Inflection Point: The Future of the Data Center

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We are all racing feverishly to improve the efficiency of our data center infrastructure, mainly as part of cost containment and perhaps to “Go Green.” However, there's a huge amount of finger-pointing and confusion in the computing world today over the impact that blade servers and virtualization are having on the data center. On the one hand, you have the faculties groups calling for a major overhaul of the data center to upgrade physical infrastructure in the data center, while on the other, IT equipment vendors are promising that the next generation of systems will be a lot more energy efficient, thereby reducing the overall power load.

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Moreover, the U.S. government has finally dropped the proverbial “other shoe” with the release of the Energy Star for Servers ver. 1.0. This should mean that between newer (presumably lower-power, more-efficient) hardware, and ultra-energy-efficient data centers, we should begin a long-term trend to reduced usage of energy by data centers.

Yet, the data center market is growing rapidly even in this depressed economy. Newer, bigger, more powerful multi-megawatt sites are being planned and built at a rate not seen since the height of the dot-com boom days of the late 1990’s.

In differential calculus, the point on a chart plot where the direction of the slope of the curve (such as a sine wave or a roller coaster) changes direction, such as positive to negative, is called the inflection point. I believe that we are at an inflection point in the curve of the data center and IT power issue.

So why is this happening and what is the answer - plan to use less energy, or plan for additional power, and even more IT systems and applications - all running in private and/or public clouds?

I believe that these groups (IT & Facilities) with diverging directions, yet common goals, will finally have to speak to each other. Not only will IT equipment be more energy efficient, but the new Energy Star requirement that servers must be able to radically reduce their power when at idle, will force a major change in manner that the data center physical infrastructure is designed and operated.

I predict the future of the "Smart" Data Center that will need to meet the new paradigm efficiently, supporting a highly variable power (and heat) load of "demand based computing," wherein the power load varies widely with the computing power used. This is unlike the present circumstances, where the power drawn by today's IT equipment does not vary in direct proportion to the computing load.

"Back to the Future"

Many decades ago when the mainframe was king and only a few organizations had them, the timeshare concept of paying for the computing you used was the norm for those without a "glass house" and their own mainframe.

Today, nearly 50 years later, many companies are exploring and utilizing the "new" concept of **cloud computing**. Whether private of public or private, the need to support this computing environment and hardware will require a re-thinking of how the IT systems will interact and communicate with the physical infrastrure that supports it.

The advent of virtualization has just begun to impact the hourly power profiles, as newer IT hardware and software become more "Power Conscious" and servers or blades could be powered down when not needed.

In order to operate efficiently, the Data Center Infrastructure will need to be responsive to continuous changes in power demands and moving and changing cooling loads, as IT equipment powers up and down in different areas of the floor.

Some new blade servers are already capable of "Power Capping" under embedded software control. The new Energy Star Servers will have much wider "Idle to Max Power" range than existing servers.

As this new paradigm evolves, "Smart" Advanced Power Management Systems will interactively begin to "broker and negotiate" power requests (and rates) from IT equipment to the UPS, PDUs and Cooling Systems.

I predict that the "Smart" Data Center must be able to efficiently scale up and down to meet the wide and constantly changing power requirements of the IT loads. The data center equipment and management systems will not only communicate with the IT equipment, they will begin to communicate and perhaps even negotiate (in real time) with the Power Utilities (not just to run back-up generators for load shedding during power shortages).

Will there be a government mandated "CAFE" for operators of public and private data centers? Will data centers be built in the polar caps for free cooling and use super-low-power IT equipment that will be able to be powered by ultra-efficient solar cells? Will Anti-Matter reactors make the power issue a mute question? Will AI finally advance to the stage where computers will deserve the term "thinking machines"?

So fasten your seatbelts, I believe the computing landscape in the next decade will look substantially different than today, but I guess that is an easy prediction!

Julius Neudorfer is the CTO and founder of **North American Access Technologies, Inc.** Julius has been involved with designing Data and Voice Networks and Data Center Infrastructure since 1987 and is the primary designer of the NAAT Mobile Emergency Data Center. Over the last 20 years he has designed and overseen the implementation of many technology projects, including Data Centers and network projects and specializes in improving the efficiency of the data center. Julius is the inventor of a high efficiency cooling system for rack-mounted computer equipment. He is also the founder of **THINK8760.org**, which is focused on improving data center and IT energy efficiency and is a member of ASHRAE and IEEE.