



Cloud and network fusion at the enterprise edge

5G and edge computing are
transforming your industry today



IDC predicts that by 2025 75% of enterprises in industrial verticals like manufacturing, logistics and mining will adopt private 5G networks to achieve network reliability and coverage and maintain data control and security.¹ A 5G and edge computing approach can help address industry 4.0 challenges and enable a well-connected system.

Both large and small businesses across all industries are going through a digital transformation journey and seeking new business outcomes. With edge computing and low-latency network options, today's businesses have the potential to extend the cloud beyond the four walls of the business location. Workloads created in the cloud, including many modern forms of AI and analytics, can now be migrated out toward the edge. Where appropriate, data generated at the edge can be cleansed, filtered and optimized and brought back to the cloud.

Edge computing enables:

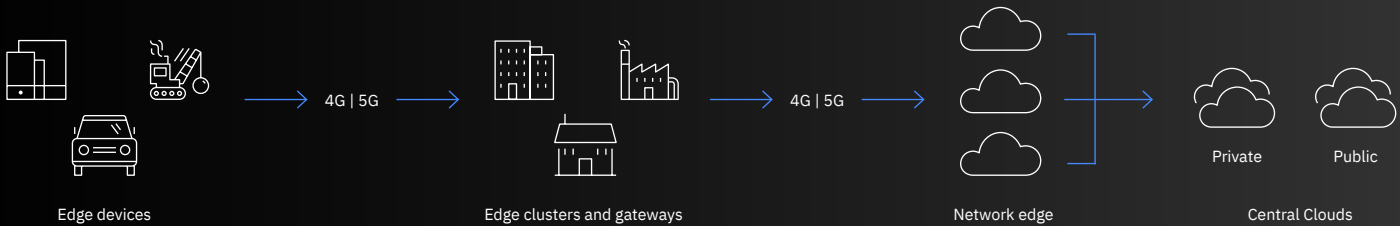
- Faster insights and actions by tapping into more sources of data and processing data locally
- A more predictable and reliable networking experience
- Better data control and lower networking costs by minimizing data transport to central hubs and reducing vulnerabilities
- Continuous operations by enabling systems to run autonomously, even when disconnected, to reduce disruption and lower costs

The promise of 5G and edge computing has advanced from a vision of the future to applied innovation that's unlocking insights today, opening new avenues of business, discovery and safer operations. Edge computing has created the foundation of data capture and brought it closer to where the data is being produced.

Edge computing, combined with 5G, creates opportunities to enhance digital experiences, improve performance, support data security and enable continuous operations in every industry. It brings computation and data storage closer to where data is created by people, places and things.

Imagine that you're a manufacturer and you're trying to deal with the potential cost of outages in your production line—costs that might occur if any of your equipment goes down and stops the production process. Or imagine that you are an automobile manufacturer trying to engage your clients with a better driving experience. These industry examples can be enhanced and extended using edge computing.

Interconnected hybrid multicloud



Choices and control essentially everywhere

When it comes to applying 5G and edge, flexibility in architectural deployments matter.

The hybrid multicloud nature of enterprise architectures—where workloads may be centralized, run on a combination of internal and third-party clouds or at the edge—underpins the focus of IBM and AT&T in helping customers best use these multifaceted environments. IBM supports hybrid cloud, enabling customers to run workloads on the infrastructure that makes sense for their business, and AT&T helps navigate the complexities of connectivity options in an ever complex and crowded space. These options include enterprise-grade 5G, both sub6 and millimeter wave (mmWave); private cellular networks (PCNs); and edge solutions, on premises with AT&T Multi-Access Edge Computing (MEC) and AT&T Network Edge (ANE).

IBM has a view of edge computing that spans many industries and multiple tiers and includes open technologies and standards like containers and Kubernetes. This viewpoint recognizes the need for a variety of edge location types, each with its own compute needs but based on widely adopted technologies.

Public, private and content-delivery networks are transforming from simple pipes to higher-value hosting environments for applications—a form of edge network cloud. Closely integrating the network with edge computing helps ensure service quality while easing connectivity between distributed workloads.

Predictable and reliable connectivity is required to enable these hybrid multicloud business models. Connectivity type and scale is driven by site and use cases. AT&T can deliver a collective set of capabilities that together establish a dynamic, highly secured, on-demand network platform. With 5G, combined with the AT&T MEC platform for use at the customer's premises, customers are able to keep business-critical data local. This process allows insights to be gathered from data and enables operational efficiencies to be obtained, for example, through automation. Having control of data within an enterprise's four walls enables customers to maintain the right level of control, latency, security and privacy.

Enterprises have options to consider for deploying edge computing on their premises, including:

- Spectrum abilities and limitations
- Configuration
- Device availability
- Deployment timelines
- Backhaul requirements
- Number of sites
- Public network access
- Costs, OpEx versus CapEx

At large, the available options may be categorized in unlicensed spectrum, such as wifi; shared spectrum, such as Citizen Broadband Radio Services (CBRS); and licensed spectrum, such as Long-Term Evolution (LTE) or 5G.

- Wifi may be better suited for small-size or consumer-like use cases that don't have high restrictions for coverage range, reliability, bandwidth and latency.
- Shared spectrum option, such as CBRS, has minimal cost for access. It has multiple 10 MHz channels that's potentially available for bandwidth support. However, it does have limited range of coverage and signal propagation.
- LTE and 5G spectrum are designed to accommodate mid-scale to large-scale enterprise use cases as it has greater capacity. 5G has greater range and capacity than wifi with flexible spectrum options to address more critical use cases and more stable throughput under load. 5G can also support more connected devices, while wifi reaches a saturation point more quickly.



AT&T provides enterprise-grade edge platforms to allow customers to migrate the processing of mission-critical applications to their premises, where the data is generated. This method provides customers with greater control of their data on our cellular networks on their own premises with MEC. For customers who require lower latency than cloud, ANE is an alternative.

The enterprise-grade 5G network brings connectivity, security, integration and control. And the dedicated cellular connectivity, built for your environment with the edge computing platform, enables a path to industry 4.0. With faster ways to detect defects across your operations, mitigate outages, and train workers through virtual experiences, using augmented reality and virtual reality (AR/VR), it helps ensure that your operations are safer.

What's involved in 5G edge computing?

It must be possible to deploy, update, monitor and recover edge compute space without human intervention.

Edge management processes must be fully automated, so enterprises can make decisions on their own about what work needs to be placed where and recognize and recover from changing conditions without intervention.

The system must have a deep awareness of the nature, location and purpose of different devices with different capabilities and different uses—and be able to use that awareness to make informed, policy-driven decisions.

These issues all need to be considered and addressed to enable the other advantages of edge computing.



Terms and trends:

- **Hybrid cloud computing.** Traditional hyperscale, public clouds—such as IBM Cloud® and other cloud offerings from providers like Microsoft, Amazon and Google—are combined with private clouds deployed in data centers on premises and off premises.
- **5G network.** During the transition to 5G, many public network providers are expanding their infrastructures to include general-purpose computing services. The edge network itself is potentially multitiered and composed of regional data centers, central offices and hub microdata centers. Network service providers (NSPs) are transforming these tiers in their core network to host application workloads using cloud technologies within the network edge.
- **Edge servers.** Servers, gateways and controllers acting as edge servers are often deployed in factories, warehouses, hotels and retail stores to provide local compute capacity for operations. These resources may or may not be clustered, but still support critical business processes.
- **Edge devices.** The number of devices that contain enough computational capacity to do work is growing rapidly. These devices commonly have sufficient CPU power, RAM and local storage to run a Linux® operating system.
- **IoT devices.** Most traditional IoT devices are closed, fixed-function devices. They are typically integrated with sensors for collecting data that's transmitted upstream to other aggregation points—traditionally the cloud.
- **Mobile devices.** Mobile devices play an important role in edge networks. They are distinct from other edge devices because they typically belong to an individual who assumes personal responsibility for them. Mobile devices that run iOS or Android operating systems may refuse to run container software that was not acquired through their app stores.

Scale unlocks value

Enterprises with edge environments must support massive scale to unlock value.

Edge computing breaks down the neat physical boundaries of the cloud data center—forcing us to think about issues, such as security, scale, management, ownership and compliance. Ultimately, edge computing multiplies the scaling issues of cloud-based management techniques.

Edge networks increase the number of compute nodes by an order of magnitude. Edge gateways increase it by another order of magnitude and edge devices increase the number even more. If DevOps is critical to managing a typical hyperscale cloud infrastructure, then zero ops—that is, operations without any human intervention—is critical to managing the massive scale that edge computing represents.

IBM has a leading solution to this growing problem not addressed by other solutions: autonomous management of edge apps at scale. IBM's edge-native, autonomous lifecycle management approach provides differentiated benefits to our customers to maximize on-premises compute. The IBM® Edge Application Manager open foundation enables inherent portability for the solution and apps running on it, allowing customers the flexibility to run workloads on the platform or cloud of their choice. Customers can create policies that will allow autonomous deployment, updates and deletion of containerized applications to the edge devices. Only containerized applications with the correct policy-defined signature can be pulled by the device.

The power of alliances

Act on insights closer to where data is created with trusted allies in edge and 5G.

The AT&T network complements cloud solutions from IBM, which run on the Red Hat® OpenShift® Platform, a leading open hybrid multicloud platform that runs essentially anywhere—from basically any data center to multiple clouds to the edge.

IBM enables you to:

- Employ autonomous management to orchestrate the scale, variability and rate of change in edge environments—running essentially anywhere.
- Implement edge-enabled industry solutions that are built on IBM expertise.
- Modernize networks so that NSPs can deliver new services at the edge.

AT&T enables you to:

- Gain capacity and speed. Deploy dedicated 5G or private cellular connectivity at your site with security to support massive device connectivity.
- Achieve proximity, which is the power of the edge. The core and radio access 5G network is designed from the get-go to be flexible and better suited for edge deployment. It brings compute resources and services closer to where data is generating. It improves the overall experience and end-to-end latency, which is critical for real-time applications and near real-time decision-making.
- Manage data traffic with the AT&T MEC platform across hyper-busy networks to have full control over your mobile data. As more industries embrace robotics, like healthcare and manufacturing, the AT&T 5G network will increase reliability and make use of licensed, shared and unlicensed spectrum models to enable greater control and automation. Enterprises will be able to take fuller advantage of automation to increase business productivity.

AT&T and the IBM edge solution components are complementary, providing customers with optimized wireless coverage, local breakout of data for business applications and extended cloud workload management.

IBM Cloud and IBM Analytics

Red Hat
OpenShift



IBM Edge
Application
Manager



IBM Cloud
Paks and
IBM Watson®
Services



IBM Cloud
Satellite™



Devices and
end-points



Rate
plans



In-building
solutions



AT&T MEC
platform



AT&T wireless connectivity

Speed to value

The convergence of 5G and edge computing will drive business in every industry and change how work gets done and businesses operate. This transformational journey requires an understanding of enterprise environments and business process optimization. AT&T and IBM understand edge, based on their deep industry and vertical knowledge and address the broader issues of integration with enterprise systems. Edge solutions don't operate in a vacuum. Our approach is customer-centric and focused on speed to value.

Wherever you are in your transformation journey, we recommend you consider these key success factors:

- When it comes to applying 5G and edge, flexibility in architectural deployments matter.
- It must be possible to deploy, update, monitor and recover edge compute space without human intervention.
- Enterprises with edge environments must support massive scale to unlock value.

Edge, enabled by 5G, empowers enterprises to extract insights closer to where the data resides. With faster insights, you can make better-informed decisions to protect workers, reduce manufacturing defects and improve operations.

If you would like further information about the value of 5G-enabled edge computing for your company, contact Jason Hunt at djhunt@us.ibm.com or Hamlet Sarokhanian at hs660p@att.com.

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¹ IDC's Worldwide Future of Connectedness 2021 Predictions, IDC,
January 2021

