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Frontiers

The technology trends **shaping the future** of the data center

Vertiv Frontiers offers a lens on the future - an exploration of macro forces and the technology trends reshaping digital infrastructure.

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Executive summary

The data center industry is advancing into a new era defined by innovation, scale, and opportunity.

After two decades of steady evolution - when cloud computing reshaped location and scale but core infrastructure remained largely constant - the next wave of transformation is accelerating at unprecedented speed.

Driven by AI and accelerated compute, this new era is redefining how digital infrastructure is designed, deployed, and scaled. The pace of change is unmatched, creating new possibilities to push the frontiers of innovation.

Vertiv Frontiers offers a lens on the future - an exploration of macro forces and the technology trends reshaping digital infrastructure. It brings together the expertise of Vertiv specialists across power, thermal, IT systems, prefabricated modular infrastructure, advanced services, and AI infrastructure, reinforcing Vertiv's position as a leading voice guiding the future of critical digital infrastructure.

Macro forces driving data center innovation

The data center industry is being reshaped by powerful macro forces fueled by the rise of AI and accelerated compute. These forces are influencing every layer of digital infrastructure, spanning technologies, architectures, and industry segments.

At the center of this transformation is **extreme densification** - the defining macro force whose effects are felt across the entire data center and technology landscape. The additional macro forces align to this shift, representing broad changes that extend from the chip level to system-level integration and full facility design.

Extreme densification

Densification is a critical driver of modern data centers, accelerated by AI and HPC workloads pushing rack power well beyond 25 kW and often into triple digits. Systems that previously filled a data hall now fit into one rack-like unit or pod. This density increase creates additional complexity in power, cooling, and space.

Gigawatt scaling at speed

Data centers are now being built at unprecedented gigawatt scale. Factory-built, modular infrastructure blocks—combining power, cooling, and IT—are designed to scale from tens of megawatts to multigigawatt campuses. And all of this must be done at speed to meet the compressed timelines of AI-era capacity demands.

Data center as a unit of compute

The AI-era increasingly requires the data center to be built and operated as a single system. The ‘unit of compute’ is no longer just a chip—it’s the entire system. Power, cooling, and compute must be highly integrated into one architecture – from rack to row to site. Component-level offerings are no longer strategic, and rising power density is driving the need for greater efficiency and tighter integration.

Silicon diversification

The chips powering AI are already diversifying to include custom silicon and other form-factors. Future data center infrastructure must be designed and optimized to support the full spectrum of chips and compute.

The technology trends defining market impact

In response to these macro forces, Vertiv has identified five key trends shaping the data center technology landscape. Each trend has been evaluated for its specific impact across critical technology areas.
Vertiv Frontiers explores these trends in greater depth.

Trends

1	Powering up for AI	Hybrid AC and DC systems are pervasive but higher voltage DC is likely to become more prevalent as rack densities increase.
2	Distributed AI	AI will become increasingly critical to businesses. But how, and from where, AI services are delivered will depend on the specific requirements and conditions of the organization.
3	Energy autonomy accelerates	Operators are expanding on-site generation despite the grid being the preferred option for many. Investment in on-site is likely to continue until grid capacity expands and transforms.
4	Digital twin-driven design and operations	Data centers can be mapped and specified virtually using digital twins, and the IT and infrastructure will be integrated and deployed as units of compute. This approach will be key to achieving the gigawatt-scale buildouts required for future AI advancements.
5	Adaptive, resilient liquid cooling	Over time, liquid cooling systems could become analogous to circulatory systems with the ability to monitor and adapt. New forms of liquid cooling will emerge as the technology continues to mature.

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The **technology trends** defining market impact

1. Powering up for AI
2. Distributed AI
3. Energy autonomy accelerates
4. Digital twin-driven design and operations
5. Adaptive, resilient liquid cooling

Macro forces driving data center innovation

Extreme densification

Gigawatt scaling at speed

Data center as a unit of compute

Silicon diversification

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1 | Powering up for AI

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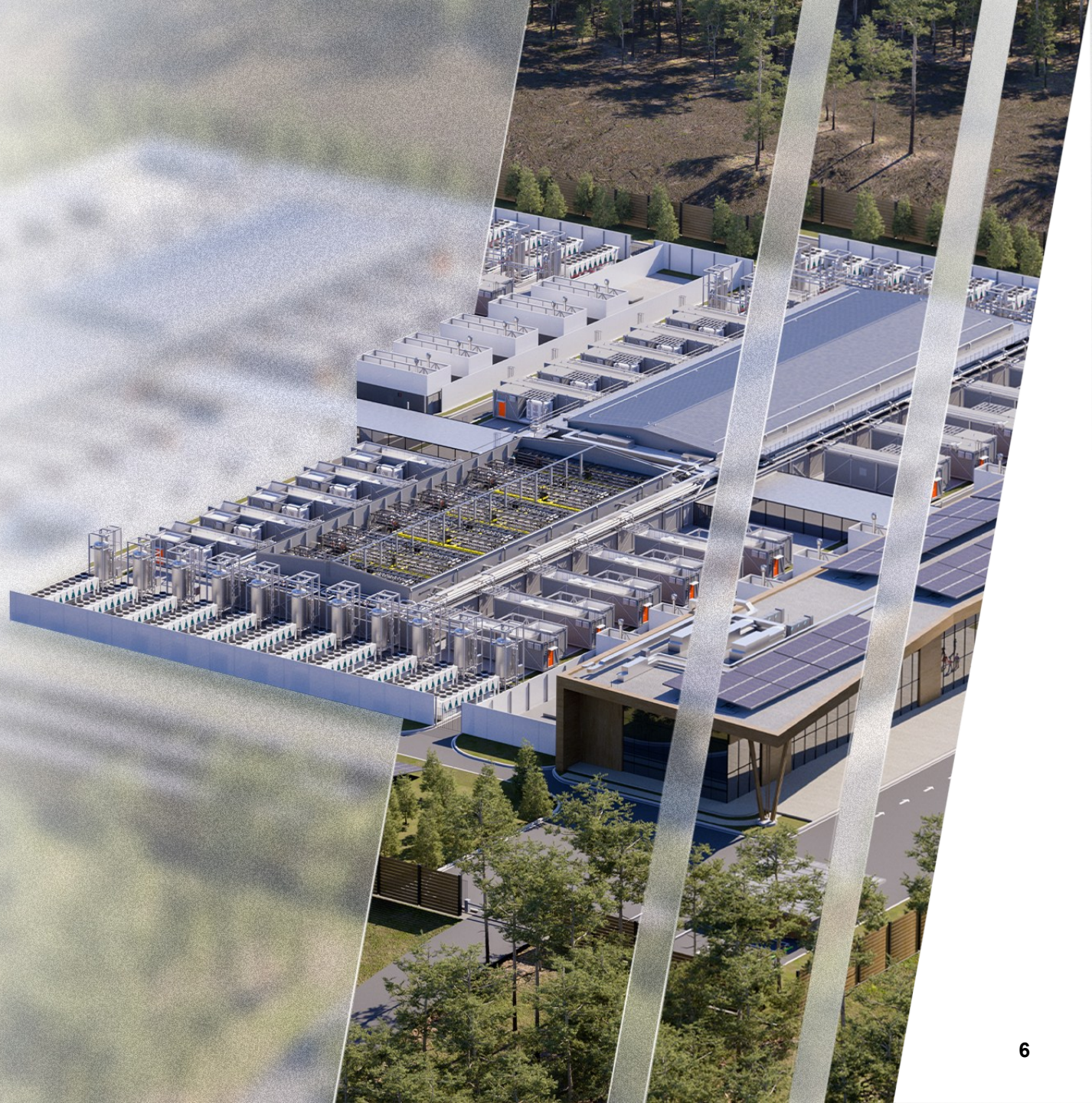

Macro forces

Extreme densification

Data center as a unit of compute

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2 | Distributed AI

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Macro forces

- Silicon diversification
- Extreme densification

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3 / Energy autonomy accelerates

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Macro forces

- Data center as a unit of compute
- Gigawatt scaling at speed

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4 | Digital twin-driven design and operations

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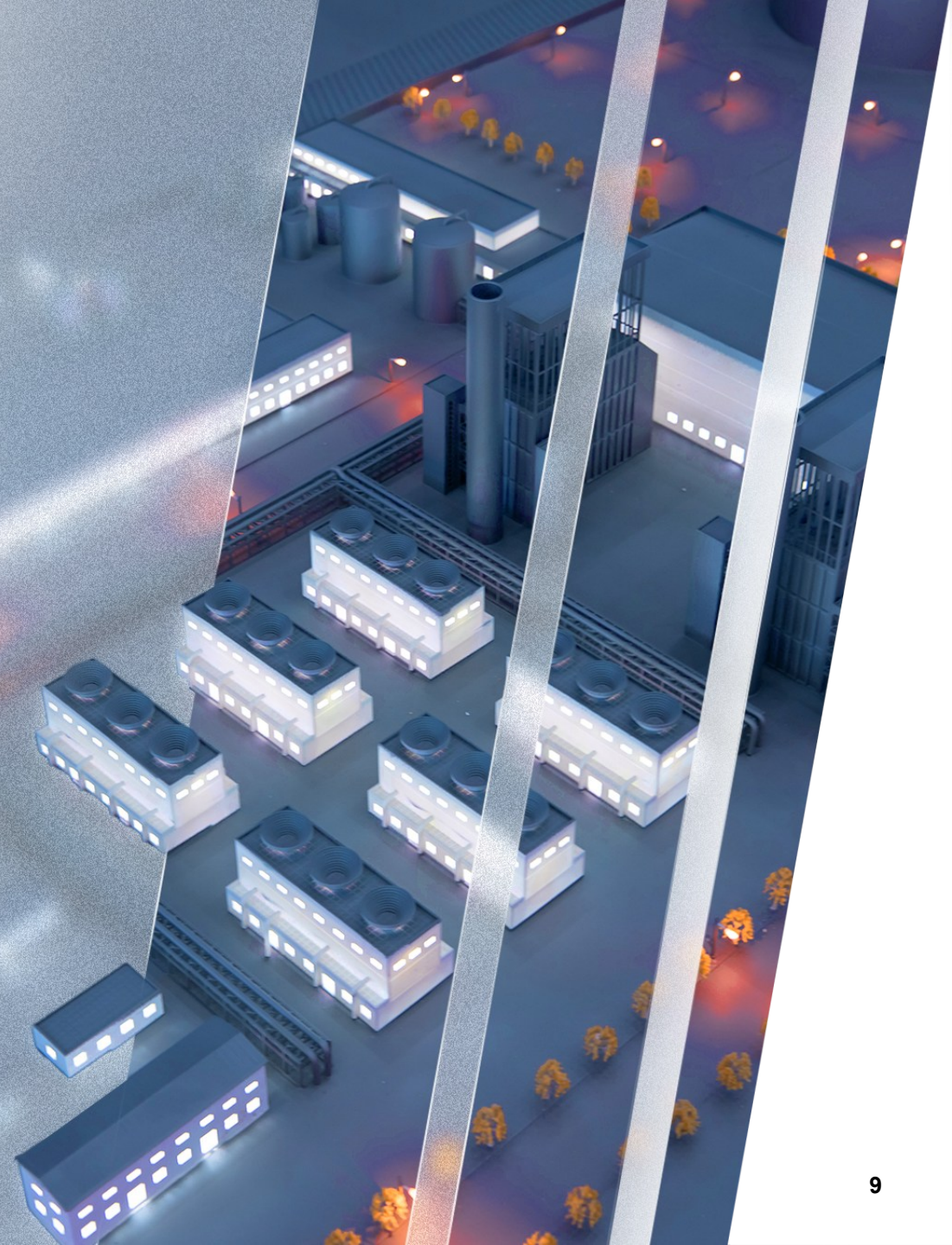

Macro forces

- Data center as a unit of compute
- Silicon diversification

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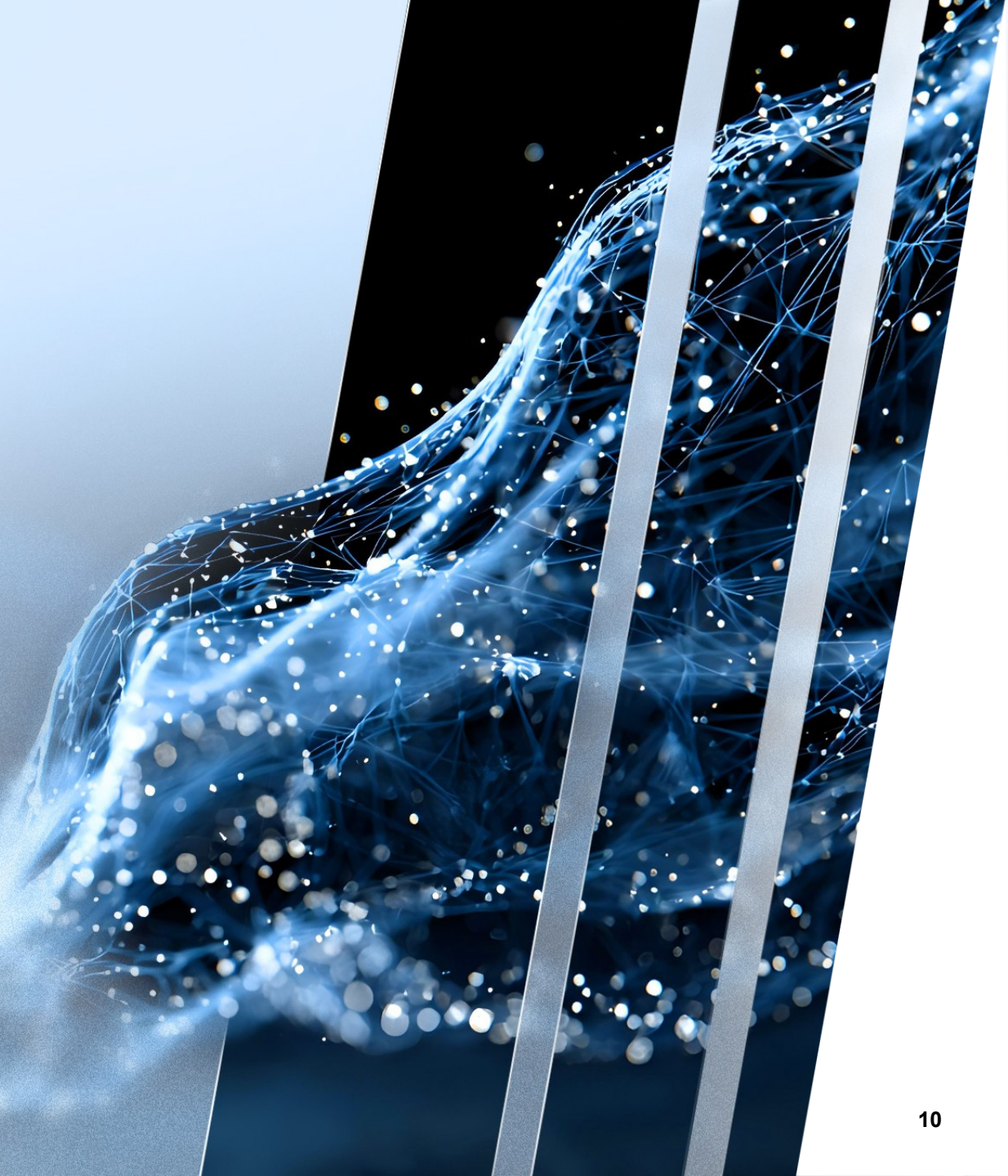
5 / Adaptive, resilient liquid cooling

Over time, liquid cooling technologies could become analogous to circulatory systems with the ability to monitor and adapt. New forms of liquid cooling will emerge as the technology continues to evolve.



Macro forces

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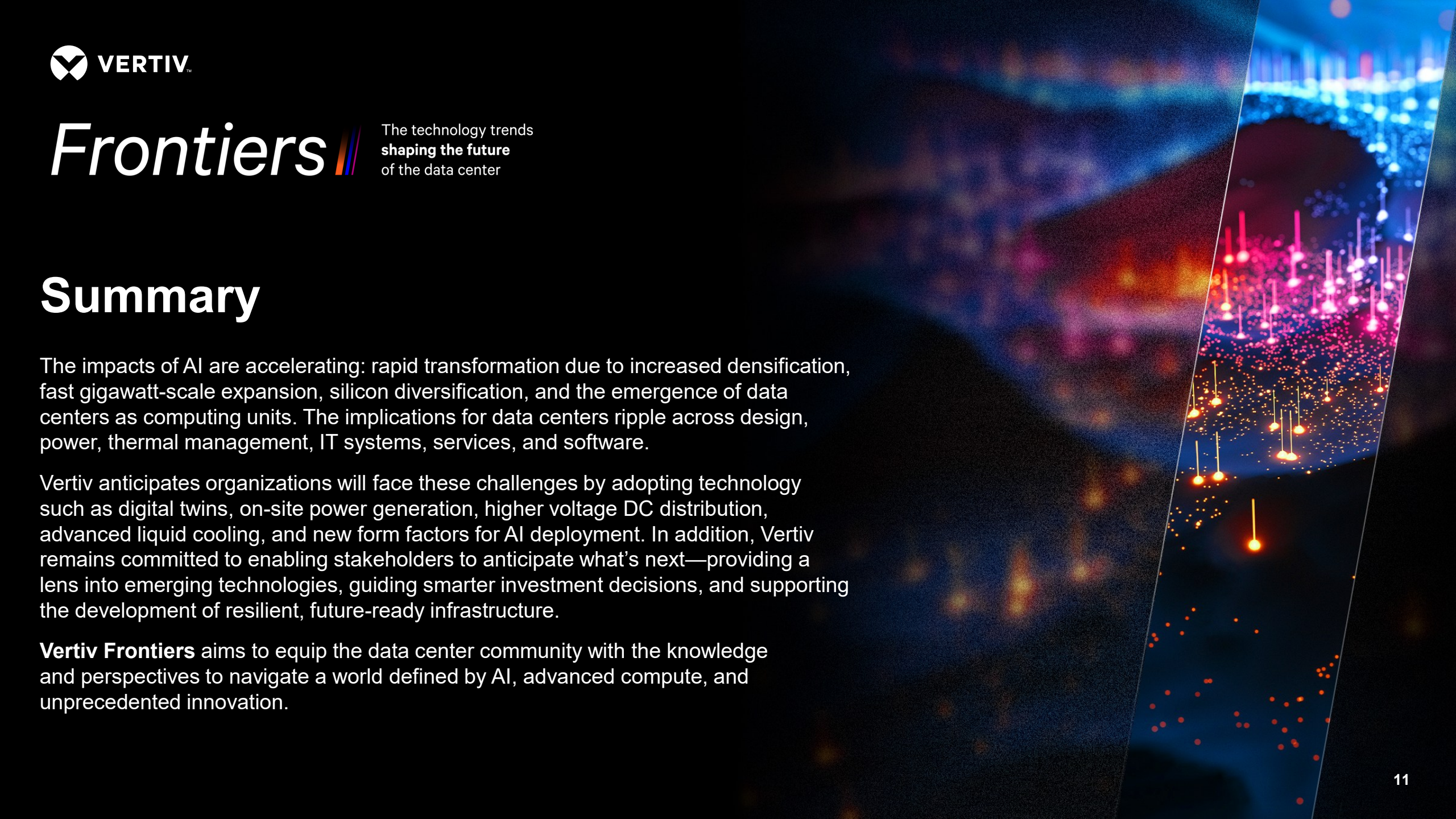
Summary

The impacts of AI are accelerating: rapid transformation due to increased densification, fast gigawatt-scale expansion, silicon diversification, and the emergence of data centers as computing units. The implications for data centers ripple across design, power, thermal management, IT systems, services, and software.

Vertiv anticipates organizations will face these challenges by adopting technology such as digital twins, on-site power generation, higher voltage DC distribution, advanced liquid cooling, and new form factors for AI deployment. In addition, Vertiv remains committed to enabling stakeholders to anticipate what's next—providing a lens into emerging technologies, guiding smarter investment decisions, and supporting the development of resilient, future-ready infrastructure.

Vertiv Frontiers aims to equip the data center community with the knowledge and perspectives to navigate a world defined by AI, advanced compute, and unprecedented innovation.

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