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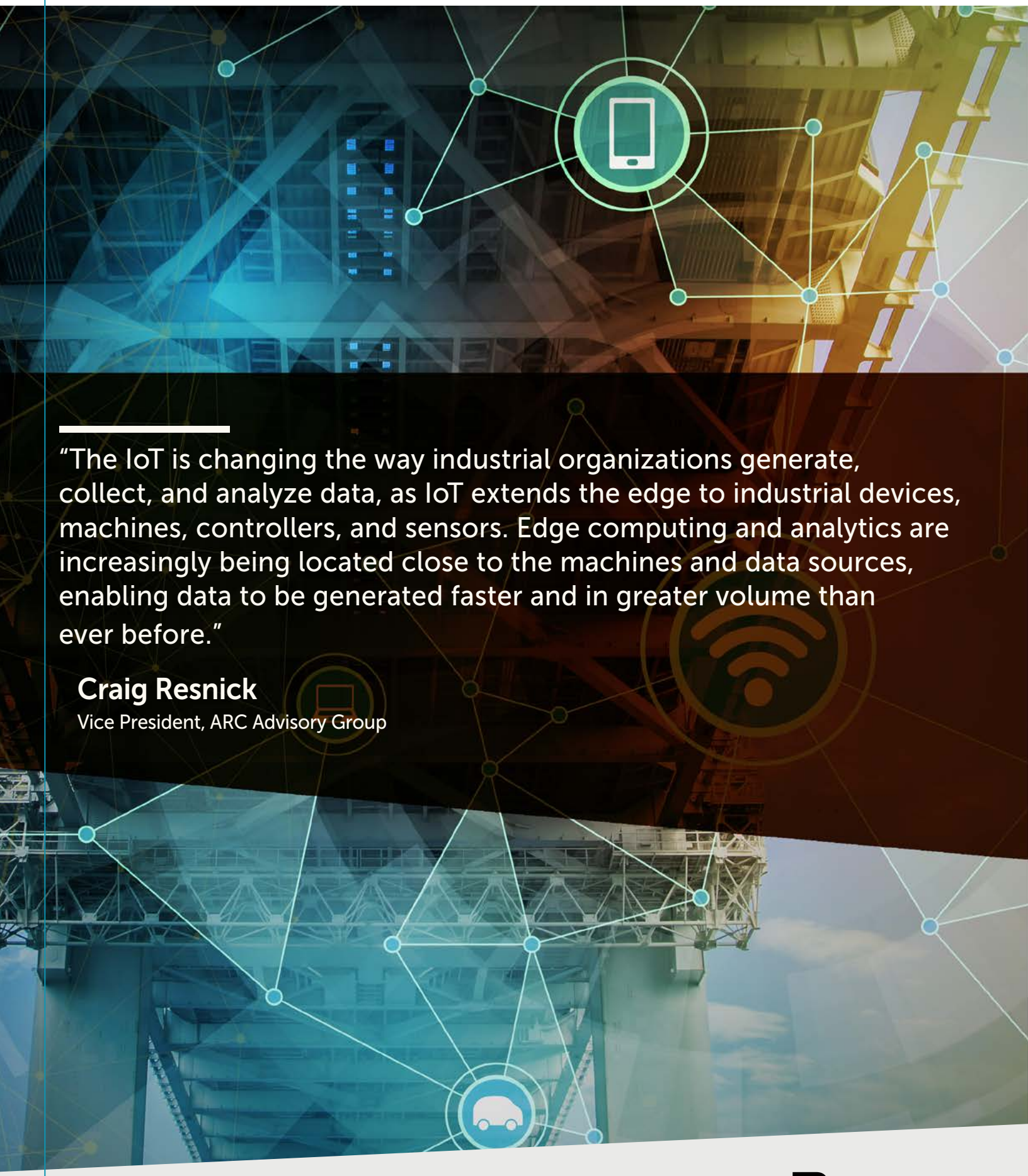
Edge Computing: Behind The Scenes Of IoT

With IoT, You May Have To Run To The Edge

WHITE PAPER



"The IoT is changing the way industrial organizations generate, collect, and analyze data, as IoT extends the edge to industrial devices, machines, controllers, and sensors. Edge computing and analytics are increasingly being located close to the machines and data sources, enabling data to be generated faster and in greater volume than ever before."

Craig Resnick
Vice President, ARC Advisory Group

The cloud has taken a strong foothold in the IT world, and why not? You can add or remove computing and storage resources as needed and there is no need to worry where those resources are located. The cloud has its place. However, there is a downside: with the cloud you do not know where the compute and storage resources are located.

When it comes to the IoT, responding in real time to events is critical. With real-time applications, the amount of network latency in the system is critical; less is more. You cannot manage latency if you do not know where the compute and storage resources are located. Not only do you not know where those resources are located, the location may change as the cloud provider balances its load among the servers within a data center. Even worse, the latency can change as the cloud provider moves those resources across its data centers.

Edge computing can rescue your network from too much latency.

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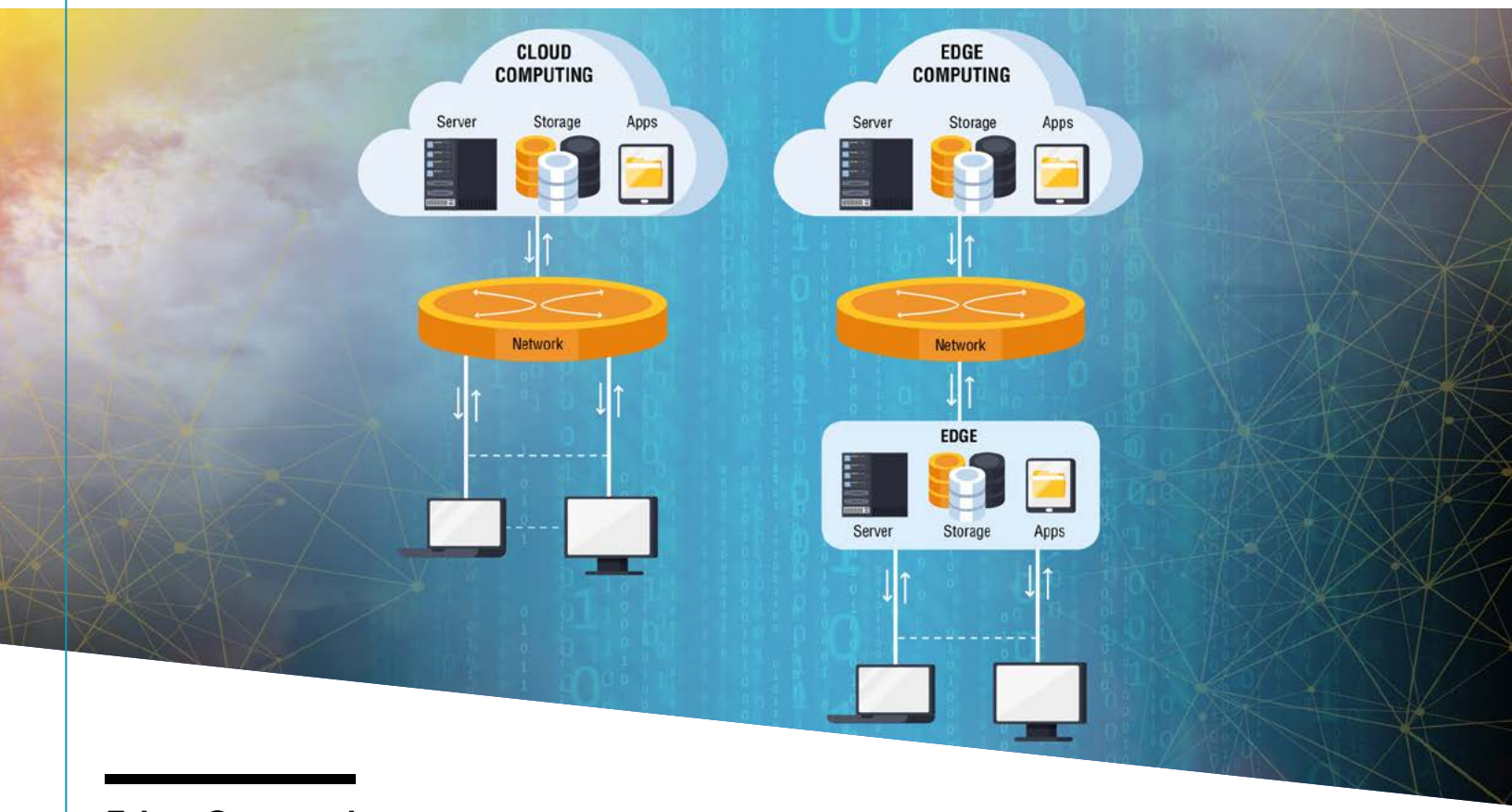


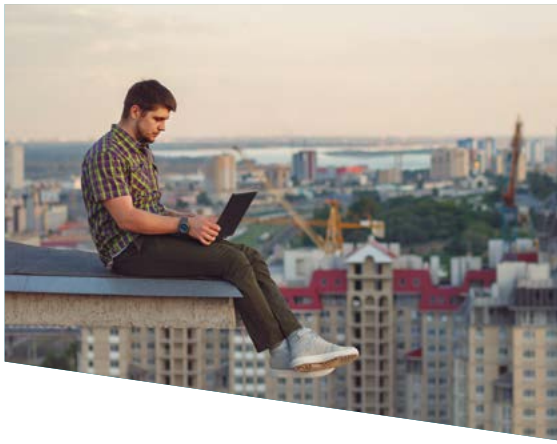
Edge Computing

Edge computing is the opposite of cloud computing. With edge computing, the compute, storage, and application resources are located close to the user of the data, or the source of the data. This is in contrast to a cloud deployment where those resources are in some distant data center owned by the cloud provider.

Although edge computing may appear to be a new concept, it is just the computing pendulum swinging to one side of the computing continuum.

Computing started with the advent of mainframes in the late 1950s. Mainframes are an example of centralized computing; they were too large and expensive for one to be on every user's desk. In the late 1960s, minicomputers appeared, which moved compute power away from centralized control and into research labs where they controlled experiments, the factory floor for process control, and many other use cases. The pendulum moved all the way to the distributed side with the arrival of the PC in the mid-1980s. With the PC, individuals had computing power at their fingertips.

The computing pendulum swings back and forth, and today, it is swinging towards edge computing, which puts the processing and storage resources closer to where they are used and needed.



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Why Edge Computing for IoT?

IoT deployments can benefit from edge computing in three ways:

Reduced Network Latency

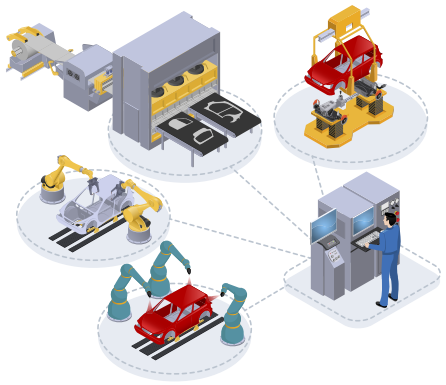
The latency in an IoT deployment is the amount of time between when an IoT sensor starts sending data and when an action is taken on the data. Several factors impact network latency: The propagation delay through the physical media of the network; the amount of time it takes to route data through the networking equipment (switches, routers, servers, etc.); and the amount of time it takes to process the data.

Let's say that the distance between an IoT sensor and the data center that needs to process that data is 2,300 miles (3,700 km) apart. That is roughly the distance between Cleveland and Lake Tahoe. The speed of light in a typical singlemode optical fiber is approximately 4.9 µs/km, therefore, the round-trip delay would then be 36mS. Adopting edge computing and locating the processing and storage resources in Cleveland would make the round-trip delay almost negligible. Additionally, the data would travel through fewer routers since it would not have to make a cross-country trip, and the possibility of the data packets being corrupted would be far less.

Reduced Network Jitter

The jitter in a network is the variation of latency over time. Some real-time IoT applications may not be tolerant of network jitter if that jitter causes the latency to lengthen such that it prevents the system to act in the required time frame.

Cloud-based applications are inherently jittery. At the data center level, the required resources for an IoT application can be moved from one server to the other, changing the latency. In addition, while the applications are being moved they will be unavailable. At the macro level, the applications could be moved among the cloud provider's data centers, which would have an impact on latency and, therefore, jitter.



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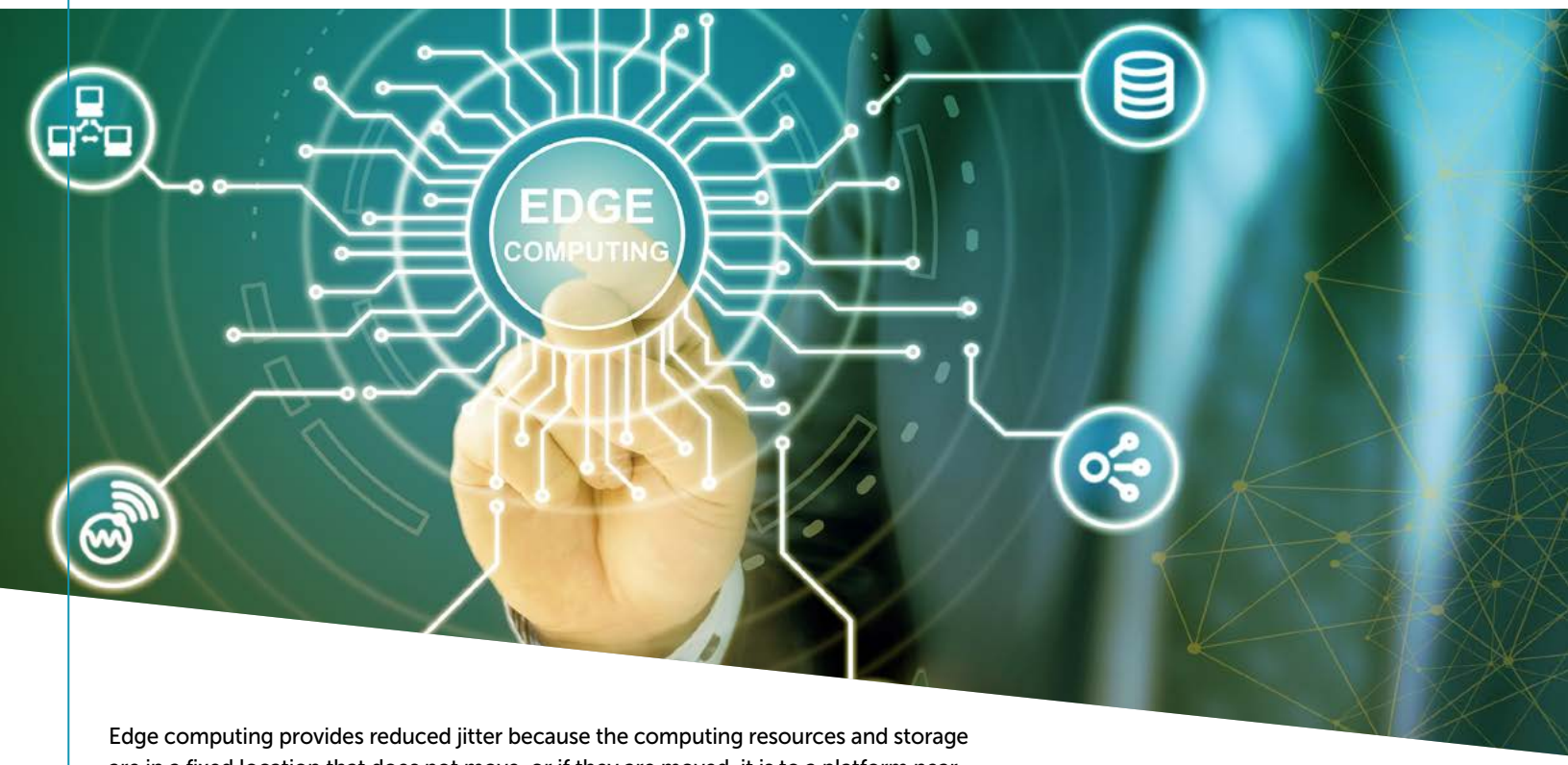


Edge computing provides reduced jitter because the computing resources and storage are in a fixed location that does not move, or if they are moved, it is to a platform near the original location. Additionally, the network is generally a fixed path, which means repeatable latency.

Another issue with the cloud is that one most likely accesses the application using the Internet, which is inherently jittery. The Internet was designed to be resilient. It will automatically route packets around downed network links and unavailable routers. One can send two consecutive packets out onto the Internet, and they could take two different paths to the destination and, therefore, be subject to two different time delays. In fact, the second packet that is sent could be the first one that arrives.

Enhanced Security

Edge computing offers the opportunity to provide a more secure environment regardless of how one would deploy: co-location or directly owning the equipment. Co-location facilities are physically secure locations. If one owns the edge computing equipment, it can be in the factory where the IoT sensors are located or in another company-owned facility.

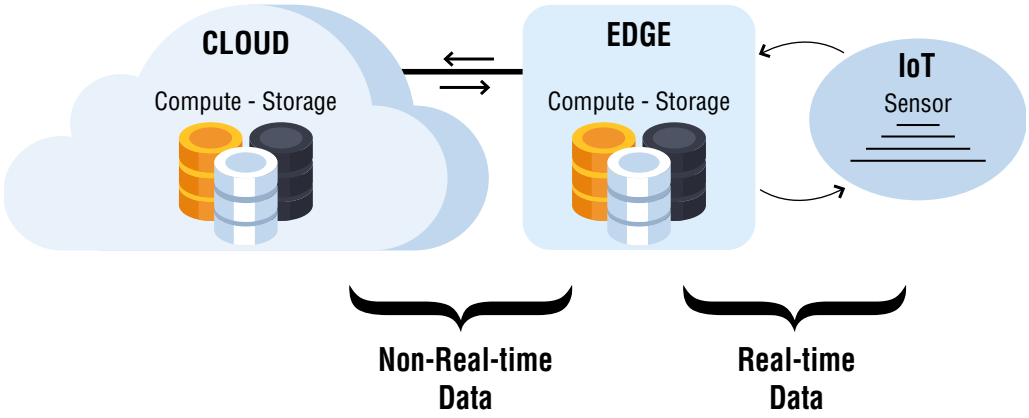
"The IoT is changing the way industrial organizations generate, collect, and analyze data, as IoT extends the edge to industrial devices, machines, controllers, and sensors. Edge computing and analytics are increasingly being located close to the machines and data sources, enabling data to be generated faster and in greater volume than ever before," according to Craig Resnick, vice president, ARC Advisory Group. "Besides providing control, these edge devices will securely collect, aggregate, filter, and relay data, leveraging their proximity to industrial processes or production assets. This data will be analyzed by powerful analytics tools, which will detect anomalies in real time, and raise alarms so that operators can take appropriate actions. As IoT and the digitization of industrial systems proceeds, so does analysis, decision-making, and control being physically distributed among edge devices, the network, the cloud, and connected systems, as appropriate."

Edge computing offers the opportunity to provide a more secure environment regardless of how one would deploy.

What to Consider When Deploying Edge Computing

Decouple the Real-Time Requirements from the Cloud

The first step toward implementing an effective edge computing solution is to identify the IoT applications that require a real-time response. These are the applications to consider when deploying on the edge. The remaining applications can run in the on-premises data centers or in the cloud.



This turns the cloud into a type of historian for the IoT-gathered data. It receives non-real-time data that can be processed, analyzed, and stored in a time frame that meets the business's needs.

Harsh Environment
The ideal location for the shortest network latency may not be the ideal choice for environmentally delicate equipment and cabling. It may be that the best place to locate the edge computing resources is on a harsh factory floor. This might necessitate ruggedized compute and storage equipment, but may impact the networking infrastructure as well. Electromagnetic interference (EMI) may also be a part of a harsh environment. This might require using shielded copper cabling which has improved immunity to EMI, or using fiber optic cabling which is completely immune.

One thing to consider would be deploying environmental sensors to monitor the environment in proximity of the edge computing equipment. Panduit offers temperature, humidity, and other sensors as part of its IoT **SynapSense® Remote Monitoring Sensors**.

Space Constraints
The edge computing solution may need to be deployed in a location that is space constrained. This would lead one to deploy a high-density network infrastructure, such as a fiber enclosure that can accommodate 72 duplex LC ports in 1 RU of rack space. Depending on the mix of copper connections versus fiber optic connections, one may opt for a lower density enclosure as it can support both copper and fiber connections within the same space.

Security
The ideal location for the edge may not be secure. It may be in a remote location where there is no surveillance or on the factory floor where there might be opportunities for unauthorized entry. In both cases, and in others, consideration should be given to how to manage access. There are a range of choices from key card entry readers, numerical keypads, and remote access control.

The Journey to the Edge

Edge computing may be a requirement in the wide deployment of IoT. The IoT requires responses in real time, but deploying the compute and storage resources for IoT in the cloud may not support IoT because of network latency. The solution to lowering latency is to move those resources closer to the IoT sensors that are providing the data, or expecting a real-time response.

If you are thinking about deploying IoT, think through the cloud and out to the edge.

For more information on the IoT and automating the factory floor, visit **Panduit's factory floor landing page** on our website.

Subscribe to our blog at Panduitblog.com to access all the papers in this IoT "101" series ncluding Packet Loss on the Plant Floor, Real-Time Data, and the Ubiquity of Bandwidth.

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