Designing the Trustworthy Cobots and Robotics Systems of the Future

Using Secure, Cloud-Based Technologies

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Executive Summary

Robotics systems currently fuel more production in the U.S. than ever before. And while many assume they operate only in factory or industrial settings, there are numerous ways they're being used today, across a wide variety of industries. Incredible uses cases and capabilities flow from the robotics systems being built for tomorrow.

Robotics is moving from an opportunity in business and facility operations to a necessity in many industries. The rising demand for cobots and industrial robots is putting immense pressure on the industry to increase productivity. It also puts pressure on facility CEOs and operators, as organizations plan for multi-vendor robots, intelligent traffic flows, storage, and more.

Innovative Plans Are Increasing Demand for Trustworthy Robotics Systems and Cobots

With new use cases and business models comes critical need for a unified approach to trustworthy cobot design. However, the robotics industry is currently facing productivity challenges; projected demands call for a tenfold increase in production.

The industrial robotics market is projected to grow from 15.7 billion USD in 2022 to 30.8 billion USD by 2027 — a CAGR of 14.3%.[1] And the demand for cobots, or collaborative robots, has been on the rise in recent years. According to a recent study, the global market for cobots is expected to reach 11.8 billion by 2027, growing at a CAGR of 44.3% during the forecast period from 2020 to 2027.[2]

With the growing demand for trustworthy and collaborative robotics systems, the robotics industry stands to face significant productivity challenges and setbacks unless more modern technologies are utilized in development and deployment.

WHERE ROBOTICS ARE USED TODAY:

- Military and defense operations
- Healthcare and hospital operations
- Medical surgeries
- Farming
- Construction
- Manufacturing
- Facility operations
- Task management and distribution
- Automobiles and transportation
- Food preparation
- Smart home devices

Modern Intelligent Systems
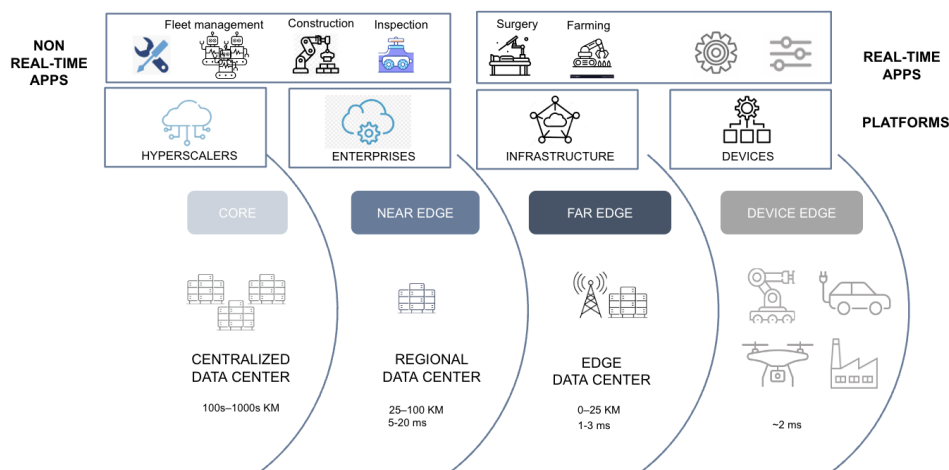
1. Industrial Robotics Market by Type, Component, Payload, Application, Industry, and Region, 2022
2. Collaborative Robot Market: Global Industry Trends, Share, Size, Growth, Opportunity and Forecast 2022–2027, IMARC Group, 2022

Meeting the Demand for Trustworthy Cobots

While there are hurdles to address, such as resource shortages and growing technology debt, three primary challenges fuel the more immediate concerns ahead:

1. Growing hardware and software complexities
2. Time-to-market and total costs of development
3. Interoperability

Growing Hardware and Software Complexities

One major hurdle in the development of trustworthy cobots is the increasing complexity of software and hardware.

For example, by analyzing the move from industrial robots to AGVs (automated guided vehicles) to AMRs (autonomous mobile robots) to cobots, we can see a clear increase in the complexity of software and hardware required.

And we know that using hardware-based approaches alone will dramatically hinder the speed of development. Overcoming the challenges and meeting the demand for trustworthy cobots will require organizations to take advantage of current technologies such as simulations and/or digital twins to stay competitive in today's market.

Time-to-Market and Related Costs

Another key challenge in meeting projected demand for trustworthy cobots is the long time-to-market and the pressures of total cost of development, making it increasingly clear that traditional development and deployment processes need to be reevaluated.

Furthermore, as the capabilities of cobots continue to expand, so too does the need for high-performance computing resources such as GPUs and multi-core CPUs. These elements add hardware and software complexities to the bottom line, as well as cost and increased testing requirements.

> "All embedded devices are now connected, autonomous, and intelligent. You can no longer consider them separate devices. They are all connected to the edge and to the cloud. And based on the predictions, 80% of the computation will happen at the edge."
>
> — **Andrei Kholodnyi,**
> *Principal Technologist, Wind River*

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Interoperability

Another challenge in the deployment of robotics systems and trustworthy cobots is interoperability.

The rapid rate at which robotics engineering is advancing with new technologies and techniques can create confusion and indecision among designers and engineers trying to determine the best solution for their specific application.

Ensuring that cobots can operate well together in large-facility deployments is crucial, especially in multi-vendor installations with shared resources, such as computation and physical space. This challenge includes addressing security concerns seen with vision technology, listening technology, and input/output (I/O) operations — all with limited access to the facility and/or hardware.

To address these challenges, the unified approach of cloud robotics is needed, with the cloud development paradigm applied to the embedded systems.
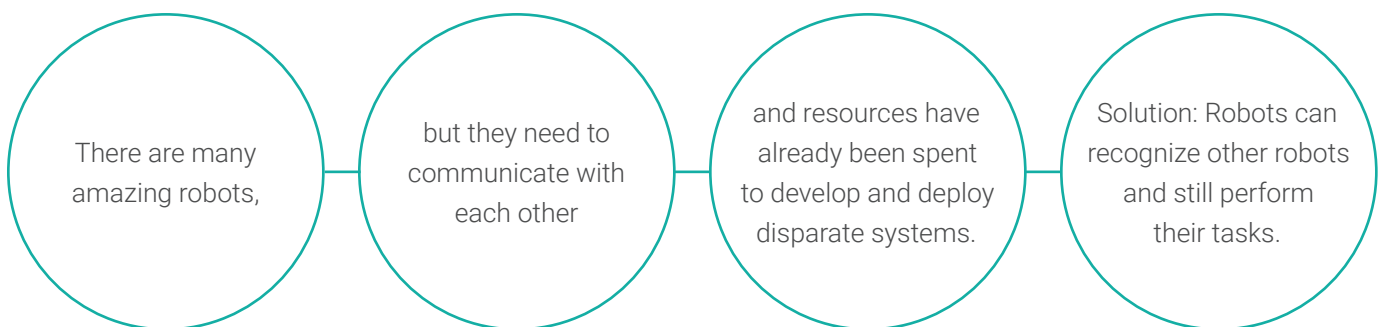
> "The question is not, 'Will a large facility deploy robots?'
>
> The question is, 'Which ones will they choose and how many can they put in?'"
>
> — **Brian Gerkey,**
> *CEO and Cofounder,*
> *Open Robotics*

The Interoperability Dilemma

There are many amazing robots,

but they need to communicate with each other

and resources have already been spent to develop and deploy disparate systems.

Solution: Robots can recognize other robots and still perform their tasks.

A Unified Approach to Cloud Robotics

A unified approach to cloud robotics is essential to address the challenges facing the industry. The unified cloud approach with edge compute allows for more software functions, real-time data processing, predictive maintenance, algorithm improvement, and the development of real-time apps on the device edge. Real-time apps can be developed once and then deployed and operated on devices at scale across multiple locations.

Additionally, a secure cloud is crucial for managing large-facility deployments and making nonlocal decisions about how an entire team of robots will interact in a space that is bigger than just the area in which one is moving around.

In this unified approach with secure cloud-based robotics, many key challenges are mediated with device, edge, and cloud continuum technologies such as real-time apps, testing, and, in some cases, simulations and digital twins that allow for if/then−scenario testing.

By 2025, there will be more than **24 billion edge connections,** and 20% of them will be 5G.[4]

According to a recent study, the edge computing market is expected to **grow from USD 44.7 billion in 2022 to USD 101.3 billion by 2027,** at a compound annual growth rate (CAGR) of 17.8%.[3]

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3. Edge Computing Market by Component (Hardware, Software, and Services), Application (Smart Cities, Remote Monitoring, IIoT, AR and VR, Content Delivery), Organization Size (Large Enterprises and SMEs), Vertical and Region - Global Forecast to 2027
4. The Mobile Economy 2020, GSM Association, 2020

Managing Large-Facility Deployments

As more and more industries take advantage of robotics systems and cobots, all who work in — and take advantage of — robotics systems need to solve additional challenges such as storage, shared computing, and even more complex interoperability considerations. The need for security is also of paramount importance, as cobots are increasingly deployed in sensitive areas and environments.

For example, hospitals are now planning and budgeting for entire infrastructure adjustments and wings just to accommodate their robotics systems and cobots. In these scenarios, planning for 5G and shared computation, security, and privacy is all the more crucial.

By taking advantage of today's methodologies and technologies, such as DevSecOps processes, simulation tools, and cloud-based approaches, the robotics industry can meet the demand for trustworthy cobots and robotics systems while overcoming the challenges of increased productivity, interoperability, and security concerns.

Take Advantage of Simulation to Design and Plan Robotics Systems for Large-Scale Facility Deployment

Simulation is also a key tool in designing and planning robotics systems for large-scale facility deployment.

Because simulations allow designers and development teams to ask a lot of what-if questions when running tests, they dramatically reduce testing time and help robotics engineering teams move toward deployment of trusted systems more quickly. Applications such as traffic flow planning, task dispatching, emergency routing, and data collection can be planned for in advance.

> "And I'll also mention that simulation is a great design tool. It allows you to ask a lot of what-if questions. Once we've got tools for inputting the whole architectural floorplan of the building — all the floors — we can bring all that into simulation and present you with a 3-D model of your whole facility."
>
> — **Brian Gerkey,**
> *CEO and Co-founder,*
> *Open Robotics*

Looking to the Future

Looking to the future, interoperability API and data model standardization and use of simulation will all be crucial in meeting the moment by taking advantage of today's technology.

Open Source Communities Can Help Solve for Interoperability

The global market for open source software is expected to reach 50.0 billion USD by 2026, according to recent projections.[5] Open source communities can play a key role in solving for interoperability. Robotics has the potential and opportunity for secure cloud and 5G autonomous mobile robot (AMR) interoperability specification, such as VDA out of Europe, which is starting to define message formats.

The quest to determine a common language for robot interaction is ongoing. As the industry evolves, it will be important for everyone in the robotics systems industry to stay ahead of the curve.

Hardware-based testing is limiting, time-consuming, and not sustainable in the new landscape of development. Developers and engineers who take advantage of simulation via Wind River Simics® technology **reduce testing time by up to 90%.**

"We have 40 years of experience serving our customers in markets with the highest standards for safety and security in real time. These markets can be described as a critical infrastructure, and the elements of that infrastructure actually cannot fail.

And that's why we exist."

— **Andrei Kholodnyi,** *Principal Technologist, Wind River*

To learn more, visit windriver.com/studio.

5. Open Source Services Market with COVID-19 Impact, by Service Type (Professional Services and Managed Services), Vertical (Manufacturing, BFSI, Telecommunications, Healthcare and Life Sciences, IT & ITeS), and Region - Global Forecast to 2026, Research

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