Chapter 14
Optimizing Cloud Storage Management Services

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ABSTRACT

Storage services are an essential part of an organization’s IT infrastructure services and contribute a significant part of total IT costs. For this reason, various service management techniques are applied to optimize a service’s storage resource usage while still addressing requirements related to performance, high availability, or disaster recovery. While storage virtualization has been the basis for many storage service management optimizations, the relatively stable environments of enterprise IT enabled all management activity to proceed in the context of change processes on specialized storage controllers. Completely virtualized environments require frequent topological changes but also enable optimized resource usage across shared resource pools. This enables lower resource and service management costs if the right storage service management architecture is deployed. This chapter focuses on cloud service management from a storage perspective, providing a set of proven methods and services to optimize storage resource usage and the management architecture that enables them.

INTRODUCTION

The IT industry is experiencing massive data growth. Data is being created by an ever-increasing number of sources through the proliferation of social media technology and applications, the near ubiquitous use of mobile devices and applications, and the increasing exploitation of large-scale data analytics. Using the traditional model of acquiring, deploying, and allocating units of storage, enterprises struggle to respond

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to changes in business demands, which may require reduced application deployment time, increasing 
use of commodity components and simplification and automation of IT operations. With the advent of 
cloud computing, the traditional service models that deliver storage are evolving towards services that 
are more modular, adaptable, responsive, and interchangeable.

In response to these pressures and challenges, software defined environments (SDEs) have emerged 
and are rapidly evolving to create an alignment of IT with business needs where the three pillars of IT 
infrastructure services (Compute, Network and Storage) are programmable for the workloads. SDEs are 
essentially a model of defining compute, network, and storage resources with software. As a result, the 
orchestration of IT resources within an SDE can automatically allocate workloads to the most suitable 
set of infrastructure resources, accommodate for potential heterogeneity across both workloads and 
resources, and continuously optimize such allocations to account for changes in workload requirements.

Gone are the days of a rigid, one-to-one mapping of a piece of hardware to a single customer or 
workload. Today, a one-to-many, multi-tenant relationship exists among IT components, where a single 
piece of hardware may be consumed by multiple, even unrelated projects or customers. The advent of 
software defined networking means a single network switch can be logically divided up and allocated 
to multiple customers. A single server can be virtualized and software defined to support multiple 
workloads of varying degrees of resource utilization. A single storage environment may be zoned and 
software defined to support the needs of multiple, independent customers. Part of the necessity for SDEs 
is born from the need to not just manage IT, but to optimize IT. The degree of optimization is determined 
by the level of granularity in the software defined components. The more comprehensive the level of 
abstraction is, the greater the opportunity to create architectures and orchestrations that optimize the 
desired condition or resource.

As these resources are abstracted, they inherently give rise to the creation of new services special-
izing in and tailoring to the performance and optimization of the abstracted resources. This is evident 
through various relatively new services and products. Nicira’s software-defined networking (now a part 
of VMware) is a full abstraction of the networking component (VMware, 2014). SwiftStack offers a 
software defined storage controller to manage enterprise storage (SwiftStack, 2014). Cloud Foundry is a 
Platform-as-a-Service which incorporates multiple software defined technologies providing an abstrac-
tion of a software development platform (Pivotal, 2014).

Beyond being the means of efficiently managing and optimizing IT resources, SDEs are proving to 
be the key enabler in achieving a potentially higher value proposition: business agility. As changes in 
business conditions occur, the ability for an organization to sense and respond to environmental condi-
tions becomes paramount. Rather than engage in a lengthy and likely capital-intensive process to support 
a new business venture or experiment, a firm’s survival may depend solely on its ability to leverage the 
flexibility and speed an SDE affords.

Software Defined Storage (SDS) incorporates the same concepts of abstraction and virtualization as 
the other two pillars of software defined environments. For example, having a clear and well-defined 
representation of a storage system and its storage pools, tiers, service classes, and cost drivers, data can 
be automatically and intelligently moved to the correct tier, based on the value of the data and highly 
customized, customer-specific requirements. As each of these parameters are software defined, they can 
be optimized based on business requirements and priorities. As business process requirements evolve, 
so too can an organization’s storage optimization strategy.

Within the storage industry, the trend for enterprise storage solutions is clearly indicating a shift towards 
complete storage virtualization, to include definitions for service classes, capacity pools, tiers, customer-
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