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# How to Build Your Perfect Edge Rack

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## The Perfect Edge Rack Doesn't Exist, but the Right One Does

The first thing to know before you build the perfect edge rack is this: there is no such thing as the perfect edge rack.

There are so many different types of edge deployments, supporting different applications, that to attempt to identify any single "perfect" rack is a hopeless exercise. The right edge rack for any given deployment does exist, however, and that's what every organization should prioritize.

For the purposes of this eBook, we will focus on what might be characterized as a "traditional" edge site — the type you might find in a bank branch, a doctor's office, or a retail outlet. We will help you identify the right questions to ask and provide some potential answers to those questions, all in the interest of building the right rack for your edge deployments.


See also: **Explaining the Surging Demand for Integrated Racks**

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## Finding the Right Size

The square footage of the space is a foundational piece of information impacting virtually every equipment and design decision. Can multiple racks fit in the available footprint?

The size of the room has implications for how the space is cooled, how it's secured, how and where equipment is deployed within the rack(s), how cables are routed, and countless other large and small decisions in what might seem to be a simple deployment.

The most common rack size is a 42-rack unit (U) height and 19-inch width, but those are internal measurements that correspond to the equipment to be housed in the rack. The 42U height and width are sized appropriately for a standard facility doorframe, ensuring that the cabinet enclosure can be moved easily. The actual footprint depends on the manufacturer and server rack model, so be sure to consider those measurements before making a purchase.

Standard rack depths are 1100 millimeters (mm) or 1200 mm. A small amount of space is required in the front and back — just under an inch in each place — to allow for doors to open and for the rails to be mounted.

In short, these edge sites may be the highest of high-tech, but planning for any given site starts with a good, old-fashioned tape measure.


See also: **Interactive Product Selector**


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## Types of Server Racks

Within the physical footprint of the rack, there are several options for the type of rack or its configuration. This allows you to choose a rack that fits your specific needs. This is especially important at the edge, where the space and environment can vary wildly. These are examples of the types of racks available:

- **Cabinet enclosure (or cabinet server rack):** These are fully enclosed with a hard shell providing robust physical security. They range in height from 6U to 48U and generally are the most common and cost-effective option.
- **Four-post open frame:** These are not enclosed, which provides substantial ventilation but little physical security. Four-post open frame racks range in height and depth from 24U to 45U.
- **Wall-mount server rack:** Designed for tight spaces, these racks typically come fully enclosed. As the name suggests, they are mounted to the wall and may include swing-out capabilities for improved accessibility.
- **Dust- and water-resistant server racks:** In industrial settings, a common edge application, it's not uncommon to have excessive particulates or moisture in the air. These racks provide additional protection against dust and water that could compromise the performance of IT equipment.
- **Self-contained server racks:** These network racks have integrated air conditioning, with a cooling capacity ranging from 800 to 12,000 British thermal units (BTU), that ensures climate control in any environment.
- **Portable server racks:** Portable racks are a lightweight, durable, fully enclosed option that can be moved easily and stacked if needed, making them a practical choice if they're likely to be moved from site to site. They're smaller than typical racks, usually between 8U and 20U.

**Additional Considerations**

### Rack density

Remember, racks hold more than servers. Account for space for uninterruptible power supply (UPS) systems, remote management devices and KVM switches, and additional IT infrastructure as needed. Also keep in mind that your needs can change over time, so make sure your rack can support future growth.

### Flexibility

Make sure your rack can adapt as your needs change. Many racks offer toolless designs that enable quick and easy reconfigurations.

### Availability

Even as supply stabilizes, not all racks are always available. Choose a vendor that can meet your delivery timeline.


See also: **Server Rack Designed for Rapid Deployment**

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## Power Distribution and Backup

Understanding which equipment to use when you close your IT equipment power chain can often be intimidating based on the number of configurations available in the market. For this chapter, we asked a UPS and a rack power distribution unit (rPDU) expert to discuss what you need to consider when looking at power distribution and backup for a "typical" edge rack, starting with the sequencing of equipment selection.


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**Trey:** When you plan the power architecture for an edge deployment, do you start with the UPS system or with power distribution?

**Chris:** First of all, start with an understanding of the equipment (IT or other) that's going to be installed in the rack. The power requirements of the equipment dictate how much power you will need in the rack, the output voltage(s) required, and the type and number of outlets needed.

**Eric:** Completely agree. The caveat being, if you already have a UPS that meets the power requirements, the output of the UPS may determine the rPDU or set of rPDUs that can be used. But how do you choose the right rPDU? Or, should I say, rPDUs?

**Chris:** I can see you're someone who understands redundancy. The rPDU we choose depends on the current draw (the total number of amps) needed to power everything in the rack. And, to your second question, it's best practice to divide that draw across two rPDUs and limit the total utilization of both rPDUs to 50% of their continuous rated current draw. That creates a redundant architecture, meaning one of those rPDUs can manage the full load in case the other fails.

**Trey:** Right. The other thing to consider when it comes to rPDUs is the number of outlets and whether they are 15-amp (NEMA 5-15R or IEC C13) or 20-amp outlets (NEMA 5-20R or IEC C19). You need to make sure you have enough of the proper outlets to accommodate the equipment at the site. Vertiv offers a combination C13/C19 outlet on their rPDUs that allows for either a C14 or C20 cord to plug into the same outlet if you want to eliminate the guesswork.

**Chris:** Yes, and if the budget allows, choosing rPDUs that enable outlet monitoring and switching will make life a lot easier for the network administrator. We've been talking about a single site, but the reality is most networks are made up of dozens or hundreds of these sites and almost all of them lack any sort of on-site IT support. Having the equipment intelligence and ability to monitor and manage systems remotely is critical.

**Trey:** So true. It's also worth mentioning, from a business perspective, that remote monitoring and management helps organizations with policy enforcement and compliance, network security, and ensuring all provisions of site service-level agreements (SLAs) are met. It also helps ensure network uptime, which reminds me … what about the UPS?

**Eric:** I thought you'd never ask. There are a few fundamental questions we need to ask when selecting a UPS system for an edge deployment. First and most importantly, is it single-phase or three-phase? This depends on the utility power distribution available at the site and how much power is required for the equipment to be connected to the UPS. Typically, single-phase is up to 20 kVA/kW and three-phase is above 20 kVA/kW of power. For the type of edge deployments we're discussing, the answer is typically single-phase at either 208 volts (V), 120 V, or both.

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**Trey:** Agreed. That matters for planning and purchasing, but ultimately you can find single-phase UPS systems with all the same functionality and sophistication of their three-phase counterparts. That includes the ability to operate in either an online interactive or online double-conversion architecture.

**Eric:** That's right. For edge network and server applications, there are two primary types of UPS; line-interactive and double-conversion online (sometimes just called an online UPS). For readers who may not be familiar with those terms, in general, line-interactive means that the equipment in the rack is running on voltage-regulated electricity from the utility and the UPS switches to battery operation if the utility power becomes unstable or goes out. Double-conversion online means that the equipment is always running on power conditioned by the UPS (through a double-conversion process). Also, usually single-phase line-interactive UPS are available up to 3 kVA/kW, whereas online UPS are available in the range from 500 VA to 20 kVA/kW of power.

**Trey:** Correct. In some applications, the equipment might be more sensitive to that switchover from grid to battery operation (typically IT network and server equipment can tolerate this switchover). If the site requires 5 kVA and above, or is in an environment with poor utility power and operation is especially critical, then an online UPS is the way to go. Let's talk about UPS batteries. Is there much of a difference between the various types?

**Eric:** The two primary types of batteries used with single-phase UPS systems are valve regulated lead-acid (VRLA) and lithium-ion. VRLA batteries tend to be larger, heavier, and are relatively unsophisticated, but they have been the preferred choice for decades because they tend to be lower cost and they get the job done. Lithium-ion batteries are closing the gap, however, because they're smaller, lighter, have a longer useful life, are more environmentally-friendly, and have a more intelligent battery management system (BMS).

**Trey**: Smaller, lighter, longer lasting and more intelligent sounds like a perfect fit for an edge-of-network site.

**Eric:** Exactly. Just about any UPS will outlast the VRLA batteries its paired with, meaning you will have to replace those batteries — usually multiple times — during the life of the UPS. That's not just a nuisance, it's an expense that lithium-ion batteries reduce or eliminate. Lithium-ion batteries also perform better at higher temperatures than VRLA, which can come into play at many edge sites, where environmental conditions can be more difficult to control.

**Trey:** This has been a great conversation. Let's do it again in a year or so. Everything is bound to change by then.

**Check out the Vertiv Rack PDU Finder**

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## Keeping It Cool

Maintaining the appropriate temperature and humidity in these small spaces requires different approaches than you might see in a traditional data center. Power densities as low as 2 kW can generate enough heat to create issues for IT systems in smaller spaces.

Traditional heating, ventilation and air conditioning (HVAC) systems are considered comfort cooling, where the systems spend energy to remove humidity in addition to controlling temperature. IT equipment is more about heat removal than humidity. It can be tempting to rely on building HVAC systems, but it's not uncommon for multi-use buildings to raise temperatures or turn off air conditioning altogether when people aren't present. That can be disastrous for the IT systems that continue to function and produce heat. Likewise, UPS battery life can be halved when operating in temperatures that are 15 degree Fahrenheit above their rated ambient temperature.

Once you accept that a building's comfort cooling systems aren't sufficient for cooling your network edge site, it's time to consider the options designed specifically for these environments.

| Perimeter cooling | In-rack cooling systems | Rear door heat exchange cooling systems |
|---|---|---|
| If the computing room is on the perimeter of the building, near a relatively secluded spot on the outside, you can consider a traditional configuration with a cool air delivery unit in the room and a chiller on the outside. The proximity of the inside and outside equipment is important due to the copper pipe running between the two. The longer that pipe, the less efficient and more impractical that configuration becomes. | More often, these types of edge sites require alternative approaches to cooling, such as in-rack cooling systems. These units are efficient and effective, but they require space behind the rack for duct work to vent hot air out of the room or into a ceiling plenum and a drain for condensation. Some all-in-one racks come with integrated, in-rack cooling systems. | Just as the name implies these cooling solutions are integrated into the door of the rack itself. These systems provide cool air evenly throughout the rack and may be a good choice for higher density edge racks. |

Ultimately, when choosing a cooling system for your edge rack, the most important consideration is matching BTUs to rack density.

**See also:** [The Edge Is Heating Up. Here's How to Keep It Cool]

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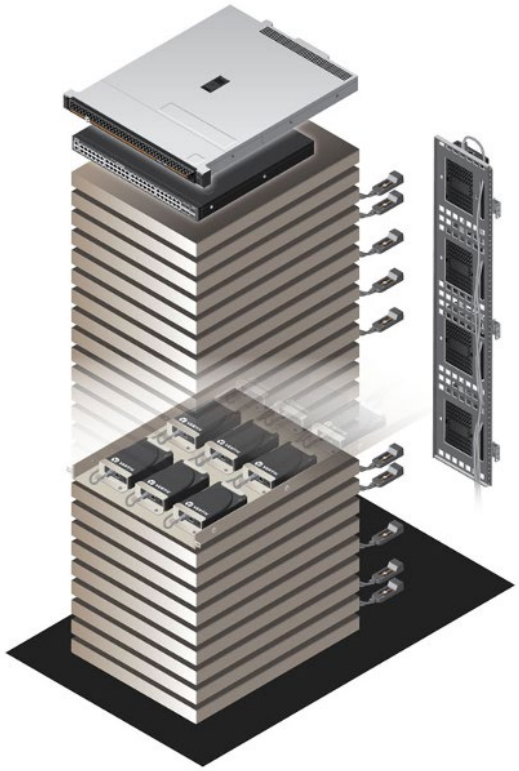
## Monitoring and Management

In a modern architecture, each edge data center is typically one junction in a distributed network of similar sites, designed to interact seamlessly with each other and often with enterprise data centers and cloud resources. Most edge deployments lack on-site IT support, making remote monitoring and management imperative to avoid failures, delays and downtime.



In considering remote management options for your edge rack, you should first determine what equipment is in the rack. If it's networking equipment, a console server with cellular capability is recommended, ensuring that if the network goes down, you can maintain visibility through a cellular connection. This will allow you to access network gear and potentially address the problem remotely.

If servers are in the rack, a keyboard, video and mouse (KVM) switch is advisable. With a KVM, IT personnel can access a server remotely through an internet browser and conduct troubleshooting or perform any number of routine functions, such as initiating equipment upgrades. You may want to consider a secure KVM depending on the sensitivity of the data housed in the servers at the edge. Again, when making that decision, consider not just the current state but also future functions and potential vulnerabilities.

If the rack has a mixture of networking equipment and servers, you should include both a console server and a KVM switch.


**See also:** [How IT and Cyber Teams Can Work Hand-in-Hand to Strengthen Server Management Security]

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## Conclusion

The edge of the network is full of paradoxes. These sites typically are small spaces, but they must interact seamlessly with all corners of modern networks. The equipment at the edge is just as sensitive, and produces just as much heat, as that in a full-sized data center, but the rooms often lack the space or existing infrastructure to properly cool that equipment. Edge deployments are an extension of the rest of the network and increasingly mission-critical, but they are scattered in branches and offices without on-site IT support. It's possible to make sense of it all, but it all starts with sound decision-making related to the edge racks.

### Additional resources

How Edge Site Operators Can Improve Power Redundancy and Streamline Management

Maximizing the Edge Computing Opportunity With Centralized IT Management

From Enterprise to Edge: Speeding Deployment and Management of Complex IT Infrastructures

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