The Impact of Current Trends on the Data Center Communications Cabling Infrastructure

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The data center has become a critical asset of today's information intensive enterprise, supporting all the applications needed to maintain daily communication, productivity, and functionality. Designing and sustaining a data center capable of supporting these applications is a considerable undertaking, and a properly designed infrastructure is key to maximizing that investment both now and in the future.

Executive Summary

Designing and implementing an infrastructure that maximizes data center management is vital to maintaining availability, operational efficiency, and aesthetics while also supporting growth, advances in technology, regulatory changes, and the increasing need for security. On the other hand, poor infrastructure design decisions can affect long-term reliability and total cost of ownership.

Making some simple choices when designing the infrastructure can result in dramatic improvements for key data center issues such as:

- ✓ Air Flow
- ✓ Response Time
- ✓ Administration
- ✓ Space Utilization
- ✓ Security
- ✓ Aesthetics

This paper discusses how to best manage these issues early on in the design of the cabling infrastructure.

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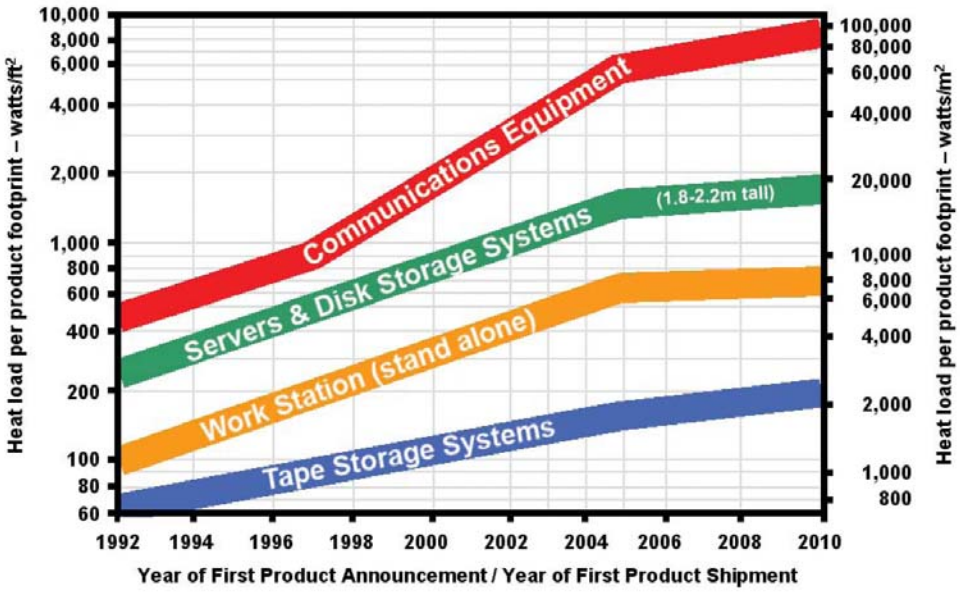
Increase in Power Consumption

The increase in power density for active data center equipment has driven the cost of cooling and power consumption to a new level. Even with the improved efficiency and discipline of switching off idle equipment, and using more energy-efficient servers and switches, heat loads in a 42U cabinet have increased 12½ times over the past six years. And the best-case scenario has that number rising another 44% over the next six years. In fact, some experts estimate a requirement of 30 to 50 kilowatts for each cabinet or rack space![1]

With higher-density cable bundles, an infrastructure design that helps manage airflow into and out of a cabinet is increasingly critical to equipment performance and lifespan, and ultimately data service levels.



Datacom equipment power trend chart (The Uptime Institute)

[1] Brill, K. (2005) "2005-2010 Heat Density Trends in Data Processing, Computer Systems and Telecommunications Equipment" (Uptime Institute).

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Cost of Downtime

Downtime is costly and unacceptable in today's data center. Recent studies show that estimated losses for downtime can run into the millions of dollars for many industries. With more than 50% of all data center infrastructure failures resulting from maintenance or other administration activities[2], the data center infrastructure must enable IT managers to deploy equipment, complete reconfigurations, and respond to maintenance issues as quickly as possible.

Floor Space Cost and Space Utilization

The rising cost of environmentally controlled data center real estate, combined with the expense to cool the active equipment, means that space utilization must be carefully considered and efficiently managed. Not only is it important to maximize data center floor space utilization, but the infrastructure must also optimize rack space, minimize connections, and increase cabling density.

Data Center floor space cost estimates range from $700 to $2,300 per sq. ft[3]. Maximizing utilization of expensive data center real estate is a key to controlling operating expenses. Probably the biggest area that the data center designer can impact the Total Cost of Ownership of the data center is in optimizing the floor space available; or in other words, to maximize the number of usable rack spaces per square foot of floor space.

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[2] "Site Uptime® Procedures and Guidelines for Safely Performing Work in an Active Data Center", CompuSite Engineering, Inc. and the Uptime Institute (2007).

[3] Richard Sawyer, "Sticker Shock: The High Cost of Modern Data Centers", AFCOM Data Center World, April 2, 2008.

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Space Utilization
TO DO's

- ✓ Minimize connection count
- ✓ Maximize connector density
- ✓ Vertical patching in server cabinets

The data center designer can increase the usable rack space by minimizing the number of connections required through the use of higher bandwidth media. For instance, the data center designer should consider using a single 12-strand MTP optical fiber connector instead of individual LC connectors.

Data center designers should also strive to increase the density of connectors (number of connections per rack space) in their efforts to maximize floor space utilization. They can accomplish this through the use of several techniques – the use of angled patch panels to reduce the number of racks spaces used for cable management or the use of vertical patch panels in server cabinets. By using vertical patch panels, the designer can locate patch panel ports closer to network equipment ports, the data center designer can minimize cable pathway congestion. Doing so has the added benefit of removing obstacles to airflow. So-called zero-U or vertical patch panels provide the ideal answer to this challenge.

The photo in Figure 2 illustrates the advantages of using vertical patch panels over traditional patch panels. Obviously, two additional rack positions are freed for servers. Note also the proximity of the patch panel ports to the server ports and resulting short length of the patch cords.

Figure 1: Comparing Vertical Patch Panels to Standard Patch Panels in Server Applications

Airflow

The increasing array of active equipment designed into smaller packages results in more heat and more cable congestion, which impedes airflow. Managing airflow is particularly important when we consider that 70% of power brought into the data center never reaches the network equipment.

Airflow
TO DO's

- ✓ Overhead utilities
- ✓ Minimize cable bulk
  - o 3-phase power
  - o High pair count cable
  - o Optical fiber

(see Figure 2)[4] As a result, managing airflow could result in lower operating costs and longer equipment life. To manage airflow, data center designers must be diligent in defining air pathways, and by extension defining pathways for power and data cabling. Recently, some designers have opted for overhead power and communications utilities to free and dedicate the space below the raised access floor for air handling. In general, by using techniques such as these, the data center designer is attempting to eliminate airflow

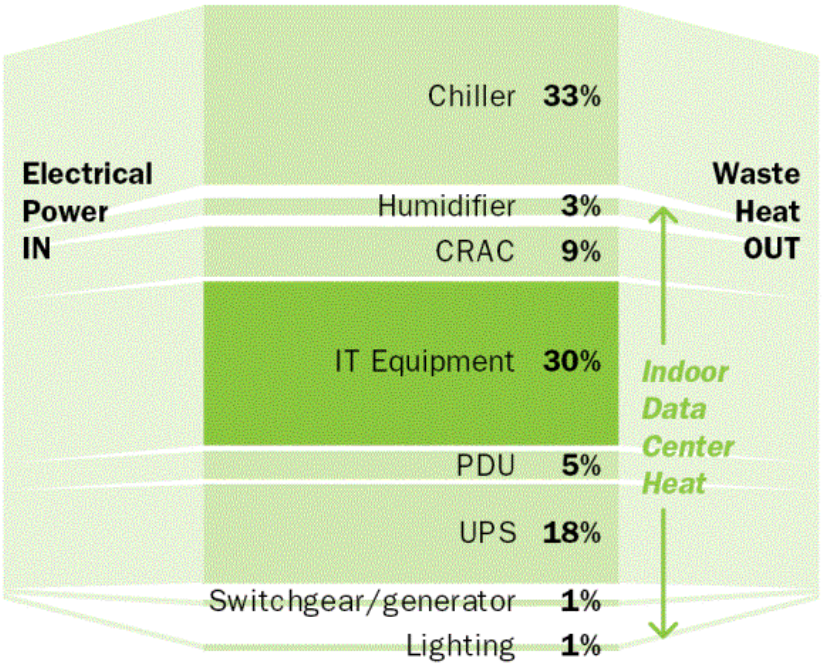

Figure 2: Only 30% of Power Sent to Data Center Makes it to the Network Equipment

[4] Guidelines for Energy Efficient Data Centers – The Green Grid, Rasmussen, N., "Electrical Efficiency Modeling of Data Centers", White Paper #113, APC (2005)

obstructions.

Other cabling infrastructure design alternatives that contribute to the same end are reducing cable bulk and condensing connection form factor. Techniques the data center designer can use to reduce the amount of cable bulk throughout the data center are: standardizing on 3-phase power delivery to the cabinets and racks, relying on high-pair-count cable where possible (example: 25 pair cable for 1000 BASE-T applications), use of optical fiber where possible, and the use of vertical patch panels to minimize the distance between patch panel ports and equipment ports.

Security

The protection of data and equipment in today's information-intensive enterprise has called for an increase in both logical and physical security. Not only do IT managers need to ensure that proper encryption and firewalls are in place, but the physical infrastructure must also protect and secure connections and equipment. Infrastructure products including sturdy, tamper-resistant enclosures and fault-resistant connections can go a long way in securing these critical assets. Protection of mission critical data, adherence to regulatory requirements and defending against unauthorized access to equipment are key requirements for today's data center environment. Certainly, the physical infrastructure presents an intrusion point and security should be considered when designing the cable plant of the data center.

In addition to controlling access to data center, the data center designer should consider limiting physical access to network connections. Factory-sealed components and fault-tolerant

Security TO DO's

- ✓ Tamper resistance
- ✓ Factory assembled components
- ✓ Secure media (e.g., shielded, fiber)

connections also provide an element of security and peace of mind. A further step the designer can take is the use of Intrinsically secure media such as shielded cable or optical fiber.

Aesthetics

While data center availability is paramount, the data center must also showcase a company's commitment to technology. When designing the infrastructure, innovative cabling management solutions can greatly improve the overall look and aesthetics of the data center, both at deployment and following future moves, adds, and changes. Data Center appearance also results from a design that minimizes cable congestion.

In short, the Data Center is a reflection of the proficiency and the capability of the enterprise. As such, savvy firms leverage the appearance of their data center as a sales tool.

To achieve a professional appearance in the data center, IT managers should strive to minimize clutter and cable congestion by maximizing the amount of bandwidth through a cable and by minimizing the length of cable used. Covered cable management and stylized equipment racks and cabinets also contribute to this design objective.

Administration
TO DO's

- ✓ Define and identify pathways and cables.

Administration

The ability to locate equipment, cables, and connections at all times is critical in the dynamic data center environment. The less time required to identify the location of cables, the quicker changes can be made and the lower the facility's operating expense. Key design objectives include the utilization of a

structured identification system and minimizing the number infrastructure components. Of course, simplified administration is another benefit of defining cable pathways as described above.

Response Time

As the enterprise strives to be more competitive, the organization must be able to dynamically and rapidly transform its communication and technology infrastructure for future growth and new requirements.

In order to ensure that the cabling infrastructure is designed to maximize response time, and provide maximum flexibility for moves, adds and changes (MACs), the data center designer should use factory-tested plug and play components (example: MTP fiber cassettes) and attempt to minimize number of component parts in the system.

Response Time
TO DO's

- ✓ Use Plug and Play where possible to eliminate termination and test time.

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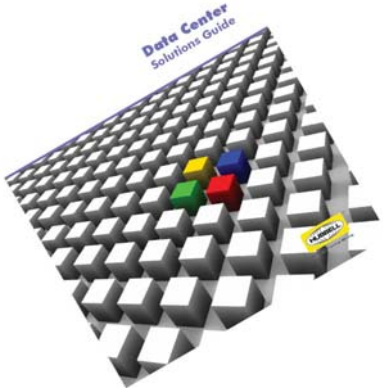
The Hubbell Commitment

As a global manufacturer of structured cabling systems, enclosures, and accessories, Hubbell Premise Wiring can help IT managers respond to the key data center issues of airflow, response time, administration, space utilization, security, and aesthetics. Hubbell is dedicated to delivering product innovation, advanced technology, the highest quality, and customer service excellence for the data center. To top it off, the Hubbell MISSION CRITICAL® program gives IT managers the assurance of system success with a 25-year guarantee on the components, performance, and installation integrity of your data center's structured cabling infrastructure.

Hubbell can help you minimize the Total Cost of Ownership of your data center operation by providing you with solutions that exceed all of the design objectives. Minimize start-up costs, downtime and operating costs and maximize long-term reliability. All under the protection of the Hubbell 25-year MISSION CRITICAL® Cabling System Warranty.

Michael Wood, Hubbell's Senior Product Manager for Data Center Infrastructure Systems, prepared this white paper. Questions can be addressed to Mr. Wood at mwood@hubbell.com.



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