Architectural Design of Compute and Storage Clouds

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A Generic Cloud Architecture Design

Cloud computing and cloud storage have become the preferred method for delivering information and online functionality.

While some cloud services focus on providing consumers with a broad range of services and functionalities, including e-tail shopping, research, social media networking, entertainment consumption and protecting important digital documents, other cloud services focus on small businesses, large enterprises, governments and other institutions.

An Internet cloud is envisioned as a public cluster of servers provisioned on demand to perform collective web services or distributed applications using data-center resources.

Cloud Platform Design Goals

Scalability, virtualization, efficiency, and reliability are four major design goals of a cloud computing platform. Clouds support Web 2.0 applications. Cloud management receives the user request, finds the correct resources, and then calls the provisioning services which invoke the resources in the cloud. The cloud management software needs to support both physical and virtual machines. Security in shared resources and shared access of data centers also pose another design challenge.

The platform needs to establish a very large-scale HPC infrastructure. The hardware and software systems are combined to make it easy and efficient to operate. System scalability can benefit from cluster architecture.

Enabling Technologies for Clouds

The key driving forces behind cloud computing is the ubiquity of broadband and wireless networking, falling storage costs, and progressive improvements in Internet computing software. Cloud users are able to demand more capacity at peak demand, reduce costs, experiment with new services, and remove unneeded capacity, whereas service providers can increase system utilization via multiplexing, virtualization, and dynamic resource provisioning. These Cloud-Enabling Technologies in Hardware, Software and Networking are:

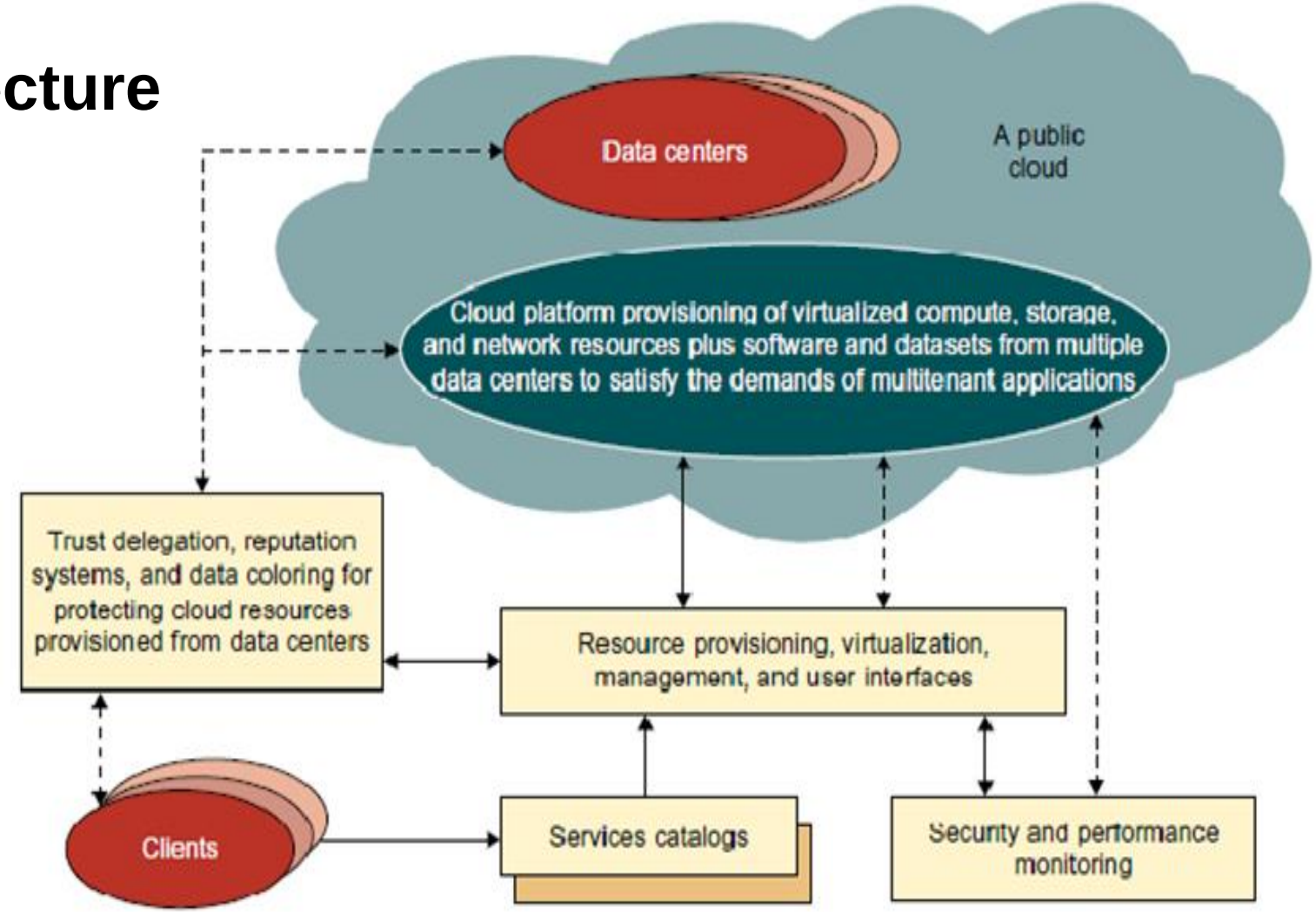
1. Fast Platform Deployment
2. Virtual clusters on demand
3. Multitenant Techniques
4. Massive Data Processing
5. Web-Scale Communications
6. Distributed Storage
7. Licensing and Billing services

These technologies play instrumental roles in making cloud computing a reality. Most of these technologies are mature today to meet increasing demand. In the hardware area, the rapid progress in multicore CPUs, memory chips, and disk arrays has made it possible to build faster data centers with huge amounts of storage space. Resource virtualization enables rapid cloud deployment and disaster recovery. Service-oriented architecture (SOA) also plays a vital role.

A Generic Cloud Architecture

A security-aware cloud platform built with a virtual cluster of VMs, storage, and networking resources over the data-center servers operated by providers is shown in the figure.

The cloud platform is formed dynamically by provisioning or deprovisioning servers, software, and database resources. Servers in the cloud can be physical machines or VMs. User interfaces are applied to request services. The provisioning tool carves out the cloud system to deliver the requested service.



Layered Cloud Architectural Development

The architecture of a cloud is developed at three layers: infrastructure, platform, and application, as demonstrated in figure. These three development layers are implemented with virtualization and standardization of hardware and software resources provisioned in the cloud. The services to public, private, and hybrid clouds are conveyed to users through networking support over the Inter- net and intranets involved.

It is clear that the infrastructure layer is deployed first to support IaaS services. This infrastructure layer serves as the foundation for building the platform layer of the cloud for supporting PaaS services. In turn, the platform layer is a foundation for implementing the application layer for SaaS applications. s