Multi-cloud Paradigm : An Integration Approach

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Evolution of Cloud Technology

1970s
- Localized Infrastructure
- Expensive

1980s
- Rise in popularity of desktops
- Decentralized Computing

1990s
- Emphasis on Networking
- Increased demand of bandwidth
- Dotcom revolution

2000s
- IT Infrastructure Management Services by 3rd party providers
- Creation of large datacenters
- Increased use of virtualization
- Launch of Amazon WebServices
- VmWare’s cloud initiative

2010s
- IBM launches public cloud service
- Microsoft launch Azure
- Launch of Openstack
- Google introduces Google Computing Engine
- Integrated Hybrid and multi-clouds

Future
- Interoperable
- Built on Open, Industry standards
- User experience adapt to patterns and behaviors
- Predictive, real-time analytics

Introduction to Hybrid and Multi-clouds

Hosted Environments & Arrival of Cloud
Drivers For Multi-cloud Strategy | Analyst View

Multi-cloud management market ($m)

<table>
<thead>
<tr>
<th>Year</th>
<th>Rate of Growth ($m)</th>
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<tbody>
<tr>
<td>2017</td>
<td>1169</td>
</tr>
<tr>
<td>2022</td>
<td>4492</td>
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CAGR: 30.9%

Avoidance of Vendor Lock-in

Increased Agility

High-level of Governance & Policies

Source: www.researchandmarkets.com

Industrial Impact

HEALTH CARE  AUTOMOTIVE  GOVERNMENT  RETAIL  OIL & GAS  MANUFACTURING  ENERGY  TELECOMMUNICATIONS
**Single Cloud Strategy | Drawbacks**

- **Discounted Pricing by cloud providers**
- **Cost of boosting team-skills to be cloud-ready**
- **Lengthy cloud On-boarding Process due to time required in getting regulatory & compliance approvals**
- **Requirement of more open APIs (ML, DB, DRaaS, Evolving technologies, such as IoT and machine learning (ML))**
- **No flexibility to recover in case of failure or regional restrictions**
- **Data Protection & Archival**
- **Outages due to unforeseen weather conditions or human errors.**
- **Geography specific Regulations (e.g. GDPR, PIPEDA)**
Multi-cloud Strategy Implementation | Challenges

**Management Complexity**
- Handling multiple consoles from Cloud Service Providers
- No Central visibility in Infrastructure

**Cost Tracking**
- Cloud diversity brings risk and loss of control over budgeting
- Cloud platforms have their unique pricing models & billing systems
- Need to proactively predict the expenditure pattern.

**Compliance**
- Considering policies of Company and Industry
- Considering regulations of country

**Security Concerns**
- Data-at-rest is secured, but data-in-transit need to be secured and encrypted.
- Policies for 3As (Authentication, Authorization and Accounting), monitoring and alerts to be implemented

**Redundancy**
- Strategy for data redundancy, backups and DRs cannot be overrated.
- Requirement of auto-switching in case of failed operability

**Cloud Expertise Gap**
- More the no. of cloud environments, more difficult to extend skills.
- Designing, implementing and managing these complex environments requires high levels of cloud and IT proficiency.
Modern Data Management Solutions | A Perspective on Benefits and Gaps

**Single Pane Management**
- Automation & Orchestration: Application migration, VM instances, Configuration management
- Security & Compliance: Identity Access & Management (IAM), Encryption, Audit
- Performance Monitoring: Storage, Compute, Application, Network

**Data Portability & Insight**
- Ability to migrate data to another cloud
- Ability to migrate within zones and regions of choice
- Temptation to use latest AI, ML and data analytics services on secondary data

**Data Protection across Clouds**
- Use of one Data Protection platform across clouds eases data silo challenge

**Improved Compliance Management**
- Functionality to consistently meet the data retention and compliance obligations of regulated organizations

**Abstraction**
- Deploying services on top of native cloud services
- Single way to look at multi-cloud resources such as Storage, Compute
- Benefit includes reduced human intervention and hence mistakes.
Multi-Cloud Storage Abstraction | Logical Architecture (High-Level)

MCS API GATEWAY

MCS Master

MCS Workflow Manager

MCS Read Engine

MCS Write Engine

MCS Metadata Manager

MCS Dispatcher

MCS API TRANSLATOR

https

S3 API

REST API

Azure Blob API

GCS JSON API

APP WORKLOAD

TCS Confidential
Thank You
Cloud Standardization Bodies and their contribution

**Distributed Management Task Force (DMTF)**

- Cloud Infrastructure Management Interface (CIMI) for Infrastructure as a service (IaaS) Management
- Proposed CIMI model for Cloud Interoperability

**Open Grid Forum (OGF)**

- OCCI (Open Cloud Computing Interface)
- OCCI is a Protocol and API for all kinds of Management tasks.
- API with a strong focus on integration, portability, interoperability and innovation
- Implementation on Apache CloudStack and OpenStack