![CCIntegration — thinking OUTSIDE the box]

Achieving Peak Performance at the Edge

What It Takes to Design and Build an Optimized Edge Computing Implementation

Today we're experiencing the "Fourth Industrial Revolution." This represents the multitude of advances brought about by connecting countless billions of increasingly smart devices to the Internet in every imaginable location. "Edge computing," as it has come to be called, is a critical component of this revolution, shifting some of the computing, data storage and analytics tasks out of traditional centralized data centers and off of the cloud to place them close to where data is actually being collected. The reason? To improve user experiences and business outcomes by reducing latency and avoiding the need for a constant back and forth of data between the core and the location where the action is.

The edge doesn't represent a single place or type of connection. Think of it instead as another logical layer in a networking topology. Every organization and every technology solution has its own unique edge (see box). That edge could be a regional data center, a cell tower, a phone, a surveillance camera, a sensor, a drone, a car or a combination of systems. Wherever that edge happens to be, the idea is to power real-time decision-making there using fresh, relevant data collected and processed within milliseconds to reduce connectivity costs and improve speed and security.

By 2022, more than

50%

of enterprise data will be created and processed outside the data center or cloud, up from less than 10% in 2019.[1]

Your Solution Has Its Own Edge

Remember: don't get hung up on terminology. The edge is simply the place where you meet your customers' needs. Whether you're presenting yourself as a software or SaaS solution, there will often be a need for an edge component to provide your customers with the best possible experience. It could be as small as a sensor or as big as a full system rack. What matters most is setting your customers up for success by bring their data, computing and communications closer together.

Unique Visions Present Unique Challenges

Given that the edge refers to something different from one implementation to the next, **achieving peak performance at the edge** is a challenge that every software and SaaS vendor faces in its own unique way. Nevertheless, the overall concept of moving computing power out of the data center and into the field brings with it some common complexities that heighten the usual integration challenges of design, validation, lifecycle management and support. Those challenges may be:

- *geographical* (new locations or new regions)
- *physical* (hot, cold, or kinetic environments)
- *technological* (power availability, connectivity or bandwidth); and
- *logistical* (regulations, auditing, management or data sovereignty).

To "bring the code closer to the data" and then process the data at the edge in a millisecond—or less—is tough, whether it's happening in a utility closet, a car, a blood pressure cuff, a factory robot, a traffic light, a power pylon or a drone flying over a corn field.

By 2023,

60%

of infrastructure deployed will be in edge locations rather than in data centers, up from 10% today.[2]

AI-Driven Video Surveillance on the Edge

Whether it's used for security, manufacturing, agriculture or traffic, data-intensive video monitoring and surveillance can be much more responsive and therefore more useful when the incoming video is processed in the camera itself or nearby on an edge server. Functions such as facial recognition, pattern flows or machine alignment detection demand near-instant analysis, and some such applications also increasingly rely on compute-heavy artificial intelligence (AI) and machine learning (ML) to become more autonomous and improve the user experience.

One key insight this market reveals is that edge devices don't have to be low power and/or low performance. It's possible to deploy enterprise-level computing power at the edge while remaining cost-effective. In one case, CCIntegration worked with a large provider of video management systems to design, manufacture and deploy a powerful Windows-based system in a single box that was easy for its clients to install and use. Creating the system involved working backward from the potential workload, which was a known quantity, to pick a server/storage solution that would be not just **cost-effective** for its customers but also **easy to maintain throughout its lifecycle**.

Once designed and built, the systems had to go through rigorous testing before they could go into the field. The integrator also helped the company bring AI into its solutions to expand its market—especially in law enforcement, where smarter cameras can implement facial recognition to generate more accurate traffic tickets—and look into special requests for more ruggedized case options and specialized server and rack designs.

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Healthcare Innovations on the Edge

IoT for healthcare is everywhere, and it's growing fast. A plethora of smart devices and sensors is helping collect and analyze data not just in hospitals but remotely as well, opening up a whole new world of telehealth solutions. For a software-centric company attempting to roll out a medical IoT solution, issues around regulations, security and top-notch connectivity are front and center.

Imagine, for example, an Internet-connected handheld device packed full of medical diagnostic tools such as a thermometer, EKG, breath analyzer, camera and more. Now imagine taking that device literally anywhere in the world, where a field clinician could, without onerous training or professional requirements, conduct fast yet detailed medical examinations and send the data back to senior medical professionals at a central site for analysis.

In this example, the tactical realities of implementation start with intensive testing of the accompanying laptops/tablets that are preloaded with the application and provide connectivity. They must be able to send their collected data back to a regional data collection center and then on to doctors working via the cloud no matter the environment. In this case, the edge could be literally anywhere.

A Retail Revolution on the Edge

The retail sector is racing toward a future in which contact-free automated checkout systems are powered by apps, sensors, cameras and AI rather than by clerks. One recent study projects that the value of transactions processed by smart checkout technologies will reach $387 billion in 2025, up from just $2 billion in 2020. Enabling a "grab-n-go" store is no small technological feat, especially if the necessary tools will be retrofit into an existing location. It begins with a site audit to determine feasibility. Will any required racks even fit through the door? Are the ceilings high enough to provide the right camera angles?

Cameras and motion sensors must collect and instantly analyze vast amounts of data as a customer picks up items (and perhaps puts them back down a minute later). Powerful GPU-based AI systems typically drive such an implementation, while connectivity back to a central location lets managers analyze rich troves of shopping-behavior trends across multiple outlets, plan optimal product placement and manage inventories. At the same time, however, the store must be able to run independently should connectivity fail.

Edge computing concepts are also showing up in all sorts of traditional retail environments, most notably in solutions that increase the efficiency of existing sales systems without making a wholesale move to the cloud. Points of Sale (PoS) devices, routers, firewalls and transaction processing devices can increasingly be virtualized and combined into a single tower or 1U server connected to the cloud. Even auto dealers can benefit from local storage of the software updates they upload into cars during tune-ups.

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Cloud-Connected Storage and Security on the Edge

Millions of people got their first real taste of remote work in 2020, and for many, there's no turning back. Managers of businesses large and small are looking for ways to move, manage and store shared data so that branch offices (or remote workers) behave as if they were all under the same roof.

Increasing the productivity of a distributed workforce is challenging because designing a file system that lives and scales within the cloud is complicated. One solution is to equip remote locations with a plug-and-play cloud-connected edge device that consolidates network-attached storage, distributed file servers, data protection, instant recovery, archiving and, perhaps most importantly, a global namespace for multi-site file sharing. With such a device on-site, users get global fire sharing with local performance. Acting as a bridge to the cloud, the device presents no capacity constraints and can manage the entire data protection lifecycle without requiring dedicated IT staff or capital.

In this case, the edge device is acting as a way station on the route to the cloud, and it serves as a clear example of what it means to bring computing power and control closer to the location where data is collected or created. It opens the doors for more enabled computing, freeing users from being tied to a single laptop iteration or location while making remote computing feel a little less remote.

Secure Gaming and Lottery Systems on the Edge

An important part of the work of integration solutions for deployment at the edge is lifecycle management: understanding how storage requirements may evolve over time, selecting future platforms and designing new system racks to meet specific demands for cost-effectiveness, space utilization or power budgets.

For one provider of gaming software technology, growing its market meant providing fully integrated rack-based software/server systems to state lottery boards and casinos of varying sizes. "Turn-key" full integration was critical because such customers have limited tolerance for outside equipment and personnel, and ease of installation and management are top requirements for satisfied customers.

In this case, the software company was essentially offering to extend its data center into the physical locations of its customers. The task was to design, build and test that rack-based system optimally before it was shipped out. Working from rough estimates of the required server performance based on transactions over time and throughout requirements, CCIntegration worked with the company to specify systems with the ideal price/performance balance and to pre-install fully virtualized systems into the racks to support the best possible customer experience.

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> By 2028,
> # 63%
> of the global infrastructure edge footprint support applications in vertical markets such as gaming, healthcare, manufacturing, energy, logistics, smart cities, video surveillance, retail, and transportation.[4]

Your Vision, Your Edge

As inventive minds create visions for products and services that leverage the data journey from edge to core to cloud, they must strategize carefully if they hope to turn their visions into reality.

Think about your own products and services and how you might improve them or grow your market by positioning them at the edge for data collection and analysis. When putting this opportunity into action, we think it most instructive to ask yourself these questions:

- What is your product vision? What new or better solutions could you offer if you were to consider decentralizing compute power, making data available locally or achieving lower latency?

- Have you calculated the "time value" of the data your solution creates and uses? How much value does it lose as seconds, hours and days pass by?

- Understanding that the edge takes on many kinds of shapes, forms and fashions, what is the edge to you? Where is your edge? What level of computing performance makes the best customer experience?

- Have you thought about how introducing AI or ML capabilities might take your product or solution to the next level or expand your potential market?

- Do you have the talent, time and money to build and deploy the hardware components of your solution on your own and then manage and maintain them in the field?

- Would you benefit from a partner to qualify new components, assemble configurations, test them, ship them to customers, handle global logistics and inventory or manage the systems throughout their lifecycles.

A Checklist of Considerations

In edge scenarios, choosing the right platform for your solution is crucial because the decentralization of compute power brings with it some inherent risks and complications. Ensuring you have the right systems for your unique edge not only in terms of features but also in terms of the entire ecosystem around each edge system is critical to successful deployment and operations and satisfied customers.

Definitions and Designs: You must understand not only the hardware you need but also the price/performance balance you should strive for, the entire end-to-end stack and ecosystem around your solution and all the tools and connections that move and process data from edge to core to cloud. Consistency and simplicity in design, installation and maintenance are always top of mind. Every small touch, down to the neatness of the system racks and the labeling of individual cables, makes a difference. Integrators exist to help design, build, ship and maintain turnkey hardware solutions preloaded with the software needed to run the applications envisioned by the software company.

Thorough Testing: Each built solution and its components must be assured prior to their shipment to your customers. It's an important step toward making sure that installation and setup will go smoothly.

Global Logistics: Every location presents its own challenges for shipping and installation, and when it comes to regulations, complex issues around data security and data sovereignty often complicate successful international deployment. Computing at the edge lets you segment data based on compliance boundaries imposed by regulation in different jurisdictions. Shipping and setup have to be managed wherever you want to go in full accordance with local regulations. In many cases it's necessary to build compliant features into the systems before they ship.

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Platform Management: Platform stability throughout the lifecycle of your solution is an obvious goal. Systems must be only as resilient— or in some cases rugged—as they need to be, and lifecycle management, including remote software updates and troubleshooting, must be addressed over the long term.

Smart Security: When data travels to and through cloud-computing configurations and is stored there, security becomes an issue. That can make the edge a real security ally. Localizing data and computing improves privacy, reliability and resilience. Less data must travel, and when it does it may travel a shorter distance. Security is an especially important consideration in telemedicine solutions, where data privacy tends to be heavily regulated. You must consider your security issues from day one.

Low TCO: By sending only the bits of data that need to be sent back to the core and the cloud, edge computing typically improves network and data storage efficiency. Consistency in hardware, tools and development processes across your solution also lowers your customer's total cost of ownership—or yours.

The Right Partner for You

CCIntegration has been addressing integration challenges for 30 years, providing consistent, high-quality integrated systems in the data center and at the edge and acting as the hardware engineering and logistics extension of some of the world's most successful software and SaaS companies. Top-level partnerships with innovative tier-one vendors like Dell Technologies allow CCIntegration to deliver reliable, successful on-premises and edge solutions for your customers.

CCIntegration goes beyond hardware integration, working with every client to implement efficiencies in inventory, logistics and product lifecycle management that can increase revenue and profitability. Our global experience means you can introduce integrated hardware/software solutions to new geographies securely and confidently.

It takes a partner who is objective, experienced and nimble enough to adapt to the unique needs that edge use cases present. CCIntegration can be that partner for you.

Let CCIntegration help bring your edge vision to fruition.

Contact us at **sales@ccintegration.com** to learn more.

1 https://www.gartner.com/smarterwithgartner/gartner-top-10-trends-impacting-infrastructure-operations-for-2020

2 https://www.youtube.com/watch?time_continue=2&v=eFgIX7xDq2A

3 https://www.juniperresearch.com/press/smart-checkout-technologies-to-process-$387-bn

4 https://stateoftheedge.com/reports/state-of-the-edge-report-2021/

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