FEATURE

Power Infrastructure Design: A Better Approach for Today's Business Problems

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APC

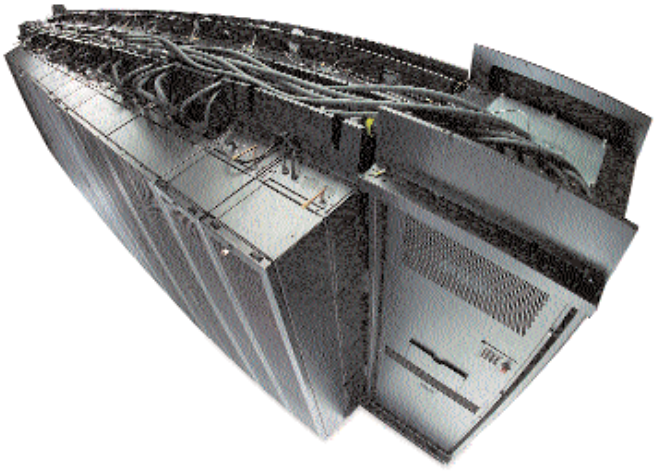
Our technological world has become deeply dependent upon the continuous availability of electrical power. A US study has shown that industrial and digital business firms are losing $45.7 billion per year due to power interruptions. Despite revolutionary changes in information technology (IT) and products over the past decades, the design of power infrastructure for mission critical installations like data centers and network rooms has changed very little since 1965. Although IT equipment has always required electrical power, the way that IT systems are deployed today has created new power-related problems which were not foreseen when the powering principles for a data center were developed over 30 years ago. Three key drivers must be considered. Availability of the data center, agility of the data center, and the total cost of ownership (TCO) of the data center.

Availability

Availability is the main reason that the power systems (and other physical infrastructure systems such as cooling) are purchased. If systems are not available, essential business objectives are sacrificed. Human error, over and over again, comes up as the biggest contributor to availability. Frequent IT changes in a data center lead to chaos which ultimately leads to human error. Consider what happens today when a new server is purchased, requiring a different receptacle than what is available - It requires the changing of live power circuits. This creates an unstable environment, subject to constant change, and invites human error.

It is amazing that you can buy a Toyota Camry for $25,000 and get a system that has gone through simulation, failure analysis, extreme environmental testing, etc. - all things that make the Camry a very reliable car. Yet, when you buy a $15,000,000 data center, you don't get any of that - instead you get a unique one-of-a-kind solution - not an environment for high availability.

Another factor for high availability is the ability to quickly recover from a failure. Many have either experienced or have heard the horror stories of data centers that went down due to a failure, and took days to recover. The impact of such an occurrence on the business is devastating. When systems are modular, hot swappable, and user-serviceable, spare parts can be kept onsite and recovery time can be cut significantly.



AGILITY

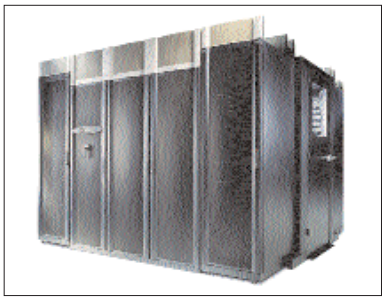
Business plans must be flexible to deal with changing market conditions, opportunities, and environmental factors. Investments that lock up resources limit the ability to respond in a flexible manner to business threats and opportunities. The bankruptcy of numerous hosted service providers during the dot com era is a classic example of how lack of agility devastated an industry. These companies spent billions of dollars completely building out data centers with the mentality of "if we build it they will come". When the power system can be built for present needs and be agile enough to adapt to any future requirement (rather than forecasting ten years into the future), the risk of prediction error is eliminated and the return on the investment is optimized.

Today, if you need a server, you can get a server in two days. But if you need more data center power capacity, that could mean 400 days. This lengthy timeline is due to the fact that traditional legacy approaches involved a high degree of customization. The process to get more capacity involved several major steps that are custom exercises - one-time engineering, one-time construction design, the construction process itself which is highly customized, and commissioning that is tailored to integrating a lot of equipment not specifically designed for that integration. Well, what if...

- The design was built on standardized parts that could be scaled to meet the need?
- The construction design incorporates a "Lego block" approach of pre-engneered components?
- The construction is mainly done in a factory instead of on-site?

The ability to scale is another key aspect to being agile. The average data center is significantly overbuilt. Research shows that typical data centers today are utilized to less than 50 percent of their infrastructure capacities. In fact, according to "Data Center Power Requirements: Measurements from Silcon Valley," a thesis written by J.D Mitchell-Jackson, et al., typical data centers are approximately only one-third full. 67 percent is not a small amount of waste. Imagine that the ROI for that project could have been three times greater. Two-thirds of the investment could have been applied to other company projects with greater return potential.

Consider the collocation company that built out 50 percent of their facility with DC power and 50 perent with AC power, only to later learn that 99 percent of their customers would require AC power. The DC investment was nearly a total loss due to this lack of agility. Now imagine the present - what if this same collocation company could have built only what their current customers required, and reconfigure only as needed for different power densities, different levels of redundancy (targeted availability), and for different voltages and plug types, without ripping apart the data center.



APC's high density data center solution is designed to use it's entire infrastructure for maximum ROI.

Total Cost of Ownership (TCO)

While upfront cost is still a very relevant factor, it simply does not tell enough of the story. It leaves the decision maker in the dark about long term costs of a solution, including operating and maintenance costs. Upfront cost was often used as the criterion because of a traditional project approach to purchasing capital items. Capital costs, for tax and depreciation reasons, were often separated from on-going expense costs in the accounting justification for a project. Even though upfront cost is only a fraction of the TCO, it was enough to get a project approved and purchased - it allowed the project to commence; And things like the electric bill were not part of the decision making process. Those types of expenses were often viewed as "fact of life" costs that were simply a necessary evil - they just came along with the project and were paid for not with project money, but with operational funding. Business decision makers are now seeing the importance of including these other costs in business value assessment when making critical business choices. A good business investment decision includes consideration of both first costs and on-going operational costs.

TCO includes all other costs associated with operating and maintaining that investment for its life (typically 10-15 years). It should be clear that in today's competitive business world, it is TCO, and not upfront cost alone, that drives real business value. Data centers and network rooms are routinely oversized to three times their required capacity. Oversizing drives excessive capital and maintenance expenses, which are a substantial fraction of the overall lifecycle cost. This results in considerable waste, including excess capital cost, operating cost, and specifically, energy cost.

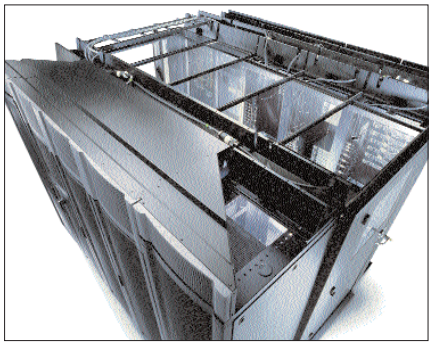
An Improved Power System Design

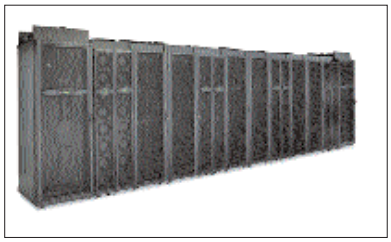
There is a proven strategy for optimizing all three business needs - through standardization, and more specifically, modular standardization. Applying the same car design approaches to IT systems, for instance, can substantially improve the business value of the data center's physical infrastructure.

Given this situation, the clear solution is to provide data center and network room infrastructure responsive to the unpredictable demand. The ideal situation is to provide a method and architecture that can continuously adapt to changing requirements. Such a method and architecture would have the following attributes:

- The one time engineering associated with the data center and network room design would be greatly reduced or eliminated
- The data center or network room power infrastructure would be provided in pre-engineered modular building blocks
- The components could be wheeled in though common doorways and passenger elevators and plugged in without the need for performing wiring operations on live circuits
- Special site preparation such as raised floors would be eliminated
- The system would be capable of operating in N, N+1, or 2N configurations without modification
- Installation work such as wiring, drilling, and cutting would be eliminated
- Special permitting or regulatory procedures would not be required in order to increase capacity.
- The equipment cost of the modular power system would be the same or less than the cost of the traditional centralized system
- The maintenance cost of the modular power system would be the same or less than the cost of the traditional centralized system.

Most of this excess cost can be recovered by implementing a method and architecture that can adapt to changing requirements in a cost-effective manner while at the same time providing high availability. An example of an adaptable system meeting the requirements above is the APC InfraStruXure architecture. In the InfraStruXure architecture, over 70 percent of the power system can be deployed in a manner that tracks the growth of the data center or network room requirement. In practice, the only part of the power system that is completely deployed up-front is the main input switchgear and main power distribution panels, which are sized to meet the ultimate room capacity. The UPS, battery system, power distribution units, bypass switchgear, and rack power distribution wiring are all deployed in a modular fashion in response to the changing load.





Typical InfraStruXure systems from APC

Failure to adopt modular standardization as a design strategy for power systems is costly on all fronts: unnecessary expense, avoidable downtime, and lost business opportunity.

[1]"The Cost of Power Disturbances to Industrial & Digital Economy Companies" White Paper copyright 2001, Electric Power Research Institute.

APC White Paper #117, "Network-Critical Physical Infrastructure: Optimizing Business Value" discusses this subject in more detail.

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