

DISTRIBUTION
UK Postings Ltd
Tel: +44 (0) 8456 444137

Printed in the UK by
The Magazine Printing Company
using only paper from FSC/PEFC suppliers
www.magprint.co.uk

IoT Now magazine covers worldwide developments in the Internet of Things (IoT), machine-to-machine (M2M) communications, connected consumer devices, smart buildings and services. To receive ALL 4 ISSUES per year of the printed magazine you need to subscribe. The price includes delivery to your chosen address worldwide. **BUY A 1-YEAR, 2-YEAR, or 3-YEAR SUBSCRIPTION**: **1 Year Normal price UK£60.00 NOW UK£51.00 for 4 issues** OR **2 Years NOW £102 (8 issues, save £18.00) SUBSCRIBE ONLINE**: **www.iot-now.com**

The future is already here as intelligent machines harness 5G connectivity, far edge cloud, artificial intelligence and cyber security

As low latency connectivity comes together with more accessible compute, data processing, and artificial intelligence at the edge, the next generation of intelligent machines are already here. Enabled by natural and cognitive user interfaces, cyber security, and safety awareness , these machines are poised to transform every economy and every society on the planet. For **Kevin Dallas, the president and chief executive officer of Wind River**, this confluence of technology is providing a springboard for the second wave of digital transformation in OT (operational technology outside the enterprise walls), that makes use of the investments already made in the first wave in IT (information technology within the enterprise walls).

He tells George Malim, the managing editor of IoT Now, that this means jobs in mission-critical, regulated industry sectors will be implemented increasingly by humans augmented by intelligent machines. Machines used for drones, robots, autonomous vehicles, smart factories, safe mining will revolutionise every industry. The only limit, he says, is our imagination and the need to ensure technologies and software are correctly certified to protect and secure customers and end users

Real-time compute, low latency connectivity, high availability, security and safety are paramount and not optional

George Malim: How are you seeing the concept of intelligence mature as more is done at the edge and we see increasing numbers of connected, embedded machines supported by software, analytics and intelligence itself?

Kevin Dallas: There's a temptation for the tech industry to talk about technology and how computing is moving to the edge, but the question to consider is what are the new devices, applications and use cases that rely on this new intelligent machine capability. It's use cases like smart factories, drones and robots that require this new generation of machines, where real time compute, low latency connectivity, high availability, security and safety are paramount and not optional.

Why is this? It's because many of these applications are customer facing in terms of the use case they satisfy. As you think through how compute is being done inside these new systems, there's the notion of sensing the environment around them, inference from the data, learning at the fleet level, and action taken by the machine. These four stages make up the artificial intelligence pipeline for these intelligent machines (AI). As a result, scenarios impossible only five years ago are achievable today. ▶

Now, in 2021, due to exponential advances in technology we're at the point where compute, data processing, and AI/ML can all be done at the edge

Now, in 2021, due to exponential advances in technology we're at the point where compute, data processing, and AI/ML can all be done at the edge. It's amazing that we are experiencing what is arguably the biggest technology innovation of our lifetime, the introduction of intelligent machines. It's a really exciting time.

GM: The world of intelligent systems is seen as a driver for economies across the globe and enabler of cloud-based businesses. Which sectors do you see maximising the benefits of new, intelligent capabilities?

KD: Every industry is embracing this new intelligent systems approach and we find that many companies are focusing on digital transformation. This transformation began in IT as organisations digitised and optimised their internal IT processes and business applications. Significant investments have been made and many enterprises have embraced cloud and are using advanced data processing.

Now, cloud computing and AI are being infused across business applications. Corporations are now starting to see a return on that investment on the productivity of their workforce IT side. What has changed is we're now seeing a shift from IT transformation, to organisations now making the same digital transformation of their OT outside the business's walls.

What's compelling is these companies are not starting from zero. They're using a proven set of cloud native capabilities and investments at the edge. This means that enterprises are able to deliver their products as-a-service, with value added software-defined services enabled by a digital feedback loop from their products to the corporation. If you look at ***Tesla*** and the way it delivers an electric vehicle; the customer may be the owner of that vehicle, but Tesla stays connected to it.

The owner gets up in the morning and finds a new capability has been downloaded to the vehicle, new services are delivered, and the health of the vehicle is monitored by Tesla. There's clearly a huge impact in automotive, but we're also seeing it across all the industries that **Wind River** serves.

Take aerospace and defence for example, if you look at planes, we're seeing the same types of capabilities in terms of ability to monitor and to update over the air and this also extends into scenarios like smart factories. These now have the notion of using edge intelligence in actual robots on the factory floor, with low latencies enabled by 5G. We're also seeing medical applications and connected MRI machines using AI and data in order to deliver much better experiences.

GM: Intelligent machines are set to stimulate 70% of GDP growth in the global economy between now and 2030 according to PwC. What needs to happen for this prediction to become reality and what will make the new industrial age enabled by the machine economy a reality? ▶

In many companies across aerospace, defence and other sectors, their lifeblood is to use systems that are certified to deliver a specific level of security and safety for the consumer

Kevin Dallas
Wind River

Intelligent machines are going to have a significant impact on society and the economy and it is estimated this is going to have an impact of up to 70% on GDP by 2030

KD: It's important to recognise that these mission-critical intelligent machines need to have several abilities, including near real-time performance and high availability and by that I mean five or six nines uptime. That means seconds and minutes of down time a year – these systems can't be down for days or weeks, but this isn't easy because many enterprise systems operate at three or four nines availability today. Five or six nines uptime is a requirement for mission-critical use cases, as are safety and security.

In many companies across aerospace, defence and other sectors, their lifeblood is to use systems that are certified to deliver a specific level of security and safety for the consumer. It's therefore becoming more important to make sure that mission-critical systems are getting certified. In fact, according to our recent intelligent systems research, over half the industries we serve see it increasing in importance by 50% over the next year. However, in the past, it has taken years for certification to happen at the subsystem level. If you want to make a change in the software in a commercial plane and provision the update over-the-air, the software has to first be certified, and the process can take years. .

As an industry we have to move to a model of continuous certification to remove this bottleneck. We must take certification time down from years to months for these mission-critical intelligent systems and do that in a way that does not compromise the safety and security of the end user.

GM: What does the term machine economy mean to Wind River?

KD: Intelligent machines are going to have a significant impact on society and the economy and it is estimated this is going to have an impact of up to 70% on GDP by 2030, which is an incredible number. Now, what do we mean by intelligent machines? They are machines that have the ability to sense infer, learn, and act. They have the ability to adapt in terms of the experience they deliver to the user.

In the past, we've had embedded devices which have performed a specific function. With intelligent machines you add the ability to adapt to learn and adjust the functionality that is provided to the user – of course, this is all within strict design guidelines.

We expect these intelligent machines to have broader and broader usage across every industry and to have a much larger role. We see them working alongside, augmenting humans. I don't think they will necessarily replace humans, but they can drive more efficiency around tasks that humans have traditionally completed. A lot of dangerous jobs such as those in mining for example, could be changed with robots or drones taking on the high-risk tasks and humans being able to manage that through augmented/virtual reality interface.

I think we are going to move more and more to a world where humans are going to interact with the real world in mixed reality. Tasks are going to be done in combination with humans and machines working in tandem. It's an exciting world and we think this will be what makes up the machine economy where machines work in concert with humans to make tasks easier, work more efficient and customer experiences better.

GM: Is 2021 the year in which everything comes together to enable intelligent systems to demonstrate their full potential?

KD: The mobile phone was the first version of an intelligent system that operates through a cloud and this was the first time that not having a connection meant a device was almost useless. ▶

We're now moving to a world where, even if that cloud connection gets severed, the device itself will continue to have intelligence. With mobile phones we had high speed connectivity and all of a sudden this changed exponentially, and users would leave home without their wallets rather than their phones.

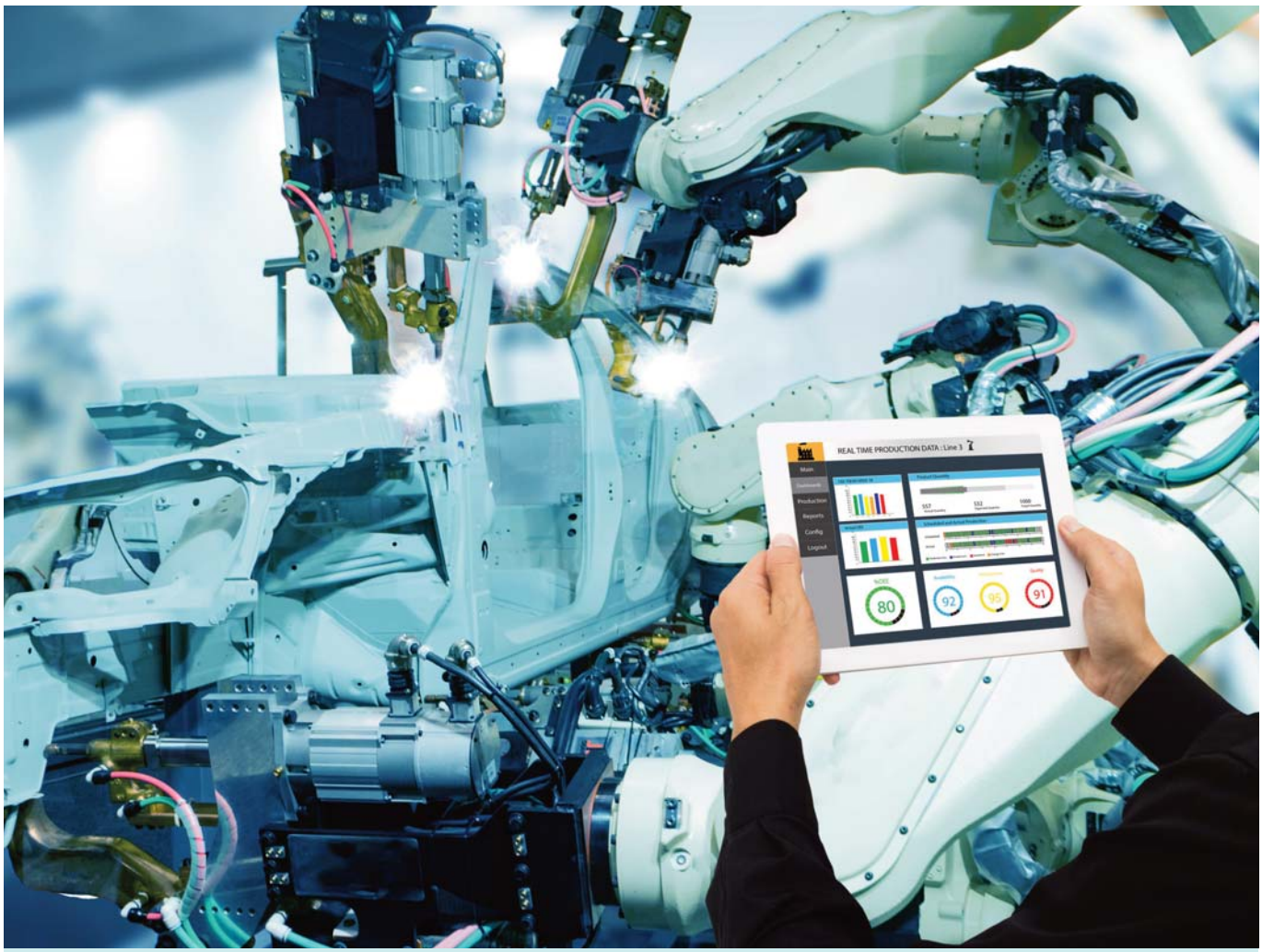
This type of change is what's going to happen. There's going to be this expectation that machines are intelligence and people will be surprised if a digital sign, for example, shows no intelligence as they walk up to it. These new scenarios will become a reality far, far more quickly than our generation believes.

The movement of technology is way ahead of where any of us expected it to be even ten years ago. Technology is advancing faster and faster to the extent that now you can have a datacentre in your far edge device. The advances that have been made in semiconductors mean that pretty much every device can have high level compute capabilities sitting in it and this means that the scenarios are now down to our imaginations.

Now we have to come up with ways in which to programme these devices, using machine learning and AI to have a high level of automated learning that can be used. You can actually programme these devices so you can use all this compute, analyse data, write algorithms with no code and no code interface. This is going to happen and the sky is the limit in terms of the scenarios we can enable and how quickly they're going to happen.

These are extremely exciting times and Wind River sees this as such a unique opportunity in which we are playing a key role with our new Wind River Studio intelligent systems platform that enables this new, digital, AI-first reality. ■

www.windriver.com



Intelligent systems at the edge and the second wave of digital transformation

Digital transformation has been a steady process in IT since 2013. The growth of intelligent systems at the edge is ushering in the second wave of digital transformation, the digitisation of operational technology (OT). The idea that customer products will increasingly need to be software defined and intelligent to be useful, is the catalyst to a new digital and AI-first world, writes **Kevin Dallas, the president and chief executive officer of Wind River**

These systems are a pathway to build digital scale and competitiveness for organisations where embedded machines, software and intelligence work together in near real-time to do tasks, pass information or deliver services through the cloud. And these systems are found at the intelligent edge where data is being collected, analysed or sensed – rather than at a centralised server. We could call this the Tesla-fication of industry.

Think of thousands of Tesla-like companies and their virtuous cycles between customers, the product and the company working together, ▶

SPONSORED ARTICLE

learning, computing, sensing, predicting in near latency-free time for the lifecycle of the products and service. Now think of 45 billion devices and applications connecting, computing, sensing, predicting, automating in the same way, so that products and services on the intelligent edge are delivering highly customised, near latency-free experiences to customers and other devices all through constant digital feedback loops through the lifecycle; adjusting, reacting, connected and constantly learning. You cannot get this to happen without a new production process and a new vision for accretive value for companies. At the heart is the device, but the ability to connect the ecosystem of needs is going to be where deep value is created.

Eight in ten leaders want intelligent systems success

Wind River recently interviewed more than 500 executives and leaders about their vision, processes, and investment models for their own intelligent systems futures. The idea of embedded devices, machines and applications computing, sensing, predicting and connecting on the far edge of the cloud may sound abstract, even niche. But to these leaders it wasn't niche or abstract. Eight in ten of them were aggressively pursuing strategies to develop intelligent systems into a core competency for themselves in the next five years. These executives lead very large companies in automotive, industrial and manufacturing, energy and utilities, medical technology, aerospace and defence, telecommunications and technology hardware. They represent more than 46% of GDP in the US, and one thing they have in common is their near-total belief in the power of intelligent systems.

It is easy to say these executives are leaders with incredible vision; and it is true that 26% of them (across sixteen dimensions) did see themselves as being visionaries ahead of their peers. Yet a full eight in ten of these executives are clearly set on developing an intelligent systems–led company. That means nearly three in four of them are pragmatically recognising the inevitability of this idea for themselves and their industry peers, since not just visionaries, but also those pragmatists who see where the world is going, are accelerating their build-out for that intelligent systems world.

The bottom line is that the time to build intelligent systems capabilities is now. Given that traditional product and service development can take three to five years, success is going to be partly defined by how companies' architect for that success now.

Enter the machine-led economy

This emerging intelligent systems world will give rise to a new machine economy. For those not familiar with the machine economy, it's where these smart, connected, autonomous, and economically independent machines or intelligent systems carry out the necessary activities of production, distribution and operations with little or no human intervention. The development of this economy is how Industry 4.0 becomes a reality.

In fact, 70% of GDP growth in the global economy between now and 2030 will be driven by machines, according to **PwC**. This is a near US$7 trillion dollar contribution to US GDP based around the combined production from artificial intelligence (AI), machine learning, robotics and embedded devices.

The creation of this new machine led economy will revolutionise how products and services will work in this new intelligent systems world for everybody, not just the few who used embedded technology before. Visionary leaders will implement new technologies and combine them with capital investments in ways that help them grow, expand, diversify, and actually improve lives. These machine economy leaders will operate in a new intelligent systems world among thousands of companies that will drive new economic models globally.

This is an exciting time for a lot of companies as they have to think of reinventing themselves in order to deliver unique value to their customers. This is a new opportunity to deliver significant economic growth and with our industry-leading Wind River Studio offering for intelligent systems, we are ready to play a key role in advancing this growth. ■

The bottom line is that the time to build intelligent systems capabilities is now

www.windriver.com

ANALYST REPORT

INTELLIGENT EDGE EVOLVES TOWARDS INTELLIGENT SYSTEMS

SPONSOR

WNDRVR

How intelligent edge is evolving towards intelligent systems

The intelligent edge and edge computing are the terms used to encapsulate the way data processing has moved from a central facility such as the cloud to a local facility that is close to the source of the data – the edge of an IoT network. Right now the functionality provided by this development is playing an important role across the business landscape, a mission-critical role in some sectors, write Beecham Research's Bob Emmerson and Robin Duke-Woolley

beecham research

Robin Duke-Woolley
Beecham Research

In the agriculture sector for example, on one hand financial success relies on accurate, timely data. Edge computing enables greenhouses to function as closed, intelligent edge ecosystems and edge artificial intelligence (AI) can provide farmers with real-time insights, allowing them to identify areas that need irrigation and fertilisation even when connectivity to the cloud is poor.

On the other hand, industrial automation systems rely on the deployment of smart devices at the edge for efficient, low-latency data collection. Like Industry 4.0, this broad-based sector is making smart machines smarter, factories more efficient, processes less wasteful, and production lines more flexible. ▶

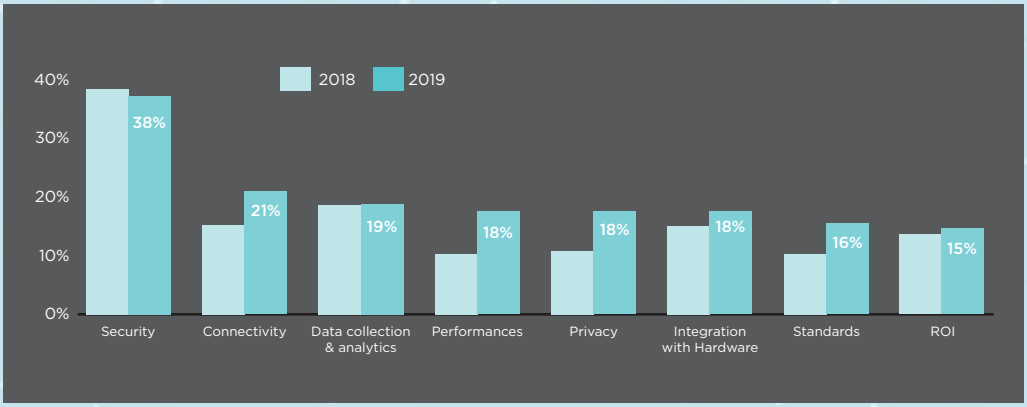


Figure 1. Top developer concerns over time: 2018 and 2019.
Source: The Eclipse Foundation.

Edge IoT is also being implemented in the energy and utilities sector to optimise energy and water generation supply and demand in real-time. Smart meters provide near real-time information on consumption, which enables more efficient, demand-based electricity generation and distribution.

These and many other application areas are pointers to the size and the importance of insightful, real-time information generated by the intelligent edge on an organisation's performance. The IoT market is predicted to encompass more than 75 billion IoT devices by 2025, reports **IDC**. And **Gartner** predicts that by 2022, 50% of enterprise-generated data will be created and processed outside a traditional data centre or cloud, up from less than 10% in 2019.

In this report, **Wind River** indicates how the role of the intelligent edge will evolve and grow, how devices will increasingly work together in various ways to add more value to and through the intelligent edge. Advanced technology such as AI and machine learning will need to work transparently and easily with these devices. And, because market needs evolve, devices must be adaptable over their lifecycle.

Cloud-native edge computing

IoT's functionality is evolving from monitoring applications remotely towards local control and automation across many ▶

The intelligence in edge computing comes from the deployment of AI technology at the edge

different sectors. This is realised by employing intelligent edge computing, which can perform data analysis tasks that were previously undertaken at a central facility such as the cloud. But today's IoT applications are based on a monolithic architecture. They are self-contained, proprietary developments and are difficult to scale.

Enterprise application development, however, has migrated to a cloud-native architecture that employs microservices, which are small, independently deployable, loosely coupled modules. They are building blocks that can be exchanged when larger scale deployments are required and when applications need to be modified in line with changes in the market and the organisation's requirements.

The edge's monolithic architecture can therefore be an issue for enterprise developers. Physical access and security are challenging, and edge devices are not standardised or interchangeable like servers in a data centre. As shown in **Figure 1**, the key concerns are security (38%), connectivity (21%) and data collection and analytics (19%).

In order to address these concerns and continue to evolve and scale easily, edge IoT applications can migrate to a cloud-native architecture that employs similar microservices to those of cloud-centric applications. This makes it much easier to enable orchestration between edge and cloud in a way that adapts to different application requirements.

Pervasive AI

The intelligence in edge computing comes from the deployment of AI technology at the edge. Small, power efficient and cost-effective AI chipsets can be embedded in IoT devices and edge hardware such as the routers and gateways. This enables them to function as an intelligent network of small, local data centres, which in turn allows massive amounts of data to be processed locally, close to the source, thereby boosting the amount of real-time or near real-time information on which operational and management decisions can be based.

In a study conducted by the **Boston Consulting Group** and the **MIT Sloan Management Review**, 75% of businesses said that AI will allow them to move into new ventures and 83% believe that AI is a strategic priority for their business. In addition, AI is seen by 64% of chief executives as a way to lower overall opex. Pervasive AI can therefore realise immediate economic benefits as well as providing long-term differentiated value for the enterprise.

Real-time intelligence

The estimated 75 billion-plus connected devices that will be in operation by 2025 according to **IDC** will be generating enormous quantities of data. This will result in an abundance of insightful, real-time information, most of which will come through the edge, that will radically transform the way businesses operate over the next few years.

The new opportunities that are enabled by AI, 5G and the intelligent edge require ▶

Intelligent system definitions may vary, but the functionality is clear

developers that have the requisite new skills, not only in application development but in all areas of code development, hardware interface, and relevance of data. **Wind River** lists ten top skills: machine learning & AI, designing for data, automation, IP networking, hardware interfacing, mobile development, UI/UX design, information security, business intelligence and teamwork. The company also highlights the fact that millennials and Generation Z will comprise almost 75% of the total workforce by 2025. And when it comes to coding, these users prefer newer languages such as Rust (83.5%) and Python (73.1%) according to research from **The World Economic Forum**. This is coding that will be created in a cloud-native edge architecture

Towards intelligent systems

Intelligent system definitions may vary, but the functionality is clear. An intelligent system is a machine with an embedded, computing facility that has the capacity to gather and analyse data and communicate with other systems. Other criteria for intelligent systems include the capacity to learn from experience, security, connectivity, the ability to adapt according to current data and the capacity for remote monitoring and management.

The intelligent edge focuses on intelligent devices. Intelligent systems involve interconnected collections of these devices as well as networks and other types of larger systems. Wind River sees these as representing the next wave of the digital machine economy, a wave that is set to develop over the next five years.

The ideas and practices behind intelligent systems are at the same stage digital transformation was in by 2015. But the growth of intelligent systems at the edge is likely to be faster and deeper, because as enterprises become increasingly software driven, intelligent systems will become the expected norm.

Products will increasingly need to be intelligent to be useful, not just intelligent as a value-added experience. Functionality will typically include adaptability, self-optimisation based upon a goal or goals, the ability for performing self-diagnostics and self-maintenance, and the ability to learn and reason.

An intelligent systems future

Research by Wind River finds that an intelligent systems approach is on track to becoming a predominant business model. 5G, AI, automation and cloud native technologies as well as an increasing intersection of IoT and the edge will open up new possibilities for applications at the far edge, such as robotics, drones, telemedicine and autonomous vehicles. Realising this promise requires a new approach to building systems that can compute, sense, learn and adjust in near latency free time on the edge.

Wind River is a global leader in delivering the software for intelligent systems and the company has created the first cloud-native ▶

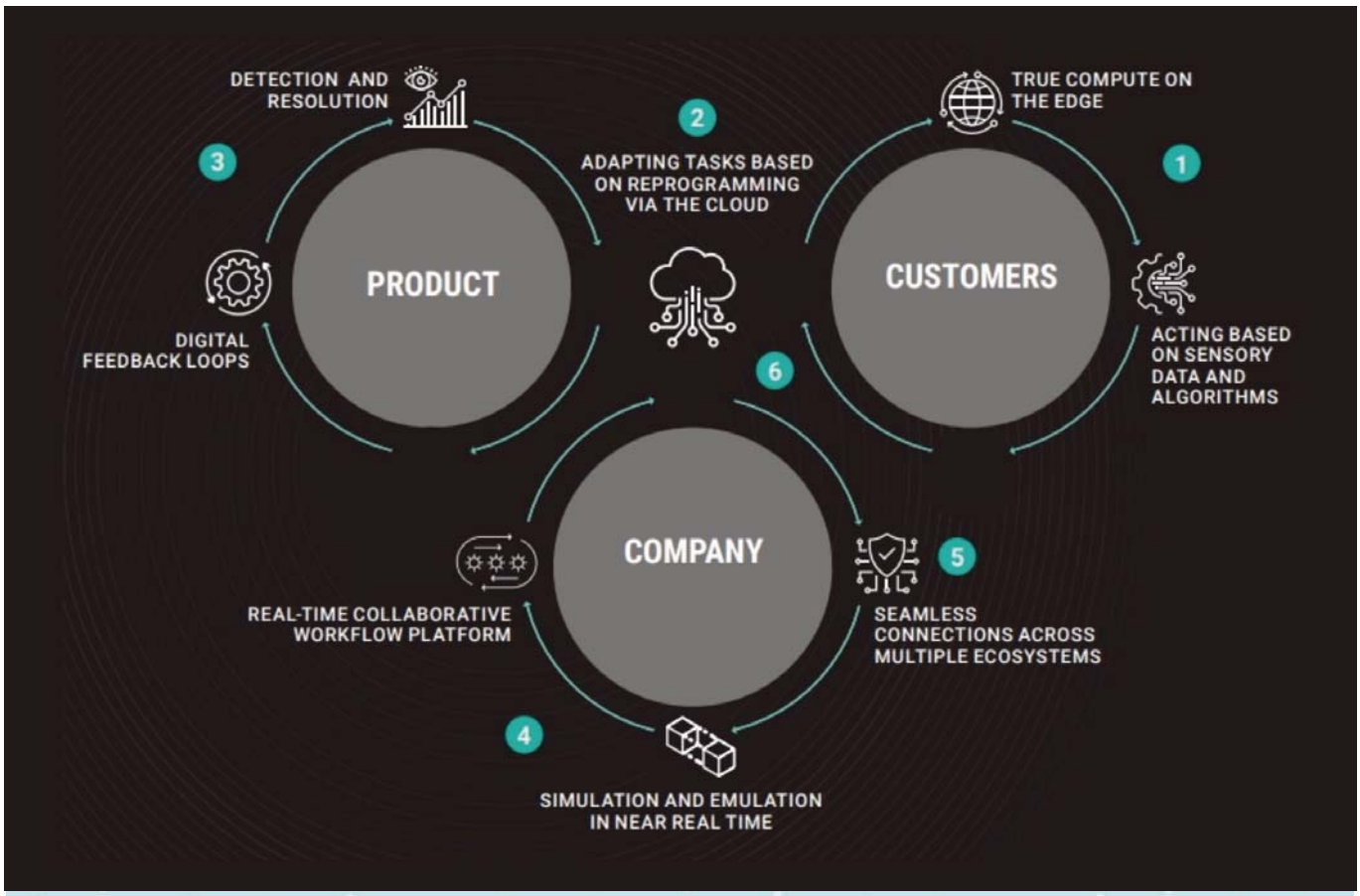


Figure 2. Five key stages in a hypothetical intelligent system deployment.
Source: Wind River

platform for the full lifecycle of intelligent systems. Its research report, which surveyed technology executives across mission-critical industries, found that 62% are implementing strategies to move to an intelligent systems future, and 16% are already committed and investing. In addition, those who are succeeding have prioritised the need to overcome key challenges such as skill shortages and ongoing cyber threats.

Key issues

The shift in workforce from boomer to millennials and Generation Z creates an opportunity to realign the future of the intelligent edge around the newer skills and thinking that they employ. However, Wind River has identified six issues that need to be addressed when taking the intelligent edge to the next level.

1. **Take a system-centric view, forget silos**. Organisations will struggle with merging operational and enterprise resources if they use legacy models to create next-generation paradigms.
2. **Lifecycle thinking is key**. Products cannot follow the build-once-and-ship-forever model. Products will need to be modified to take in new data, mainly through the edge, and offer changing assets and experiences throughout their lifecycles.
3. **Designs must scale**. The need to go system-centric means thinking about scaling during the design process and rethinking what this entails. In a world of 75 billion (and growing) connected devices by 2025, architecture must be designed to handle near-infinite scale from the outset.
4. **Understanding specific functionality is critical**. Entire system upgrades cannot happen all at once. The capacity to perform hitless updates of live systems at scale must coexist with the ability to update applications at the microservice levels.
5. **The speed, accuracy, and value of data matters in real-time decisions**. The ▶

New simulations show a better way to program robotics at a key step in the production process to increase quality and throughput

ability to extract, manage, and infuse AI components is crucial. Chief executives in sectors such as industrial manufacturing already understand it as truly differentiating: According to Wind River research, 28% already use infused AI in data collection and ongoing management.

6. **The nature of security is changing**. Security has always been a priority, but historically that was the security of the platform. Now that every device can interact with every other device, the need for security is amplified greatly. Building in intelligence and adaptability is key.

A hypothetical intelligent system

Figure 2 visualises the development process for a customised, time-sensitive production that begins with precision robotics in a remote factory (1 in the schematic). Production challenges are detected (2), with robotics affecting the quality of a precision – low run – production line. These issues are fed back to the team (3).

New simulations show a better way to program robotics at a key step in the production process to increase quality and throughput (4). Knowledge is shared on the workflow platform across geographies and new applications are recommended for increased performance (5). Tasks are adapted through the cloud (6). The objective is to make the production processes more effective and efficient and to bring it in at target cost. Total quality management (TQM) targets are then achieved and profit improved.

Summary

The relatively recent increase in the data processing and analysis capability at the edge of device deployments has resulted in an intelligent edge that provides insightful, real-time intelligence on the performance of an organisation's operations. The resulting business benefits are significant, as evidenced by the deployment of IoT solutions right across the business landscape. This development has enabled solutions to evolve from monitoring applications remotely towards local control and automation across that landscape.

IoT data is also processed and analysed in the cloud, together with data provided by mainstream business applications such as customer relationship management (CRM) and enterprise resource planning (ERP). Enterprises are using this facility to blend real-time information from their operational environment with up-to-date information from the enterprise environment. IoT real-time information is therefore playing a key role in the overall management and decision-making processes of many companies.

This development is enabling IoT solutions to shift the focus from intelligent devices deployed at the edge to intelligent systems that operate within mainstream environments. These systems will compute, sense, learn and adjust in ultra-low latency time. Wind River sees them as tangible representatives of the next wave of the digital machine economy, a wave that is set to develop over the next five years. ■

Wind River has revealed the digital DNA for intelligent systems success.

Find out which characteristics will matter for your company in the next three years and how **Wind River Studio** accelerates development velocity, modernizes processes, and transforms businesses.

SEE THE BLUEPRINT FOR YOUR INDUSTRY:
WINDRIVER.COM/INTELLIGENT-SYSTEMS

WNDRVR

WHEN IT MATTERS IT RUNS ON WIND RIVER STUDIO