Software Engineering Institute | Carnegie Mellon

Executive Overview

Architectures for the Cloud: Best Practices for Adoption of Cloud Computing

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CLOUD COMPUTING: WHAT IT IS AND THE BARRIERS TO ADOPTION

Cloud computing is defined as "a large-scale distributed computing paradigm that is driven by economies of scale, in which a pool of abstracted, virtualized, dynamically-scalable, managed computing power, storage, platforms, and services are delivered on demand to external customers over the internet."[i] Clouds can be public, where resources are offered as a service, usually over an internet connection and for which a provider charges a fee, or private, in which the cloud is deployed inside a firewall and managed by the user organization. The main drivers for cloud computing adoption include scalability, elasticity, virtualization, cost, mobility, collaboration, and risk reduction. Major concerns include security, interoperability, control, and performance.

Commercial, government, and Department of Defense (DoD) organizations are adopting cloud computing as a way to reduce the operational cost of their information technology (IT) resources. In particular, DoD and government see cloud adoption as a strategic enabler for accelerating net-centric performance.

DoD and government face two main problems with cloud adoption:

- Most current work and guidance focuses on using resources from public clouds, which is where organizations see economies of scale. However, because of security concerns, most of the DoD and government focus is on private clouds.
- Many organizations see cloud computing as a set of new technologies rather than a computing paradigm that affects how systems should be architected and designed. Not much attention has been placed on the architecture aspect of clouds, especially for private clouds.

In addition, the same misconceptions about service-oriented architecture (SOA)—that "SOA provides the complete architecture for a system" and that "SOA is all about technology"—also exist for cloud computing. A further misconception concerns the relationship between SOA and cloud: "Cloud is the new SOA." The reality is that cloud is not a replacement for SOA. Cloud environments can be implemented using SOA concepts and technologies to provide cloud resources while gaining all the benefits related to SOA adoption. SOA and Cloud are complementary concepts.

THE IMPACT OF SEI RESEARCH ON INFORMATION DOMINANCE

The goal of SEI research is to create best practices for architecture and design of systems that take advantage of the cloud, leading to greater system quality from both a consumer and provider perspective. From a cloud consumer perspective, systems must be architected to determine the proper use of all system components, including those that exist in the cloud. From a cloud provider perspective, cloud environments must be architected to satisfy system qualities and take advantage of the economies of scale supported by virtualization, parallelization, and horizontal scaling.

SEI research will also uncover the implications of data location, traceability, and caching strategies when data is placed in the cloud, and the criteria to determine the use of public vs. private clouds, and explore the option of hybrid clouds.

In summary, the SEI will analyze the state of research and practice against information dominance goals and mission objectives, propose architecture and design principles to fill the gaps, and conduct contextual experimentation to validate applicability of proposed architecture and design principles to meet performance and assurance imperatives.

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[i] From I. Foster, Y. Zhau, R. Ioan, and S. Lu. “Cloud Computing and Grid Computing: 360-Degree Compared.” Grid Computing Environments Workshop, 2008.