Embrace Your Edge

A Guide to Edge Computing

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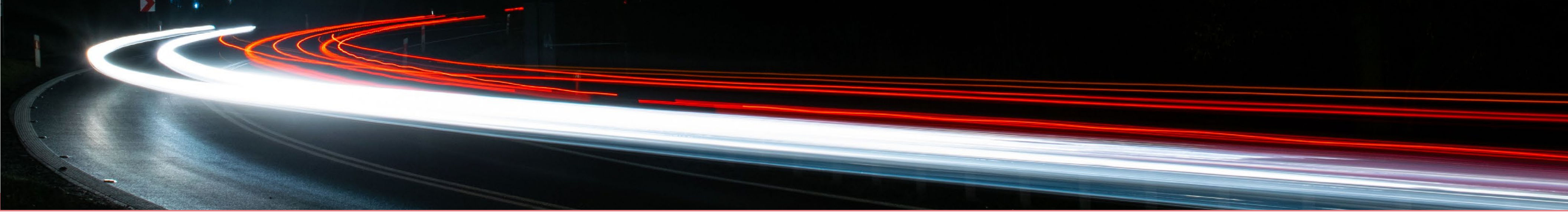
Why Edge? Why Now?

Edge computing uses a distributed computing model that places the data processing as close as possible to the devices that are generating and using data. This is in contrast to a centralized model based on hyper-scale "cloud" datacenters. Edge computing improves application response times, saves on bandwidth costs, and enables real-time applications such as driverless vehicles, video analysis, and augmented reality, to name a few. The concept of edge computing has been around for many years; however, there has been no immediate need for widespread adoption—until now.

Gartner, Inc. predicts that 75% of enterprise-generated data will be "created and processed outside a traditional centralized data center or cloud" by 2025.



3 Drivers Growing Adoption of Edge Computing

Three significant drivers are converging that are driving the rapid adoption of edge computing; the accelerated adoption of remote learning and work, the realization of quantifiable benefits from IoT, and the emergence of faster access speed driving an avalanche of raw data.

1

Emergence of Remote Work and Learning – Fast broadband is no longer a nice-to-have. It is essential to everyday life. With the rapid transition to remote work, distance learning, and telehealth, ubiquitous high-speed connectivity is now woven into the fabric of our lives. The pandemic has only accelerated the demand for higher bandwidth, for both businesses and consumers who need and demand faster, higher-capacity networks with ultra-reliable, ultra-low-latency connectivity.

2

Realization of IoT Benefits – Simultaneously, IoT for both consumers and businesses is reaching an inflection point. IoT and Industrial IoT (IIoT) have moved beyond the hype, and are now delivering digital lifestyles and workstyles to billions of people, and are providing actual, quantifiable personal and business outcomes. Now that the value proposition has been validated, the challenge becomes scale and performance. According to Deloitte, enterprises are increasingly complementing their cloud-based IoT solutions with edge computing to alleviate latency, boost scalability, and increase access to information, accelerating faster decision-making and enabling more enterprise agility. An added benefit is the ability to operate autonomously, without access to the Internet, if the need arises.

3

Faster Device Access Speed – 5G, Wi-Fi 6, fiber-to-the-premise, and emerging Cable standards (DOCSIS) boost the ability of any device to generate more data faster. Wi-Fi 6 provides up to a 2.5X speed boost over Wi-Fi 5 for wireless LANs and public hotspots, while 5G provides up to 20X speedup over 4G LTE for mobile devices. 5G promises huge data rates between the user, device, and the network, and it will open up the possibilities for new applications. However, if the additional processing, storage, and upstream bandwidth to the cloud are not in place to manage this data tsunami, apps will not be as responsive as needed, and users will become frustrated. You had likely experienced this when your phone showed four wireless 4G LTE service bars, but your apps and browsing felt slow. The connection was great, but the infrastructure behind it was out of balance, and your phone can’t tell you that. The rest of the infrastructure must be in balance with these higher-speed connections.

Edge Computing Solves Four Significant Challenges

Here are the challenges edge computing solves:

1 **Responsiveness:** Real-time decision-making requires processing data in milliseconds. Manufacturing control systems, robotics, autonomous vehicles, access controls, live human interaction, interactive video, AI applications, and augmented reality/virtual reality systems all require localized processing to deliver an essential level of responsiveness. Centralized clouds, which may be hundreds or thousands of miles from the data source, can be plagued by network congestion, server capacity, or scaling issues.

2 **Bandwidth:** Moving all of the collected data from every device back to a central cloud has a cost. By processing the data as close as possible to the sources, and only passing relevant events to the data center, you gain tremendous savings. These savings include the cost of the bandwidth and reduce the need to build out infrastructure capacity continually to handle it.

3 **Storage:** Storage is relatively cheap, but if the price of storage falls by 50%, and we create 100% more data, we still have a problem. Data is only as useful as the knowledge we can extract from it. Rather than shipping all of that data to a remote storage location for future processing, the ability to process the data as close as possible to the source in real-time, compressing it into meaningful knowledge, results in far greater storage efficiency.

4 **Security:** IoT devices of all types – smart doorbells, cameras, thermostats, garage door openers, and the entire spectrum of IoT devices can be hijacked by cybercriminals, and turned into a botnet, an army of devices that are used to stage massive attacks across the Internet . Your devices are used without your knowledge. And they can be used not only to attack the Internet, but your network too. By deploying edge computing, traffic profiles can be analyzed to spot unauthorized traffic both coming into your devices and being generated by them. Security countermeasures at the edge of the network, using distributed resources, is a powerful deterrent against cyber-attacks.

Edge Computing Complements a Core Cloud

Once edge processing is in place, new applications previously considered unfeasible will emerge. However, this will only happen if the industry uses edge-processing capacity as an addition to core capacity – not as a replacement. Just as SaaS upended on-premise software, edge software applications will evolve the cloud-computing paradigm from a centralized model to a distributed model, unleashing better responsiveness for real-time applications and giving applications a local performance boost.

This new model means software architects will have to design orchestration capabilities to use the combined processing capacity of both core and edge as a whole, allocating and partitioning where their applications run to take advantage of the unique and complementary benefits.

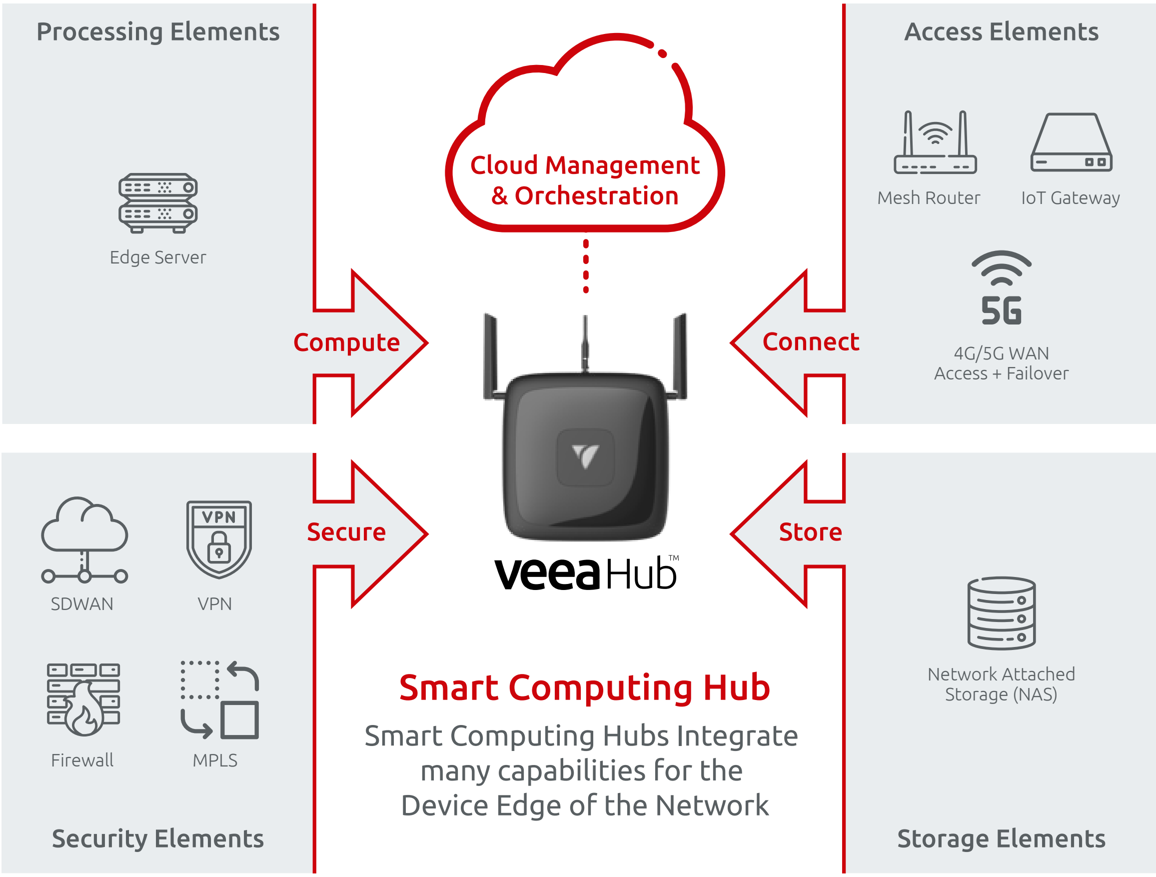
However, adding more compute capacity at the edge does not just mean building many smaller datacenters. The scale economies that drive the central cloud's hyper-scale datacenter implementation, with racks and racks of servers contained in a single massive facility does not exist at the edge of the network where user's devices connect.
For an effective edge cloud, separate routers, IoT gateways, security systems, and processing servers from multiple different vendors – and the infrastructure and human support they require – are not the answer. Separate hardware elements create more failure points and require more support.

The hardware platform needs to be an integrated, multi-function hybrid of all of these different elements.

Multi-Functional Hardware at the Edge

Since processing needs to be as close as possible to where devices connect, and we need to keep things manageable, it makes sense to co-locate, or even integrate processing resources with cellular access points, Wi-Fi routers, and IoT access points/gateways. This new, essential integrated “connectivity + computation” hardware for edge architectures is the Smart Computing Hub.

Beyond connect and compute elements, Smart Computing Hubs must also have security built into its DNA, in the interface, processing, and overall system architecture. This embedded security is critical since the more deployed nodes in this distributed computing architecture offer a larger attack surface for bad actors.



Including security as a core Smart Computing Hub capability, the increased number of edge elements shifts from being a potential liability to a position of strength against many kinds of cyber-attacks.

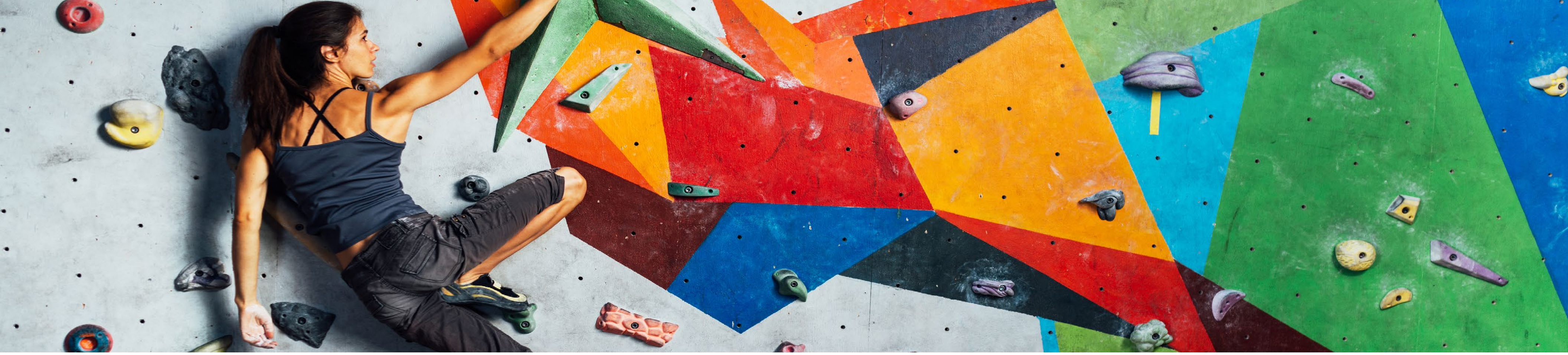
Elements of Smart Computing Hubs

So, what do Smart Computing Hubs require to meet all of these needs?

1 **Robust wireless and wired connectivity –** For LAN connections, dynamic, auto-configuring/self-healing mesh Wi-Fi is essential. It provides the reliable connectivity needed to create the edge cloud's application mesh, as well as the Wi-Fi access for the end-user devices. Also, given that IoT devices are everywhere, Smart Computing Hubs need to offer wireless IoT connection technologies like Zigbee and Bluetooth/BLE for short, high-speed data transfer and LoRa for long-distance connections and for locations where Wi-Fi struggles. Physical Ethernet LAN ports provide power to IoT devices such as smart cameras. For WAN connectivity, both physical Ethernet ports as well as wireless 4G/5G cellular connectivity is required, both for persistent backhaul and WAN failover connectivity.

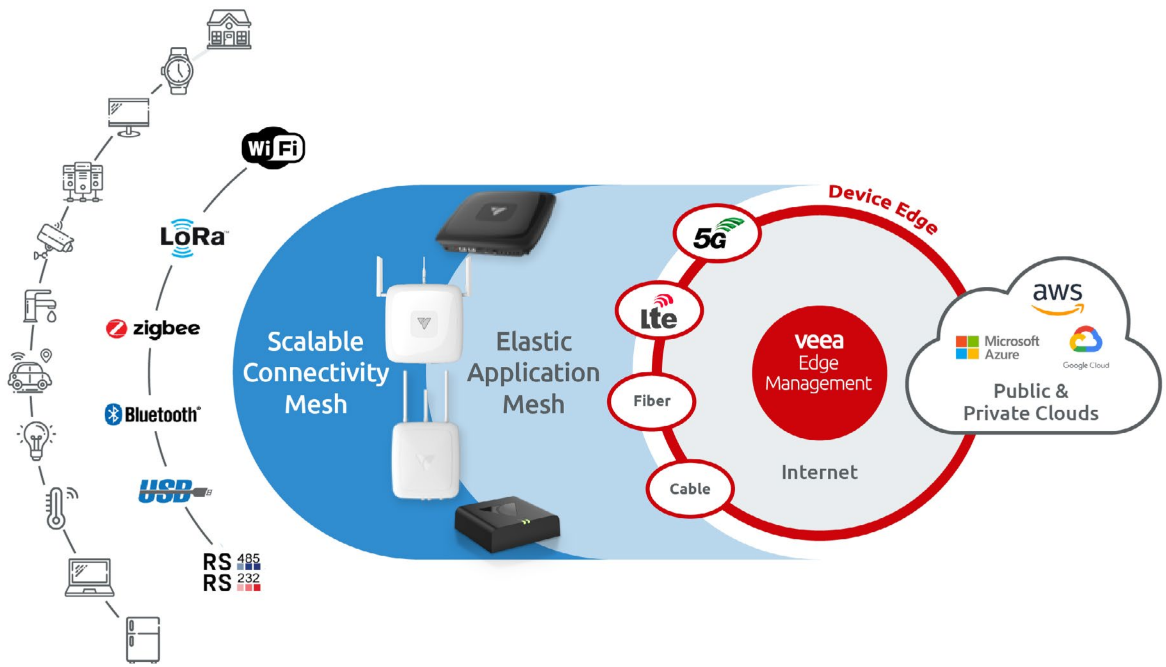
2 **Server-grade processing capabilities –** Beyond enterprise switching and routing capabilities, Smart Computing Hubs must offer easily accessible processing capacity for customized applications. As the applications running in the central datacenters today move to edge clouds, an application processing mesh is needed to support processing fluidity between core and edge cloud processing resources, potentially allowing them to merge into a tightly integrated logical processing system. Microservices in container-based architectures will be an essential part of a successful edge computing strategy, offering the fluidity required at the network edge.

3 **Built-in Security –** Smart Computing Hubs must also have security built into their DNA. It needs to be built-in to the interfaces, processing, and overall system architecture, especially since the additional number of nodes deployed offers a larger attack surface for bad actors. They must be clone-resistant. And the software application architecture must be secure – secure application sources, secure containers, and secure APIs, to name a few. As a benefit of designing in security as a core Smart Computing Hub capability, the increased number of distributed edge elements shifts from being a potential liability to a position of strength against many kinds of cyber-attacks.



Scaling the Edge with Smart Computing Hubs

Because 5G's higher radio frequency and shorter reach demand more physical access points than prior cellular technologies such as 3G and 4G/LTE, it is now essential that Smart Computing Hubs be easy to deploy and manage so that we can upgrade existing sites and add new ones.



Smart Computing Hubs must also have the ability to become part of an application mesh with other Smart Computing Hubs so that the processing capacity of all of these nodes in a given local edge network can be abstracted as a single aggregated resource. If this application mesh can be created wirelessly and cellular WANs are used, the Smart Computing Hubs need only have a physical connection to power. All other connectivity may be achieved wirelessly, making Smart Computing Hub deployment incredibly simple. Adding additional edge cloud processing capacity is as easy as powering up another Smart Computing Hub.

Scaling IoT with Edge Computing

IoT/IIoT means many different things, depending on the market application. Real-time drone control is a very different application from smart building access control and temperature monitoring, even though they both fall under the IoT umbrella.

As a result, Smart Computing Hubs need multi-dimensional scalability, the flexibility to scale capacity and functionality quickly across a wide array of applications as well as cover different operational scale within each application.

4 Must Haves for IoT/IIoT Implementions

Pay as you go processing power
Start slow and add more Smart Computing Hubs when more processing power is needed.

Ease of deployment
Simply deploy more Smart Computing Hubs wirelessly, with only a power cord.

Flexible processing and connectivity feature sets
Add different types of processing and features to the application mesh based on the local need. For example, add more graphics processing units (GPU) for image AI and video processing applications. Add more storage for content caching, or more radio types such as LoRa WAN for long-range telemetry and control, or where Wi-Fi cannot penetrate (Smart Buildings).

Make autonomous application operation possible
When the WAN goes down, the system can keep processing.

Smart Computing Hubs can be wirelessly added or removed from any application mesh, making it easy to place the right resources where they are needed and to shift them quickly as changing requirements demand.

Edge Computing Enables New Applications

Many new applications will be unleashed by edge computing. According to MarketsandMarkets Research, the Augmented Reality (AR) market will grow from $15.3B in 2020 to $77.0B by 2025. Engaging AR applications must be hyper-responsive, but processing performed in cloud data centers located hundreds or thousands of miles away from users adds unacceptable delay. Local edge cloud processing with hyper-low latency is increasingly critical as AR moves from novelty to necessity across a broad swath of markets, including industrial, education, and healthcare.

One example offers an Augmented Reality (AR) experience running on Smart Computing Hubs to provide real-time interactive engagement for a historical exhibit is in Seongnam, South Korea. The Seongnam Cultural Foundation's Independent Activist Webtoon Project exhibit uses AR to delight, engage, and educate visitors as they learn about the lives and spirits of 100 historically important activists. Seongnam's Smart City project funded the deployment of a group of indoor and outdoor Smart Computing Hubs with all of the necessary local device connectivity and processing this exhibit demands. The resulting responsiveness supports the level of interactivity and engagement that the exhibit owners wanted while keeping operational costs low; all of the required capabilities are integrated into a few highly integrated network elements, and data bandwidth to the cloud is kept to a minimum.

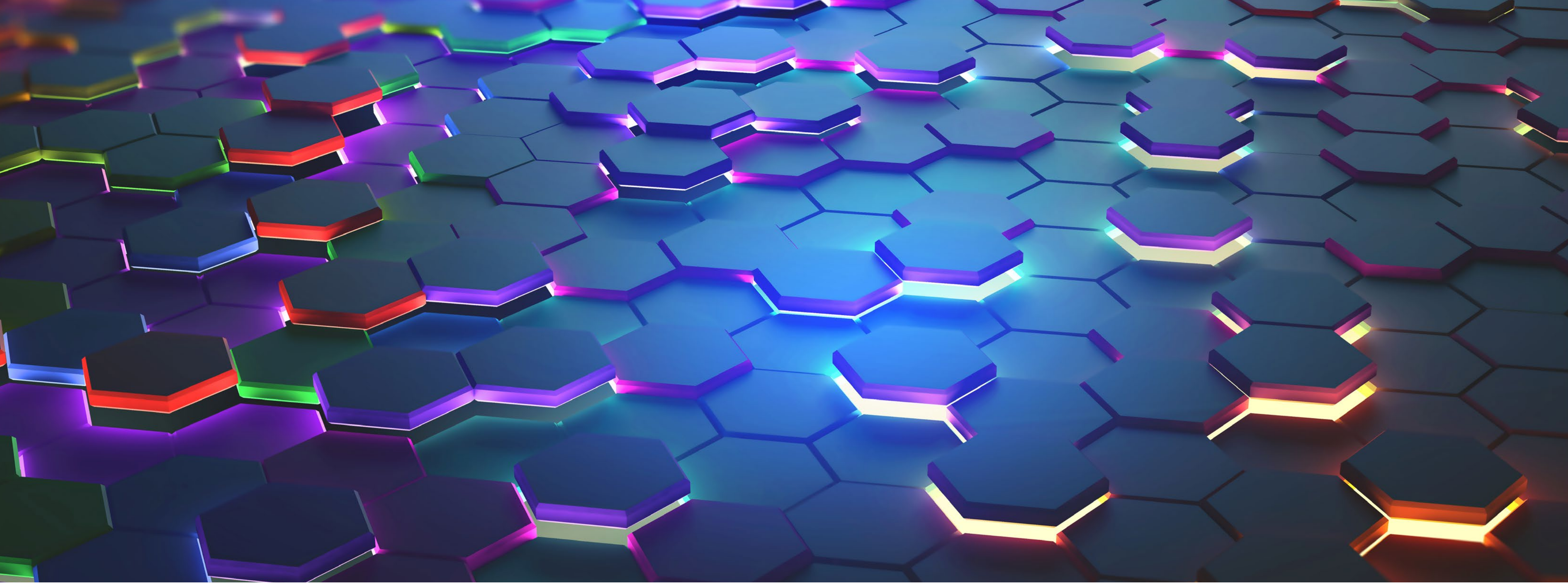
AR software running on Smart Computing Hubs allows visitors to view and hear webtoon animated characters on their smartphones as they move through the exhibit. Exhibit visitors can even take selfies with the characters and view giant 3D elephants and rabbits playing in the exhibit plaza grass.

Embrace Your Edge

Consumers and businesses are demanding new types of applications that require reduced or no latency, more predictable performance, greater autonomy, and less WAN bandwidth costs. A distributed cloud edge computing model is needed.

The equipment requirements for providing edge computing are very different from hyper-scale data centers. There is already a footprint at the device edge for access equipment. By integrating access features into edge servers, these familiar access point locations can be unified with a new hybrid class of Connect + Compute + Secure devices, providing the edge computing needed with minimal physical disruption at the device edge of the network. There is no need for new equipment closets and racks or the power and cooling they require.

The Smart Computing Hub is a new equipment class that creates the highly distributed, scalable edge application mesh that is required.



About Veea

The Veea Edge Platform™ provides everything organizations need to quickly and easily tap into the power and benefits of Edge Computing. VeeaHub® Smart Computing Hubs connect to form an elastic, scalable, easily deployed, and managed connectivity and computation mesh. Veea Edge Services use this mesh to address common edge application needs. And Veea Developer Tools accelerate the deployment of our partners' and customers' edge and IoT solutions. Veea is blazing the path to new levels of integration, performance, and value at the network edge, resulting in operational simplicity, lower cost, and greater user satisfaction. For more information, visit https://www.veea.com and follow Veea on LinkedIn and Twitter.

Intelligently Connected™

Veea, Inc.
164 E 83rd Street
New York, NY, 10028
info@veea.com

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