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Enabling enterprise transformation through 5G with edge computing

Accelerating the return on investment

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Table of contents

Summary

5G network's distributed architecture design, combined with edge computing technology enables low-latency connectivity for devices at the network edge and/or customer premises. Demand for 5G and related edge services is expected to skyrocket in the coming years as enterprise customers continue to enable applications and use cases that require significant amounts of data processing and storage.

Private 5G networks provide dedicated access to spectrum, communication hardware, and software resources giving enterprises the ability to deploy a range of use cases customized to their specific needs. Private 5G combined with edge computing has the potential to enable a variety of compelling use cases for organizations across multiple industry and consumption verticals including manufacturing, health care, oil and gas/utilities, and transportation.

Enterprise CIOs/CTOs have taken note of this trend and are looking for cost-effective ways to deploy reliable, secure, and scalable private 5G networks to better support the evolving needs of their customers and end users today, with a maximum runway into the future. However, they face a myriad of business and technical choices in the journey to realize their 5G vision.

Deloitte offers its 5G Ignite™ accelerator capabilities to help enterprises define their 5G vision, strategize on return on investment (ROI) and business case, visualize network blueprints, envision product road maps, and create go-to-market plans. AT&T, on the other hand, has a robust portfolio of private 5G/edge computing solutions that have been deployed successfully across multiple industries to support a range of enterprise-focused use cases. Together, the two organizations are responding to enterprise needs with their unique offerings.

This paper presents both Deloitte's and AT&T's respective perspectives on private 5G/edge computing and how the two organizations can support enterprise CIOs and CTO's 5G connectivity vision.

Demand for 5G and related edge services is expected to skyrocket in the coming years as enterprises continue to enable applications and use cases that require significant data processing and storage.

5G with edge computing – An overview

Communication service providers (CSPs) are designing 5G networks to support ultra-reliable communication across millions of Internet of Things (IoT) sensors and devices running data-hungry applications while performing near real-time computations and updates.

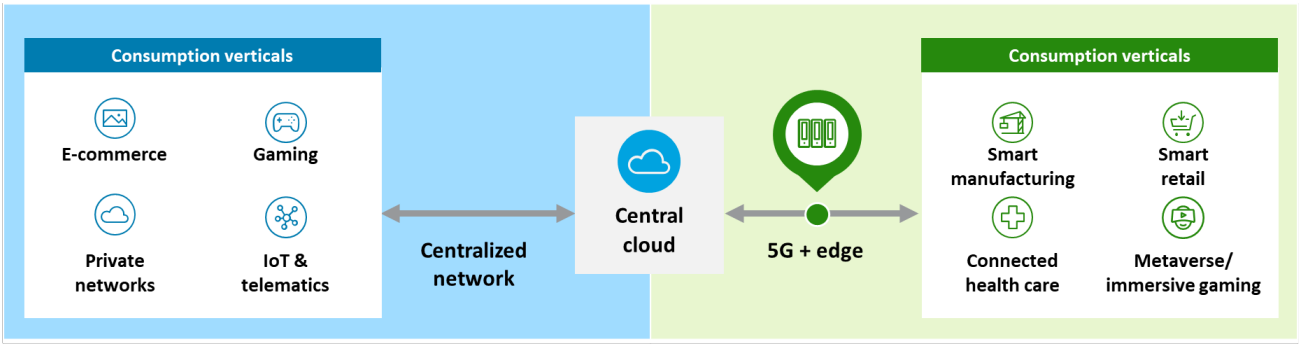
The distributed design principles of 5G architecture allow for flexibility to place computational and storage resources near, at, or far from the enterprise site. Network design can now be tailored to truly address specific computational speed and performance demands of use cases.

For instance, use cases requiring large and complex workflows and differentiated user experiences can potentially be executed at millisecond latency with a 5G/edge computing solution in place.

5G network deployment with edge computing (figure 1) has the potential to enable a variety of compelling use cases for enterprises across multiple consumption verticals.

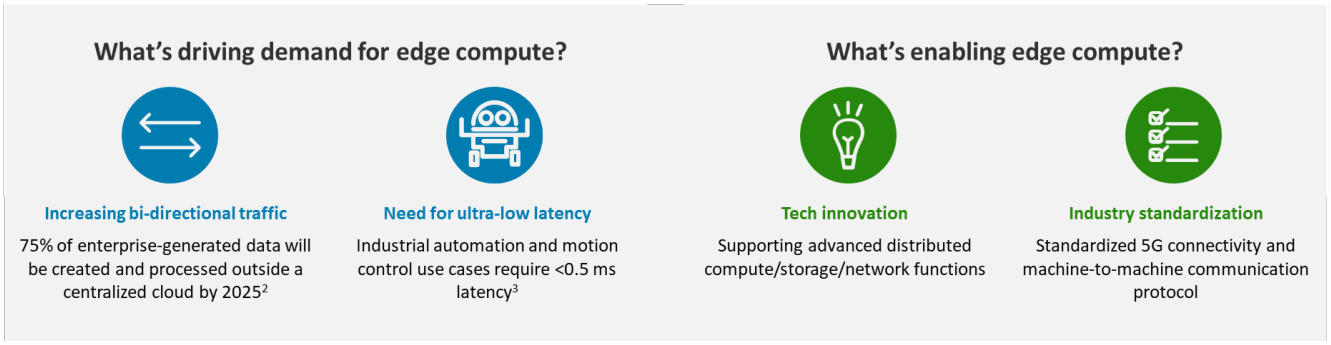
Figure 1: Centralized vs. distributed cloud in an enterprise

Centralized cloud computing	Distributed 5G/edge computing
• Massive strides have been made to optimize performance **of centrally deployed cloud resources** to meet data ingress/egress needs of most consumer and enterprise-centric use cases • However, the solution can be **difficult** and **costly to scale** for use cases that require ultra low-latency and reliable connectivity	• 5G with edge allows data **computation closer to the end device** and can support low-latency requirements for use cases across multiple industries and consumption verticals • Enterprises can readily **scale** their private 5G and edge resources up or down, using network management tools



IDC predicted worldwide spend on edge computing to be around $176 billion in 2022,[1] an increase of 14.8% over the previous year. The United States, being the largest investor in edge solutions, had a 2022 spending forecast of around $76.5 billion, which accounts for service provider spend on edge infrastructure buildout and enterprise spend on buying edge services. Industry watchers are predicting a surge in demand for edge services in the years to come due to continuous improvements in technology and industry standards (figure 2).

Figure 2: Growing importance of edge computing



Enterprise 5G use cases – ROI and benefits

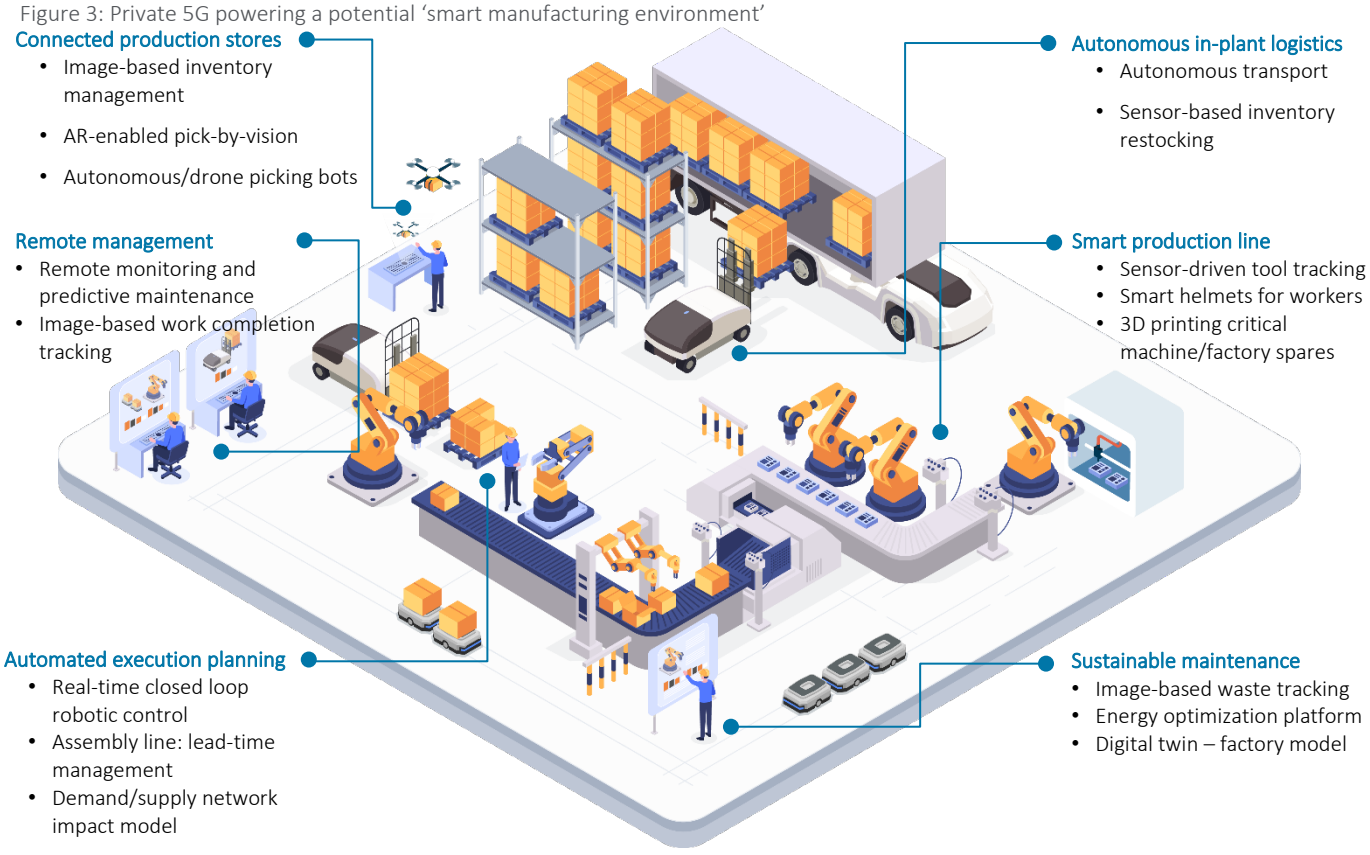
Enterprise CIOs/CTOs are constantly looking to invest in best-in-class customer and product experiences while balancing connectivity costs, reducing implementation complexity, improving data security, enabling continuous innovation, and driving digital transformation.

Private 5G/edge computing solutions enable faster go-to-market by offering DevOps: enterprise-grade tools to build, deploy, test, and manage applications quickly and securely on a private network. In addition, 5G use cases deployed on the private network can be monetized to generate incremental revenue, eliminate redundancies, and produce operational cost savings for the enterprise over time.

Deloitte has identified a list of key 5G/edge computing use cases spanning various industries, along with adoption strategies and value-creation models for each of them. Deloitte offers a wide variety of consultative services to enterprise customers, including an accelerator—5G Ignite—to help nurture ideas, define capability blueprints, identify benefits, and determine business models to pilot, prioritize, implement, and monetize use cases.

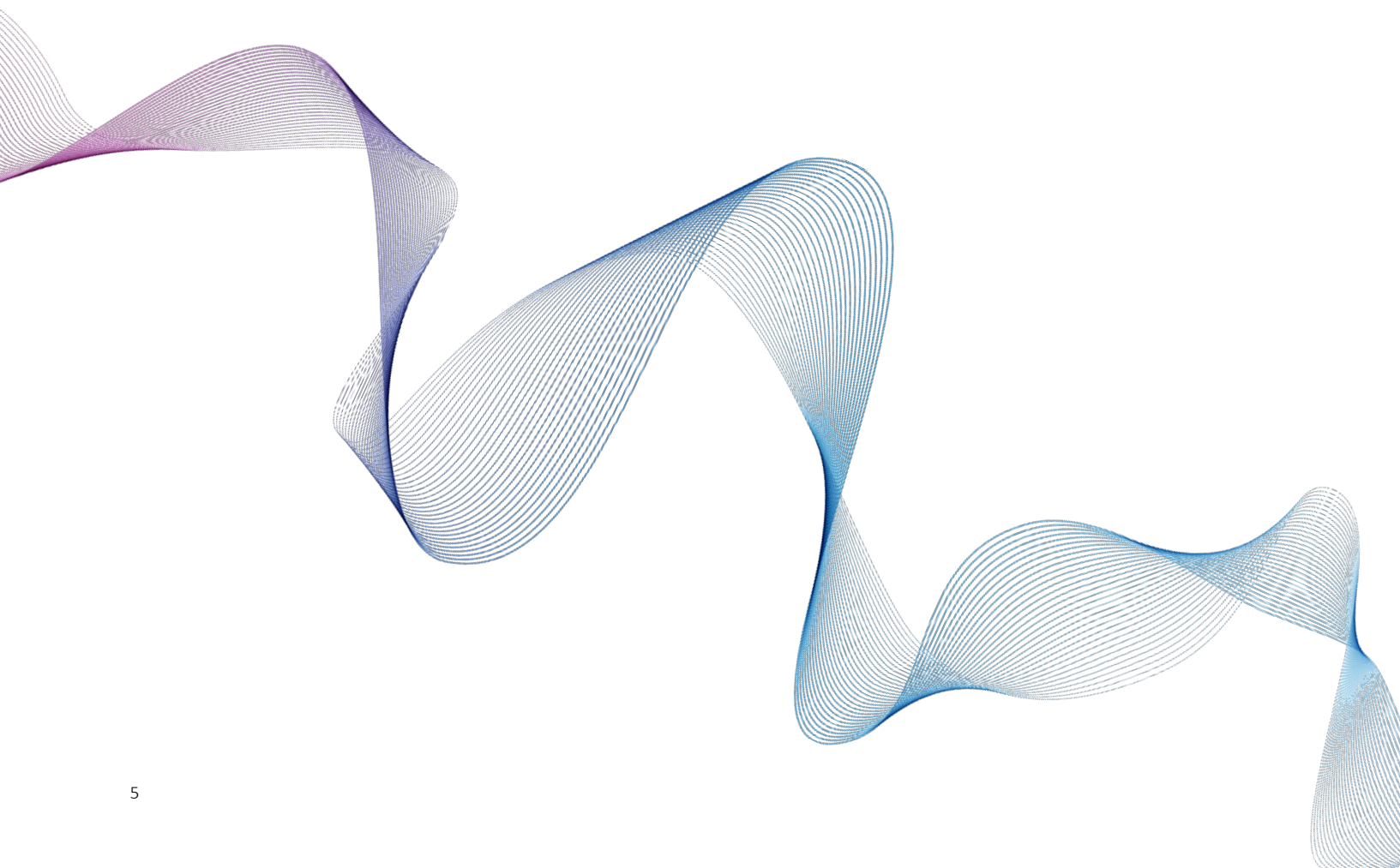
Figure 3 illustrates some use cases in a smart manufacturing environment that could take advantage of a private 5G/edge computing implementation. A use case such as digital factory twinning requires a massive amount of data that must be created, aggregated, and consumed long before the twin is generated. The private network within the smart manufacturing environment must support ingress and egress of an exponential amount of data to help visualize the digital twin, maintain dynamism like the factory floor itself, and provide a seamless end-user experience.

Figure 3: Private 5G powering a potential 'smart manufacturing environment'



Digital factory twinning is one of many manufacturing consumption vertical use cases requiring utilization of massive bandwidth to support near-real-time data processing and frequent synchronization of data. It also needs to support end users navigating the digital twin environment with minimal jitter or latency using AR/VR/XR hardware. Furthermore, the smart manufacturing environment of the future will combine advanced wearable hardware technology with computer vision, 5G, and edge computing to support critical safety and maintenance use cases that rely on human intervention and cognition.[4] Such complex performance and customer experience requirements can be better served if the application is developed, hosted, and managed in a scalable cloud infrastructure closer to, or at, the facility, with 5G connectivity on the customer's premises.

AT&T offers multiple private network solutions in addition to 5G connectivity (both low band and high band) and tools to enterprises, based on their unique requirements and deployment needs. For instance, AT&T's Multi-Access Edge computing, is an on-premises edge solution that brings the power of 5G to an enterprise's local network, while AT&T Private Cellular Network (PCN) provides a localized cellular LAN utilizing LTE and 5G. Read more about how AT&T's 5G network helps to innovate technology solutions and services in the industries of manufacturing, health care, oil and gas/utilities, and transportation.



5G with edge computing – Deployment considerations

Enterprise CIOs/CTOs face a myriad of complex technical choices and business decisions when considering the architectural design of their private 5G/edge computing deployment (figure 4). The challenge will be to understand which network type(s) will be the most advantageous in covering the scale of priority, from easy to difficult, while providing value to the organization.

Network deployment considerations need to be understood and evaluated based on the different user groups and site types they are meant to support. Network considerations may include RAN design, spectrum coverage statistics, licensed versus shared versus unlicensed spectrum use, device interoperability, fixed versus nomadic user groups, security management, reliability, and support requirements. The objective from a network perspective should be building a network that adheres to cost parameters and maximizes capacity and control over the longest time horizon.

A typical private 5G/edge computing deployment requires the provider and system integrator to successfully deliver on both business and technical requirements.

Subject-matter specialists who understand various aspects of network buildout, including design, build, orchestration, provisioning, assurance, and management, are involved in the creation of an implementation blueprint aligned with the future needs of the enterprise.

There could be instances where existing enterprise applications, though hosted on cloud ware, are still very monolithic in nature. Applications that can truly exploit cloud-native features of 5G/edge computing solutions will require strategic investments in user research, capability design, agile development, training, feature prioritization, and deployment. Enterprises will need to put a DevOps operating model in place, if they haven't already, to ensure success and go-to-market velocity.

Overall, enterprises need to carefully think about their partner ecosystem during the 5G and road map planning phase, to maximize their chances of achieving success and the necessary ROI.

Figure 4: Range of complex choices

AT&T and Deloitte offerings

AT&T and Deloitte bring exceptional industry expertise and implementation know-how to enterprises for 5G/edge computing. Together, they play critical supporting roles in all aspects of the 5G deployment value chain and collaborate on helping enterprises realize their 5G vision.

Deloitte's 5G Ignite™ accelerator (figure 5) is meant to augment AT&T's capability suite by helping the enterprise CIO/CTO community identify high-impact areas where 5G/edge computing can play a crucial part in activating key use cases. The accelerator presents a suite of tools that help the end user shape perspective on piloting and monetizing various use cases; it presents end users with options to define business cases and understand the ROI based on various scenarios and inputs across infrastructure and network dimensions. The 5G Ignite suite of tools includes:

- Requirements Management wizard: Allows the end user to select and define deployment considerations and requirements across application, service, and network dimensions for a vertical-specific use case.
- Network Design and Dimensioning module: Allows network designers to choose optimal network access technology and define network blueprint based on the selected attributes, e.g., number of devices, type of devices, latency, bandwidth, coverage, quality of service (QoS), etc.
- Edge Design and Dimensioning module: Recommends placement of application modules across different edge locations and provides best practices and guidelines on edge-native application architecture and design for the selected use case.
- Total Cost of Ownership (TCO) Calculator: Provides a high-level estimate on the cost of ownership, including CapEx and OpEx required to enable the selected private 5G/edge computing use case.
- Net Benefit Calculator: Uses industry research and inputs from the user to generate a high-level overview of financial benefits and ROI of implementing the use case.

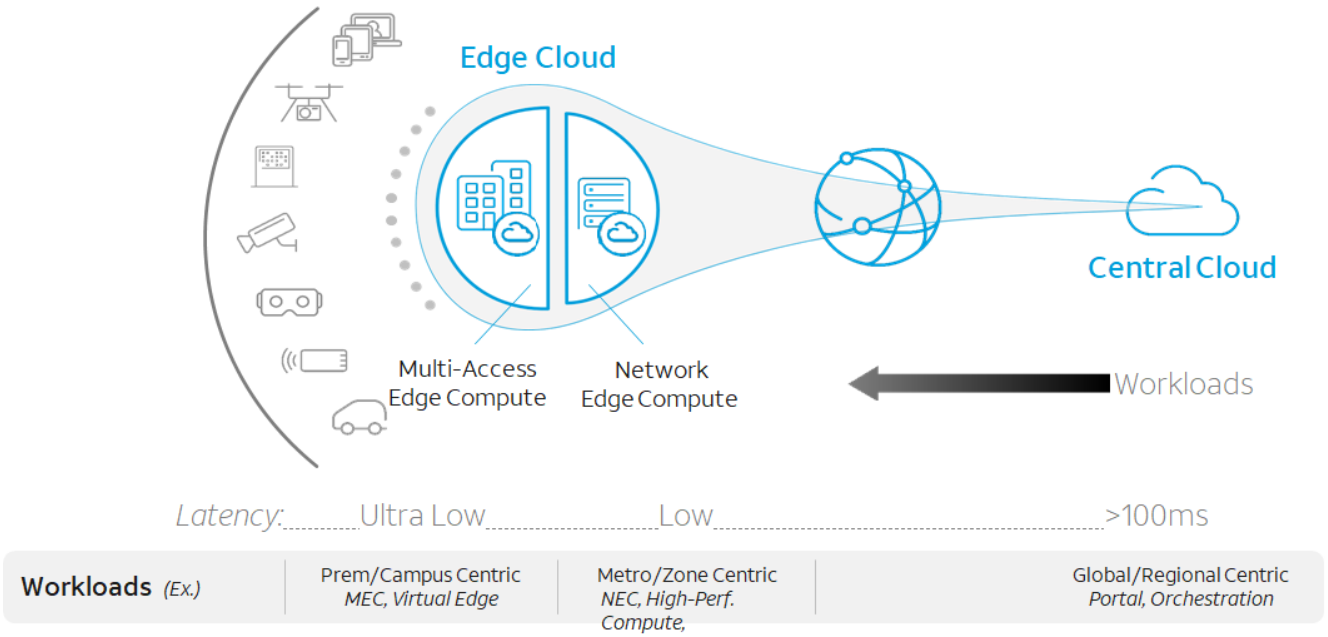
Figure 5: 5G Ignite™

AT&T offers a holistic private 5G cellular network portfolio to enable a customer's private cellular journey by utilizing both LTE and 5G models, including licensed and unlicensed spectrum via CBRS. AT&T also has go-to-market agreements[5] with major cloud service providers and system integrators, enabling cloud functionality and giving enterprises the flexibility to work with vendors of their choice.

Some of the in-market solutions include:

- AT&T's Multi-Access-Edge computing (MEC): A distributed network implementation that establishes on-premises cellular network access and a virtual user plane function. This keeps designated enterprise traffic local and allows control and use by other enterprise elements, including compute at the customer premises. MEC enables connections with IoT devices, tablets, and smartphones, to name a few. One of the MEC benefits to manufacturers is the ability to connect to adjacent macro cell site and remote servers as needed.[6]
- AT&T On-Premises Cellular Networks: On-premises private cellular solutions equip enterprises with the ability to do more with their cellular networks. Previously Wi-Fi networks were the alternative to wired solutions; however, networks relying on unlicensed spectrum may have difficulty meeting the demands that many of these machines and new workloads require.
- AT&T Private Cellular Network (PCN): An isolated cellular network with a private core that gives customers additional control of where and how their data is routed and processed to address business-critical needs. It is an alternative to AT&T MEC for specific considerations when a fully isolated network is desired. AT&T is reviewing a go-to-market model to offer its value-added assets, such as licensed spectrum and use of its commercial public network for broader geographic coverage to solution providers as a service.
- AT&T Network Edge (ANE): Brings high-performance cloud computing closer to the edge of customer networks. It offers enhanced connections to 5G technology and fiber network services that can improve the end-user application experience with lower latency, less jitter, and higher throughput.[7]

Figure 6: AT&T's MEC Solution



AT&T offers expertise in building, operating, and supporting enterprise-grade private 5G networks for businesses of all sizes. The AT&T private 5G cellular strategy creates a mobile edge/core on the customer's premises. This enables customized coverage with increased privacy and control of the network environment. It also provides a streamlined experience to support both connected workers and newly emerging technologies such as extended reality, use of automated guided vehicles (AGV), quality sensing and detection using video analytics, to name a few.

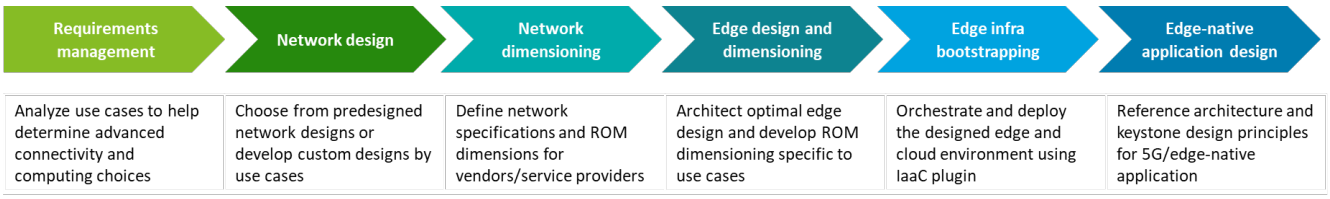
Requirements involve increased performance, lower and more predictable latency, reduced jitter, and support for applications with higher bandwidth and increased speeds for time-sensitive, critical work functions. These solutions are essential to manufacturing, health care, oil and gas/utilities, and transportation verticals that are looking to improve productivity and transform their businesses.

Conclusion

Deloitte and AT&T's offering suites can arm enterprises with the ability to quickly identify, evaluate, and define requirements and pilot industry use cases that could potentially benefit from private 5G/edge computing.

As enterprises continue exploring private 5G/edge computing solutions as part of their 5G network deployment journey, Deloitte and AT&T aim to provide their respective thought leadership, consultative expertise, industry-leading product portfolios, and system integration capabilities at each step of this journey.

Figure 7: Illustrative 5G use case design and deployment journey using Deloitte's 5G Ignite™ accelerator



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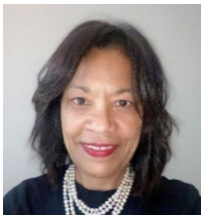

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Endnotes

1. IDC - "New IDC spending guide forecasts double-digit growth for investments in edge computing," press release, January 13, 2022.
2. Rob van der Meulen - "What edge computing means for infrastructure and operations leaders," Gartner, October 3, 2018.
3. Gabriel Brown - *Ultra-reliable low-latency 5G for industrial automation*, Qualcomm, accessed January 2023.
4. Mahadev Satyanarayanan and Arpan Tiwari - "Trying on wearable cognitive assistance: How enterprise wearable technologies will change work," *Deloitte On Cloud Podcast*, August 2022.
5. AT&T - "AT&T Multi-Access Edge Computing," accessed January 2023.
6. Satyanarayanan and Tiwari - "Trying on wearable cognitive assistance: How enterprise wearable technologies will change work."
7. AT&T - "Network Edge," accessed January 2023.

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