

Intelligent Edge and Cloud Networks in 5G Era

Use Cases and Execution Best Practices



Pathfinder

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About this paper

A Pathfinder paper navigates decision-makers through the issues surrounding a specific technology or business case, explores the business value of adoption, and recommends the range of considerations and concrete next steps in the decision-making process.

About the Author



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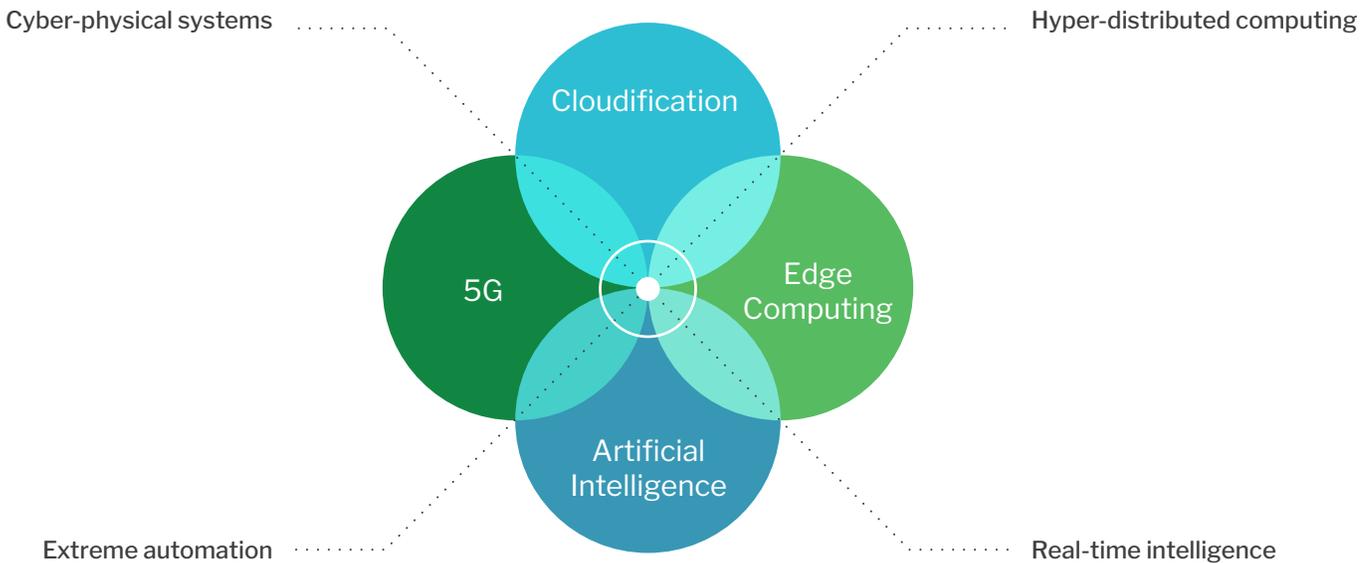
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Executive Summary

The 5G era of connectivity powered by intelligent edge and cloud networks will bring lightning-fast bandwidth and ultra-low-latency performance as well as deep integration with cloud services. After years of anticipation, we are entering the implementation phase marked by initial rollouts of 5G networks around the world. Business leaders should now be identifying use cases that can harness these platforms to deliver positive business outcomes. Over the next few years, we expect that intelligent edge cloud networks will be a core driver of business transformation in several industries including manufacturing, retail, healthcare and transportation. Strategic planning is critical. Confidence in execution is crucial. Success will come to those organizations that harness the power of these technologies quickest and execute change programs to align strategies, people and processes accordingly. This Pathfinder paper is designed for business leaders who want to jump-start ideation, review common requirements and consider some practical recommendations.

Figure 1: Four key technology pillars are converging to enable intelligent edge networks



Source: 451 Research

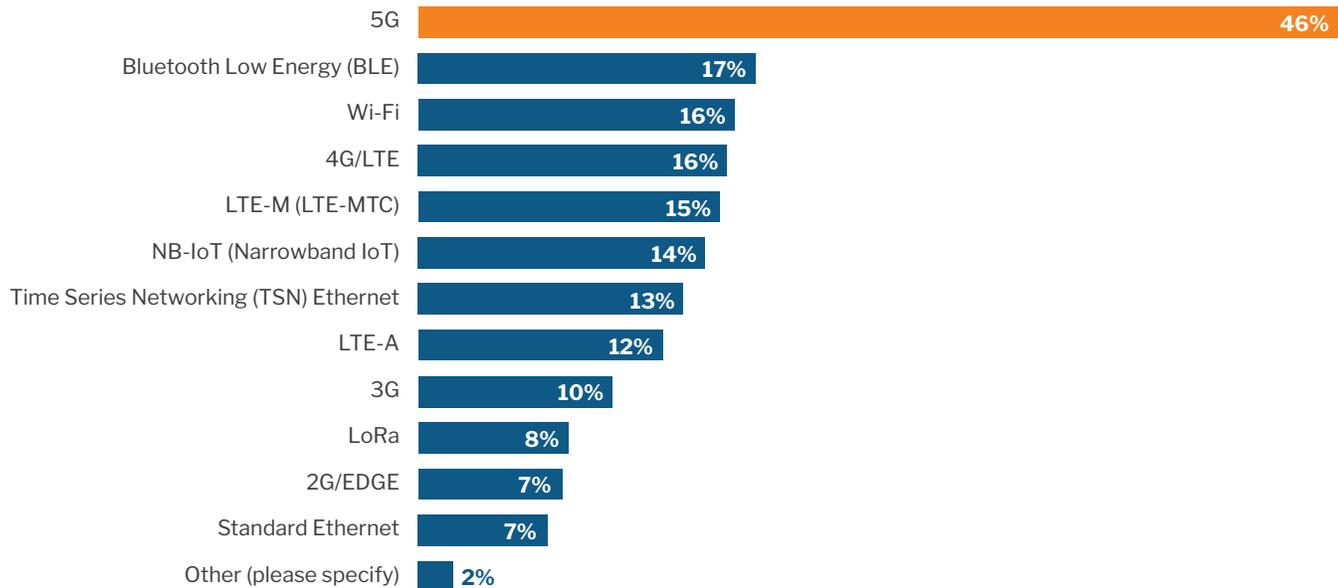
A Roadmap to Intelligent Edge Cloud Networks

Intelligent edge cloud networks are made possible by the convergence of four major technology pillars: artificial intelligence (AI), 5G, edge computing, and the cloudification of enterprise and telco network systems (see Figure 1).

1. **Cloudification:** Enterprises and telecom operators have set out on a path toward embracing cloud technologies and operating models. This includes the deployment of cloud-native IT and network infrastructure that embraces open, hybrid and multicloud architectures. Networks are becoming more intelligent, fungible, automated and integrated via technologies like microservices, network slicing, SDN/NFV and SD-WAN.
2. **Edge computing:** Enterprises are fully embracing the transition to hybrid IT infrastructures that incorporate edge computing. Edge computing is required for emerging workloads like IoT that enable the digitization of physical assets and processes. The emerging edge is driving new ways of working and allowing greater OT/IT collaboration and convergence.
3. **Artificial intelligence:** AI, machine learning and advanced analytics will play a central role in the emergence of extreme automation with 'Zero Ops' as the goal and business operations becoming more data-driven and automated.
4. **5G:** Global deployment of 5G accelerates these transitions by providing a step change in mobile bandwidth, device density and latency performance. 5G is also the first 'G' transition that will require extensive use of cloud-native technologies and development and testing practices. Moving to cloud-native increases the speed with which telcos can roll out new services and tightens integration with enterprise IT.

For the next few years, intelligent edge cloud networks will introduce new complexity and integration challenges requiring careful planning around issues like data privacy, security and manageability. Business leaders must determine the operational and consumption models that best align with their goals, existing governance models and internal skills. Enterprises have high expectations for 5G. According to 451's Voice of the Enterprise: Internet of Things survey, nearly half of respondents (46.4%) said they are planning to use it as the primary network technology for IoT connectivity.

Figure 2: 5G expectations are high for IoT



Q: Which of the following technologies do you expect to use primarily for IoT connections?

Base: All respondents (n=276)

Source: 451 Research's Voice of the Enterprise: Internet of Things, Budgets and Outlook 2020

Importantly, the B2B units of telecom operators will soon be able to operate at 'cloud speed' with the global deployment of 5G supported by cloud-native core networks. 5G and edge cloud networks greatly increase their relevance and attractiveness as service delivery partners.

Use Cases: Intelligent 5G Edge Cloud Networks

The capabilities of 5G edge cloud networks will enable more high-value use cases than any other previous generational technology shift. Let's double-click on a couple of examples.

Manufacturing

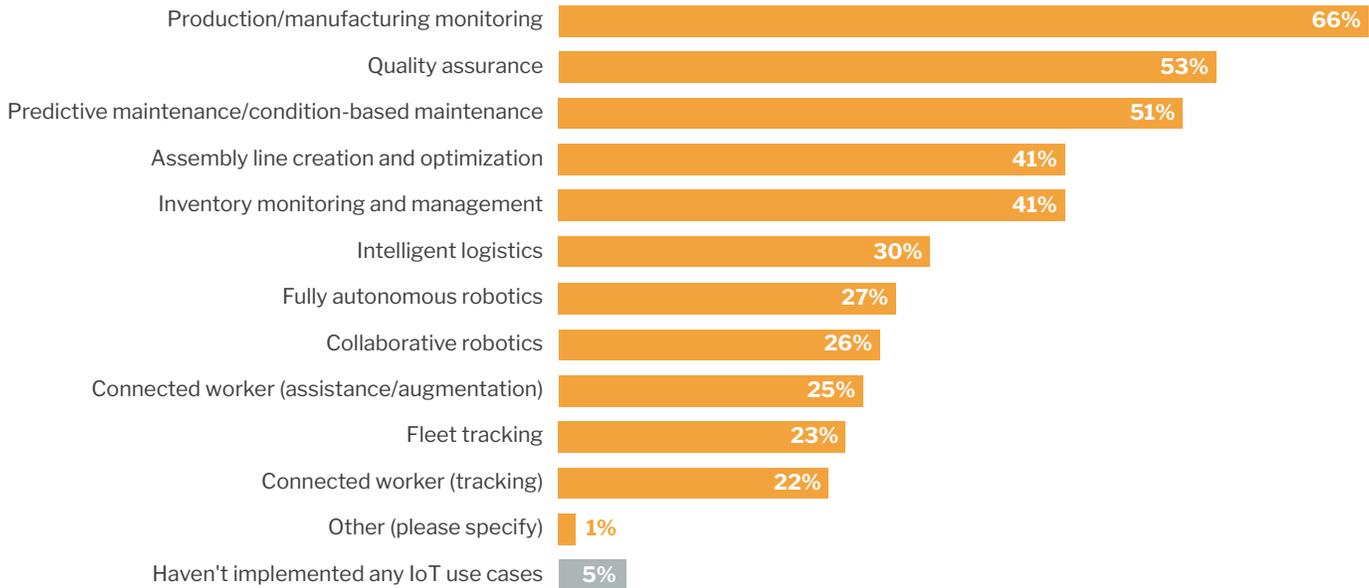
Discrete and process manufacturing firms are facing an urgent need to automate and add intelligence to their physical processes to increase manufacturing quality, speed and efficiency. They must also manage institutional risk by improving overall safety and protecting equipment and workers. Many must also contend with the 'great shift change' – the loss of expertise and skills associated with an aging workforce. The beginnings of this call for digital technologies to support these goals arrived with the Industry 4.0 movement. 5G edge cloud networks combined with augmented/virtual reality, AI/ML and IoT sensors provide the platform that takes the Industry 4.0 concept forward.

5G edge cloud networks deliver the performance needed for production monitoring and condition-based maintenance, quality management using vision analytics, advanced robotics and human worker coordination (so-called cobots). These networks enable worker safety solutions based on wearable sensors and support real-time worker augmentation via low-latency-dependent AR/VR platforms that help troubleshoot problems with field factory equipment or enable knowledge transfer between experienced and inexperienced workers. 5G capabilities such as utilizing a master clock to allow for synchronization of robotic processes will further improve efficiency and safety.

In summary, 5G edge cloud networks simplify, enhance and up-level the art of what's possible in these industrial environments by replacing costly, inflexible fixed networks and inferior legacy wireless deployments with a single physical network that can be logically provisioned to meet every workload requirement. Figure 3 shows the array of IoT workloads deployed by manufacturing companies today – all can be supported with 5G edge cloud networks. These systems can be run by the manufacturer, the telecom service provider, or by a systems integration partner in public or private setups. Manufacturing firms that lean into 5G edge cloud networks will be doing so as part of a much larger business transformation agenda that calls for convergence of OT/IT groups, processes and systems, as well as further digital instrumentation in digital twins and digital threads. The latent potential for 5G among manufacturing respondents was revealed in 451 Research's Voice of the Enterprise: Internet of Things – The OT perspective survey 2H19, in which 75% of respondents indicated 5G will be the primary connectivity for IoT connections in two years.

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Figure 3. IoT use cases in manufacturing environments ripe for 5G edge cloud networks



Q: Within your vertical, which of the following IoT use cases have you implemented today? (Please select all that apply)

Base: Manufacturing industry respondents (n=73)

Source: 451 Research's Voice of the Enterprise: Internet of Things, Workloads & Key Projects 2020

Retail

Supermarkets, online merchants and department stores are all under tremendous pressure to increase their brand relevance, create operational efficiencies and elevate the customer experience. 5G edge cloud networks combined with IoT sensors and machine learning offer great potential in retail because retailers work on thin margins and greatly benefit from increased efficiencies in managing inventories. They need better systems for fraud detection, stock automation, expediting and mobilizing POS, predicting demand, and tracking assets. IoT together with 5G edge cloud networks holds the potential for retailers to reinvent all aspects of the shopping experience – digital signage, analyzing footfall data, optimizing product placements in physical spaces, shop-floor cobots, concierge assistants, etc. These will drive a step change in shopper personalization by serving customers with contextually relevant information or providing a salesperson with the exact insight needed to add immediate value to a customer interaction.

Imagine a car dealership showroom enabled with 5G edge cloud networking – every workload and operation running within that physical location could be supported by a single virtual network. Workloads might include offering visitor connectivity for personalized advertising, employee connectivity, site security and surveillance, video analytics for customer movement and footfall analysis, connectivity to ensure productivity for all the machinery in the service shop and worker safety, and predictive maintenance for the most critical tools and machines. Edge computing drastically reduces the costs of the I/O devices themselves as compute power is transitioned from the device edge to the network edge cloud. This could reduce the costs of cameras, tablets, digital kiosks and various sensors by 10x or 100x.

Horizontal Use Cases

There are many other verticals where 5G edge cloud networks will disrupt the status quo. In addition, there are other broader 'horizontal' use cases such as distributed content delivery networks, smart buildings, drone and camera-driven security and surveillance, and condition-based maintenance of all types of industrial machinery. To illustrate the scale and range of 5G's potential, Figure 4 maps horizontal and vertical industry use cases against an X-Y axis of application bandwidth requirements and latency tolerance and sensitivities and the relative addressable market opportunity.

The opportunities with the greatest potential for 5G edge cloud networks are represented in the upper right quadrant, where both bandwidth and latency performance are key to application experience. The use cases in this quadrant have been widely identified as those where 5G edge cloud networks can have the most transformational impact.

Figure 4: Plotting horizontal and vertical 5G edge cloud network use cases



Source: 451 Research

5G and Edge Cloud Foundational Requirements

These requirements will both reinforce and interact with each other and include:

- Adaptive networks that can simultaneously support high-bandwidth, low-latency, massive device volumes with high mobility and low-bandwidth, low-power device estates across a wide range of technologies including 4G/5G, satellite and Wi-Fi and low-mid-high spectrum bands.
- A common policy framework that spans identity and access management (IAM), compute and data distribution, and networking that guides the interaction between the users and their enterprises, trading partners, content providers and external service providers.
- Strong identity management technologies and processes including moving components of IAM to the 'edge' to ensure a coherent access control framework that maximizes usability and security.
- Data distribution functionality to effectively manage the movement and storage of data across centralized and edge execution venues. These edge systems must be able to run with complete autonomy for extended periods but will also be coordinated with centralized cloud and network resources.
- Use of open source technologies such as OpenStack, OpenShift and Kubernetes to harness the power of modern, cloud-native technologies to enhance agility and flexibility.

The underlying flexibility of these new cloud-native and open platforms is what makes them so valuable. The 1:1 relationship between physical network and service capability is blown apart via cloudification, NFV/SDN, SD-WAN and network slicing and replaced with a one-to-many, fungible infrastructure and application environment. Enterprise and telecom network functions seamlessly interact, integrate and interoperate such that networks can be literally sliced to meet the most stringent latency budgets while concurrently connecting and serving edge compute services to millions of low-cost, low-power sensors.

Execution Best Practices/Recommendations

1. Enterprise leaders should provide executive-level sponsorship and oversight of 5G intelligent edge cloud network investigations.
 - 5G edge cloud networks can serve as a disruptive change agent that extends far beyond the traditional IT control points.
 - Executive-level sponsorship can help align proof-of-concept work to strategically desired outcomes while aligning the efforts of diverse operational units (OT, IT, sales, products, marketing, facilities, DevOps) through clear communication of desired business outcomes, common governance and KPIs.
 - These initiatives should be driven by the CIO or CTO organization where possible.
2. Enterprise business leaders should rethink the partnership potential of telecom operators.
 - CSPs have a role in achieving the enterprise digital transformation agendas underway globally.
 - More than ever, network boundaries will fall away and be replaced with logically integrated infrastructures via SDN/NFV and 5G slicing. As edge computing becomes embedded into networks, data management will be orchestrated among near and far edges and core cloud resources.
 - Enterprises should expect a higher degree of shared roadmaps and coordination with their CSP partner(s). Where a direct relationship is untenable, preferences should be for CSPs with the strongest ecosystems that include preferred digital suppliers.
3. Get started now or risk falling behind the competition.
 - Intelligent 5G edge cloud networks hold disruptive potential. Digital transformation teams should immediately engage with key technology partners to ideate how these capabilities might be applied to existing or new workflows.
 - Cultural inertia is inevitable for disruptive technology. Anticipate this challenge by soliciting participation of key stakeholders and paying attention to new skills requirements and integration with existing processes and systems.

Conclusion

Intelligent 5G edge cloud networks offer a mix of performance and flexibility, enabling a dramatic impact on core business processes. These new capabilities can turbocharge transformation efforts underway or spark completely new initiatives bound only by imagination and the ability to manage change. The time to get started is now, well ahead of expected enhancements to 5G edge cloud standards arriving over the next 12-24 months. Waiting only creates a window of opportunity for competitors to act first. The core capabilities required are understood and should be supported by existing or new technology partners. Reevaluating the potential that telecom operators can play in your digital journey is also necessary because 5G edge clouds could bring them higher into your value chain. Look for additional reports in this series, which will offer deep dives on execution best practices.



To learn more, download the full report: [Network Cloudification, 5G and Edge Computing](#) or visit the [Kyndryl website](#).

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