

# The Silver Lining: To Build an Effective Cloud Computing Infrastructure, Start With the Right Core Technology

For cloud service providers, choosing optimal enabling technologies is vital to long-term success. By Samuel Greengard

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## Executive Summary

Over the last few years, cloud computing—the delivery of data, applications, and services via the Internet—has evolved from a promising technology into a powerful tool for boosting the efficiency of business and IT functions. A technology with roots in mainframe computing and fueled by the growth of social networking, cloud computing is now attracting attention from the commercial and public market segments, which are exploring it as a means to better manage email, desktop, and mobile productivity applications; CRM and ERP systems; and much more. By entrusting certain IT functions to remote servers that are accessible via the Internet, organizations are helping to usher in a new era of IT flexibility and cost-efficiency. Moreover, the companies responsible for delivering Web-based services to end users are experiencing healthy growth, as demand for cloud computing accelerates among small and large businesses alike.

However, as with any emerging technology, success in cloud computing is far from guaranteed. Cloud service providers interested in leveraging this powerful new IT delivery methodology must select underlying technologies that offer a high level of performance, reliability, power efficiency, and cost-effectiveness.

This white paper discusses emerging trends in the cloud computing marketplace and key qualities that cloud service providers should look for in data center technologies. It then discusses the benefits of basing cloud computing data centers on servers equipped with AMD Opteron™ processors, and provides real-world examples of cloud vendors that are successfully utilizing AMD Opteron processor-based systems to achieve strong performance, solid TCO, and low power consumption.

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## **Cloud computing goes mainstream**

The concept of cloud computing has been around for years under numerous labels: mainframe multitasking, grid computing, software as a service (SaaS), on-demand computing, and hosted IT. Essentially, cloud computing uses the Internet to deliver remotely hosted applications, data, and infrastructure services. The location of the physical servers and storage that house the applications and data is unknown—and unimportant—to the user. Typically billed on a recurring, pay-as-you-go basis, cloud solutions require no end-user infrastructure other than client devices equipped with a browser and reliable Web access. And since most cloud solutions are hosted in vast, third-party data centers, users can scale them up on the fly, without having to invest time and money in procuring and provisioning new server hardware.

The current interest in cloud computing is being fueled by the depressed state of the economy, which is causing businesses to look for alternative ways to maintain a competitive IT environment. Cloud computing promises to help free businesses from server procurement and maintenance costs. In addition, leveraging a well-designed cloud computing platform enables businesses to deploy new applications more quickly, trim development costs, and achieve greater agility. No wonder, then, that spending on IT cloud services is projected to grow from \$16.2 billion in 2008 to \$42.3 billion in 2012, according to Framingham, Mass.-based analyst firm IDC.

Cloud computing can take multiple forms:

- **Productivity applications** such as Google Apps™ are already widely used by consumers and small businesses via Web browsers and mobile devices.
- **Commercial applications** such as Salesforce.com® are quickly gaining traction among businesses looking for anywhere, anytime access to CRM data and other enterprise solutions.
- **Platform environments** are rapidly helping to turn computing into a utility. Such services offer a virtual server environment containing applications, libraries, data, and associated configuration settings. Unlike conventional on-premise data centers, cloud-based platform environments provide the ability to dynamically dial capacity up or down in minutes rather than hours or days. Examples of platform environments include Amazon Elastic Compute Cloud (Amazon EC2) and AMD's Fusion Render Cloud, a forthcoming massively parallel supercomputer announced in January 2009. Fusion Render Cloud will allow content providers to seamlessly deliver video games, films, and compute-intensive applications via the Internet to an array of mobile devices, maximizing their battery life and improving performance through more sophisticated streaming and delivery.

In addition, organizations are beginning to experiment with “private” or “internal” clouds. Such systems utilize all of the architectural elements of a cloud computing environment, but are situated behind a company's firewall and designed for the

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exclusive use of that company's employees. Though still an emerging phenomenon, private clouds offer many of the benefits of public cloud computing—such as easier application provisioning and simple, browser-only access—but leave IT departments more firmly in control of their data.

All cloud environments have certain distinctive feature set, power, and performance requirements. These include efficient virtualization support, encryption features for security, performance monitoring mechanisms, resource management techniques to ensure fairness, and most important, inexpensive, low-power hardware that minimizes the cost of provisioning, operating, and managing the data center. What cloud computing installations do not require is any feature that increases cost without providing a significant benefit. This includes costly, energy-hungry parts optimized for performance over power efficiency, multiprocessor support beyond two or four sockets, and enterprise-class hardware reliability features.

### **Building a better cloud**

Building a solid foundation for cloud computing means adopting systems with the right balance of processing horsepower and energy efficiency. Increasingly, it also means consolidating servers via virtualization in order to boost utilization levels and cut maintenance costs. Finally, a cloud environment must ultimately fit a service provider's budget.

Essential components of any cloud computing environment are servers equipped with processors that deliver excellent performance, strong I/O characteristics, low energy consumption, and robust virtualization assistance. The Quad-Core AMD Opteron™ processor offers all of these qualities.

For starters, the Quad-Core AMD Opteron processor uses HyperTransport™ technology to increase communication speeds between integrated circuits up to 48 times faster than some existing technologies.

AMD Opteron™ processors also feature AMD-Virtualization™ technology (AMD-V™), a set of hardware extensions to the x64 architecture designed to improve the efficiency and reduce the overhead of virtualization software. AMD-V enables virtualization software to operate with optimal efficiency, and its AMD-V Extended Migration functionality enables live migration of virtual machines across all available AMD Opteron processor generations. That can help cloud service providers manage their vast virtual server farms without incurring downtime.

In addition, AMD-V features Rapid Virtualization Indexing (RVI) technology, which offers fast and efficient performance by executing functions typically handled in software within the CPU. This results in faster switching times between virtual

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machines and ultimately helps reduce the performance penalty commonly associated with software virtualization.

Furthermore, the Quad-Core AMD Opteron™ processor contains a variety of features that can significantly reduce energy usage. For example, all AMD Opteron™ processors feature AMD PowerNow!™ technology, which dynamically manages power utilization across processor cores, and AMD CoolCore™ technology, which reduces power consumption within individual cores. They also feature Dual Dynamic Power Management™, which can reduce idle processor power consumption while enabling per-processor power management in multisocket systems. Together, those technologies and others can help enable cutting-edge energy efficiency. That can be a major competitive advantage for cloud service providers, whose data centers typically house large volumes of power-hungry servers.

### **Solid market momentum**

The bottom line, then, is that servers based on AMD Opteron processors can help organizations optimize data center performance and cost-effectiveness. Consequently, a growing number of organizations are turning to the AMD Opteron processor-based platform to build robust cloud computing infrastructures. Consider these examples:

- **Microsoft® Corp.** has chosen to base the Azure Services Platform (Azure), its new cloud services platform, on AMD-based servers. Azure allows developers to create Microsoft-compatible software and host it within Microsoft's global data center network. It combines cloud-based developer features with storage, processing, and networking infrastructure services. Essentially, Azure performs the basic functions of a network operating system such as Microsoft Windows Server®, but hosts applications and data in the cloud instead of on a locally installed server.
- **Rackspace™** chose AMD for its cloud computing strategy to develop a data center hosting environment that helps organizations maximize and optimize IT resources. With 40,000 servers in eight data centers scattered across the globe, Rackspace is tapping into the AMD Opteron™ processor's virtualization capabilities to help improve utilization and efficiency while slashing energy costs. Using AMD-V™ Extended Migration, Rackspace is also migrating virtual machines seamlessly from one host server to another to perform updates and maintenance without forcing customers to go offline.
- **STRATO**, Europe's second largest Web hosting company, has adopted both virtual and dedicated servers running on ultra-efficient Quad-Core AMD Opteron™ HE processors. This environment not only produces consolidation benefits, but

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also lowers energy consumption and provides superior manageability. STRATO can scale according to demand in real time and thus react to immediate changes in the competitive landscape as well as new market opportunities.

- **Daum Communications**, one of the largest portal Web sites in Korea, now uses more than 1,000 Quad-Core AMD Opteron™ processors to power the servers behind its next-generation Web search service infrastructure.

## Conclusion

Cloud computing is changing the enterprise in profound ways, which is why experts expect adoption of cloud-based solutions to accelerate in coming years. Cloud service providers can position themselves to take maximum advantage of that powerful trend by building the right foundation for their cloud-based solutions now.

To remain competitive in what will be a fast-paced market for many years to come, cloud computing service providers must equip their data centers with advanced enabling technologies offering an optimal balance of performance, power efficiency, and TCO. The Quad-Core AMD Opteron processor has proven itself to be just such a technology. Service providers should carefully consider the AMD Opteron processor when making hardware commitments at this critical time in cloud computing's evolution.

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## Appendix A: What exactly is cloud computing?

Many people use terms such as cloud computing, grid computing, software as a service, and hosted IT almost interchangeably. In fact, the terms have somewhat different meanings. Here's a brief guide to understanding the differences—and nuances—that separate these important technologies:

- **Cloud computing:** A model that uses the Internet to deliver data storage and computer processing, as well as business and Web applications.
- **Grid computing:** An approach that relies on multiple computers—and thus a larger number of processors working in parallel—to address computational problems.
- **Hosted services:** The growing business of housing, serving, and maintaining files for Web sites and applications via a remote data center.
- **Software as a service (SaaS):** An application that is licensed for use as a service and provided to customers on demand via the Internet.