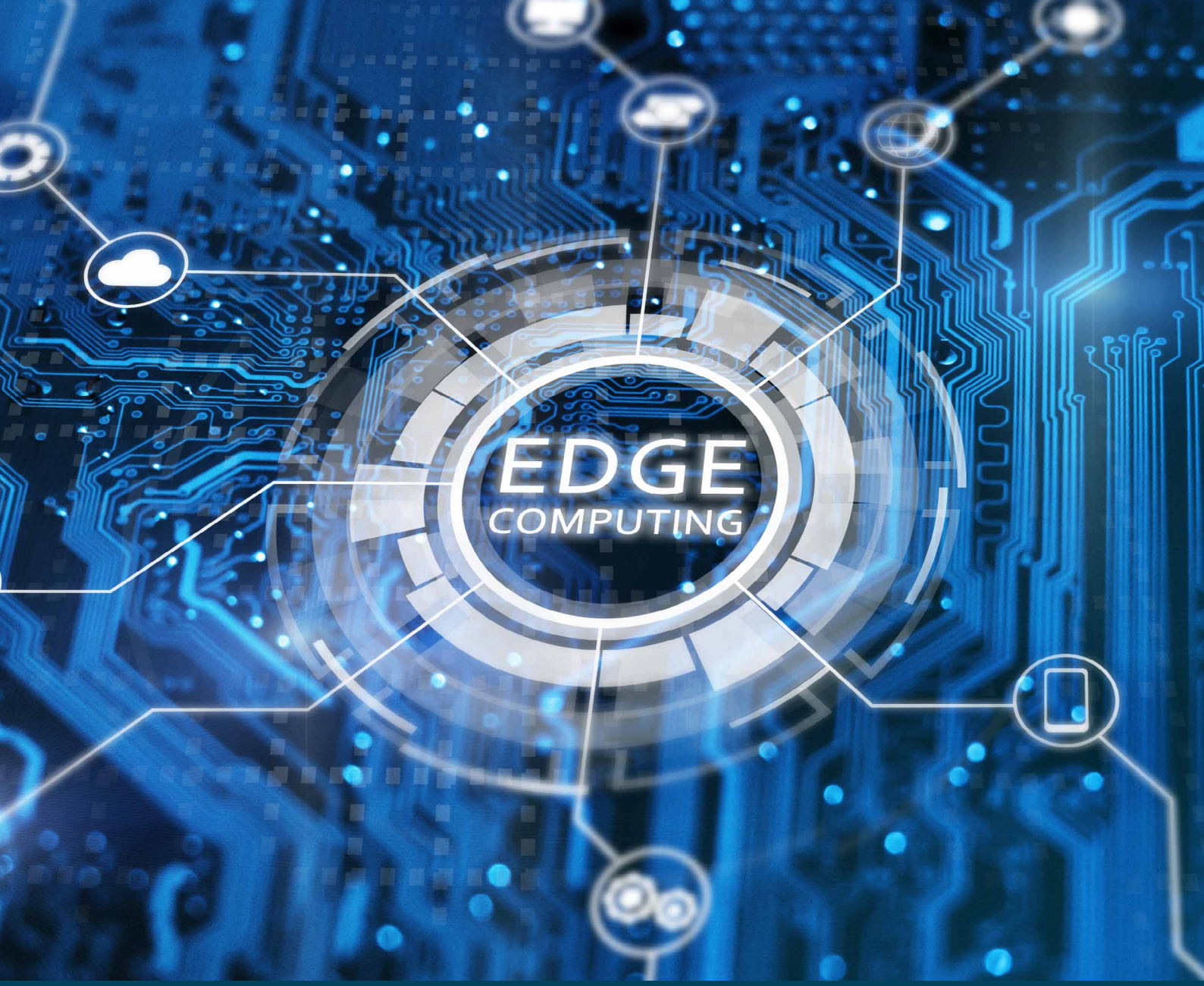

WHITEPAPER

Evolving Power Architectures to Capitalize on the Full Potential of 5G and Edge Computing

Vertiv™ NetSure™ Inverter Series Provides Converged AC and DC Power to Support Digital Business Growth

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Executive Summary

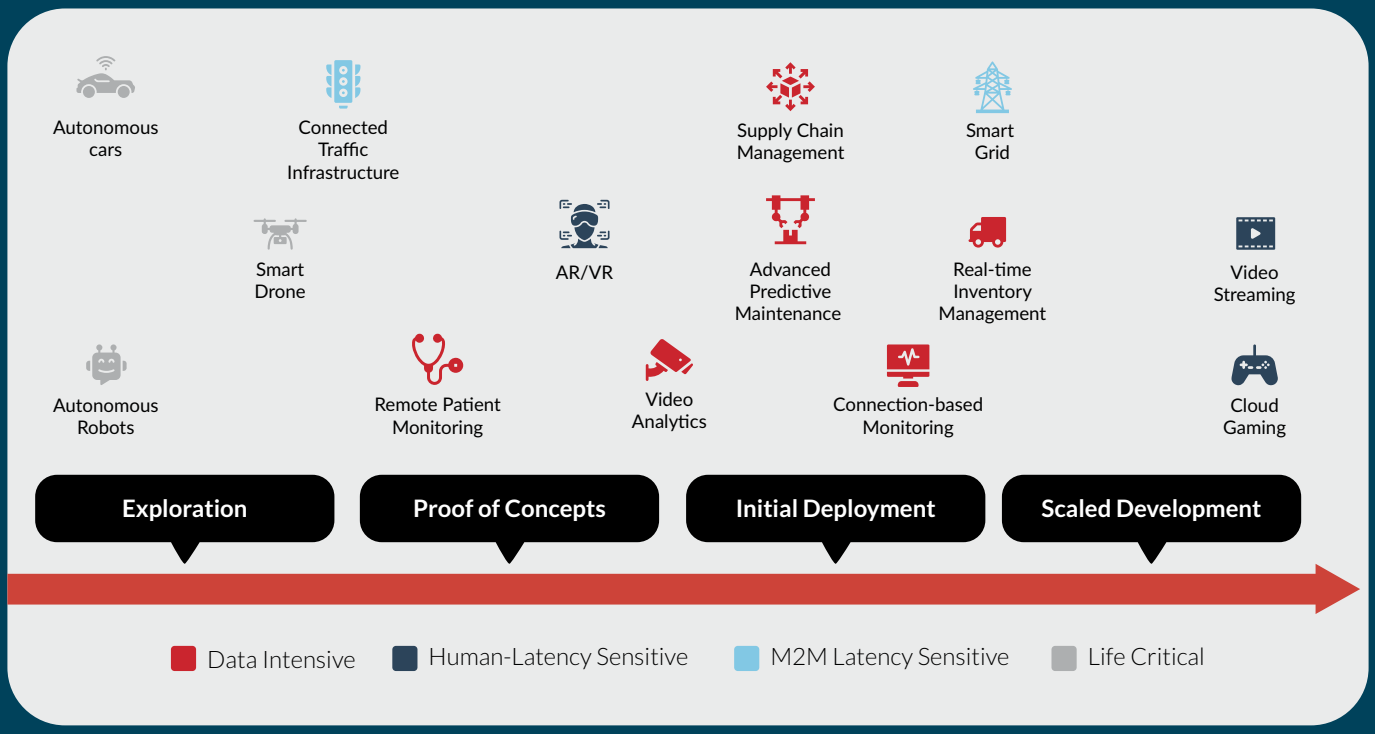
Pervasive connectivity is rewriting the rules of business—and it's happening much faster now that organizations around the world have fully embraced digital transformation. As a result, convergence is accelerating across industries. Telecommunications operators are converging with IT services providers, by offering enormous bandwidth and ultra-fast processing speeds that can be used to develop and deliver new products. Organizations are converging with telecommunications providers, by standing up private high-speed networks for their own use and packaging voice, data, and video in a single offering. Business models are converging, as partners work together in new ways to enable exciting industry use cases. Computing is converging, as it becomes embedded in more processes, shapeshifts across devices and form factors, and guides how humans interact with the world. And equipment is converging, as high-performance IT equipment now sits next to both AC and DC power equipment at edge and access sites.

If all of this change seems high stakes, it is: 5G will create $13.2 trillion in new economic opportunity by 2035.[i] Everyone wants to be a 5G leader, to seize the opportunities this transformative mobile wireless technology will enable. 5G provides processing speeds that are 100-times faster than LTE; supports 100X more connections than 4G; offers latency that's less than a millisecond; and delivers reliability that's 99.999 percent guaranteed.[ii] As a result, organizations will use 5G to unleash incredible innovation around the world.

The development of 5G networks also means that supporting power requirements are changing fast. This trend is creating both challenges and opportunities for telecommunications operators and other organizations to master.

During the pandemic, organizations increased their adoption of edge computing, to support workloads such as digital workspaces, video conferencing media streaming, and more. Their success doing so—as well as the continued global rollout of 5G—has set the stage for even more data-rich use cases, where processing speeds, latency requirements, and other factors are even more critical. Some applications, such as widespread use of autonomous cars and robots and smart transportation, are still years off. However, others such as retail inventory management, predictive maintenance in manufacturing, and supply chain management in multiple verticals are happening right now, providing organizations with incredible value.

How Industry Use Cases Map to the Four Edge Computing Archetypes



Access and Edge Site Growth Creates New Challenges and Opportunities for Telcos

Edge infrastructure refers to the physical compute infrastructure—servers, power, cooling, and enclosures—that is installed on networks between end devices and core data centers. Four different edge models are key to supporting fast-paced digital business growth globally: device edge, micro edge, distributed edge data center, and regional edge data center.

As the graphic on page 5 indicates, telecommunications providers and organizations will be building out micro edge and distributed edge data centers. (Device edge solutions pack compute right onto the device, while regional edge data centers require sophisticated Tier 3+ infrastructures that are typically the province of cloud and colocation providers.) In addition, telecommunications firms may operate access sites that require AC loads or need to refresh power and IT equipment at core sites. As a result, telecommunications providers and other organizations may face one or more of the following challenges monitoring and managing power across far-flung networks.

Operating AC and DC power together

Telecommunications equipment, which has traditionally been fed by 48V DC, is now being placed next to IT equipment, which uses AC power at both edge and some access sites. In the U.S., that is 120VAC and 240V AC, while in Europe is it is 240V AC.

Telecommunications providers and organizations want to process AC and DC loads together, while gaining the ability to add more capacity over time to support the higher-density racks used for data-intensive digital applications. Any organization can harness converged AC and DC power systems to process data loads onsite. Consider colleges and universities, which previously have had to pay significant sums to technology partners to store and process their data. With edge sites and combined AC-DC power architectures, these education institutions can now process these workloads in-house, enabling new use cases, increasing data security and privacy, and reducing their operational costs.

Vertiv™ NetSure™ Inverter Series Converged AC and DC Power Systems include an intelligent NCU controller, along with rectifiers and inverters supported by the same battery bank, to control AC and DC power and provide hours of battery




		EDGE INFRASTRUCTURE MODEL*			
		Device Edge	Micro Edge	Distributed Edge Data Center	Regional Edge Data Center
CHARACTERISTICS	Location	Smart devices (e.g., in vehicle, street lamp, IoT)	Enterprise site (e.g. retail, factory floor, IT closet, municipalities)	Enterprise site (e.g. warehouse, office), telecoms site, parking lot, tier 2/3 city	Tier 2/3 city**
	Number of Racks	0	0-4 racks	5-20 racks	20+ racks
	Power	Up to 1 kW	Up to 20 kW	Up to 200 kW	Up to 4000 kW
	Tenancy	Single Tenant	Single Tenant	Single Tenant / Multi-Tenant	Multi-Tenant
	External Environment	Controlled (within Device), Harsh & Rugged	IT Closet, Commercial & Office, Harsh & Rugged	Harsh & Rugged, Commercial & Office, Conditioned & Controlled	Conditioned & Controlled
	Passive Infrastructure	May or may not have power and filtration, no cooling, etc.	Has power with limited cooling and filtration, etc.	Tier 1+	Tier 3+
	Edge Infrastructure Provider	Device manufacturer or in-house solution within enterprise / government	Hardware OEM, data center provider, telecoms operator or in-house solution within enterprise / government	Colocation provider, hyperscale cloud provider (public cloud), telecoms operator	Colocation provider, hyperscale cloud provider (public cloud)
	Expected Deployments	Millions	Hundreds of thousands	Thousands	Hundreds

*by 2030 per major region
** Tier 2 and Tier 3 cities often have a population below one million people. Currently, most lack an Internet exchange/peering point and a hyperscale data center.

backup. Hot-pluggable and hot-swappable modular inverters enable users to add AC capacity in 1.2kW increments. The control unit makes it easy to track load fluctuations and predict future capacity needs. As a result, telecommunications providers and other organizations can seamlessly add AC power to an existing DC-powered site or increase AC power capacity at sites to support digital business growth.

Centralizing visibility

As they integrate AC and DC power, telecommunications providers and other organizations want to reduce complexity and improve visibility into both power sources.

Vertiv™ NetSure™ converged power solutions provide a single remote controller that monitors both loads in real-time. The solution provides detailed logs, including data on the past 10 battery discharges, battery temperature, 4,000 alarms, and 60,000 events. IT and power teams can use this vital performance information to manage and shift loads, plan maintenance, and add new capacity when and where it's needed.

Ensuring high availability

Many organizations deliver digital services that can't risk even a second of downtime. As a result, edge sites must ensure continuous uptime, placing new pressure on their backup power systems. While IT equipment has typically been protected by uninterruptible power supplies (UPSs), these solutions often provide just a few minutes of backup power, which may not be enough time to resolve the source of outages.

Vertiv™ NetSure™ Inverter solutions provide zero-transfer time from the main power source to the battery, while avoiding single point of failure issues that can occur with traditional inverters and automatic bypass switches. In addition, telecommunications operators and enterprises can increase AC source availability to

provide hours of battery backup time for both AC and DC power loads. For example, any organization running mission-critical workloads could use Vertiv™ NetSure™ combined inverter solutions to avoid costly outages due to power loss. Those that operate in areas with planned or unplanned power outages, due to aging or degraded infrastructure or climate issues such as wildfires, also benefit by being able to maintain operations amidst challenging circumstances. Whatever the situation, IT and power teams gain by protecting IT equipment, digital services, and the customer experience, while avoiding revenue loss.

Reducing energy consumption

High-density racks require more power and cooling, necessitating that telecommunications operators find more efficient solutions to control power use and costs. Energy comprises 20 to 40 percent of a telecom company's total operating expenditures,[iii] so any solution that provides power conversion efficiency and can be scaled across sites will deliver significant cost savings. In addition, telecommunications providers are facing increased regulatory and shareholder pressure to improve the sustainability of their operations, while new capital investments may be tied to achieving ambitious energy efficiency goals. Similarly, organizations typically seek to reduce operational costs to fuel cost savings back into innovation initiatives.

The converged Vertiv™ NetSure™ Inverter Series solution minimizes energy cost by providing up to 98 percent rectifier efficiency and 96.3 percent inverter efficiency in normal AC-AC mode—the best on the market. As a result, organizations can achieve power and cost savings immediately by deploying this solution, as long as they use the accompanying inverter cassette. With remote visibility, IT and power teams can also continue to make ongoing operational improvements that boost efficiency.

Vertiv currently offers three 230 VAC options: a 19-inch and 23-inch converged system that provides up to 14.4 kW inverter capacity and 24 kW rectifier capacity; a combined 19-inch converged system that offers 4.8 kW inverter capacity and 12 kW rectifier capacity; and a 19-inch subrack cassette with three 1200W inverter modules. The 19-inch cassette can be used with any existing DC power system from Vertiv or other providers.

Making the most of edge site space

Access and edge sites are often small, fit-for-purpose sites that typically don't have a lot of room for extra equipment. As a result, telecommunications operators are looking for space-saving solutions that free up space for more IT equipment.

Vertiv™ NetSure™ Inverter Series systems power AC and DC loads in a single subrack with a common battery bank. They offer market-leading power density, at 23 watts per cubic inch, and provide full front access to all terminations. The stand-alone 1U complete inverter cassette is thus again the perfect space-saving solution for adding AC power to existing DC systems.

CASE STUDY

U.S. Research Lab Innovatively Uses Vertiv™ AC and DC Power Systems to Enable Future of Work Models

Some companies are moving beyond traditional power backup applications to use inverters in new and exciting ways.

This U.S. research lab has opened a future-of-work building, which will sustainably support hybrid-remote work models. The building uses Vertiv technologies and services to increase energy efficiency and achieve net-zero carbon emissions.

A Vertiv™ Liebert® EXM 100 kVA UPS system with lithium-ion batteries provides backup power to the building's IT equipment and critical systems. In addition, a Vertiv™ NetSure™ outdoor DC power enclosure provides inverters, rectifiers, and maximum power point tracker (MPPT) solar converters to support on-site solar energy generation. Vertiv also provides ongoing maintenance to ensure the high availability and performance of these systems.

Conclusion

Edge computing holds a world of promise for both telecommunications providers and industry organizations. They can unlock greater value from the data they possess, while designing and delivering data-rich, latency-sensitive applications for B2B and B2C customers alike.

To exploit the full value of edge computing, telecommunications providers and organizations will need to support evolving power architectures: processing AC and DC power in the same location and adding capacity when and where it's needed.

Vertiv™ NetSure™ Inverter Series Converged AC and DC Power Systems offer the power density, availability and scalability to enable high-availability applications, while streamlining day-to-day operations with a simpler interface.

When it comes to expanding edge deployments, it pays to work with a market leader that has years of experience in providing DC power and AC UPS solutions. Vertiv has helped customers back up mission-critical AC and DC loads for decades. We also provide a range of other solutions to equip edge sites, including weatherproof outdoor enclosures, lithium-ion batteries, racks, and more, as well as monitoring and maintenance services to keep edge sites performing at peak levels.

Learn more about Vertiv™ NetSure™ Inverter Series Converged AC and DC Power Systems today.

Vertiv (NYSE: VRT) brings together hardware, software, analytics and ongoing services to ensure its customers' vital applications run continuously, perform optimally and grow with their business needs. Vertiv solves the most important challenges facing today's data centers, communication networks and commercial and industrial facilities with a portfolio of power, cooling and IT infrastructure solutions and services that extends from the cloud to the edge of the network. Headquartered in Columbus, Ohio, USA, Vertiv employs approximately 21,000 people and does business in more than 130 countries.

For more information, and for the latest news and content from Vertiv, visit Vertiv.com.

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Endnotes

[i] *The Impact of 5G: Creating New Value Across Industries and Society, report description*, World Economic Forum, January 7, 2020, https://www.weforum.org/whitepapers/the-impact-of-5g-creating-new-value-across-industries-and-society

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