

Make the Most of Data Center Space without Oversizing

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Introduction

Is your equipment eating up valuable space that could be better managed? Are you cooling and maintaining equipment you're not using? Space utilization inside a data center is a delicate balancing act.

If you undersize and underutilize a space, then you'll need to expand or build a new facility in the future. If you oversize and overutilize a space, then you'll unnecessarily increase capital and operating costs.

With the average data center being 18 years old, according to Forsythe Data Center Solutions, you'll likely be in your space for a while. So how can you make sure your data center provides the workload management you need today but will also be ready for new applications and business requirements that arise in the years to come?

Instead of designing your infrastructure system to "grow into," it should be designed for flexibility and scalability to optimize space and resource utilization. This also helps you improve sustainability and control energy and operating costs. Even in data centers that seem to be running out of space, there are ways you can recapture, repurpose and reallocate square footage. Introduction

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To make the most of your data center space without oversizing, there are three components to consider:

- Cabling and cable management
- Racks and cabinets
- Utilities (power and cooling)

Here are 11 ways you can make the most of data center space without oversizing.

1. Make Use of Vertical Space

Vertical growth allows more equipment to occupy the same square footage in your data center.

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You can put currently unused space outside the rack to work with zero U solutions that maximize RUs for equipment by mounting connectivity in other areas, such as on ladder racks above cabinets to provide vertical rack space. Patching above the rack or cabinet is also another way to use above-the-rack space more efficiently.

You could also consider zero U vertical patching to accommodate fiber or copper connectivity in data center cabinets without taking up valuable rack space. These patch panels mount vertically inside the cabinet along equipment mounting rails. Not only does this help you maximize rack space to keep energy and space usage in check, but it also reduces the number of racks you need to purchase in the first place.

While cross-connects can go into a rack, a wallmount cross-connect takes advantage of free real estate. This not only lets you install passive connectivity on the wall, but it may also reduce the number of racks you need.





Aside from saving valuable rack and floor space, wall-mount cross-connects offer another benefit, too: When networking equipment is upgraded every three to five years—and also changes in terms of form factor and density—having all equipment ports replicated on a wall-mount system ensures a smooth transition and avoids forklift upgrades to cabling infrastructure.

2. Invest in Smaller-Diameter, Rightsized Cables and Patch Cords

Even if you're not struggling with cable congestion now, smaller-diameter cable can prevent this problem in the future. As density grows, equipment footprints may get smaller—but the number of cables in your cabinets will go up.

Cable with small ODs (outside diameters) save space by increasing the number of cables permitted in a pathway without requiring larger, more expensive ladder racks and cable trays. A smaller-diameter cable also allows rack space to be used to house more equipment instead of dedicating space to cable management.

Lastly, smaller-diameter cable improves cabinet airflow, reducing cooling needs and ensuring an environment that is conducive to peak performance. Because it takes up less space, air can easily move around it.

Also make sure you have cables that are the right length without lots of slack. Otherwise, you'll have clogged up pathways, excessive weight and reduced airflow—and you'll have to make room to store the slack. Proper cord routing can also help improve space utilization. Solutions like angled panels can break up loads of cords to take up less room.

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3. Provide Ample Cable Pathways & Management

Pathways may be overlooked, but coordinating them with power and airflow (and other resources, including liquid cooling) can help reduce interference and optimize access and utilization.

When investing in cable management solutions, look for options that can:

- Support cable density
- Provide plenty of room for cables to be added in the future
- Allow enough airflow around cables
- Support copper and fiber

Cabinet design can also impact how you manage cable. Depending on depth, power distribution units (PDUs) can be placed on one side and cables can be placed on the other side. Belden's Customer Innovation Center (CIC) can help you design your data center infrastructure to optimize cable management.

4. Use High-Density and Mixed-Media Options

Today's high-density solutions allow more computing power to be done in a smaller amount of space. High-density connectivity and mixedmedia options (which allow for both copper and fiber) optimize space while supporting large port densities.

High-density connectivity solutions provide the flexibility and scalability needed to support demand increases. Additional connectivity can be added as necessary without data center managers having to know exact numbers of ports or connector types.

High-density patch panels, for example, can achieve up to double the port density in 1 RU of rack space. This allows for density increases and technology changes without tearing out and replacing existing infrastructure. High-density solutions also require fewer cabinets and PDUs,



involve smaller fire detection and suppression systems, and utilize shorter telecommunications runs and electrical power feeders. This not only saves space but also reduces operating costs.

Mixed-media panels that can manage fiber and copper save space and make it easier to transition from copper to fiber (or vice versa) without having to make room for additional components. Fiber optic cable is steadily taking hold over copper cable as speeds increase and bandwidth requirements go up. Moving from media-specific connectivity to mixed-media options lets you use both copper and fiber, transitioning to fiber at a speed and timeline that works best for your data center. You don't need separate panels for fiber and copper; by combining the two, you achieve automatic space savings.

5. Push Racking to Its Full Potential

Racks take up considerable square footage. Making the most of the space they offer will help you capitalize on space utilization. The more connectivity you can fit into a space, the less square footage needed to house it all—which translates to less energy usage and more space that can be used for other purposes.

If you're not efficiently using cabinet or rack space, new racks may have to be purchased (which takes up more physical floor space) to house future equipment, connectivity and cabling. We've seen data centers that run their cabinets at only 40% capacity. Not only is this inefficient, but it also means they're spending nearly twice the amount of money they need to on cabinets!

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When racks are fully populated, you make the most of the space you already have without increasing costs (you're saving money by preventing the unnecessary purchase of additional racks). You also don't have to worry about using blanking panels to cover empty RU space.

Non-traditional connectivity, such as the zero U solutions we mentioned earlier, can also maximize rack potential, allowing you to move high-density connectivity options completely out of the rack and along equipment mounting rails instead.

To maximize efficiency, it's important to make the most of the space within each rack. If racks are highly underutilized or poorly managed, then you're not getting the most out of the resources you have available.



Avoid single-use or single-purpose racks (or racks branded for specific equipment). They often remain partially loaded, which wastes space. They're also not flexible enough to accommodate changes. Instead, consider build-to-suit modular and components-based racking systems that can manage multiple brands and applications and be easily reconfigured as needs evolve.

6. Try a Centralized Distribution System, If Possible

When it comes to saving space, a centralized distribution system using a cross-connect scenario often wins. This means that all cables are brought to a single location for maintenance, patching and servicing. It "un-links" infrastructure topology from network topology. (Think of how much more productive staff could be if they weren't constantly moving around to do routine maintenance!)

A centralized distribution system allows network components to have permanent equipment cables that remain terminated on the backs of panels. Equipment is then connected with patch cords or jumpers at the cross-connect. Comparatively, the alternative—direct cabling—requires more cables, which requires more space.

But centralized distribution isn't optimal for every situation. Consider a 5G edge data center, for example. A purpose-built distribution system may serve this environment better. Know your environment and what is required to support it.

7. Think About Hyperconverged Solutions

To save rack space, hyperconverged infrastructure solutions are able to "de-silo" infrastructure. They allow you to put compute, network and storage in the same cabinet instead of relying on separate cabinets, which saves floor space. By centralizing these disparate parts, you can greatly reduce the amount of physical space you need to allocate for infrastructure. By 2023, Gartner projects that 70% of enterprises will run some form of hyperconverged infrastructure.

You can also connect hyperconverged solutions to a fabric network like leaf-spine architecture to reduce latency for east-west traffic (traffic that moves from server to server in a hyperconverged solution). In this scenario, data doesn't have to return to a main distribution area, go through a cross-connect, out to storage and come back to the server before being sent to where the customer needs it to go. Instead, data moves from the main distribution area to horizontal distribution and then to equipment distribution.

Hyperconverged solutions also improve and streamline cable management: Cables run within a row or between two cabinets instead of across multiple cabinets and every row.

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8. Place Workloads in the Right Space

Each workload has a place: You just need to figure out where that place is. Its location impacts business processes and the customer experience. Where does your data center's workload belong so it provides optimal functionality and service delivery?

Instead of taking an all-in approach and choosing either cloud adoption or traditional data center infrastructure, place your workloads wherever they'll best satisfy business demands. Adopting cloud and edge solutions in combination with traditional data center infrastructure puts workloads in the right place at the right time so you only need to make room for the workload that takes place in that space.

Consider retail environments during the holiday rush. The amount of data being transferred in October, November and December increases significantly; to accommodate this, you need network elasticity to grow during those months and "shrink" again in January. In some cases, the cloud may allow you to do this, but you don't need to put all your applications there—just the applications that need to expand and contract over time. Being able to ramp networks up and down saves money and space.

Education is another environment that may benefit from better workload management. When students are on campus, specific applications are used during certain parts of the year. Again, this requires network elasticity; the applications aren't needed during the summer months, during long breaks or during certain parts of the year when hands-on learning may be happening outside the classroom.

The moral of the story: If applications need elasticity, then they're great candidates for the cloud. If certain data and applications need to be close to users, then edge solutions are a good option to manage that workload. When you're dealing with lots of compute power and frequent ingress/egress of information (north-south movement), then these workloads work well in your core data center.

9. Deploy Air-Handling that Makes Sense for Your Environment

There is no one-size-fits-all solution when it comes to air-handling in a data center. Your goal? To manage hotspots. Depending on your space, this could require CRAC/CRAH units, chimney containment, doors, hot-/cold-aisle containment or a mixed approach that involves several of these options.

Where you place equipment—and how much power your equipment uses—also plays a role in the type of air-handling solution you select. For instance, you may have one cabinet that runs at only 5 kW. If it's sitting next to a cabinet running at 20 kW, then the heat from that cabinet will impact the 5 kW cabinet next to it and cause issues. There is no "right" or "wrong" way to fix the problem. Implement hot-/cold-aisle containment? Separate the two cabinets for better airflow? It simply depends on your environment, how much space you have and how the rest of your data center is being managed.



Remember: To optimize cooling resources, systems must be working at optimal efficiency (above "low" or "idle"). By right-sizing your utilities and making sure equipment runs at around 80% of maximum load, you can reduce the amount of total space you'll need to devote to air-handling equipment.

10. Increase Cabinet Power Density

By providing more computing power at less cost per square foot, you can support more density per rack (or the same amount of IT equipment with fewer cabinets)—which means less occupied floor space. Fewer cabinets also mean less cabling, fewer PDUs and less equipment to manage.

Using 3-phase power in your data center is another option to optimize space. It allows utilities to deliver more power to you over smaller, less expensive wires as compared to a single-phase power system. It also makes it possible to carry more load because it combines three alternating currents that vary by 120 degrees in phase (this keeps the power from ever dropping to zero). Along with reducing the number of cables being run, 3-phase power reduces the number of PDUs within a cabinet, providing space for other devices and eliminating equipment that blocks airflow.

11. Don't Forget About DCIM

A data center infrastructure management (DCIM) solution can help you manage power, cooling, capacity, loads, pathways and spaces, giving you confidence that you're using space and resources wisely.

By collecting data in real-time, it monitors, measures and manages data center utilization and energy consumption. It connects your facilities and assets with your network management software and applications to provide a holistic view of your data center, its performance trends and potential capacity issues.

A DCIM solution can also help you forecast the impact of proposed data center projects on space, power, cooling and networks. It takes you beyond "A plugs in to B" by providing a holistic look at infrastructure. While that patching information is important, you'll still have to go investigate problems right away, which diminishes ROI.

Learn More: Adapt, Change, Anticipate

Your data center approach should change as your needs and new realities evolve. Data centers are never "done." One-size-fits-all design no longer works. Instead—to maximize space—you need flexibility. Growing in place and making the best use of existing square footage helps you expand data center output without more infrastructure to manage.

The better your space utilization, the less likely it is that you'll have to expand your data center or build a new space in the future. Belden can help you design, upgrade and maintain a data center to maximize existing space.

Our space-saving solutions include:

- Data center products that maximize space to efficiently maintain and scale your business
- High-density solutions that provide better space optimization and allow for additional bandwidth
- Standard product family footprints so everything fits together and reduces required RU space
- Space-efficient product innovation that ensures superior performance while decreasing necessary product space

To learn more about Belden data centers, visit **www.belden.com/markets/data-centers**.



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