Chapter 4

Cloud Computing
Architectural Patterns

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ABSTRACT

Cloud computing has been one of the most disruptive technologies, which has changed the way IT is consumed by enterprises, both small and large. The ability to subscribe to “as-a-service” consumption model, while converting capital expenditure to operational expenditure, has been a key driver for Cloud adoption. Rapid provisioning and deprovisioning of services, elastic scaling of infrastructure resources and self-service ability for users are some of the key characteristics and benefits offered by Cloud. Infrastructure as a Service (IaaS) provides the basic building block, with Platform as a Service (PaaS) providing a layer of abstraction on top of IaaS and similarly Software as a Service (SaaS) providing a layer of abstraction on top of PaaS. Moving up the layers reduces complexity and enables users to tap into a much larger spectrum of benefits that Cloud computing has to offer. While Cloud opens the door for “as-a-service” consumption model, there are many additional benefits that can be realized by enterprises beyond the typical IaaS, PaaS and SaaS. A number of these benefits can be realized by leveraging Cloud in different scenarios and use cases. For example, an enterprise may continue to pursue a traditional non-Cloud based infrastructure deployment strategy, however, it could use a public Cloud for storage elasticity. Such use cases exemplify many atypical benefits that Cloud can provide, which often got overlooked. This paper will present a number of such cloud deployment use cases that go beyond the typical IaaS usage of cloud. A hierarchical architectural model of cloud solution pattern is proposed to describe both the business requirements and technical considerations of these use cases. These cloud architectural patterns are further elaborated through real-life case studies and examples.
INTRODUCTION

Cloud computing has been one of the most disruptive technologies, which has changed the way IT is consumed by enterprises, both small and large. The ability to subscribe to “as-a-service” consumption model, while converting capital expenditure to operational expenditure, has been a key driver for Cloud adoption. Rapid provisioning and de-provisioning of services, elastic scaling of infrastructure resources and self-service ability for users are some of the key characteristics and benefits offered by Cloud. Infrastructure as a Service (IaaS) provides the basic building block, with Platform as a Service (PaaS) providing a layer of abstraction on top of IaaS and similarly Software as a Service (SaaS) providing a layer of abstraction on top of PaaS. Moving up the layers reduces complexity and enables users to tap into a much larger spectrum of benefits that Cloud computing has to offer. More importantly, while Cloud opens the door for “as-a-service” consumption model, there are many additional benefits that can be realized by enterprises beyond the typical IaaS, PaaS and SaaS. A number of these benefits can be realized by leveraging Cloud in different scenarios and use cases.

A pattern describes a solution for a recurring problem in a given context. Patterns help capture best practices in solving problems in almost every domain. Using patterns can help identify and document design principles that are repeatable given a well-defined problem statement. Using patterns provides a concise way of documenting solutions to repeatable problems. As a result, it becomes much easier to refer to a well-defined pattern as the solution to a problem, instead of repetitively detailing out the solution each time the problem is encountered. This reuse of successful patterns also facilitates avoidance of common mistakes and pitfalls in solution design.

While the use of patterns is most common in software design, however, their use is not restricted to software domain only. Patterns have been applied to areas ranging from the architecture of buildings (Alexander, 1979) to teaching (Bergin, 2012). In this chapter, we use patterns to describe a number of cloud deployment uses cases that go beyond the typical Infrastructure-as-a-Service (IaaS) usage of cloud. For example, an enterprise may continue to pursue a traditional non-Cloud based infrastructure deployment strategy, however, it could use a public Cloud for storage elasticity. Such use cases exemplify many atypical benefits that Cloud can provide, which often got overlooked.

USE CASE SCENARIOS

We use the pattern format of (Buschmann, Meunier, Rohnert, Sommerlad, & Stal, 1996) to capture the following key components for each cloud deployment use case scenario:

- **Problem**: Identifies the key issue(s) that must be resolved
- **Context**: Describes when it makes sense to apply the pattern
- **Solution**: Describes the key steps to address the problem
- **Benefits**: Highlights the impact and advantage of applying the pattern
- **Offerings**: Describes some of the offerings and products that are relevant or required in applying the pattern
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