

Top 6 Trends for Cloud Data Centers of the Future

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Seagate Point of View

It is difficult to know with certainty what data centers of the future will look like, however, here is a summary with regard to some of the major trends.

Data Center Size

Cloud data centers seem to be moving toward extremes in terms of size, either becoming massive or very small. In general, commoditizing cloud storage and cloud computing services will likely erode profit margins and favor larger players, with the exception of highly-specialized services. Larger sizes, along with highly-consolidated operations and supply chains, offer greater negotiation power when purchasing components, allow for better strategic and tactical planning, use relatively fewer resources (employees-to-server ratio), and allow for better optimization of all essential and non-essential functions. One future data center, the [Langfang Range International Information Hub](#) (in China's Hebei Province) will look like a small city constructed of data centers, office space and homes for people working there. When completed (target date is in 2016), it should have about 6.6 million square feet of data center floor space!



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Data Center Locations

As data centers increase in size, building them in the right places becomes more and more important. Data centers may be built in cooler climates to reduce cooling costs, because outside air could be used to chill those data centers. Rural areas with affordable land and room for expansion may be favored. Financial incentives, available water supplies, and proximity to customers, major cities and airports are all important considerations.

Data Center Power

Power becomes an even bigger concern for future data centers, with an emphasis placed on efficiency and, ideally, use of renewable energy. For example, Apple's Maiden, North Carolina data center is now 100% supplied by renewable energy, with 42 million kWh coming from an on-site solar array and the rest from bio-gas stored in nearby fuel cells. Since further reduction of Power Utilization Efficiency (PUE) below 1.1 could prove difficult to achieve, the focus will likely shift to lower-power solutions and renewable energy sources.

Cost Reduction

Cost reduction is an important part of data centers of the future, with cloud data centers continuing to rely on low-cost hardware utilizing architectures designed to tolerate failures without loss of customer data or service interruptions. Focus on cost reduction is a given. Thus, power saving solutions such as low-power processors will gain in popularity, especially in less performance-centric storage-oriented applications. Commodity components should be scrutinized for quality and reliability in the persistent effort to find the right trade-offs between lower acquisition costs and lower maintenance and service interruption costs. Overall, the cost of computing, networking and storage in data centers of the future will continue to fall.

Data Center Architecture

The software-defined or virtualized data center is the next step in the evolution of virtualization and cloud computing with the entire infrastructure being delivered as a service (IaaS). Software-defined architecture (compute, networking and storage) will dominate the future data centers, resulting in cost reductions, improved flexibility, greater elasticity, better resource use, and simplified operations, troubleshooting, and control.

It is likely that disaggregated rack-scale server architecture (disaggregation of the compute, memory and storage capacity

in a rack) becomes more popular over time. This approach, promoted by Intel amongst others, could become a major part of data centers of the future. Rack-scale server architectures, when implemented correctly, enable independent provisioning, replacement, and upgrading of compute, network and storage subsystems, allowing for potential cost savings.

Migration from replication-based data redundancy schemas to large-scale erasure-coding solutions gains in popularity for storage-focused applications. Faster network fabric and powerful processors reduce the performance penalty of erasure-coding, making its reduced data storage overhead (and, therefore, reduced cost and footprint) irresistible.

More exotic architectures like immersive oil cooling gain in popularity but mostly in high-performance computing applications, since the majority of mega-sized storage silos can rely on air-cooling setups.

New storage architectures, such as the Seagate® Kinetic HDD and Open Storage platform, reduce the number of components required in large-scale storage systems and will garner a high level of interest among those looking to optimize systems at scale.

Cloud Open-Source Software

Open-source software, such as OpenStack, will continue gaining popularity and compete successfully with their proprietary counterparts. Associated cost savings will be tremendous, and issues of software maturity and support will be addressed in the near future, much in the same manner that Linux maturity and support are addressed today. Companies providing services enhancing user-friendliness and capabilities of the open-source software will benefit from this trend. Many of these companies could be acquired by the larger players and become an integral part of their offerings.

Additionally, advanced, complete and accurate DC design tools—both open source and proprietary—will be available for quick and easy prototyping and testing of the entire data center or storage cloud. In fact, Seagate is close to completing one implementation of these future design tools within its Cloud Modeling and Data Analytics organization.

Data center orchestration software solutions will further gain importance and continue adding capabilities by using new types of collected data, using more data in general, and finding new ways to apply advanced analytics for real-time decision making. As a result, while the data center operation becomes more and more efficient, some parts of the decision making process could become more opaque due to increased automation and reliance on complex black-box analytics models.

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Conclusion

The future of cloud data centers and cloud storage/computing is exciting. Many more improvements and technological trends beyond the ones described here are sure to be implemented. It will be interesting to see how many of these trends mature and gain popularity in the next 5 to 10 years.

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