Discussion on Data Center Infrastructure Energy Saving Reconstruction Plan

Fang Fang and Xiaofeng Yu
Network Engineering and Research Center, South China University of Technology, Guangzhou, China, 510641
The Siemon Company, Guangzhou, China, 510620
Email: ffang@scut.edu.cn; Felix_Yu@siemon.com.cn

Abstract. The data center infrastructure must support current IT needs and future enterprise expansion needs. In data centers with higher computing power, the amount of heat generated is increasing, making power and heat issues more and more significant. This article outlines the basic meaning and characteristics of a green data center. From the aspects of advanced network system design, cabinet system design and intelligent infrastructure management, the paper discusses the green energy-saving transformation plan of data center infrastructure, proposes energy-saving proposals, improves data center heat dissipation, and promotes data center intelligence and energy conservation.

1. Introduction
In the early construction of the data center, the total cost of ownership increased exponentially with the increase of servers, facing issues such as heat dissipation, power supply, and cost:

- Insufficient power and cooling capabilities limit IT infrastructure expansion or the inability to take full advantage of high-density computing devices;
- The power consumption is too high, the cost is too high, and it cannot be afforded;
- The temperature in the equipment room is too high, which affects the stable operation of the computing equipment;
- The increase in the operating density leads to a rapid increase in the density of electricity used.

When management costs, resource integration, business response speed, information security, and energy management all face crises, green data centers have become the inevitable upgrade of data centers.

Green data centers refer to IT systems in the data room, cooling, lighting, and electrical to maximize energy efficiency and minimize environmental impact. We can measure whether a data center is “green” in terms of building energy efficiency, operational management, and energy efficiency. The “green” of the green data center is embodied in the overall design planning and application of IT equipment and management software such as computer room air conditioners, UPS, servers, etc. It must have energy saving, high reliability and reasonable availability. The green environmental protection of the data center is mainly to save energy as much as possible in the selection of materials. Secondly, in terms of energy use, energy control is adopted to achieve energy conservation.

2. Cabling System Is An Important Infrastructure For Green Data Centers
With its cabling system compatibility, openness, flexibility, reliability, and economy of advanced features, became the basis of data transmission in green building construction, so that the relationship between the various subsystems buildings more clearly and tightly. After cabling intelligent, we can
build, operation and maintenance of green buildings of management, resource sharing, remote monitoring. Cabling standards directly affect the level of complexity involved in numerous professional and technical support green building products. [1]

The idea of green data center includes energy saving and environmental protection. In considering ways to achieve green data center, people's attention for the cable infrastructure is not enough. Because the electrical devices, cooling systems and computer hardware are direct energy consumptions, so they always have a higher green configuration. However, the choices of cable media types and quantities, and transmission of energy consumption, will impact the data center environment. High-performance, reliable cabling systems are critical to data center infrastructure:

- The cabling system can support 2-3 generation switches, servers and storage devices.
- Cabling systems are typically maintained for 10 years, 15 years or more, replacing a cabling system with the most disruptive and labour-intensive, and a good cabling system can increase the time between updates.
- The cost of a cabling system is only a small fraction of the cost of active equipment, power, software, and maintenance in the data center.
- The root cause of 70% of network problems is from poor wiring systems.

3. The Infrastructure of Energy-efficient Data Center

3.1. Advanced Cabling System Design

Use advanced infrastructure designed to meet green building future mission requirements decades of continuous development. Design must be forward-looking. When designing a new data center, the backbone connection should use a fiber backbone that will not need to be rerouted when migrating to 40/100GbE in the future. Traditional copper application and monitoring, centralized KVM and management, and should ensure 10GBASE-T transmission in the future. Both TIA and ISO standards recommend the installation of Category 6A or higher cabling systems in the data center, enabling future support for higher speed applications such as 10GBASE-T without the need to upgrade or replace cabling systems.

3.1.1. Advantages of using shielded wiring in the data center

- Longer life cycles lead to lower total cost of ownership
- Excellent external crosstalk performance eliminates the need for external crosstalk testing at the installation site
- Outstanding resistance to external noise, compared to UTP, its anti-interference ability is more than 100 times.
- Enhance data security
- Simplified grounding
- Better heat dissipation results in lower insertion loss and longer support distance for higher temperature and POE Plus applications.

The high speed application of 10GBASE-T is very sensitive to crosstalk between lines. The shielding layer cleverly solves the problem of crosstalk between ANEXT lines. In Category 6A cables, shielded cables are typically more compact than unshielded cables, saving pipe space, optimizing airflow, and making them more energy efficient. The 6A type of shielding layer solves the influence of alien crosstalk between adjacent cables, and its excellent external crosstalk performance eliminates the need for users to perform on-site testing of the indicator, eliminating the need for field testing. The shielding system has better electromagnetic compatibility EMC, as well as better heat dissipation and energy saving. Therefore, in terms of performance, density, installation and testing, the 6A F/UTP shielding system is far superior to the 6A UTP system when supporting 10GBase-T applications. Siemon's shielded Z-MAX solution is not only a high-performance, high-bandwidth cabling system, but it also significantly reduces installation time, speeds up completion and saves time and money, eliminating the long-held belief that shielded systems is difficult to install.
3.1.2. Fiber Solutions of Data Center

With the rapid growth of network applications and transmission rate requirements within the data center, the corresponding wiring design has emerged. Category 6A and above copper and OM4 fiber are the first choice for TIA / EIA 942A standards, suitable for 10G applications. LC connectors and MPO connectors for 40G / 100G applications are standard fiber optic connectors.

Siemon fiber system features:
- Factory-terminated and tested components accelerate 90% faster than traditional field terminations.
- Siemon's RazorCore cable with a 12-pin MTP connector provides the industry's smallest diameter plug-and-play components, reducing pipe usage and improving airflow.
- In high-density wiring environments, the optimized adapter space design facilitates fiber optic patch cord access.
- Pre-terminated and tested fiber backbones can be deployed quickly.
- Available in a variety of options from 12-core to 114-core, multi-mode, single-mode, and multiple jackets.
- With future support for 40 GB/s and 100 GB/s performance margin. [2]

3.2. Cabinet System

As an integral part of the data center infrastructure, the cabinet's main role is to facilitate the placement of servers and other IT equipment, so many people simply think of the cabinet as a shelf for placing equipment. This is actually a misunderstanding. In addition to the equipment, the cabinet also needs to provide convenient and standardized wiring systems for these devices, and it is also conducive to the heat dissipation of the equipment. A standard server rack configuration requires a 48-port patch panel port for each server, requiring 2U of horizontal mounting space. With Siemon's VersaPOD, these panels can be installed in vertical space, allowing more servers to be installed while the network is expanding in the same space.

Siemon's VersaPOD provides a new and efficient solution for the data center physical layer infrastructure, providing a scalable, versatile, high-density rack system. By utilizing the vertical space between the cabinets in a row for wiring and cable management, critical horizontal space is released for active devices, providing the highest density in the smallest floor space. Integrated zero-U vertical patch panels (VPPs) support both copper and fiber cabling, providing 288 copper ports in the front or rear vertical section between two cabinets that do not occupy any cabinet horizontal installation space or 864 fiber ports. By releasing the horizontal space, a higher density of active devices can be provided. [2]

3.3. Intelligent Infrastructure Management

Management also needs intelligent, space-saving is saving. Sophisticated management and software implementation of the data center infrastructure management, the purpose is to save energy. Siemon's MapIT G2 intelligent infrastructure solution integrates innovative intelligent electronic distribution frames, user-friendly host controllers, and EagleEye software systems to track network connections in real time, enhance security, and automate document management of physical layer changes.

- Detailed network view: Uses a hierarchical view to show the entire network, the internal facilities of the cabinet and rack; the layout of the work area and floor; and the complete end-to-end link including active devices.
- Accurate data storage: All network information is stored in the software database. The database automatically updates any movements, additions or changes in the physical layer in real time, ensuring real-time network status.
- Maximize network usage: EagleEye software provides device usage reports to see which switches or patch panel ports are available. These important network facilities can be better
displayed and utilized by tracking the terminal equipment by location, device type, manufacturer or other parameters.

- Green and environmental protection: The system hardware adopts hibernation settings, and the hardware is optimized without fan cooling. Because smart components are integrated into the distribution frame, the spatial density of MapIT hardware is 80% higher than that of similar systems. For example, some systems manage 60,000 ports and require 60U of cabinet space. MapIT G2 manages the same number of ports and only needs 7U of cabinet space. Because the intelligent distribution frame and intelligent fiber distribution box combine smart components, it is required to connect intelligent systems. The slot space is greatly reduced, saving up to 76% compared to similar systems. [2]

4. Summary
Green Data Center is complex system engineering. In this article, we focus on some of the methods that can be applied to upgrade a green data center infrastructure. Through the discussion of energy-saving renovation programs, the following objectives are achieved:

- Reduce costs: Effectively reduce data center construction and operating costs by effectively reducing energy consumption;
- Increase capacity: reduce cabinet waste caused by power supply and heat dissipation problems, increase the density of scalable cabinets in the data center, and keep data center capacity at a healthy level;
- Improve reliability: Reduce abnormal downtime due to energy issues, avoid data disasters, and improve data center reliability.

In the future, with higher bandwidth and more energy-saving requirements, high-performance Category 6A shielded wiring and fiber will become a trend. Factory-terminated and tested bundled copper and pre-terminated cable systems, coupled with Siemon’s high-density Zero-U vertical wiring data center cabinets, will give users higher performance, longer life cycles, and more green technology. As the data center of our university is in the midst of an update, the data center of the new campus is also being planned, and the discussion plan will be considered. The new data center solution will be able to meet the current and future needs of South China University of Technology.

5. References
[1] http://www.qianjia.com/special/cabling-system/cs-2014004/, Intelligent city intelligence begins with integrated wiring
[2] http://www.siemon.com, 2018