Hot Topics in Cloud Computing

Liang-Jie Zhang, *IBM T.J. Watson Research Center*
Jia Zhang, *Northern Illinois University*
Jinan Fiaidhi, *Lakehead University*
J. Morris Chang, *Iowa State University*

C loud computing has become a scalable-services consumption and delivery platform in the field of services computing.[1] It aims to share resources among cloud-service consumers and cloud partners and vendors in the value chain shown in Figure 1.

The resource sharing at different levels results in various cloud offerings: infrastructure as a service (IaaS) focuses on hardware and IT infrastructure management, platform as a service (PaaS) concentrates on middleware and design tools as a service, software as a service (SaaS) deals with traditional software applications such as customer relationship management or social networking as a service, and business process as a service (also known as the business cloud) offers value-added services. To tie some of these aspects together, we use the cloud computing open architecture (CCOA)[2] as the landscape to illustrate some hot topics about cloud computing.

Hot Topics

Figure 2 illustrates a cloud ecosystem for integrating the various participants of the cloud value chain. The technical foundations of cloud computing include service-oriented architecture (SOA) and virtualizations of hardware and software. The current trend is to push cloud computing to enrich its technical foundations so it can seamlessly share resources at all levels, thereby generating more value.

Figure 2 also shows some hot topics in this area categorized in layers in two dimensions. Hardware and software virtualization and infrastructure management provide the fundamental platform (see layer 2). SOA covers the service-orientation layer in Figure 2 (layer 3). All reusable services for the cloud computing platform and application-specific services should be defined based on the SOA to enable the cloud's reusability and extensibility. Software offerings and applications are important related issues (layer 4), as are the business solutions (layer 5).

Cloud information architecture covers data models such as XML, as well as the cloud service construction and deployment platform (layer 6). Cloud computing maintenance and management, as well as best enabling practices, are hot topics for the cloud quality and governance layer (layer 7). This layer covers security, collaboration, and standards. In addition, cloud computing consulting methods, design and
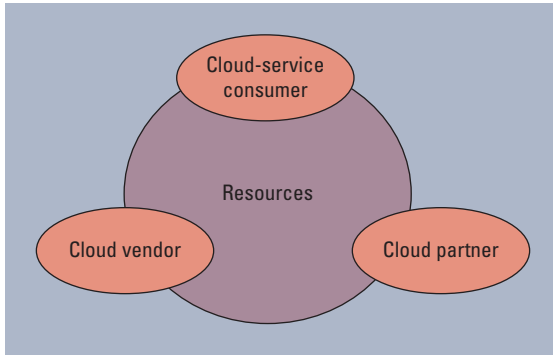
Figure 1. The cloud value chain. Cloud vendors offer services to consumers, while cloud partners help facilitate interactions between the two.

development tools, and killer applications in vertical industries are becoming core enabling weapons to support cloud transformation.

The cloud computing infrastructure itself is still evolving, but CCOA is an example reference architecture for building cloud computing solutions.[2]

In This Issue

In "Establishing Trust in Cloud Computing," Khaled M. Khan and Qutaibah Malluhi explain the issue of trust in cloud computing—an issue of paramount concern for cloud customers. Then they discuss emerging technologies that might tackle the trust issue and suggest that better transparency and more consumer control are two key solutions. This article contributes to trust in the cloud in terms of the cloud quality and governance layer (see A1 in Figure 2).

In "Experiments with Storage and Preservation of NASA's Planetary Data via the Cloud," Chris A. Mattmann, Daniel J. Crichton, Andrew F. Hart, Sean C. Kelly, and J. Steven Hughes report a case study of migrating from traditional software engineering solutions to cloud computing to support large-scale scientific data storage and movement. The article also presents
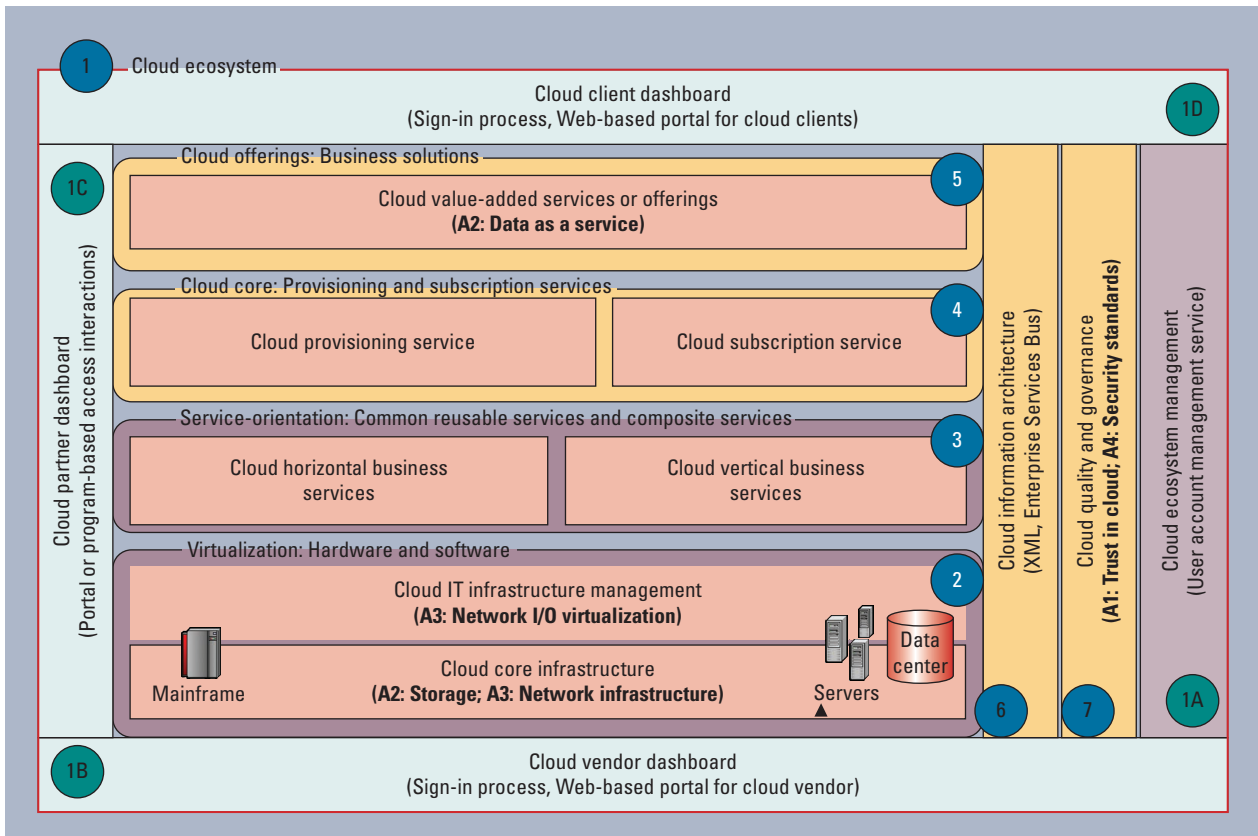

Figure 2. A cloud ecosystem. The ecosystem comprises seven layers (labeled in blue) for integrating the four components of the cloud value chain (labeled in green). We also show where the articles of this special issue (labeled A1–4) fall in this landscape.

metrics-based analytical results on evaluating several cloud platforms. The engineering practice of enabling data as a service illustrates a cloud offering as well as storage virtualization (see A2 in Figure 2).

In "Network I/O Virtualization for Cloud Computing," Yan Luo introduces network I/O virtualization technologies toward scalable data-center networking for cloud computing. Luo also discusses the advantages and challenges, addressing some of the issues in the virtualization layer (see A3 in Figure 2).

In "Interoperable Security Standards for Web Services," Sitaraman Lakshminarayanan discusses the set of Web services security standards and explains how they can interoperate to secure a Web service in a cloud environment. Lakshminarayanan then illustrates a sample security architecture to secure Web services in the context of a mixture of heterogeneous systems and cloud service models. The accomplishments presented in this article contribute to the security standards in the cloud quality and governance layer (see A4 in Figure 2).

This special issue also features two related departments. In "Time to Push the Cloud," John Walz and David Alan Grier advocate the cloud computing paradigm by analyzing its comprising models, benefits, and challenges. In the From the Editors department, "Ethics and the Cloud," Keith W. Miller and Jeffrey Voas discuss the rapidly emerging cloud computing paradigm from an ethical perspective.

Cloud computing is no longer just paper-based discussions about its hype.[3] It's quickly evolving and gradually realizing its business value. It's now attracting more and more researchers and practitioners, who are creating innovations around its core enabling technologies and architectural building blocks. For more information and research results on this topic, we refer readers to the *Proceedings of the IEEE International Conference on Cloud Computing* (IEEE CS Press, 2010). ⫿

References

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3. J. Voas and J. Zhang, "Cloud Computing: New Wine or Just a New Bottle?" *IT Professional*, Mar./Apr. 2009, pp. 15–17.

Liang-Jie Zhang *is a research staff member and program manager of application architectures and realization at the IBM T.J. Watson Research Center. His technical interests include services computing, Internet media, and software engineering. Zhang has a PhD in pattern recognition and intelligent control from Tsinghua University. Contact him at zhanglj@ieee.org.*

Jia Zhang *is an associate professor in the Department of Computer Science at Northern Illinois University. Her technical interests center around services computing. Zhang has a PhD in computer science from the University of Illinois, Chicago. She is a member of IEEE. Contact her at jiazhang@cs.niu.edu.*

Jinan Fiaidhi *is a professor and graduate coordinator in the department of computer science at Lakehead University, Ontario-Canada. She's also an adjunct research professor at the University of Western Ontario-Canada. Her research interests include mobile and collaborative learning, ubiquitous computing, and Web-oriented architectures. Fiaidhi received her PhD from Brunel University, UK. She's a Professional Engineer of Ontario and a senior member of IEEE. Contact her at jfiaidhi@ lakeheadu.ca.*

J. Morris Chang *is an associate professor of electrical and computer engineering at Iowa State University. His research interests include wireless networks, object-oriented programming languages, and embedded computer systems. Chang has a PhD in computer engineering from North Carolina State University. He is a senior member of IEEE. Contact him at morris@ iastate.edu.*