CenturyLink® Business

EXECUTIVE BRIEF

# Data Center Selection & Design Best Practices

## Challenge

Designing data centers for optimal density and 100% uptime.

## At Stake

Inefficient data center designs cost organizations significantly more money — year in and year out.

## Solution

Best practices in data center selection and design that have been honed by users of enterprise colocation services.

Creating and maintaining data centers is a complex exercise that balances power, cooling, space, cost, and planning for the future. Mixing these considerations properly in a highly efficient and cost-effective data center saves your organization time and money. Further, creating clear documentation and procedures to manage equipment and run services helps to ensure business continuity.

Over the course of many years working with and observing its customers' use of its data center colocation services, CenturyLink has seen some high-level best practices emerge. The actionable insights in this paper, derived from that experience, may help you develop your own best-practice-based data center design.

## Density: The Secret to Efficiency in Space and Capacity Planning

Ideally, you want to design your data center space with optimal density — i.e., the most compute, storage, and networking power in the smallest footprint that can be cost-efficiently cooled.

It's important to think about density in both physical and virtual dimensions. Consider the number of machines in a rack, as well as the number of applications, processes, and servers you can run per machine. Today's racks can hold as many as 42 servers, but companies often don't use them efficiently. Increasing servers per rack lowers the number of racks, the number of power circuits, and, thus, the cost. We've seen inefficient installs with a large spread of racks and only a few servers per rack. When that happens, you're paying for more capacity than you really need.

Increasing density while maintaining reliability takes experience and expertise to design rack layouts and cooling design. For example, it's important to follow best practices for hot/cold air containment, structured cabling, and inlet air temperature monitoring to assure the IT infrastructure operates within ASHRAE standards (https://www.ashrae.org/). Adhering to these standards will optimize equipment operation and life expectancy. Leveraging the experience of a colocation provider who does this for hundreds of clients is an easy way to increase density and, thereby, efficiency.

When thinking about virtual density, you must continuously be on the lookout for opportunities to consolidate more applications onto a smaller number of servers using appropriate virtualization technologies. Virtualization technology is constantly improving, and the more you can increase virtual application density the more savings you can accrue by keeping your data center footprint smaller. This reduces capital expenditure and improves utilization of existing hardware. Some vendors claim using virtualization can reduce server footprints to where one server can do the work of 10.

### The Cost Of Comatose Servers

Even worse than low density is a high density of what Uptime Institute Founder Ken Brill called "comatose servers" — they're still running but no longer used by anyone. Because, "Nobody gets promoted for going around … unplugging servers," the Uptime Institute launched its annual **Server Roundup contest** in 2011. In the first two years, content participants decommissioned 30,000 units of obsolete IT equipment. At up to $2,500 per unit, annually, they're saving millions.

Predicting future requirements is a top challenge, notes Jim Kozlowski, Vice President, CenturyLink Business. "You have to split it into immediate needs, shorter term needs, and far-future requirements. If your company is in a regular growth mode, you may need to purchase capacity for that 6-to-12 month period." Remember to consider new business applications and products, mergers and acquisitions, and whether your organization prefers to capitalize or expense infrastructure costs.

## Continuously Seeking Power and Cooling Efficiency

Like virtualization, power and cooling technology is continuously improving. Modern data centers have standardized on "Hot Aisle/Cold Aisle layouts," which use physical barriers to separate the front of a rack (where cool air flows in) and the back (where the hot air flows out).

This approach reduces fan energy use by 20-25% or more,[1] lets you pack equipment together more densely, and operate at higher "Cold Aisle" temperatures, thus saving cost in multiple dimensions. The design also increases the life of components in racks.

Data center operators are always looking for ways to increase cooling efficiency to reduce cost. By devising a way to push more hot air through returns, and keeping it trapped, CenturyLink operation teams have increased efficiency in cooling units while reducing the need for cooled air. Improving cooling system efficiency through the use of variable speed fans and automated control software that adjusts fan speed and chilled water temperature, thus optimizing airflow and inlet air temperature to match the IT load, saved one data center about $100,000 per year.

## Messy Wiring Messes With Efficiency

Designing proper wiring and wire lengths keeps cabinet airflow consistent, and improves access to the machines for maintenance and replacement. Having unorganized wires under the floor can affect airflow and cooling efficiency. If servers in a rack only need six-inch patches to the network, don't use three-foot cables; avoid "spaghetti."

Of note, the Uptime Institute reports that in a data center that has "excellent management of raised-floor air distribution," the cooling unit discharge set point can be as high as 68° F — instead of the more typical 55-to-58° F. That increase of 10° can result in dramatic cost savings. Proper design and installation of cabling becomes significantly more critical as the density of the rack goes up. Anything that interferes with optimal airflow can degrade efficiency and potentially causes equipment in the rack to overheat.

In addition, labeling and documenting the wiring is key, of course, to facilitate future adds, changes, and deletes. Properly labeled and routed cables reduce downtime through fast incident troubleshooting and change management operations.

## Documentation and Planning

The importance to data center resiliency of planning, process, and documentation cannot be understated. Case in point: because CenturyLink's data center operations teams had "crisis" mode plans in place — and tested them regularly via simulated disaster drills — customers of the 15 data centers in Hurricane Sandy's path experienced 100% uptime during the storm and in its aftermath.

Testing exercises helped to ensure staff knew their roles, and how they were critical to the entire plan. The real-life stress test Hurricane Sandy provided proved that extensive documenting, planning, and testing was worth the time and effort.

## Calculations and Tradeoffs

Organizations must consider many trade-offs when deciding whether to build their own data centers or opt for colocation, managed, or cloud services. Total cost of ownership considerations should include personnel with the skills to run, maintain, and upgrade all aspects of the data center, plus ongoing training to stay current with the continuous advancement in technologies and procedures. Facility team members must be experts in uninterruptable power, cooling, security, networking, and related systems.

Along with many other factors (both strategic and tactical), the cost of establishing and then maintaining the required level of expertise in technology and best practices should be weighed against the cost of leveraging an outside partner for whom these things are core competencies.

## Conclusion

IT management should carefully consider all of the above best practices in the design of its own data center or selection of a colocation services provider. Data centers aren't just big rooms with raised floors and power and cooling anymore. They are investments in real estate and infrastructure that comprise ecosystems of technologies tied together by critical interdependencies, requiring management personnel with advanced skills and expertise. They need regular maintenance and upgrades. When considering your own needs, ensure these best practices are observed.

## Data Center Design & Selection Short List

- Efficient design saves time and money.
- Optimal density maximizes space usage and minimizes power requirements.
- Hot aisle/cold aisle design improves cooling efficiency and extends equipment life.
- Careful planning of physical wiring minimizes mess, maximizes cooling, and simplifies moves and changes.
- Documenting hardware and software saves costs and makes fixes easier.
- Planning, process, and simulated testing enhances data center resiliency.
- Demand continuous, iterative improvement: CenturyLink has updated its "perfect data center" design five times in the last seven years based on customer experience with all of the above.

## About Hybrid Infrastructure Solutions from CenturyLink

CenturyLink's Hybrid Infrastructure solutions infuse agility into IT infrastructure, whether your business is challenged with controlling costs, managing performance, or scaling and expanding into new markets. CenturyLink is recognized as the No. 2 retail colocation provider, with an extensive global footprint that includes more than 60 state-of-the-art data centers across North America, Europe, and Asia, with over 2.6 million square feet of raised floor space.

## About CenturyLink Business

CenturyLink Business delivers innovative managed services for global businesses on virtual, dedicated and colocation platforms. It is a global leader in cloud infrastructure and hosted IT solutions for enterprise customers. Parent company CenturyLink, Inc. is the third largest telecommunications company in the United States, and empowers CenturyLink Business with its high-quality advanced fiber optic network. Headquartered in Monroe, LA, CenturyLink is an S&P 500 company and is included among the Fortune 500 list of America's largest corporations.

For more information visit www.centurylink.com/technology.

[1] http://www.energystar.gov/index.cfm?c=power_mgt.datacenter_efficiency_hotcold_aisles

**Global Headquarters**
Monroe, LA
(800) 728-8471

**EMEA Headquarters**
United Kingdom
+44 (0)118 322 6000

**Asia Pacific Headquarters**
Singapore
+65 6591 8824


600010615 - CM150453

CenturyLink® Business