REPORT REPRINT

Hybrid multi-cloud architecture, and the vendors aiming to enable and manage it

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The Internet of Things will dramatically change the way that many datacenters are designed, deployed and sited. 451 Research has mapped a schema for the divergent yet connected IoT datacenter landscape.

The tools and technologies needed to craft and manage hybrid multi-clouds as part of IT architecture are fragmented, and ripe for vendor innovation. Many enterprise leaders anticipate the use of several dozen cloud services in the coming years.

As workloads, data and processes shift across multiple on-premises, hosted, private and public cloud services, there will be a need for a new approach to hybrid multi-cloud cloud management – one that requires a uniform means for access control, billing and provisioning, capacity management, cost control and performance analysis (among others). Enterprises will demand that IT vendors craft a holistic platform to allocate workloads strategically to the best execution venue, and do so while managing business continuity across what has become a hybrid multi-cloud enterprise architecture.

THE 451 TAKE

The ways in which IoT datacenters will be designed, deployed and sited will depend on the IoT applications themselves. But it seems likely that two distinct levels of compute will emerge: for edge and for core processing, with each layer requiring a combination of different types of datacenters (see our schema below). Datacenters at the edge will require high availability and low latency, and oftentimes will be scalable extensions to a large-scale public cloud or enterprise or colocation datacenter in the core. There is likely to be many different owners and operators of datacenters at the edge. Public cloud, colo providers and telcos will likely have the largest appetite to own and operate datacenters across both layers, along with an elite group of big enterprises that have mission-critical requirements. But as the IoT sector evolves and matures, the lines will become increasingly blurred.

THE NEED TO MANAGE MULTI-CLOUDS

The infrastructure that enterprises have trusted for years is in metamorphosis. IT organizations are no longer limited to managing datacenters and a few hosted and managed services providers. Needy lines-of-business teams and impatient IT developers have procured SaaS, IaaS and PaaS cloud services to overcome resource constraints. Now all enterprise IT structure is composed of multi-clouds. When multi-clouds enable the execution of distributed business processes, they become hybrid clouds.

The middleware used to connect and integrate applications and systems, exchange messages, translate data, and monitor and manage usage and performance, is in many ways ill-equipped to deal with hybrid architecture. As noted in our earlier report, multipurpose hybrid integration platform-as-a-service (iPaaS) is maturing, and is now a staple in enterprise integration toolkits as the means to assimilate clouds, big data, devices and things into a hybrid enterprise IT architecture.

But multi-clouds and hybrid clouds bring workload and infrastructure challenges that will drive the development of new cloud management technology. In addition to having to manage resource utilization, performance and costs of various public and private cloud services, cloud management platforms must also be aware of the integrations and processes that transcend on-premises and cloud execution venues, and interoperate (in some way) with the new multi-purpose hybrid iPaaS that connects them, to assure business continuity.

HYBRID MULTI-CLOUD REFERENCE ARCHITECTURE

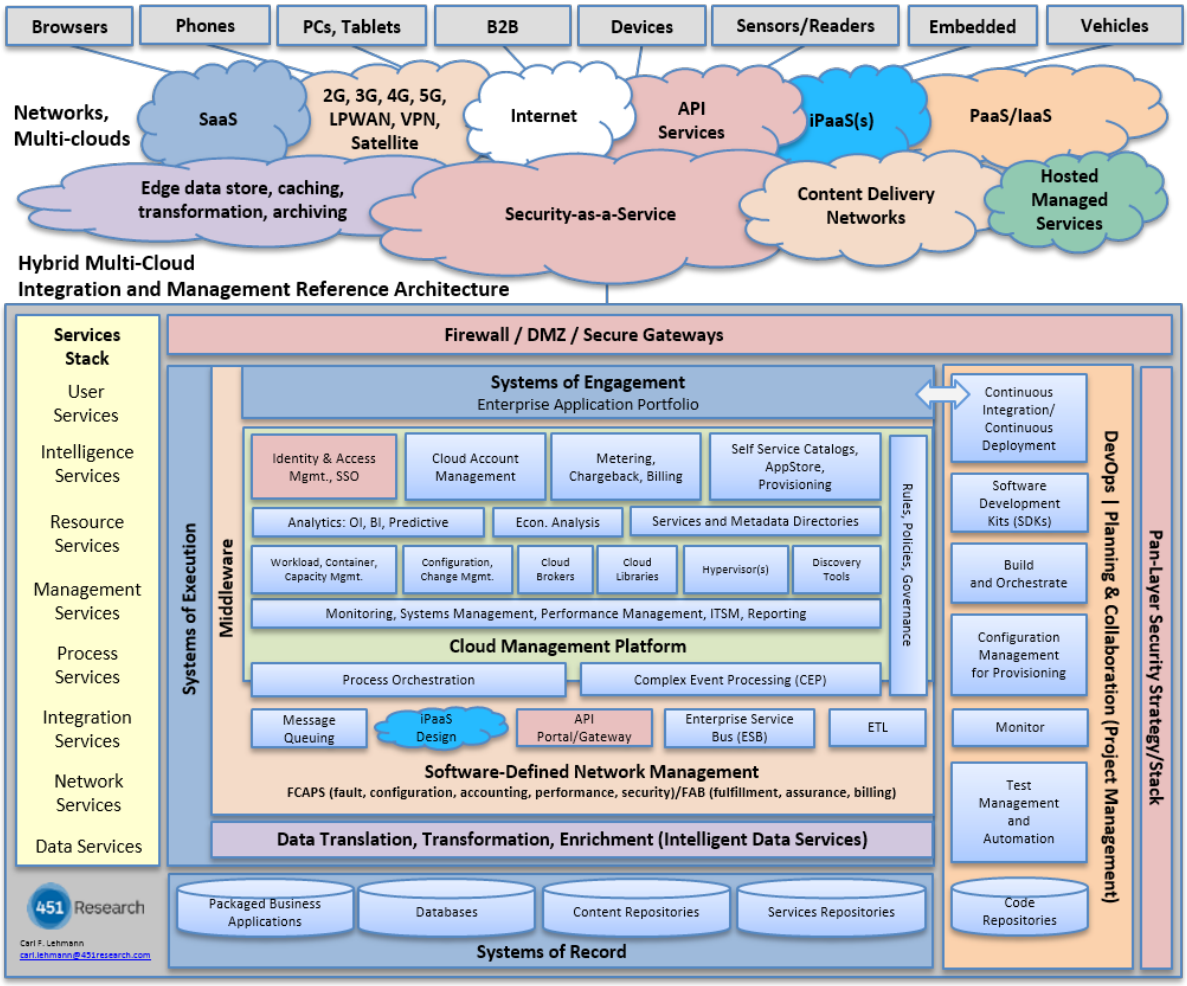
One way to decipher how cloud management platforms will evolve to support these needs is to list and model all the capabilities needed to deploy and manage a hybrid multi-cloud environment. Modeling helps visualize capabilities. It enables examination of each individually, and within the context of other related or tangential capabilities. It also reveals potential relationships that may not otherwise be obvious. The result is a reference architecture that can be used by enterprises to determine the capabilities they need for their environment, against which they can evaluate vendors. It also helps vendors determine their capabilities and limitations versus rivals, to assess product strategy and roadmaps.

Hybrid multi-cloud reference architecture is generally described in terms of three systems: systems of engagement that are designed for user interaction, systems of execution that orchestrate work, and systems of record that are transactional and/or data/content stores.

Each of these systems can then be described by the capabilities they need to serve their purpose. The figure below illustrates our reference architecture for a system of execution specific to hybrid multi-cloud integration and management. It considers a stack of hybrid multi-cloud services and infrastructure needed to provision users with the applications (systems of engagement) and the information they need to perform work (systems of record) – services that also must assure process orchestration and business continuity as workloads execute across the entire hybrid architecture.

Unlike our earlier report on hybrid multi-cloud integration and management, this report's version of the reference architecture considers DevOps, software-defined networks (SDN) and content-delivery networks, and illustrates the capabilities needed to craft and manage hybrid multi-clouds.

A HYBRID MULTI-CLOUD INTEGRATION AND MANAGEMENT REFERENCE ARCHITECTURE



Not all of the components cited in the reference architecture are required to perform well for an enterprise. In fact, most enterprises will implement only a select subset. So too, vendors may offer only stand-alone componentry, or perhaps cross-section capabilities of the reference architecture. Integrating such fragmented capabilities in the current market is complex, inefficient and costly. There are too many options from too many disparate vendor, and not enough interoperability among them.

Hybrid multi-cloud management is ripe for innovative options to consolidate much of this functionally into a common platform, a unified management console, or a federated set of consoles organized within a portal. How such consolidation and interoperability may occur can be structured into clusters of related services.

HYBRID MULTI-CLOUD SERVICES

The Services Stack illustrated on the left side of the reference architecture organizes various related capabilities into logical clusters that identify their value and purpose:

- User services are the systems of engagement, or the enterprise's application portfolio.
- Intelligence services assign access privileges, expose analytics, and apply rules to application and resource utilization.
- Resource services represent utilities needed for workload provisioning.
- Management services provide command and control of infrastructure configuration, workload deployment and overall performance management.
- Process services enable orchestration of events, data and workflows.
- Integration services provide synchronous and asynchronous exchange of batch, real-time and streaming data flows – internal and external to the enterprise.
- Network services control and dynamically allocate network resources in response to the transmission, latency and security requirements of specific data, content and workloads.
- Data services manage the quality, purpose and use of data from capture through consumption.

There are no hard and fast lines for the layers in the service stack – the capabilities within each service layer are loosely coupled, and are likely to overlap with other services layers. For example, various integration and data management vendors (Informatica, Dell Boomi, MuleSoft and others) have been extending their platforms (via development and acquisition) to enable varying degrees of converged process, integration and data services.

So too, the capabilities that compose intelligence, resources and management services may overlap. Cloud management vendors will be called upon to extend their functionality or interoperate with other related service layers and capabilities. One example may be the coupling of cloud account management software with monitoring and performance management tools.

In some cases, enterprises may want currently integrated capabilities to decouple – economic analytic engines typically found within cloud brokers will be in high demand, but without the need for provisioning that brokers provide. Such analytic capabilities may interoperate with management services and be supplied with data from various intelligence, resource and other management services.

Vendors likely to build out these platforms will hail from various PaaS, cloud management and (potentially) integration market segments. Other markets are likely to play a role in hybrid integration and management as well. AppDev, DevOps and continuous integration/continuous deployment vendors also have capabilities to deploy, monitor and manage workloads in a hybrid architecture.

However, such vendors are currently experiencing their own metamorphosis, inventing new ways to create, deploy and update compelling applications (systems of engagement) in minutes rather than months, using micro-services and containers (among other emerging technologies). So we don't anticipate they will innovate broadly in the emerging hybrid multi-cloud management market. Nevertheless, their workload deployment and management capabilities should be evaluated and considered as part of an overall hybrid cloud management strategy.

CORE CLOUD MANAGEMENT CAPABILITIES

In any event, when faced with the need to manage a hybrid multi-cloud environment, most enterprises will turn to cloud management vendors for support. Capabilities common to many cloud management platforms are highlighted against the green panel in the reference architecture. They should be able to:

- Analyze and compare the economics (price/performance characteristics) of various execution venues.
- Automate the provisioning of compute, storage, network, security, application stacks and data.
- Intelligently deploy workloads and services based on economic analysis and policies across on-premises infrastructure, private and public clouds.
- Manage identity authentication and access control or administrators, tenants, and user accounts.
- Provide financial metering, reporting and chargeback/viewback by cloud, tenant, user, applications, compute hours.
- Manage runtime execution and performance of all venues and enact policies to automate scaling, bursting, high availability and disaster recovery,

- Maintain a service library that includes operating system images, databases, middleware, message busses, load balancers, servers.
- Deploy a self-services application catalog based on access control and governance polices.

Savvy vendors will plan a product strategy that also gradually includes various other capabilities illustrated in the reference architecture. Most will likely move up the service stack to create/acquire and integrate various intelligence, resource and management capabilities. Others may move down the service stack to create/acquire and integrate process, integration, network and data capabilities.

CLOUD MANAGEMENT VENDOR LANDSCAPE

- Abiquo offers a unified platform to manage and control private, public and hybrid cloud infrastructure. Its cloud management software supports multiple infrastructure types, and has grown to manage hybrid cloud environments from on-premises hypervisors to Docker containers to public clouds.
- ActOnMagic's ActOnCloud Platform manages public and hybrid cloud deployments, and enables cloud governance to exercise controls and analytics to control and manage unused capacity and hybrid cloud performance. Its ActOnCloud Business Manager is a self-service portal, service catalog, billing engine and role-based access manager.
- Adaptive Computing offers a workload and resource orchestration software platform called Moab. It manages large-scale computing environments, intelligently places workloads, and adapts resources to improve application performance and increase system utilization. Moab's predictive capabilities evaluate the impact of future orchestration decisions across diverse workload execution venues (high-performance/throughput computing, cloud VMs) enabling rapid deployments and cost controls.
- Amazon Web Services offers a portfolio of management tools (which can use some rationalization) that are exclusive to its 70+ cloud service offerings. They include CloudWatch, CloudFormation, CloudTrail, Command Line Tool, Config, Management Console, OpsWorks, Service Catalog and Trusted Advisor.
- BMC Cloud Lifecycle Management automates the provisioning of multi-tier IT services across cloud and non-cloud platforms. It integrates to IT processes like change management, configuration management databases, compliance and patching, and enables governance and compliance controls for cloud workloads.
- CA Technologies CA Cloud Service Management is a SaaS general-purpose IT service management offering that integrates with its Release Automation offering. CA Enterprise Mobility Management manages mobile applications, devices, email and content.
- Cisco acquired CliQr Technologies in April 2016 for its application-defined cloud orchestration platform. It enables users to model, deploy and manage new and existing applications to any cloud and datacenter, and manage the application lifecycles across hybrid IT environments.
- Embotics vCommander Cloud Management Platform enables organizations to deliver IT as a service while managing public, private or hybrid cloud infrastructures to optimize the automation, deployment and configuration of IT services.
- Fujitsu acquired UShareSoft for its UForge AppCenter, a unified application delivery platform for hybrid IT that automates enterprise DevOps processes, brokers cloud services and maintains software governance. It has become part of Fujitsu's K5 OpenStack cloud.
- Hewlett Packard Enterprise's Helion Cloud Suite delivers and manages a spectrum of traditional, open source, hybrid cloud and multi-cloud environments for existing and cloud-native applications, and enables continuous design, deployment and operations to deploy cloud workloads on their best execution venue. It includes a Cloud Foundry-certified app platform.
- IBM Cloud Orchestrator automates the delivery of software and infrastructure, and reduces the number of tasks needed to manage public, private and hybrid clouds. In November 2015, IBM acquired Gravitant for its cloud broker software.
- Microsoft Operations Management Suite is a collection of cloud-based services for managing on-premises and cloud environments that include process automation and configuration management, backup and disaster recovery, log analytics, and security and compliance audit controls. When integrated with System Center Operations Manager, they provide a full hybrid IT management. It recently added Azure security technology.
- Oracle Enterprise Manager is a cloud management platform that includes self-service provisioning guided by centralized, policy-based resource management; integrated chargeback and capacity planning; and visibility into physical and virtual environments from applications to disk.

- Red Hat CloudForms (based on open source ManageIQ) manages hybrid IT environments, and includes a self-service portal and catalog with automatic provisioning; workload lifecycle management, reconfiguration and retirement; resource quota enforcement, cost allocation and chargeback; continuous discovery, monitoring and tracking; resource usage, optimization and capacity planning; automated policy enforcement and remediation; segmented user access with approval workflows; configuration auditing and change tracking.
- RightScale includes a self-service portal that enables developers to access public and private cloud infrastructures, and helps automate and accelerate cloud application deployment. It provides a cloud management tool to design, deploy and maintain control over cloud services, monitor performance and control user access; cloud analytics to monitor, forecast and optimize costs across public and private clouds; and a multi-cloud platform that provides a single interface and API for private and public IaaS environments. In addition, it supports multiple hypervisors (KVM, Xen and vSphere) and operating systems (CentOS, RHEL, SUSE, Ubuntu and Windows).
- Scalr Cloud Management Platform enables enterprises to manage, automate and control multi-cloud environments through an administrative console that uses a single UI and API to orchestrate, automate workload deployments and enforce policy across multiple clouds.
- Vistara Lifecycle Management is a SaaS platform for IT operations lifecycle management. It offers enterprise IT and service providers a unified command center to manage applications and on-premises infrastructure and cloud resources.
- VMware vRealize Suite is a management platform designed to deliver and manage infrastructure and applications across private and public clouds, multiple hypervisors and physical infrastructure. It proactively addresses health, performance and capacity management of IT services; automates the delivery and ongoing management of IT infrastructure; enables the ongoing management of provisioned resources; and reveals the cost of infrastructure options and the consumption of resources.

GUIDANCE

End users should evaluate the breadth of offerings from cloud management, DevOps and integration vendors. Numerous cloud management vendors seek to provide a so-called 'single pane of glass' to control many of these capabilities. However, they are not comprehensive, and in many cases just loosely coupled – acting more as a federated portal rather than a tightly integrated suite of hybrid multi-cloud management services.

Vendors need to closely monitor their customers to note the urgency associated with the capabilities we have noted. Not all enterprises are prepared for, or now require, the convergence suggested here – at least not yet. Nevertheless, industry-leading enterprises are ramping up, and will call for such interoperability.

The vendor investment can be costly. Therefore, the priorities established by customer input (and willingness to pay) will help gradually integrate these components into a hybrid multi-cloud product roadmap. We believe both enterprise and SMB cloud service provider markets will be highly receptive to such an offering delivered as 'cloud management as a service.'