The Cloud Computing Handbook
Resources to Plan, Build, and Manage Private and Public Cloud-Based Infrastructure Services
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EXECUTIVE SUMMARY

2013 survey data shows that the amount of application and web-hosting capacity expected to reside on cloud-based architectures by 2015 has increased from 50% to 58%. Much of this is driven by the success of private cloud implementations across 2012. Externally, infrastructure organizations plan to triple their use of managed cloud services in two years, while use of public cloud will also rise to about 10% of total capacity by 2015.

Clearly the use of cloud-based architectures is maturing. But like any other disruptive technology, the introduction of the cloud into traditional architectures has substantially complicated infrastructure management. This new complexity, when unchecked, undermines the benefits infrastructure organizations expect from cloud investments.

Successful Infrastructure organizations consider the cloud to be more than just a set of technologies that generate cost-efficiency. Rather, these organizations approach cloud as a “methodology” to reorganize and deliver infrastructure services to business and applications partners at the speed and quality they expect while simplifying Infrastructure’s cost and governance management.

This handbook compiles best practice tools and templates that assist in planning, building, and managing both private and public cloud-based architectures, organized in three sections:

1. Establishing a Cloud Strategy: The development of cloud-based architectures, both public and private, presents a migration challenge similar to that previously seen in the move from physical to virtual models. To establish an effective cloud strategy, target discussions, investigations, and analysis not just on changing technologies and architectures but also on changing service features, capabilities, and business models. Engage business and IT partners in decision making by focusing on concrete benefits and risks relevant to economic outcomes, both in the short and long terms.

2. Private Cloud Implementations: In planning new private cloud implementations, successful infrastructure groups avoid large, up-front capital outlays and are mindful of the potential for vendor lock-in. Instead, they build a roadmap for phased introduction that controls investment and uses early success to win the interest of applications owners. But building a private cloud on top of a conventional set of technology towers often incurs significant coordination costs and service quality degradation. Leading organizations create a new class of generalist roles that take a broader architectural perspective and can oversee both cloud and non-cloud architectures. Finally, many organizations fail to address changes the private cloud can bring to the Infrastructure–Applications interface. Leading organizations approach the private cloud through a services perspective and optimize automated self-provisioning based on a balance of developer and infrastructure needs.

3. Public Cloud-Based Externalization: The growing maturity of public cloud-based services has disrupted the sourcing market, causing uncertainty in investment decisions and limiting the impact of traditional vendor management practices. Successful infrastructure organizations reposition themselves as “technology brokers” to enable consistent and reliable decision making regardless of who makes the decisions or where decisions are made. Vendor evaluation mechanisms must evolve to emphasize criteria—such as ease of interoperability, capability integration that does not impact usability, and capability maturity—over conventional criteria, such as vendor reputation and company maturity. Finally, it is important to invest in persistent exploration of public cloud opportunities focused on removing lingering deployment risks and engaging company leaders in discussions about the comparative economics of public cloud computing. This approach positions Infrastructure to gain an early-mover advantage through innovation in rapidly maturing public cloud solutions.
ROADMAP

Cloud Maturity and Adoption Trends

Private Cloud Implementations

Public Cloud-Based Externalization

UNDERSTAND CLOUD FUNDAMENTALS

MONITOR KEY ADOPTION TRENDS

TEST VIABILITY OF DIFFERENT CLOUD MODELS
A TECHNOLOGY, A FEATURE SET, A BUSINESS MODEL?

Common Cloud Computing Models

**Software as a Service (SaaS)**
Applications accessible through a web browser where the consumer does not manage the underlying cloud infrastructure or even individual application capabilities.

**Platform as a Service (PaaS)**
Consumer-created or acquired applications using programming languages and tools furnished by a provider, where the consumer does not manage the underlying cloud infrastructure but can control the deployed applications.

**Infrastructure as a Service (IaaS)**
Fundamental computing resources such as processing, storage, and networks where the consumer does not manage the underlying cloud infrastructure but can control not only the deployed application but also the operating systems.

Resource Layers

- Applications
- Data
- Runtime
- Middleware
- O/S
- Virtualization
- Servers
- Storage
- Networking

Early Cloud Definitions

“The key thing we want to virtualize or hide from the user is complexity… all that will be virtualized and hidden from us and taken care of”

Ivan Wladasky Berger
Strategic Advisor, Citigroup

“One of the catch-all buzz words like ‘Web 2.0’ that tries to encompass a variety of aspects ranging from deployment, load balancing, provisioning, business model and architecture”

Reuven Cohen
Founder, Enomaly

“Using the Internet to allow people to access technology-enabled services”

Praising Gaw
Technology Marketer

“Outsourced, pay as you go, on demand”

Thorsten von Eicken
Founder, RightScale

Source: CEB analysis.
### DEFINING FEATURES OF ANY CLOUD SERVICE

<table>
<thead>
<tr>
<th>Cloud Characteristics</th>
<th>Perceived Importance to IT Executives</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Multi-Tenant</strong></td>
<td></td>
<td>The services are architected such that several customers share the underlying infrastructure resources without compromising the privacy and security of any single customer’s data.</td>
</tr>
<tr>
<td><strong>Elastic</strong></td>
<td></td>
<td>The service delivery infrastructure can expand and contract automatically based on capacity needs.</td>
</tr>
<tr>
<td><strong>On-Demand</strong></td>
<td></td>
<td>All cloud services are available over the Internet and can be consumed as needed.</td>
</tr>
<tr>
<td><strong>Usage Metered</strong></td>
<td></td>
<td>Resource usage can be monitored, controlled, and reported, providing transparency for both the provider and consumer. Billing may be based on actual usage.</td>
</tr>
<tr>
<td><strong>Self-Service Access</strong></td>
<td></td>
<td>All services are simple and easy to use and can be provisioned directly by the user from a user interface (UI) or an application programming interface (API).</td>
</tr>
</tbody>
</table>

**Architectural Features**

**Service Model Attributes**

**Importance Legend**

- High
- Low

Based on data from 17 senior IT managers and augmented by interviews with more than 50 heads of Infrastructure.

Source: CEB analysis.
The use of cloud hosting often starts with simple scenarios that allow for risk-free experimentation.

- Some use cases are equally applicable to both private and public cloud, and others are unique to the public cloud.

**TOP USE CASES FOR CLOUD-BASED HOSTING**

Expansion of Cloud Infrastructure Based on Popular Use Cases

1. Test and Development Environments
2. Rapid Business Prototyping
3. Transactional Production Applications
4. Complex Analysis or Data Mining
5. Cloud Bursting

**Typical Deployment Sequence**

Source: CEB analysis.
Cloud sourcing is on the rise, with organizations reporting an average spend increase of 35% on cloud sourcing.

- From 2011 to 2012, spending on infrastructure as a service increased by 28% and is expected to rise by another 52% in 2013.

- The pharmaceuticals and biotech sectors are leading investments in software as a service, with 3.7% of 2012 IT spending allocated to this area of cloud sourcing.

- Although platform as a service has had the least traction to date, retail and manufacturing and chemicals organizations appear to be early adopters, with between 1% and 2% of total IT expenditure allocated to this area.

**GROWING MIGRATION TO THE CLOUD**

Cloud Sourcing as a Share of Total IT Expenditure

*Percentage of Total IT Expenditure, 2011–2013 (E)*

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Source: CEB analysis.

n = 154.
USHERING IN THE CLOUD ERA

Distribution of Hosting Strategies
What percentage of your total application and web-hosting capacity will be delivered via each of the following sources?

- The typical organization expects cloud to grow from its current 15% of total hosting capacity to almost 50% by 2015.

- This data highlights the importance of a hybrid cloud strategy with integration between private and public resources.

Source: CEB 2013 Emerging Technology Roadmap Survey.
Note: Totals may not equal 100% due to rounding. n = 74 IT organizations.
Cloud usage is clearly maturing with organizations planning to adopt Converged Infrastructure, Managed Cloud Services, SaaS Collaboration, and HR solutions in 2014.

CLOUD/HOSTING TECHNOLOGY ROADMAP: 2013 TO 2016

Technologies by Mainstream Adoption Timeline, Value and Risk

Adoption Timeline
Represents at least one-half of all companies having a technology deployed at scale

Enterprise Value
Based on:
- Reduction in Infrastructure cost
- Improvement in infrastructure service speed
- Improvement in infrastructure service quality

Deployment Risk
Based on:
- Marketplace maturity risk
- Architecture fit risk
- Security risk
- Support risk

Uncertainty factor
Blue denotes technologies for which significant uncertainty exists on value and risk (33% or more responded “no opinion”).

Sustainable Responsiveness
Asterisk (*) denotes investments correlated with Infrastructure’s ability and confidence that it can sustain service speed and quality regardless of demand/supply shifts.

Source: CEB 2013 Emerging Technology Roadmap Survey.
n = 74 IT organizations.

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