Data Centers, The Future Is Both

Consolidated and Dispersed

Data Centers are becoming increasingly important in today's mobile connected world, where they store and process a lot of consumer and commercial data, enable mobile applications and are the basis of many modern business models. Very large hyperscale data centers, such as those run by Google, Amazon and Facebook, get a lot of attention and are very energy efficient, but these data centers represent only about 5% of total national data center usage.

According to a recently released NRDC report there are about 3 million other data centers in the US that house about 95% of all servers throughout the country. These other data centers include multi-tenancy co-location facilities as well as internal organization data centers. According to the NRDC report, servers at these data centers operate at only about 12-18% of available capacity, resulting in considerable wasted resources and energy inefficient operation.

The report estimates that by 2020 data center energy consumption could reach 140 killowatt-hours with electricity costs of about $13 B. The report also estimates that if just half of the potential savings from cost-effective energy efficiency best practices were realized, electricity use could be cut by 40%. There are a number of technologies available that can enable this higher data center energy efficiency. These technologies include higher utilization using physical to logical virtualization but also higher performing and more efficient equipment and new network architectures.

Another recent report from Emerson, a major electronic technology manufacturer, based upon a survey of data center professionals, seems to indicate that the future of data centers may lie in less centralization, rather than more. In this survey 58% of respondents expect that data centers will be half the size of current facilities or smaller by 2025. 31% of the respondents envision neighborhood-level Internet switching centers by 2025 and 68% believe at least 60% of computing will be cloud-based by the same year.

This survey suggests even more efficient hyperscale data centers in the future as well as smaller individual data centers connected with high speed networks embedded in neighborhoods and even within our homes. The rise of more local technology resources to support the growth of large arrays of connected devices often called the "Internet of Things "may help drive the development of local IT resources, including digital storage, to aggregate and process this local data before passing it on to the broader network.

In order to create increased energy efficiency in distributed IT resources such as suggested by the Emerson survey, new power-saving modes must be developed for servers and other IT equipment. These modes must allow fast response when needed but involve low or no-power modes when not needed. One way that servers can accomplish this is through the use of non-volatile rather than volatile memory in the processing unit.

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Today flash memory in various interfaces, including the DIMM sockets commonly used for DRAM memory are allowing some level of non-volatile memory in computer and server architectures but in the future non-volatile memory architectures, such as STT MRAM (or STTRAM), could replace the internal cache memory in CPUs and enable instant on capabilities without any need for data refreshes. The change from volatile to non-volatile memory architectures will play an enormous role in improving the energy efficiencies of all size data centers.

There is an increasing need for greater data center efficiency as our dependence upon cloud-based applications and other data center services increases. Consolidation of resources provides new paths to greater efficiencies and cost savings—a big factor in decreasing costs for on-line storage. At the same time new non-volatile memory technologies allow more efficient individual server operation with more energy savings modes. This enables a possible increase in local server and IT resources to support the connection, analysis and use of more and more connected things (the Internet of Things). The future is both consolidated and dispersed.